Universiteit
Leiden
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Parenting unraveled : predictors of infant attachment and responses to crying

Out, D.

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1 General introduction

The assessment of insensitive, harsh and abusive parenting has received much interest, as evidenced by the number of measures that have been developed to assess parenting and to identify parents at risk for dysfunctional caregiving (see for reviews, Holden, 2001; Locke & Prinz, 2002; Peters & Barlow, 2003; Stowman & Donohue, 2005). Most of these instruments rely on a questionnaire format, whereas the development of structured interviews and systematic observational methods received less attention. Although each method comes with its own strengths and weaknesses, questionnaires in which parents report on their own behavior have especially been criticized for their limited validity (for an overview see Morsbach & Prinz, 2006). It has often been recommended that multiple measures should be used in order to obtain more accurate information on parenting practices (Holden, 2001).

Because of the complexity of insensitive, harsh and abusive caregiving, an alternative approach may be to examine specific components of parenting, measured at different levels. The current thesis is based on this approach. In the first chapter, a new coding instrument for the observation of disconnected and extremely insensitive parenting is introduced, and the unique contribution of these types of parenting behavior to the development of disorganized attachment in infants is examined. The second and third chapters focus on perceptual, physiological and caregiving responses to infant cry sounds, investigated in a behavioral genetic design. Thus, the current thesis addresses parenting in relation to infant disorganized attachment and infant crying, using observational and experimental measures that focus on different levels of assessment (e.g. behavior, perception, physiological reactivity, and the genetics of these measures).

Atypical parenting and attachment disorganization

The development of an attachment relationship with a caregiver is a normative phenomenon in infancy (Bowlby, 1969), but the quality of attachment depends on the caregiver's ability to respond in a sensitive and responsive way to the infant's signals (Ainsworth, Blehar, Waters, & Wall, 1978; see for a meta-analysis De Wolff & Van IJzendoorn, 1997). Parents of infants with a secure attachment generally respond in a prompt and appropriate way to their signals, which allows these infants to use their parents as a secure base for exploration and as a safe haven in times of (di-)stress. In contrast, insecure avoidant children have experienced a rejecting and uninvolved caregiver and therefore minimize the expression of negative affect, whereas infants with a resistant attachment exaggerate their negative emotions in order to elicit attention from an inconsistently sensitive caregiver (Main, 1990).

Some infants from middle-class samples were difficult to classify in one of these three organized attachment categories (e.g. Main & Weston, 1981). Although many of these infants were forced into the secure category, the actual behavior of the children led coders to believe that these were not secure infants. In fact, Main and Weston (1981) observed more conflict behavior in these infants compared to the other (insecure and secure) children. These conflict behaviors were described as having "an odd, purposeless, or disordered appearance" and were hypothesized to result from repeated experiences of rejection by the parent, which led the infant to simultaneously seek proximity and withdraw. In addition, several studies reported that some infants with a background of abuse and neglect had to be placed in the secure category, while close examination of the behavior of these infants revealed signs of disorganization and disorientation (Carlson, Cicchetti, Barnett, & Braunwald, 1989; Crittenden, 1985; Egeland & Sroufe, 1981; Gauensbauer & Harmon, 1982; Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985).

Main and Solomon (1986, 1990) reviewed the tapes of more than 200 infants who were either difficult to classify or from high-risk and maltreating families. They noticed that these infants displayed a breakdown of an organized attachment strategy to deal with stressful circumstances and negative emotions. A coding system was developed consisting of a wide range of behaviors characteristic of infants with a disorganized/disoriented attachment (Main & Solomon, 1990). Examples include contradictory behavior patterns (e.g. approaching the parent sideways or with head averted); direct indices of fear of the parent (e.g. fearful facial expression, hand-to-mouth movement when seeing the parent); stilling and freezing of all body movement for a substantial amount of time; stereotypies, misdirected and undirected movements (e.g. infant is distressed but moves away from the parent).

