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Unresolved states of mind, anomalous parental behavior, and disorganized attachment: A review and meta-analysis of a transmission gap

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Abstract
The current meta-analysis examines the links between unresolved representations of attachment, anomalous parental behavior, and disorganized attachment relationships in 12 studies including 851 families. We found moderate effect sizes for the associations between unresolved states of mind and anomalous behavior ($r = .26$), unresolved states of mind and infant disorganized attachment relationships ($r = .21$), and anomalous behavior and disorganized attachment relationships ($r = .34$). Sample characteristics, observational context, and observational measure were not associated with differences in effect sizes. Only a small part of the association between unresolved states of mind and disorganized attachment relationships was explained by the mediation of anomalous parental behavior (.26* .34 = .09). Other factors yet to be uncovered must mediate the influence of unresolved states of mind on infant disorganized attachment; thus, further exploration of infant, parental, ecological, and genetic factors are warranted.

Keywords: *Attachment, parental behavior, meta-analysis*

Introduction

A central tenet of attachment theory is that parental behavior toward the infant is the primary determinant of individual differences in attachment relationships. Given the theoretical and clinical importance of elucidating the etiology of disorganized attachment, attachment researchers have been devoted to understanding the role of parental interactive behavior in the development of disorganized attachment relationships. Main and Hesse (1990) used the term ''frightened, threatening, and dissociative'' behavior to capture the salient quality of the anomalous, conflictual, and inexplicable behaviors displayed by some primary caregivers during interaction with their infants. They proposed that the display of frightened, threatening, and dissociative interactive behavior is the primary determinant in the development of a disorganized attachment relationship. Lyons-Ruth, Bronfman, and Parsons (1999) expanded this model and suggested that disorganized attachment can also

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be the product of an extremely insensitive or "disrupted" parent who perpetually fails to soothe and comfort the infant's arousal of attachment needs. In the current paper, we provide a narrative review of extant studies on frightened, threatening, and dissociative (FR behavior; Main & Hesse, 1990) and disrupted behavior (Lyons-Ruth et al., 1999) (hereafter collectively referred to as anomalous behavior), and we test meta-analytically the association between unresolved states of mind, anomalous parental behavior, and disorganized attachment relationships.

Bowlby's (1969/1982) original exposition of attachment theory emphasized the evolutionary function of infant–caregiver attachment in enhancing the likelihood of infant survival. Bowlby proposed that the attachment behavioral system is responsible for regulating the infant's propensity to monitor physically and psychologically the accessibility of the attachment figure. He suggested that the attachment behavior system is especially salient during fear inducing situations, where the infant engages in rapid flight to an attachment figure to provide a solution to the condition that elicits their fear (Hesse & Main, 2000). Bowlby's influential work gave impetus for Ainsworth and colleagues' (Ainsworth, Blehar, Waters, & Wall, 1978) seminal observational studies on attachment. Ainsworth et al. (1978) developed a tripartite system delineating the three basic patterns of organized infant attachment, labeled secure, avoidant, and resistant. Using this tripartite system, it was observed that, during fear inducing and stressful situations, infants with organized attachment strategies were able to maintain behavioral and attentional organization as they resolved their distress (Main, 2000). As studies began to include populations with known parenting problems such as maltreatment (Crittenden, 1985; Egeland & Sroufe, 1981), it was observed that a subsample of infants could not maintain behavioral and attentional organization. Not only were there children who could not be readily classified into one of Ainsworth et al.'s three attachment patterns, but there were some for whom classifications seemed anomalous in view of known information (i.e., severely maltreated infants who were judged "secure"; Main & Solomon, 1986). As a result, Main and Solomon (1986, 1990) embarked on a systematic review of 200 infants who failed to meet criteria for the three known attachment patterns and identified infants they described as "disorganized/disoriented" (hereafter referred to as disorganized). These infants lacked a clear and coherent strategy for using the caregiver for comfort when distressed.

Main and Hesse (1990) contend that when the potentially protective parent is also a source of fear, a disorganized attachment relationship may ensue. Under these circumstances, (i.e., fright without solution) the child is faced with an insoluble dilemma that prevents the development of an organized strategy for the use of the attachment figure when distressed or prompts a breakdown of an existing strategy. In the absence or breakdown of an organized strategy for dealing with distress, odd, conflicted, contradictory, or inexplicable behaviors associated with disorganized attachment are displayed (e.g., stilling, freezing, repeated incomplete approaches to the parent, failing to approach the parent when distressed; Main & Hesse, 1990; Main & Solomon, 1990). These disorganized behaviors appear to reflect fear, apprehension, and confusion toward the caregiver, rather than an organized response for making use of the attachment figure when distressed.

