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Parenting unraveled : predictors of infant attachment and responses to crying

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Citation

Out, D. (2010, March 25). *Parenting unraveled : predictors of infant attachment and responses to crying*. Retrieved from <https://hdl.handle.net/1887/15123>

Version: Not Applicable (or Unknown)

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Note: To cite this publication please use the final published version (if applicable).

INTRODUCTION

The present thesis addressed parenting as a predictor of disorganized attachment in infants and as a response to infant crying. Both observational and experimental measures were used in order to assess parenting and its precursors at different levels, ranging from observed behavior to perception and physiological reactivity. In the first part of the thesis, we examined the nature of the specific caregiving behaviors associated with disorganized attachment, for which a new coding instrument was developed. We focused on the observation of disconnected and extremely insensitive parenting, and examined the unique contributions of these types of parenting to the development of disorganized attachment. Central to the second part of the thesis are adults' perceptual, physiological and intended caregiving responses to infant cry sounds varying in fundamental frequency. The etiology of caregiving responses and physiological reactivity to cry sounds was investigated in a genetically informative design. In the current chapter, the results of the studies are discussed. Recommendations for future research, limitations, and clinical implications of the studies are also presented.

DISCONNECTED AND EXTREMELY INSENSITIVE PARENTING

Even in the first publications on disorganized attachment in infants, a more or less explicit claim was made regarding the role of specific parental behavior in the development of this insecure type of attachment (e.g., Carlson, Cicchetti, Barnett, & Braunwald, 1989; Egeland & Sroufe, 1981; Main & Solomon, 1986, 1990; Main & Weston, 1981). Especially the description of disorganized attachment as representing a state of 'fright without solution' (Main & Hesse, 1990; Hesse & Main, 2006) refers to the importance of parenting in the etiology of disorganization. However, despite the growing number of studies on parenting in relation to disorganized attachment (for a meta-analysis see Madigan, Bakermans-Kranenburg et al., 2006), the nature of the caregiving behaviors that are associated with this type of attachment remains unclear.

The study presented in chapter 2 was the first to address the separate contributions of disconnected and extremely insensitive parenting to the development of disorganized attachment in infants. We developed a new instrument aiming at the distinction between these two different types of adverse parenting. Based on the FR system by Main and Hesse (1998), the first dimension of the DIP concerns disconnected behavior, which refers to a sudden change in normal behavior during which the parents displays inexplicable frightening,

frightened, dissociated, deferential or disorganized behavior. Based on the AMBIANCE (Bronfman, Parsons, & Lyons-Ruth, 2004), the second dimension of the DIP consists of extremely insensitive behaviors, which could be withdrawn and neglectful or intrusive, harsh and aggressive.

Disconnected and extremely insensitive parenting could be reliably assessed with the new coding system; the intercoder reliability was high for both the continuous scores and the classifications. A modest number of mothers were observed to display disconnected and/or extremely insensitive behaviors. Interestingly, more disconnected behavior was observed in the subsample of mothers who experienced the loss of an important person, suggesting that traumatic experiences may indeed negatively affect parents' caregiving behavior. Mothers who displayed more disconnected behavior were also more likely to engage in extremely insensitive behavior towards the infant, although the association was modest. Thus, the dimensions of the DIP assess two different aspects of parenting behavior.

It can be argued that disconnected behavior is by its very nature extremely insensitive, since parents are not only frightening their infant through their behavior but they also seem unable to perceive the child's signals of distress and to provide adequate comfort and soothing (see also George & Solomon, 1999; Lyons-Ruth, Bronfman, & Parsons, 1999). However, traditional conceptualizations of insensitivity refer to a *consistent pattern* of behavior that allows children to organize their behavior around the parent in order to elicit the best possible care (Main, 1990). The sudden and unpredictable occurrence of disconnected behavior, unrelated to the context and interfering with the parent's normal way of interacting with the child, renders it qualitatively different from extreme insensitivity.

The analyses revealed that disconnected parenting predicted infant disorganization but not organized attachment security, whereas extreme insensitivity was marginally related to insecurity in boys but not to attachment disorganization. These results indicate that disconnected parenting may be more stressful to the child than extreme insensitivity – at least the forms of insensitive behaviors observed in our low-risk sample. Indeed, studies on cortisol responses to psychological stressors have demonstrated that the experience of not being able to control the situation, especially when an important goal is threatened, activates the HPA-axis (for a meta-analysis see Dickerson & Kemeny, 2004). Uncontrollable and unpredictable caregiving behavior that denies the infant the opportunity to seek proximity to the parent may thus be extremely frightening and disorganizing.