As proposed by Main and Hesse (1990, 2006), disorganized attachment behaviors appear in stressful circumstances when the child experiences 'fright without solution': the infant cannot resolve feelings of stress and anxiety since his/her parent is at the same time the source of fear as well as the only potential haven of safety. This irresolvable paradox is especially apparent for maltreating families; although these parents frighten their children through their abusive behavior, they remain the only available attachment figure to whom the infant can turn for comfort and protection. As a result, the child's organized attachment strategy falls apart, leaving the child in a state of extreme fear. Indeed, the majority of abused and neglected infants display disorganized and disoriented attachment behaviors (e.g. Carlson et al., 1989; for a meta-analysis see Cyr, Euser, Bakermans-Kranenburg, & Van IJzendoorn, in press), but this insecure form of attachment may also develop in infants of parents with unresolved trauma (for a meta-analysis see Van IJzendoorn, 1995).

Main and Hesse (1990) proposed that these parents display a collapse in their caregiving behavior when unresolved memories and affects concerning the trauma suddenly intrude into the consciousness of the parent. Although these sudden and unpredictable lapses in normal parenting behavior are not necessarily abusive, they are inherently frightening for the infant and may lead

to a disorganized attachment relationship. Lyons-Ruth, Bronfman, and Atwood (1999) have suggested that the parent's unresolved loss/trauma may result in disorganized attachment in infants not only through behavioral manifestations of a dissociated state in the parent but also through extreme insensitivity. These parents may display hostile or helpless behaviors that repeatedly arouse fear and distress in infants, and do not provide the necessary comfort and soothing (Lyons-Ruth, Bronfman, & Parsons, 1999).

A recent meta-analysis has demonstrated that a child who has experienced extremely insensitive parenting or parental behaviors indicative of a dissociated state, is almost four times more likely to develop disorganized attachment than a child whose mother does not display such behavior (Madigan, Bakermans-Kranenburg, et al. 2006). However, the exact nature of the caregiving behaviors that compromise the development of an organized attachment is not yet clear: in the existing measures, no separate scores are assigned to extremely insensitive behaviors and frightening behaviors indicative of dissociation. Since disorganized attachment is considered to be the most insecure form of attachment in infants, associated with a problematic stress regulation and later problem behavior and psychopathology (for a meta-analysis see Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999), more insight is needed into the nature of the caregiving behaviors associated with disorganized attachment.

Harsh parenting in response to infant crying

Crying in infancy has been considered as a highly adaptive behavior, evolved to alert the environment and to elicit nurturance and close physical proximity to the caregiver (Bowlby, 1969; Murray, 1979; Zeifman, 2001). The sound of the cry conveys a sense of urgency and triggers physiological arousal in parents that prepares them to respond and reduce the infant's distress (e.g. Del Vecchio, Walter, & O'Leary, 2009). Crying also communicates information about the infant's current needs and state as well as on its long-term health and viability. Thus, crying is unique for its role in the survival, health and development of the child (Zeskind & Lester, 2001). However, crying can also be maladaptive as it may trigger avoidance and abuse rather than care if the sound exceeds a certain intensity or duration (for reviews see Frodi, 1985; Soltis, 2004).

Murray (1979) described the infant's cry as a graded signal: acoustic and temporal features of the sound do not differ according to what caused the cry, but change as a function of the infant's level of distress (Porter, Porges, & Marshall, 1988; Zeskind, Sale, Maio, Huntington, & Weiseman, 1985). Based on acoustic variations (e.g. fundamental frequency or pitch, length of the cry expirations and of the pauses between expirations) as well as contextual information, parents decide when and how to respond (for a review see LaGasse, Neal, & Lester, 2005; see also Wood & Gustafson, 2001; Zeifman, 2004). Several models of cry production have described the physiological pathways by which the infant's distress is reflected in the cry (Golub & Corwin, 1985; Green, Irwin, & Gustafson, 2000; Lester, 1987; Lester & Zeskind, 1982; Porges, Doussard-Roosevelt, & Maita, 1994). These models point to the vagal system as the primary source of variation

in acoustic and temporal characteristics of crying. The vagus (cranial nerve X) has a right and a left branch, with fibers that originate in either the nucleus ambiguus or the dorsal motor nucleus. The nucleus ambiguus affects the sino-atrial (S-A) node of the heart and the right side of the larynx by way of the vagus, and thereby regulates both heart rate and vocal intonation. Fundamental frequency is considered as one of the main acoustic features affected by these vagal processes (Porter et al., 1988; Soltis, 2004). In physiologically stressed infants, decreased vagal tone causes the laryngeal muscles to contract, which leads to an increased tension in the vocal folds and an increase in the fundamental frequency of the cry. Indeed, Porter and colleagues (1988) demonstrated that decreases in infants' vagal tone during a painful surgical procedure were paralleled by increases in cry pitch.