Although the higher prevalence of disorganized attachment in high-risk samples (up to 77%; Carlson, Cicchetti, Barnett, & Braunwald, 1989) suggests that it arises in chaotic environments where caregiving is inadequate, its occurrence in low-risk community samples (15–20%) indicates a more complex origin (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). Mounting evidence suggests that a history of a disorganized attachment serves as a marker for later unfavorable outcomes in childhood and adolescence (Carlson, 1998; Lyons-Ruth, Alpern, & Repacholi, 1993; Moss, Cyr, & Dubois-Comtois, 2004; Shaw,

Owens, Vondra, Keenan, & Winslow, 1996; Solomon, George, & De Jong, 1995). A meta-analysis of 12 studies (combined $n = 734$) by van IJzendoorn et al. (1999) found a substantial association ($r = .29$) between disorganized attachment and later behavior problems. As a result of this association with later adverse outcomes and maladaptation, much recent research has been dedicated to understanding the genesis of disorganized attachment relationships.

Mental representations of attachment are assessed using the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1996), an hour-long semi-structured interview that focuses on childhood and current relationships with attachment figures and attachment-related traumas such as abuse, and loss of significant persons through death. On the basis of qualitative characteristics and coherence of the verbatim transcript, a categorization of the individual's current state of mind regarding attachment is assigned. Each category reflects a distinctive but central or organized state of mind (autonomous, dismissing, or preoccupied; Main & Goldwyn, 1984–1998; Main, Goldwyn, & Hesse, 2002). Individuals are assigned to a fourth category, ''unresolved/disoriented'' (hereafter referred to as unresolved), if their narrative regarding attachment-related trauma includes momentary lapses in the monitoring of reasoning or discourse, i.e., if sections of their narrative appear disorganized or disoriented when discussing experiences of attachment traumas. Thus, in the same way that the disorganized infant exhibits odd, unpredictable, and inexplicable behaviors, adults with unresolved states of mind display mental disorganization and disorientation by way of odd, unpredictable and inexplicable lapses in their narratives. Hesse and Main (2000) suggest that unpredictable lapses in reasoning or discourse can imply that the speaker continues to experience unusual absorption regarding the trauma, or reflects sudden changes in states of consciousness. They further suggest that if such unpredictable breakdowns or sporadic and anomalous lapses occur during daily interactions with the infant, they have the potential to sufficiently disrupt ongoing dyadic interactions and may lead to the development of a disorganized attachment relationship.

The development of the unresolved category resulting from the AAI was intended to correspond theoretically to the disorganized attachment category that is assigned based on anomalous infant behavior displayed during the Strange Situation. Supporting evidence for this assertion was provided in a meta-analysis that included 548 mother–infant dyads from nine different studies where 53% of mothers with unresolved states of mind had infants classified as disorganized (van IJzendoorn, 1995). Main and Hesse (1990) purport that the same mechanism that gives rise to the caregivers' propensity to display striking state shifts during discussions of loss or abuse could also produce frightening anomalies in interaction with their infants, a ''second-generation'' effect linked to the development of disorganized attachment relationships (Hesse & Main, 2000). Main and Hesse thus suggest that the pathway to disorganized attachment in otherwise normally developing children involves the (often unintended) evocation of fear in the child by the caregiver, fear that triggers an approach-avoidance paradox similar to that experienced by maltreated infants. Main and Hesse have coined the phrase ''fright without solution'' to describe this phenomenon. They propose further that parental expressions of fear result from the caregiver's frightening fragments of memories and emotions associated with experiences of unresolved trauma. In such circumstances, the consequent lapses in monitoring may lead the caregiver to become frightened in the presence of the infant or may predispose the caregiver to engage in sporadic lapses in parental action that are conflicting, unpredictable, or anomalous to the infant. Such substantially anomalous behavior by the caregiver elicits fear, confusion, and disorientation in the infant, contributing to the development of a disorganized attachment relationship.