The contribution of parenting to the prediction of infant attachment was only statistically significant for mothers who received a classification for either type of caregiving behavior. The lack of a significant association with the continuous measures of the DIP may be due to the non-stressful observation setting but can also indicate a threshold effect (Bernier & Meins, 2008). Either the parenting behavior has to be rather severe and pervasive before the child's organized attachment strategy falls apart, or certain child characteristics may affect infants' vulnerability to the negative effects of disconnected behavior. Three studies

have suggested that specific genetic polymorphisms affecting the serotonin or dopamine system are related to infants' susceptibility to the effects of parental unresolved loss (Van IJzendoorn & Bakermans-Kranenburg, 2006), maternal unresponsiveness (Spangler, Johan, Ronai, & Zimmerman, 2009) and disrupted affective communication (Gervai et al., 2007).

Future research should focus on the nature and underlying mechanisms of disconnected behavior. Most importantly, the interrelations between trauma, dissociative and post-traumatic stress symptoms, and disconnected caregiving behavior need to be carefully examined. Several researchers have speculated about the psychological processes that give rise to frightening and extremely insensitive behavior as observed in parents with an unresolved loss/trauma. Originally, unresolved trauma and FR behavior were considered from the perspective of dissociation (Hesse & Main, 2006; Liotti, 1992, 2004; Main & Hesse, 1992), and insights from the study of PTSD have recently enriched this perspective (e.g. Fearon & Mansell, 2001; Lyons-Ruth & Block, 1996; Stovall-McClough & Cloitre, 2006). Hesse and Main (2006) suggested that brief collapses or failures of working memory due to the intrusion and activation of (segregated) memories of the traumatic event may be one of the underlying processes of unresolved loss and trauma. Most of the attentional resources are directed at these traumatic memories, and since working memory has limited capabilities, disruptions in the functioning of working memory may occur.

A similar argument has been made by Fearon and Mansell (2001) with regard to attentional processes in FR behavior. Based on cognitive models of PTSD, they argued that the intrusion of dissociated traumatic memories captures the parent's attention. When the parent attempts to reduce the activation of these memories through avoidance or safety behaviors, even less attentional resources are available. Lapses in the monitoring of sensory-guided action may occur as well as a failure to recognize the effects of parental behavior on the infant. Thus, parental behavior is carried out in such a way "that is disconnected from the emotional systems that normally automatically regulate caregiving behavior" (p. 391). Schuengel, Bakermans-Kranenburg and Van IJzendoorn (1999) followed a similar line of reasoning when they discussed the protective function of mothers' secure attachment representation in the development of disorganized attachment in infants. They argued that secure mothers monitor their infant more closely and focus their attention on the child's signals. Thereby, less attentional resources are available that can be directed at unresolved traumatic memories, and disconnected behavior may therefore be less likely to occur. Indirect evidence supporting this hypothesis comes from a meta-analysis which demonstrated that interventions aimed at improving sensitive parenting were effective in reducing infant disorganized attachment (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2005).

Only a few studies have attempted to unravel these processes directly and in an empirical way. Rifkin (2005) demonstrated that adults with an unresolved loss or trauma performed significantly worse on tests of working memory, conducted under somewhat stressful circumstances. Gribneau (2007) employed event-related potentials (ERP) and found that all individuals who experienced

an important loss displayed a larger amplitude for the N2 component (reflective of early attentional processing) while viewing highly disturbing pictures of dead and dying persons compared to more pleasant nature scenes. In contrast, only individuals with an *unresolved* loss showed a heightened N2 response to symbolic reminders of death (such as peaceful cemetery scenes). Finally, Atkinson and colleagues (2009), using an emotional Stroop task, found that unresolved mothers displayed longer response times for threat stimuli compared to neutral stimuli than mothers with an organized attachment representation, which is indicative of a threat-related attentional bias. Similar studies have not been conducted with regard to FR behavior; only one study investigated its relation with self-reported dissociative experiences but failed to find a significant association (Schuengel et al., 1999).