However, deficits in brainstem functioning or higher brain functioning may also affect vagal control of the cry, producing severe abnormalities in cry acoustics, especially in terms of fundamental frequency (Green et al., 2000). Indeed, a wealth of studies have shown that abnormal cry sounds are associated with a range of chromosomal, endocrine, metabolic and neurological disturbances, with an unusually high cry pitch as the most common cry characteristic indicative of serious pathology (for reviews see LaGasse et al., 2005; Soltis, 2004; Wasz-Höckert, Michelsson, & Lind, 1985). In addition, acoustic cry analysis has reliably differentiated infants suffering from drug exposure, prenatal and postnatal malnutrition, poor fetal prenatal growth, prematurity and low birth weight (for a review see also Corwin, Lester, & Golub, 1996; Zeskind & Lester, 2001). Because infants with serious pathology or at risk for neurological problems are known to be at increased risk for abuse and neglect, it was suggested that their aversive, high-pitched crying may play a causal role in infant maltreatment (Frodi, Lamb, Neff et al., 1978; Zeskind & Lester, 1978). Indeed, there are several indications that excessive and inconsolable crying as well as crying characterized by extreme increases in fundamental frequency contribute to the development of abusive parent-child interactions (see for reviews Frodi, 1985; Soltis, 2004).

Crying is frequently mentioned as the final trigger of a form of abuse that includes violently shaking the infant, which may result in severe head trauma and fractures of the long bone or ribs (e.g. Dykes, 1986; Ludwig & Warman, 1984; Reijneveld, Van der Wal, Brugman, Sing, & Verloove-Vanhorick, 2004). However, most of the evidence for crying as precipitant of Shaken Baby Syndrome (SBS) is based on anecdotal reports. For example, Reijneveld and colleagues (2004) showed that 6% of Dutch parents of 6-month-old infants reported that they had smothered, slapped or shaken their baby at least once in order to reduce its crying. Prevalence rates of these abusive behaviors were even higher for parents who judged their infant's crying as excessive. A study on SBS in Estonia reported that 89% of the families contacted their physicians because of excessive crying prior to the admission to the hospital with SBS (Talvik, Alexander, & Talvik, 2008). Levitzky and Cooper (2000) interviewed mothers from a middle-class background, whose infants were diagnosed with colic. The intense, shrieking and inconsolable crying of these infants could go on for up to five hours, sometimes interrupted with quieter whimpering, short naps and feeding sessions. Aggressive

thoughts and fantasies were revealed by 70% of the mothers, while 26% of the mothers admitted that they had thoughts of infanticide during a colic episode. For example, one mother reported that she had a fantasy about shaking the baby and threatening to leave him, while another mother's fantasy took the form of dropping the infant out of the window.

Three studies obtained more systematic support for the potential role of crying as a proximal stimulus to SBS, by comparing the age-specific incidence of SBS to the normative crying curve. Normally, the average duration of crying begins to increase at 2-3 weeks of age, peaks around 6 weeks, after which it declines to more stable levels by the fourth and fifth month (Brazelton, 1962; Hubbard & Van IJzendoorn, 1991; Hunziker & Barr, 1986; St. James-Roberts & Halil, 1991). The incidence of SBS follows a similar curve, starts at 2-3 weeks of age and peaks around 8 to 12 weeks, followed by a decline to more stable levels (Barr, Trent, & Cross, 2006; Lee, Barr, Catherine, & Wicks, 2007; Talvik et al., 2008).

With regard to the role of high-pitched crying in eliciting abuse and neglect, one of the earliest reports can be found in a discussion on the child's role in 'battered child syndrome', where one physician commented on the particularly irritable cry of some infants (Milowe & Lourie, 1964). In the hospital, caretakers often placed these children in the cubicle far away from the nurses' station, where they would not hear the infants' cries. Experimental studies have shown that cry sounds with abnormal acoustic and temporal characteristics are perceived as especially aversive (Frodi, Lamb, Neff et al., 1978; Frodi & Senchak, 1990; Zeskind & Lester, 1978; for a review see LaGasse et al., 2005), and that they may elicit higher levels of autonomic arousal in adults than normal cries (Boukydis & Burgess, 1982; Crowe & Zeskind, 1992; Frodi, Lamb, Neff et al., 1978; but see also Frodi, Lamb, & Wille, 1981; Zeskind, 1987), and less optimal and withdrawn caregiving responses (Frodi, Lamb, Neff et al., 1978; Boukydis & Burgess, 1982). However, no study has directly examined whether high-pitched cry sounds are associated with more active, harsh parenting.