Solomon and George (1999) elaborated on Main and Hesse's (1990) concept of "fright without solution," suggesting that the caregiver's repeated failure to protect the infant and satisfy attachment needs when they have been aroused subject the infant to an extreme state of fear. The child may ultimately be faced with the frightening realization that, when in need of protection, the caregiver is unlikely to provide a haven of safety, thereby preventing the infant from developing an organized attachment strategy. Lyons-Ruth et al. (1999) further suggest that disorganized attachment relationships may not only result from a frightening or frightened caregiver but also from an extremely insensitive caregiver. Furthermore, they postulate that the same caregivers who repeatedly provoke fear in their infants because of their unresolved experiences of loss or trauma are also likely to be unable to respond appropriately to the infants' cues. In fact, these same unresolved fearful affects likely prevent the caregiver from recognizing situations that are indeed fearful for the infant. Thus, the infant perpetually experiences arousal of attachment needs without receiving the comfort and soothing to terminate them. Failure to repair responses, lack of response (i.e., withdrawal), or insensitive responding (i.e., affective communications errors) can be as fear provoking for the child as behaviors that are directly frightening.

In their pioneering discussion, Main and Hesse (1992) included relatively brief descriptors in categories which they called threatening, frightened, and dissociative behaviors. More recently, Main and Hesse (1998) have expanded their coding system to encompass: threatening (e.g., looming); frightened (e.g., backing away from the infant while stammering in an unusual and frightened voice, "D-don't follow me, d-don't"); dissociated (e.g., using a "haunted" voice while interacting with the infant); sexual (e.g., excessive intimate or sexualized caressing of the baby); deferential/timid (e.g., interacting with the infant as though the infant was in control and powerful); and disorganized (e.g., mistimed or asymmetrical movements) behavior. They suggest that the three latter forms of anomalous behavior may not be frightening in and of themselves, but instead suggest an entrance into an altered or dissociative state, increasing the propensity that the same caregiver would, at other times, express additional forms of FR behaviors (Hesse & Main, 2006). The first independent empirical test of the model linking unresolved state of mind to disorganized infant attachment through FR parental behavior confirmed and qualified the proposed associations (Schuengel, Bakermans-Kranenburg, & van IJzendoorn, 1999). Several other independent studies also have found evidence supporting Main and Hesse's (1992, 1995, 1998) model in various contexts, populations, and settings (Abrams, Rifkin, & Hesse, 2006; Jacobvitz, Leon, & Hazan, 2006; True, Pisani, & Oumar, 2001).

Bronfman, Parsons, and Lyons-Ruth (1992, 2004) broadened Main and Hesse's (1992) coding scheme to encompass a wider spectrum of disrupted parental interactive behaviors and called this instrument the Atypical Maternal Behavior Instrument for Assessment and Classification (AMBIANCE). The AMBIANCE contains five dimensions of disrupted behavior: affective communication errors (e.g., contradictory signaling to infant); role/boundary confusion (e.g., treats child as sexual/spousal partner); fearful/disorientation behavior (e.g., appears frightened in relation to the infant); intrusive/negative behavior (e.g., behaves aggressively toward infant); and withdrawal behavior (e.g., maintains interaction at a distance). Lyons-Ruth et al. (1999) found that this broader set of disrupted parental behavior was associated with disorganized attachment in their high-risk sample, a finding replicated and expanded by other studies (Goldberg, Benoit, Blokland, & Madigan, 2003; Grienenberger, Kelly, & Slade, 2005; Madigan, Moran, & Pederson, 2006).

The current interest among attachment researchers and clinicians alike in understanding and further explicating the link between unresolved states of mind and disorganized attachment relationships has resulted in a series of studies on the association between

unresolved states of mind and anomalous behavior or the association between anomalous behavior and disorganized attachment. These studies, however, differ in terms of sample characteristics (e.g., low-risk community samples to high-risk disadvantaged samples), context used to examine the phenomena (e.g., during the Strange Situation, laboratory play, home observation), and length of time observing the phenomena (from 3 minutes to 4 hours). Furthermore, no attempts have yet been made to systematically compare the contributions of the AMBIANCE and the FR coding system to exploring the predicted associations between unresolved states of mind, anomalous parenting, and disorganized infant attachment relationships. Work in this area has now advanced to a stage where a review and quantitative analysis of extant research would be of critical value. The purpose of the current paper is twofold. First, we present a narrative overview of the current empirical literature on anomalous parental behavior. In this narrative overview, our most important question is whether anomalous parental behavior is linked to unresolved states of mind or disorganized infant attachment. Second, through a quantitative meta-analysis, we will examine the strength of the associations between unresolved states of mind, anomalous parental behavior, and disorganized infant attachment, and we test the influence of sample, context, and assessment characteristics on these associations.