Given the importance of parenting to the development of disorganized attachment in infants, there is a need to investigate disconnected behavior in relation to trauma and dissociation and to unravel the underlying neuropsychological processes. Objective measures of trauma, dissociation, attention and working memory are essential in future studies (see also Van IJzendoorn & Schuengel, 1996). Indeed, Giesbrecht, Lynn, Lilienfeld and Merckelbach (2008) have convincingly demonstrated that there is a large discrepancy between the theoretical notions of dissociation – the relation to trauma, deficits in attention and memory function – and empirical findings from many controlled studies. For example, there is no good evidence for a traumatic etiology of dissociative disorders (for reviews see Kihlstrom, 2005; Merckelbach & Muris, 2001). Most studies relied on retrospective self-report of traumatic events, while individuals with dissociative tendencies are known for their positive response bias, interrogative suggestibility and cognitive failures (for a review see Giesbrecht et al., 2008). In addition, Giesbrecht and colleagues (2008) have argued that controlled, experimental research has failed to find evidence for the relation between dissociative symptoms and many of the cognitive processes hypothesized to be related to traumatic dissociation (e.g. memory fragmentation, avoidant information processing). Thus, future studies should investigate the core assumptions pertaining to the relation between unresolved loss/trauma and disconnected parenting, using objective and well-validated measures of caregiving, cognitive and neuro(psycho)logical processes.

SENSITIVE AND HARSH PARENTING IN RESPONSE TO INFANT CRYING

Perceptual, physiological and caregiving responses

Fundamental frequency of the cry and its perceived urgency were found to be important predictors of adults' intended caregiving responses in our study. With regard to sensitive parenting, there was clear evidence for mediation. Higher-pitched cry sounds elicited more immediate and affectionate responses, but the effect of pitch became nonsignificant when perceived urgency was taken into account. In other words, sensitive parents evaluate the urgency of the infant's cry on the basis of acoustic information, and then determine the timing and nature of their caregiving response. Furthermore, there was an interaction effect of cry pitch and perceived urgency. Separate analyses of participants' responses to

each cry stimulus revealed that adults who rated the 500 and 900 Hz cries as more urgent were more likely to indicate sensitive caregiving responses. With regard to harsh parenting, an increase in cry pitch but not perceived urgency was directly associated with more intended harsh responses. Finally, all cries elicited an increase in adults' heart rate (HR) compared to baseline levels. Although there were no significant differences in HR between cry stimuli depending on pitch, each cry episode elicited an increase in cardiac reactivity compared to the previous one.

Overall, these results confirm aspects of the model describing a synchrony of arousal between infants and their caregivers (Zeskind, Sale, Maio, Huntington, & Weiseman, 1985). According to this model, severe distress vocalizations are characterized by a distinct acoustic and temporal structure, which elicits an increase in perceived and physiological arousal in parents. The study described in chapter 3 is the first to demonstrate how perceived urgency of infant crying mediates the relation between fundamental frequency and sensitive caregiving.

However, we found no significant differences in cardiac reactivity between the cry stimuli of varying pitch, in contrast to previous studies (Boukydis & Burgess, 1982; Crowe & Zeskind, 1992; Frodi, Lamb, Neff et al., 1978; but see Frodi, Lamb, & Wille, 1981; Zeskind, 1987). This may be due to the short intertrial interval between the cry sounds in our study, which may have diminished any differences in reactivity. In addition, the stimuli differed only in pitch, while other acoustic and temporal features also vary depending on the infant's level of arousal and are associated with perceived infant distress and timing of intervention (e.g. Wood, 2009; Wood & Gustafson, 2001; Zeifman, 2004; Zeskind, Klein, & Marshall, 1992). Thus, although fundamental frequency is one of the central acoustic characteristics, in future studies it is imperative to include cry sounds varying in a wide range of acoustic and temporal features (e.g. Dessureau, Kurowski, & Thompson, 1998).

The cumulative effect of repeated infant distress vocalizations on adults' HR indicated that the participants became increasingly sensitized to these signals, which may form the basis for attributions of increased urgency and aversiveness (e.g. Del Vecchio, Walter, O'Leary, 2009). Whether this increased cardiac reactivity will be translated into actual caregiving behavior may depend on acoustic and temporal characteristics of the cry sounds. For example, Zeifman (2004) presented a 4-min long cry segment and found that most adults were more likely to intervene after a sudden increase in the duration of cries. Similarly, Wood (2009) found that cry distress ratings over another 4-min cry segment were associated with more dysphonation, more frequent wails and shorter pauses between wails over time. Parents also use contextual information in deciding when and how to respond to their infant. In fact, sensitive caregiving requires that they consider the meaning of the cry in the wider context in which it occurs (Murray, 1979; Hubbard & Van IJzendoorn, 1991). Indeed, Wood and Gustafson (2001) have shown how a simple context manipulation – informing listeners that the infant was tired and needed sleep – influenced how quickly adults would respond to the infant, but not their perception of how distressed the infant sounded. Thus, increased cardiac reactivity may indicate a preparation for active responses, while specific cry

parameters and contextual information may determine whether this reactivity is expressed in actual caregiving behavior.