Further, research has only begun to explore specific caregiver characteristics that may provide the basis for sensitive versus harsh caregiving responses to (high-pitched) infant crying. For example, Zeskind (1987) showed that some parents display heart rate *decelerations* to hyperphonated cries, whereas other parents show high heart rate *accelerations*, indicative of a defensive response to aversive sounds. Indeed, there are several indications that abusive parents and adults at risk for physically abusing their children display a hyperreactive trait that makes them overly responsive to noxious and aversive child-related stimuli (Knutson, 1978), as manifested in strong negative emotional reactions (e.g. Bauer & Twentyman, 1985; Frodi & Lamb, 1980) and in excessive and prolonged physiological reactivity (for a review see McCanne & Hagstrom, 1996). Based on Vasta's (1982) dual-component model of physical child abuse and Berkowitz' (1990) cognitive-neoassociationistic model of aggression, it was suggested that physiological hyperreactivity to stressful child stimuli may act as a disinhibitor of normal impulse controls and may increase parents' readiness to engage in aggressive and abusive behavior towards their children (Casanova, Domanic, McCanne, & Milner, 1992).

Furthermore, there are several indications that more basal, neurobiological factors are implicated in adults' perceptual and physiological reactivity to infant crying (Newman, 2007). Specific brain structures, neurotransmitters, and peptide hormones have been found to be related to the perception of and sensitivity to infant signals (e.g. Bakermans-Kranenburg & Van IJzendoorn, 2008; Feldman, Weller, Zagoory-Sharon, & Levine, 2007; Fleming, Corter, Stallings, & Steiner, 2002; Lorberbaum et al., 2002; Swain, Lorberbaum, Kose, & Strathearn, 2007; Van IJzendoorn, Bakermans-Kranenburg, & Mesman, 2008). Although research on genetic influences on parents' reactivity to infant crying has not been conducted, a genetic vulnerability may form the basis of differential caregiving responses to (higher-pitched) crying (see below).

Behavioral genetic studies of parenting

In the last century, studies on the determinants of parenting have mainly focused on experiential influences, such as how parents were raised themselves, and on environmental factors. Belsky (1984) for example noted in his well-known essay on the origins of parenting that multiple influences affect parental functioning and stressed the importance of parents' own developmental history, specific child characteristics and the broader social network in which the parent-child relationship is embedded. The study of the *genetic* basis of parenting is a relatively neglected area of research. In fact, most behavioral-genetic researchers did not view child-rearing as a phenotype (Moffitt, 2005). In studies on child development and psychopathology, parenting was mainly considered as a purely environmental factor, unaffected by genetically influenced characteristics of parents and children (McGuire, 2003). It is only recently that a small number of behavior genetic studies has investigated the heritability of parenting by studying adult twin pairs who are now parents (Ganiban et al., 2007; Losoya, Callor, Rowe, & Goldsmith, 1997; Neiderhiser, Reiss, Lichtenstein, Spotts, & Ganiban, 2007; Neiderhiser et al., 2004; Pérusse, Neale, Heath, & Eaves, 1994; Spinath & O'Connor, 2003).

Twin studies provide a unique opportunity to examine the relative contribution of genetic and environmental factors to individual differences in a phenotype (Plomin, DeFries, McClearn, & McGuffin, 2005). Monozygotic (MZ) and dizygotic (DZ) twins differ in their genetic relatedness: MZ twins share 100% of their genes whereas DZ twins share on average 50% of their genes. Thus, by comparing the resemblance of MZ twins for a trait with the resemblance of DZ twins, it is possible to estimate to what extent genetic factors explain phenotypic variation for that trait. Environmental influences can be *shared* by both members of a twin pair and make them more similar in their behavior, whereas *nonshared* or *unique* environmental factors make twins more different. In order to quantify and test the significance of genetic factors and of shared and unique environmental factors, structural equation modelling is employed in which each of these influences are modelled as latent factors that affect phenotypic variation. These latent factors represent the effects of many unidentified genes or environmental factors. This univariate model can be extended to a bivariate or multivariate model in which more than one phenotype per person is analyzed.