Method

Data collection

Pertinent studies were collected using one of three search strategies. First, a systematic computerized literature search within PsycINFO, Dissertation Abstracts, and Medline was performed on the topic of frightening/frightened behavior and on disrupted behavior. Second, the references lists of the collected papers, review articles, and book chapters were searched for relevant studies (e.g., Lyons-Ruth & Jacobvitz, 1999). Third, studies were identified through personal communication with the developers of the FR coding system, Mary Main and Erik Hesse, and of the AMBIANCE coding system, Elisa Bronfman and Karlen Lyons-Ruth. Inclusion criteria were as follows: (1) the study should report an empirical investigation of anomalous parental behavior; and (2) the study should report the data in sufficient detail to allow for computations of effect sizes for the dichotomous variable (i.e., classification of FR versus a non-classification of FR, or a classification of disrupted versus non-disrupted communication) or for the continuous rating scale.

Narrative review

The studies reported in the narrative review were not restricted to a specific population, the age of the infant, or the context in which anomalous behavior was assessed. Of the studies reported in the narrative review, ten have been published, one study is currently under review and four are unpublished. We have organized the narrative review as follows: (1) studies that examined the associations between unresolved states of mind or disorganized attachment and FR behavior (Main & Hesse, 1992, 1995, 1998); (2) studies that examined the associations between unresolved states of mind or disorganized attachment and disrupted behavior (Bronfman et al., 1992, 2004); and (3) studies that examine the stability of disrupted behavior (Bronfman et al., 1992, 2004).

Studies of FR behavior. The FR behavior (Main & Hesse, 1992, 1995, 1998) coding system is utilized to code anomalous behavior during videotaped parent–infant interactions. The FR

coding system, initially developed by Main and Hesse (1992, 1995) and used empirically by Schuengel, Bakermans-Kranenburg, and van IJzendoorn (1999), contained three categories of behavior: frightening behavior, dissociated behavior, and frightened/deferential behavior. The current version of Main and Hesse's (1998) FR coding system contains six categories of behavior that may be directly (categories I to III; threatening, frightened, and dissociative behavior) or indirectly (categories IV to VI; timid/deferential, sexualized, disorganized/disoriented behaviors) frightening or disorganizing to the infant. Each individual instance of FR behavior is rated, and a summary score is assigned for each subcategory of FR behavior. A summary score is then provided for the entire observational period based on the frequency, intensity, and patterning of individual behaviors, yielding an overall 9-point FR score, where 1 equals no FR behavior, 3 mild, 5 moderate, 7 intense, and 9 extreme. Scores above a 5 qualify a parent for the FR category.

Preliminary support for Main and Hesse's (1990) hypothesis was first provided by Schuengel, van IJzendoorn, Bakermans-Kranenburg, and Blom (1998) using the FR coding scheme with a pilot sample composed of 12 low-risk community mother–infant dyads. Adult Attachment Interview's (AAI) were collected when the infants were approximately 12 months of age and Strange Situations were conducted when the infants were 14–15 months of age. FR behavior was coded on the basis of four hours of unstructured home observations conducted when the infants were between 10 and 11 months of age. The authors reported that of the five mothers classified as unresolved, three (60%) were in disorganized attachment relationships with their infants. Furthermore, five of the six (83%) non-unresolved mothers were in organized relationships with their infants[1]. All of the five mothers classified as unresolved engaged in FR behavior, whereas only three of the seven (43%) non-unresolved mothers did so. Contrary to theoretical expectations, there was no significant correspondence between frightening behavior and disorganized attachment. Of the four mothers of infants classified as disorganized, three (75%) engaged in FR behavior, however five of the seven (71%) parents of organized infants also engaged in FR behavior.