Given the importance of accurate perception of the infant's level of distress (e.g. Lester et al., 1995), future research should identify relevant factors residing in the parent, the child, and the environment that affect this process of synchrony between caregiver and infant. For example, Schuetze and Zeskind (2001) have demonstrated how maternal depression alters the perception of infant crying. Women with severe depressive symptoms perceived cry sounds as less urgent and were less likely to display active caregiving behavior, especially in response to the high-pitched cries. Using signal detection methods, Donovan, Leavitt and Walsh (1998) also found that depressed mothers experienced difficulties in differentiating between cries with small and systematic variations in fundamental frequency. Similar results have been found for mothers who used cocaine during pregnancy (Schuetze, Zeskind, & Eiden, 2003). Thus, future studies should investigate parental characteristics that may provide the basis for differential caregiving responses to severe distress vocalizations.

While an extremely high fundamental frequency has often been mentioned as an important risk factor of abuse, neglect and infanticide (Frodi, 1985; Frodi, Lamb, Neff et al., 1978; Soltis, 2004; Zeskind & Lester, 1978), this is the first study that has directly demonstrated that high-pitched crying elicits more (intended) harsh caregiving. In his essay on the signal function of crying, Soltis (2004) adopts an evolutionary approach in order to explain why chronic and severely abnormal crying may result in insensitive parenting, abuse, neglect and infanticide. As predicted by parent-offspring conflict theory (Trivers, 1974), parents are more likely to reduce or withdraw their investment in the child when prospects for infant survival are low. Poor health of the child is considered as an important factor that may contribute to this process, especially in combination with other risk factors at the parent, family, community and cultural level. Indeed, several studies demonstrated that children with physical health conditions or with developmental disabilities are more likely to become victims of abuse, neglect and infanticide (e.g. Daly & Wilson, 1988; Jaudes & Mackey-Bilaver, 2008; Sullivan & Knutson, 2000). Crying with many abnormal acoustic features, such as an extremely high pitch, rapid alterations in fundamental frequency, biphonation (simultaneous production of two fundamental frequencies) and atypical melodies are much more common in these children (for reviews see LaGasse et al., 2005; Soltis, 2004; Wasz-Höckert, Michelsson, & Lind, 1985). In fact, these acoustic abnormalities are not only larger in degree than severe distress vocalizations of normal, healthy infants but also occur chronically. Soltis (2004) argued that the abnormal cries of these infants function as an important signal to the environment, indicating severe illness, "poor quality" and low reproductive potential, and that they activate psychological mechanisms in the parent that may result in insensitive and abusive caregiving.

However, it should be noted that persistent and severely abnormal crying does not automatically lead to infant abandonment or maltreatment. Parents' investment decisions are also influenced by the resources available to them (Trivers, 1974). These resources include the parent's ability to care and provide

for the child as well as the availability of support from other persons and access to information about parenting (Bugental & Happaney, 2004). Beaulieu and Bugental (2008) proposed that the combined influence of parental resources and child characteristics involves a *contingent* pattern. When parents have low resources, they may be more likely to abuse or neglect an infant who is less likely to survive (see for an extreme example, Scheper-Hughes, 1992). In contrast, when parents have many resources, they will invest more in their at-risk child than in their other children, but only if they have sufficient resources to also provide for their other children.

Indeed, as discussed by Belsky (1993), child abuse and neglect are multiply determined by factors operating at multiple levels, ranging from parent and child characteristics to social and demographic factors, and the wider community and cultural context. Thus, future research should go beyond a main effect of chronic and severely abnormal crying and examine specific additional risk factors that influence the likelihood that parents will respond with insensitive and harsh behavior to high-pitched crying. It is essential to tease apart the relative importance of these risk factors and investigate their unique contribution to different components of parenting (including perception, cognition, and physiological reactivity). To this aim both observational methods and experimental designs with standardized infant stimuli are indispensable. These studies may contribute to our understanding of variations in parental response to infant distress and assist in identifying vulnerable parents and designing effective interventions.