Previous behavior genetic studies have demonstrated that the heritability of parenting varies across dimensions and depends on the developmental time period and on the use of observational versus self-report measures. The genetic contribution to self-reported positive parenting such as warmth and support has been found to be substantial, varying between 32% and 60% (Ganiban et al., 2007; Losoya et al., 1997; Pérusse et al., 1994; Neiderhiser et al., 2004; Spinath & O'Connor, 2003). In contrast, heritability estimates of negativity, rejection and control (as reported by the parent) are considerably lower or even nonsignificant, ranging from 0% to 39% (Ganiban et al., 2007; Losoya et al., 1997; Neiderhiser et al., 2004; Spinath & O'Connor, 2003). When assessed by direct observation, the heritability of parenting is substantially lower than when obtained by self-report (Neiderhiser et al., 2004, 2007; see also Kendler & Baker, 2007). These behavior genetic studies focused almost exclusively on females; only two studies focused on parenting as reported by fathers (Ganiban et al, 2007; Neiderhiser et al., 2007). These two studies suggested that the genetic contribution to negativity was larger compared to its contribution to positive parenting and warmth, but clearly more studies are needed on this issue.

In sum, the quality of the parent-child relationship may be significantly influenced by the parent's genotype, especially with regard to the positive-emotional aspects of parenting. However, most of the behavior genetic studies employed only self-report measures of parenting; since genetic factors have been found to influence specific reporting biases (e.g. Eaves et al., 1999), the heritability of parenting may have been overestimated. Furthermore, no behavior genetic study has yet investigated the precursors or endophenotypes of parenting in order to elucidate the pathways by which genes may affect caregiving behavior. The concept of endophenotypes emerged in the study of the genetics of complex psychiatric disorders. In order to facilitate the identification of relevant genes and to elucidate their function, complex behaviors were reduced into components which are considered to be at an intermediate level between genotype and phenotype (Bearden & Freimer, 2006; Gottesman & Gould, 2003; Gould & Gottesman, 2006). These endophenotypes represent more elementary and straightforward processes that are associated with specific behaviors or clinical disorders, and they may include a range of measures (e.g. neurophysiological, biochemical, cognitive etc.).

Focus and outline of the present thesis

The general aim of this thesis is to provide more insight into the role of parenting in infant disorganized attachment and in response to infant crying. Both observational and experimental measures are used in order to assess parenting and its precursors at different levels, including observed behavior, perceptual processes, physiological reactivity and the genetic components of these measures.

Central to the first part of the thesis is the role of parenting in the development of disorganized attachment in infants. More specifically, we present and test the validity of a new instrument for the observation of disconnected and extremely

insensitive parenting, and examine the unique contribution of these two types of negative parenting to the development of disorganized attachment. For this study, maternal behavior and infant attachment was observed in a large sample of mothers and infants who participated in studies previously conducted at the Centre for Child and Family Studies at Leiden University. The second part of the thesis addresses adults' perceptual, physiological and caregiving responses to infant cry sounds in a genetically informative design. An experimental measure with standardized cry stimuli is introduced which allows us to assess the independent influence of cry pitch and adult characteristics on their perceptual, physiological and caregiving responses. This study is based on a sample of 184 adult twin pairs, including males and females, parents and nonparents. The third chapter examines genetic and environmental influences on intended sensitive and harsh caregiving responses to infant cry sounds, as well as the role of cry pitch and perceived urgency as more specific predictors of intended caregiving. The fourth chapter focuses on the development of adults' heart rate across repeated presentations of cry sounds as a potential endophenotype of caregiving. A genetic contribution to cardiac reactivity is examined in more detail using a bivariate behavioral genetic approach.

In the last chapter, the results of the studies are discussed and clinical implications of the studies are presented. More specifically, the guidelines on prevention and treatment of excessive crying that were recently proposed in the Netherlands are discussed, as well as an evidenced-based intervention program aimed at the prevention of harsh parenting in response to infant crying.