On the basis of this initial pilot study, Schuengel et al. (1999) conducted a second study of 85 low-risk, middle upper class mother–infant dyads. The sample was composed solely of participants whose trauma was the result of an attachment-related loss. AAI's were collected when the infants were 12 months of age, Strange Situations were conducted when the infants were 14–15 months, and maternal behavior was assessed when the infants were 10–11 months of age. A scale for FR behavior was developed based on examples described in Main and Hesse's (1992) FR behavior coding system that included three subscales: frightening, dissociated, and frightened/deferential behavior, as well as a summary score for disorganizing behavior. They found that unresolved loss predicted disorganized attachment among mothers with non-autonomous representations but not among mothers with autonomous representations of attachment. Mothers classified as unresolved with a secondary non-autonomous classification (i.e., unresolved/dismissing or unresolved/preoccupied) exhibited more FR behavior than mothers classified as unresolved but otherwise autonomous on the AAI, suggesting a protective role for autonomous states of mind. Results for the disorganized versus organized contrasts revealed that mothers in disorganized attachment relationships displayed significantly higher levels of FR behavior than did mothers of infants who showed one of the organized patterns of attachment. On the level of the subscales, dissociative behavior was the only subcategory of the FR coding system significantly related to attachment disorganization (Schuengel, 1997; Schuengel et al., 1999). The authors also examined the relation between factors such as maternal sensitivity (using the Maternal Behavior Q-Sort; Pederson & Moran, 1995), severity of loss,

dissociative experiences (using the Dissociative Experience Scale; Bernstein & Putnam, 1986), and maternal FR behavior. No significant associations were revealed.

The Main and Hesse (1992) coding scheme was used cross-culturally by True et al. (2001) in a mother–infant study of the Dogon ethnic group of Mali, West Africa. Forty-two mother–infant pairs were observed interacting with their 10.5 to 12-month-old infants in home and clinic settings. Maternal behavior was assessed using the weigh-in segments of well infant exams; once several weeks before the Strange Situation paradigm and once several weeks later. The authors reported that mothers in disorganized relationships displayed significantly higher levels of FR behavior ratings than mothers in secure relationships. FR behavior explained approximately 13% of the variance in attachment disorganization.

Jacobvitz et al. (2006) used an adapted version of Main and Hesse (1995) 9-point coding scheme on a sample of 113 low-risk community mothers and their infants. AAI's were administered prenatally and mother–infant pairs were observed when the infants were 8 months old in a 30–40 minute structured and potentially stressful context that included a feeding session, a play session, and a diaper changing session. Of the 23 mothers classified as unresolved, 11 (48%) engaged in FR behavior. Only 11 of the 87 (13%) non-unresolved mothers engaged in FR behavior. Furthermore, Jacobvitz et al. found that mothers classified as unresolved displayed significantly higher levels of FR behavior than mothers with non-unresolved states of mind. Mothers with unresolved/autonomous states of mind were less likely to display FR behavior than their unresolved/insecure counterparts. In addition, the authors reported that, independent of unresolved status, mothers who lost a parent anytime during their lives engage in significantly more FR behavior than those who did not lose a parent. Finally, the authors examined the association between FR behavior and maternal sensitivity and found a significant but modest negative association, indicating some overlap between the two caregiving patterns (Jacobvitz et al., 2006).

Abrams et al. (2006) applied Main and Hesse's (1998) more recent FR coding system on a low-risk community sample of sample of 75 parent–infant dyads (25 fathers, 50 mothers). Parental FR behavior was observed two weeks prior to the Strange Situation (55 infants were 12 months old and 20 infants were 18 month old at the time of assessment) during approximately 18 minutes of mildly stressful play sessions in which parents were instructed to prohibit their infants from touching several objects, followed by 12 minutes of a more structured parent–child interaction involving a stranger dressed as a clown. AAI's were administered when the infants were 6 years of age ($N = 31$). Abrams et al. found that parents who were Unresolved in discussion of loss or abuse more frequently engaged in FR behaviors. Of the six parents classified as unresolved, four (67%) were placed in the FR category whereas only two of the 26 (8%) non-unresolved parents were categorized as FR. Of the 23 mothers of infants classified as disorganized, 13 (56%) were placed in the FR category; whereas only two of the 50 (4%) parents of organized infants were categorized as FR. Furthermore, the parents in disorganized relationships displayed significantly higher FR behaviors ratings than parents in organized attachment relationships, in particular dissociative behaviors. Dissociative parental behavior was exhibited by 20 out of 23 (87%) parents with disorganized infants.