Genetic and environmental influences

Our behavior genetic analyses revealed that normal variations in intended sensitive caregiving responses to infant crying were influenced by genetic factors, whereas harsh caregiving responses were solely due to shared and unique environmental factors. These results were comparable for males and females, parents and nonparents, and across cry pitch. A bivariate behavior genetic analysis was employed to analyze adults' HR responses in order to investigate how the genetic contribution to HR develops during the cry paradigm. Genetic factors contributed significantly to individual differences in cardiac reactivity to infant crying. The heritability of HR at baseline and during each cry episode was substantial; similar genes influenced HR both at baseline and during each cry episode. There was evidence for gene-by-stress interaction as the genes that affected baseline levels of HR became less influential during the cry episodes while new genes emerged that affected HR only during these episodes.

The difference in heritability between sensitive and harsh caregiving responses is remarkable and converges with the results from a previous study by Jaffee and colleagues (2004) who studied *children's* genetic contributions to being (harshly) disciplined. They demonstrated that children's genetically influenced behavior elicited physical discipline but not maltreatment from their parents. Indeed, previous adult twin studies also suggested that the heritability of (self-reported) parenting is larger for the positive aspects of caregiving than for control, negativity and discipline (e.g. Losoya, Callor, Rowe, & Goldsmith, 1997; Kendler & Baker, 2007; Spinath & O'Connor, 2003). Thus, harsh and abusive caregiving

is less influenced by the parent's or the child's genes than normal variations in sensitive parenting.

These results should of course not be interpreted as genes having a direct and inevitable influence on parents' ability to respond in a sensitive and responsive way to a crying infant. Such a straightforward deterministic view of genetic effects is clearly incorrect (Kendler, 2005; Rutter, Moffitt, & Caspi, 2006). Instead, our results suggest that there are genes that influence individual differences in reactivity to stressful infant stimuli. In other words, some parents are for genetic reasons more affected by their infant's crying, which motivates them to respond more promptly and alleviate the infant's distress. Indeed, physiological reactivity to crying and adults' perception of the level of infant distress were also found to be moderately heritable, and these variables may prove to be valuable endophenotypes for parenting.

In addition, although genes may play an important role in the etiology of sensitive caregiving, additional risk factors may be needed before a genetic risk is translated into insensitive or even abusive parenting. The seemingly contradictory findings of no genetic contribution to harsh parenting and a moderate heritability of physiological reactivity to infant crying (a potential precursor of harsh parenting) should be interpreted in this way. Genes may make some parents physiologically more reactive to infant crying, only in the presence of additional risk factors (e.g. parenting stress, excessive or aversive infant crying) will this genetic reactivity be expressed in less optimal parenting (e.g. Van IJzendoorn, Bakermans-Kranenburg, & Mesman, 2008). This is similar to Belsky's model of the determinants of child maltreatment (1993), discussed in the previous section. In this context, it is also interesting to note that Pérusse, Neale, Heath and Eaves (1994) argued that "evolution would have generated a universal system of human parental rearing genetically influenced to be sensitive to adaptive salient features of the local environment, and characteristics of children related to their reproductive potential" (p. 334).

For example, the cultural context has a profound influence on caregiving practices in relation to infant crying, and may moderate (or even override) genetics effects on parenting. In non-Western societies, infants are often carried in a sling which offers constant contact, early detection of precursors of crying, and prompt calming responses such as feeding. Parents detect subtle discomfort cues like fussing and whimpering earlier, and respond to them before full-blown crying develops (Barr, Konner, Bakeman, & Adamson, 1991; Zeifman, 2001). In sum, future studies of parenting in response to crying should test which parental, child and environmental factors make parents more reactive to infant crying. This reactivity can be either positive or negative: it may result in enhanced sensitivity to infant distress signals or in withdrawn and harsh caregiving, depending on environmental conditions. These studies may provide more insight into the pathways by which a genetically based reactivity is expressed in terms of caregiving behavior. In this context the study of harsh parenting and its precursors should be given high priority.

EXCESSIVE AND AVERSIVE CRYING IN INFANTS: PRACTICAL IMPLICATIONS

Recently, a survey study reported that 6% of Dutch parents of 6-month-old infants had smothered, slapped or shaken their baby at least once in order to reduce crying (Reijneveld, Van der Wal, Brugman, Sing, & Verloove-Vanhorick, 2004). Advice that parents receive about the causes of crying and appropriate caregiving responses may have the potential to alleviate or exacerbate feelings of frustration and anger, and thus affect the probability that they engage in abusive behavior. Advice that does not reflect evidence-based understanding of infant crying, however well intentioned, cannot be considered innocent and may have iatrogenic side-effects (Catherine, Ko, & Barr, 2008).

Recently, a new mother and child nursing guideline has been initiated in the Netherlands by the association of health care providers ActiZ (2007), which consists of a behavioral intervention for parents of excessively and inconsolably crying infants. This guideline has been provisionally approved by the Dutch National Institute for Public Health and the Environment. These guidelines include a behavioral modification intervention emphasizing regularity and uniformity in daily infant care, stimulus reduction, and swaddling, which were investigated in a clinical trial by Van Sleuwen and colleagues (2006). The publication of these guidelines elicited much negative publicity from both professionals and parents. Most of the criticism focused on the use of a kitchen timer: parents are encouraged to wait at least 30 minutes before responding to their crying infant so that the infant learns to fall asleep alone and on its own. The Dutch professional association for psychologists (NIP) worried that the behavioral intervention would increase the risk for problematic parent-child relationships, insecure attachment, learned helplessness and even inflict lasting neurological damage (NIP, 2008). Therefore, these guidelines have not (yet) been made official. In the following, a short overview is provided on excessive and inconsolable crying in infants, after which the guidelines will be discussed in more detail.

Excessive crying and colic syndrome

Excessive crying (often described by the term 'colic syndrome') is characterized by prolonged cry bouts that are resistant to soothing, cluster in the evening, and mainly occur in the first few months of life (Barr, 2000; Barr, Paterson, MacMartin, Lehtonen, & Young, 2005; Barr, Rotman, Yaremko, Leduc, & Francoeur, 1992; St. James-Roberts, Hurry, & Bowyer, 1993; Stifter & Braungart, 1992). The cry bouts are often described as 'paroxysmal': they have a rapid onset, begin and end without warning and are seemingly unrelated to anything in the environment. Other features include the infant clenching its fists, flexing its legs over the abdomen and having an active and grimacing face. Cry acoustics of colicky infants are somewhat different from other infants and include a higher fundamental frequency, a greater percentage of dysphonation and a longer duration of cries (Lester, Boukydis, Garcia-Coll, Hole, & Peucker, 1992; Zeskind & Barr, 1997). A common quantitative description of colic is one in which an infant cries for more than 3 hours per day for more than 3 days per week during more than 3 weeks (Wessel, Cobb, Jackson, Harris, & Detwiler, 1954).

Few organic diseases present as a colic syndrome and it seems that fewer than 5% of all cases are accounted for by these diseases (Gormally & Barr, 1997; Lehtonen, Gormally, & Barr, 2000). In addition, excessive crying can occur in the context of optimal and sensitive parenting (St. James-Roberts, Conroy, & Wisher, 1998), although caregiving behavior may be implicated in some cases of colic or may exacerbate normal crying behavior (Barr, 2000). It has been suggested that excessive crying is a direct consequence of Western caregiving practices that discourage physical closeness, frequent feeding and prompt responses to distress – a caregiving style presumed to be qualitative different from the one typical of our evolutionary history (Lummaa, Vuorisalo, Barr, & Lehtonen, 1998; Zeifman, 2001).

Colic was first considered to be an early manifestation of a persistent difficult temperament (e.g. Weissbluth, Christoffel, & Davis 1984), but the evidence for this hypothesis appears to be tenuous (for a review see Barr & Gunnar, 2000). Crying in colicky infants peaks in the second month after which a substantial decrease is observed (e.g. Barr et al., 2005; St. James-Roberts et al., 1998), a pattern that parallels the normal crying curve (e.g. Brazelton, 1962; Hunziker & Barr, 1986; St. James-Roberts & Halil, 1991). These infants do not differ from infants with a difficult temperament at the time when colic is manifest; however, after their colic resolves these infants are no longer described as having a difficult temperament and do not have difficulties with other regulatory functions (e.g. Lehtonen, Korhonen, & Korvenranta, 1994). Barr and Gunnar (2000) have suggested that infants with colic manifest increased levels of responsivity compared to non-colic infants, which are *transient* and not persistent as in infants with a difficult temperament. In fact, there are several indications that decreased regulation and not heightened reactivity (both subdimensions of responsivity) is an important feature of colic. For example, resistance to soothing is one of the most prominent characteristics, and increased carrying is not as effective in reducing the amount of crying as it is for normal infants (Barr, McMullan, et al., 1991; Hunziker & Barr, 1986; St. James-Roberts, Hurry, Bowyer, & Barr, 1995). In addition, one study has shown that the duration of cry bouts but not the frequency of crying distinguished infants with colic from other infants (Barr et al., 1992; but see also Barr et al., 2005).