Buettner, Hieber, and Grossmann (1997) examined FR behavior in approximately 50 mother–infant dyads during interactions in the Strange Situation. The authors failed to find an association between FR behavior and disorganized attachment.

Studies of disrupted parental behavior. The AMBIANCE measure is used to code disrupted caregiver behavior during videotaped caregiver–infant interactions. To capture disrupted

behavior as completely as possible, a descriptive and thorough narrative of the caregiver–infant interaction is recorded. After recording all instances of disrupted behaviors, a frequency score is derived for each of the five dimensions of the AMBIANCE: affective communication errors, role/boundary confusion, fearful/disorientation, intrusive/negative, and withdrawing behavior. The AMBIANCE coding system also involves a continuous 7-point scale, labeled the global level of disrupted communication, where 1 equals high normal behavior, 3 is low normal, 5 is clear evidence of disruption in affective communication, and 7 equals disrupted communication with few or no ameliorating behaviors. The global level of disrupted communication score is assigned based on the frequency and intensity of disrupted behaviors displayed by the caregiver. A binary classification is then assigned based on the 7-point level of disrupted caregiver behavior, where scores of 5 or above are classified as ''disrupted'' and scores of less than 5 are classified as ''not-disrupted.''

Adaptations to Bronfman et al.'s (1992–2004) AMBIANCE coding system were performed by Madigan, Evans, Bento, Oliphant, Pederson, and Moran (2004). In an attempt to circumvent psychometric problems associated with frequency count analyses, Madigan et al. (2004) developed 7-point qualitative rating scales for each of the five dimensions of the AMBIANCE. The dimension ratings were developed based on Bronfman et al.'s (1992–2004) original 7-point scale for the global level of disrupted communication, emphasizing the intensity and frequency of behaviors associated with each dimension.

Lyons-Ruth et al. (1999) applied the AMBIANCE coding scheme to a sample of 65 low-income, disadvantaged mothers and their 18-month-old infants. The authors coded disrupted behavior during mother–infant interactions in the Strange Situation. Mothers in disorganized relationships were more likely than mothers in organized relationships to display disrupted interactive behavior with their infants, in particular more affective communication errors. Within this group of disorganized relationships, there were differences in the patterning of disrupted behavior: mothers of infants who were disorganized/secure were more likely to exhibit withdrawal, whereas mothers of those who were disorganized/insecure had elevated scores on the role/boundary confusion and intrusive/negative dimensions.

Lyons-Ruth, Yellin, Melnick, and Atwood (2005) examined associations between disrupted behavior expressed in the Strange Situation and unresolved states of mind, assessed when children were 7–8 years old ($N = 45$) using the same sample of mothers as Lyons-Ruth et al. (1999). The authors reported that unresolved states of mind tended to be associated with the global level of disrupted communication.

Goldberg et al. (2003) explored the association between unresolved states of mind and disrupted maternal behavior in two low risk community samples totaling 197 mother–infant dyads. Expectant primiparous mothers were administered the AAI during the third trimester of pregnancy and disrupted behavior was observed in the Strange Situation when the infant was 12 months of age. Of the 46 mothers classified as unresolved, 20 (44%) were in disorganized attachment relationships with their infants and 126 of the 151 (83%) non-unresolved mothers were in organized relationships with their infants. Analyses examining the association between unresolved states of mind and disrupted maternal behavior revealed that, of the 46 mothers classified as unresolved, 24 (52%) were disrupted in mother–infant dyadic interaction whereas only 53 of the 151 (35%) non-unresolved mothers were categorized as disrupted. Moreover, mothers with unresolved states of mind displayed significantly higher levels of disrupted communication, fearful/disorientation behavior, and withdrawal behavior. There were, however, no significant differences between autonomous and non-autonomous mothers within the Unresolved group. For the disorganized versus organized contrasts, Goldberg et al. reported that 28 of the 45 (62%) infants classified as

disorganized had mothers classified as disrupted whereas only 46 (32%) of the 151 organized infants had mothers classified as disrupted. Mothers in disorganized attachment relationships also had higher levels of disrupted communication than mothers whose infants displayed organized attachment patterns. Goldberg et al. tested the mediation model proposed by Main and Hesse (1990) but found that disrupted maternal behaviors did not account for a significant portion of the association between unresolved states of mind and disorganized attachment. Goldberg et al. suggested that their failure to find evidence of such mediation could be attributed to the small numbers of cases of unresolved mothers and disorganized dyads in their low-risk community sample.