Infants with colic are now believed to be otherwise normal but as a group represent the upper end of the spectrum of normal crying behavior (Barr, 2000; Barr et al., 2005). A review of prospective studies in which the diagnosis of colic was made during the period of colic revealed that the prognosis for these infants was remarkably good in terms of physical health, cognitive and social development, and family interactions (Lehtonen et al., 2000).

A behavioral management approach

The behavioral intervention as employed in the study by Van Sleuwen and colleagues (2006) was based on the experience of a Dutch nurse (Blom, 2005; Blom, Van Sleuwen, De Vries, Engelberts, & L'Hoir, 2009). It includes a consistent and recurrent pattern of caregiving with structure, regularity and stimulus reduction as the central components. Parents feed the infant as soon as he/she wakes up,

after which there is some time for positive interaction. The infant should then play alone in a playpen and as soon as the parents observe any sign of fatigue, the infant is put to bed sleepy but awake. It is emphasized that excessively crying infants should learn to fall asleep on their own and may need to cry themselves to sleep for up to 45 minutes. Parents are encouraged to use a kitchen timer in order to keep a realistic sense of time. When the infant is still crying after 30 minutes, parents should offer some consolation but not take the child out of the bedroom. If the infant continues crying, parents should repeat the whole sequence as described above.

In total, 382 parents who perceived their infants' crying as excessive were included in the study (age of the infants < 3 months). All parents received instructions about the behavioral intervention, and 185 caregivers were asked to additionally swaddle their infant during each sleeping period. Parents recorded their infants' behavior using a diary. For both groups, a substantial reduction in the amount of crying occurred: two weeks after the intervention there was an average reduction of 50% that amounted to 75% six weeks later. No additional effect for swaddling was observed, except for young infants (1-7 weeks of age) during the first week of the intervention.

Clearly, these results suggest an impressive reduction in the duration of crying due to an intervention that is both simple and easy to implement. However, before this behavioral approach can be translated into a nation-wide guideline on the treatment or even the prevention of excessive crying, independent replication of these results is imperative. Indeed, some methodological considerations should be mentioned.

Most importantly, there was no control group included. Normally, the amount of crying decreases after 6 weeks of age, even in colicky infants (e.g. Barr et al., 2005; St. James-Roberts et al., 1998), which makes it difficult to assess how successful the behavioral intervention actually was. The authors argue that it was impossible to include a 'care as usual' group as there is no standardized care in the Netherlands for excessively crying infants, and compare the reduction in the amount of crying in their study to the normal crying curve. However, the randomized inclusion of a control group of *excessively* crying infants is both essential and feasible (see for example, Wolke, Gray, & Meyer, 1994).

Secondly, families were included when parents *perceived* their infants' crying as excessive, while only 32% of the infants met Wessel's criteria for colic (see for a comparable percentage, Barr et al., 1992). In fact, the results suggest that even infants of 1 week old were included, for whom a pattern of persistent inconsolable and excessive crying could not have been established. Clearly, the parental component of the problem is substantial in this sample, which complicates an interpretation of the results and a comparison with previous studies on colic. Moreover, it is difficult to ascertain what the effective component of this intervention actually was, and why it may have worked so well. This is even further complicated because the program lacks a sound theoretical basis. In fact, many components of the intervention do not reflect evidence-based understanding of infant crying and colic.

Differential responsiveness

Stimulus reduction, regularity and structure may indeed support the infant's developing self-regulating abilities, especially in colicky infants who are hypothesized to display decreased regulation abilities (Barr, 2000; Barr & Gunnar, 2000; see also McKenzie, 1991). However, leaving a crying infant alone in its bed for up to 45 minutes so that it learns to fall asleep on its own is not a sensitive caregiving strategy that is supportive of the infant's low regulation abilities. Instead of allowing a kitchen timer to decide when parents should intervene when their infant is crying its heart out, they may learn to respond differentially to their infants' distress vocalizations (Hubbard & Van IJzendoorn, 1991; Van IJzendoorn & Hubbard, 2000).

The concept of differential responsiveness takes into account the varying meaning of different cry sounds (based on the acoustic characteristics and on contextual cues) as well as the child's own resources to modulate its negative emotions. Thus, whereas delayed caregiving responses to mild distress vocalizations may support the development of emotion regulation skills in infants, severe distress vocalizations require immediate and sensitive caregiving responses – independent of whether the kitchen timer has given its alarm or not. Sensitive care may support the colicky infant's decreased regulation abilities: previous studies of normal infants have indeed demonstrated the importance of sensitive parenting for infants' physiological and behavioral systems of regulation (e.g., Moore & Calkins, 2004; Propper et al., 2008; for a review see Propper & Moore, 2006).

In conclusion, although the behavioral intervention presented by Van Sleuwen and colleagues (2006) may contain some effective elements, more research is needed before this behavioral approach is translated into guidelines that are applied in clinical settings in order to prevent or treat excessive crying. In designing potentially effective interventions, it is crucial to recognize and distinguish between infant and parental components of the problem (St. James-Roberts, 2004). Indeed, since the outcomes appear to be less favorable for infants whose parents are vulnerable and *perceive* the crying as excessive (Lehtonen et al., 2000; see also Barr, 2000), priority should be given to the development of strategies for identifying and supporting these parents.

In this context, two randomized control trials should be mentioned in which the effect of educational materials on mothers' knowledge concerning infant crying and shaken baby syndrome, and on appropriate responses to crying was examined (Barr, Barr et al., 2009; Barr, Rivara et al., 2009). These PURPLE materials were developed by the National Center on Shaken Baby Syndrome; the letters in PURPLE stand for properties of crying in infants that may frustrate caregivers (P for peak pattern; U for unexpected timing; R for resistance to soothing; P for pain-like look on the infant's face; L for long crying bouts; E for evening clustering). The materials explain that these are normal properties, suggest ways to sooth but do not claim that inconsolable crying is consolable if caregivers act appropriately, and describe how frustrating inconsolable crying can be and may lead to physically abusive behavior. Three caregiving (non-)responses are emphasized: 1) typical calming responses such as carrying and comforting, 2)

when crying is too frustrating, parents can put the infant down and walk away in order to calm themselves, 3) never shake the infant.

Results from two large randomized controlled trials indicated that mothers had more knowledge on crying and the effects of shaking, were more likely to walk away if frustrated, and more often shared the information with others (Barr, Barr et al., 2009; Barr, Rivara et al., 2009). Thus, information provided to parents after the birth of their child about what constitutes normal crying behavior, appropriate responses and the danger of shaking their child may decrease the incidence of shaken baby syndrome. Indeed, Dias and colleagues (2005) designed a hospital-based parent education program, in which information was provided to parents on the dangers of infant shaking and on alternative responses to persistent infant crying. There was a clear decrease in the incidence of abusive head injuries during the first six years of the program compared to the incidence during the six preceding years and compared to state-wide incidence rates.

CONCLUSION

The general aim of this thesis was to provide more insight into the role of parenting in infant disorganized attachment and in response to infant crying. A new coding instrument was presented for the observation of disconnected and extremely insensitive parenting. Using this instrument, it was demonstrated that disorganization in infants was predicted by disconnected parental behavior and not by extreme insensitivity.

With regard to infant crying, an experimental measure was employed in order to assess adults' perceptual, physiological and intended caregiving responses to cry sounds. Results indicated that the perception of cry sounds as urgent paved the way for more immediate and affectionate caregiving responses, while an increase in cry pitch was directly associated with more irritated, negative and even harsh responses. Adults' cardiac reactivity increased with each cry episode, indicating that adults were increasingly sensitized to repeated infant distress signals. Finally, the influence of genetic factors was substantial for cardiac reactivity and sensitive caregiving responses to infant crying, but absent for harsh caregiving responses.

The results of the studies presented in the current thesis demonstrate that assessment of parenting and its precursors at various levels provides more insight into parental functioning. Knowledge of the underlying processes that affect parental behavior can be used to develop intervention programs for the prevention of harsh parenting and its negative consequences for children.