Grienenberger et al. (2005) observed mother–infant interactions in 45 low-risk middle-upper class dyads. Maternal attachment status was assessed prenatally. Similar to initial research utilizing the AMBIANCE (Goldberg et al., 2003; Lyons-Ruth et al., 1999), the authors coded disrupted maternal behavior during mother–infant interactions in the Strange Situation when the infants were 14 months of age. Results revealed that mothers in disorganized and resistant attachment relationships displayed significant higher levels of disrupted communication than mothers in secure attachment relationships. Therefore, the AMBIANCE was not successful at differentiating disorganized and resistant attachment, which may indicate a lack of discriminant validity. The authors also demonstrated that disrupted maternal behavior mediated the relationship between maternal reflective functioning (Fonagy & Target, 2005) and infant attachment.

Kelly, Ueng-McHale, Grienenberger, and Slade (2003) examined associations between disrupted behavior, assessed at 4 months during a 10 minute face-to-face interaction in the laboratory, and disorganized attachment, using the same sample of mothers as Grienenberger et al. (2005). Of the nine infants later classified as disorganized, six (67%) were classified as disrupted whereas only six of the 38 (16%) mothers of organized infants were categorized as disrupted. Furthermore, the mothers in disorganized relationships displayed significantly higher disrupted communication ratings than mothers in organized attachment relationships.

Madigan et al. (2006) examined the occurrence of disrupted patterns of maternal interaction in a high-risk sample of 82 adolescent mother–infant dyads. AAI's were conducted in the mother's home when the infants were 6 months old and Strange Situations were conducted when the infants were 12 months old. Of the 29 mothers classified as unresolved, 23 (79%) were in disorganized attachment relationships with their infants and, correspondingly, 28 of the 53 (53%) non-unresolved mothers were in organized relationships with their infants. Unlike previous studies utilizing the AMBIANCE coding scheme (Goldberg et al., 2003; Grienenberger et al., 2005; Lyons-Ruth et al., 1999), Madigan et al. (2006) examined disrupted behavior outside of the Strange Situation during two 3-minute play situations immediately following the assessment paradigm. The first 3-minute play session was conducted without toys and the second with a standard set of toys. In the play session without toys, 20 of the 29 (69%) mothers classified as unresolved were classified as disrupted and 24 of the 53 (45%) non-unresolved mothers were classified as disrupted. In the play session with toys, nine of the 29 (31%) mothers classified as unresolved were classified as disrupted and 10 of the 53 (19%) non-unresolved mothers were classified as disrupted. No significant differences between the unresolved and non-unresolved mothers were found on the five dimensions of disrupted maternal behavior. Results for the disorganized versus organized contrasts revealed a robust link between an adolescent mothers' display of disrupted behavior and the development of a disorganized attachment relationship, particularly in the play session without toys. In the play without toys, 36 of the 48 (75%) disorganized infants had mothers classified as disrupted whereas only eight of the

34 (24%) organized infants had mothers classified as disrupted. In the play session with toys, 16 of the 48 (33%) disorganized infants had mothers classified as disrupted whereas only three of the 34 (9%) organized infants had mothers classified as disrupted. In the play session without toys, mothers in disorganized relationships had higher levels of overall disrupted communication, reflected in elevated levels (based on Madigan et al.'s 2004 7-point qualitative dimension rating scales) of affective communication errors, role/boundary confusion, fearful/disorientation, and intrusive/negative behavior than mothers in organized relationships. In the play session with toys, mothers in disorganized relationships had higher levels of overall disrupted communication, reflected in elevated levels of affective communication errors and fearful/disorientation behavior. A mediational analysis suggested that disrupted behavior displayed in the play session without toys statistically mediated the association between unresolved status and disorganized attachment relationships.

Evans, Forbes, Bento, Moran, Pederson, and DeOliveira (2003) examined associations between disrupted behavior, assessed at 24 months old during a 5-minute play period followed by a 3-minute long introduction of a potentially fear-evoking remote-controlled toy spider, and disorganized attachment assessed in the same situation at 24 months old, using the same sample of mothers as Madigan et al. (2006). Of the 32 infants classified as disorganized, 25 (78%) were classified as disrupted whereas only 14 of the 52 (27%) mothers of organized infants were categorized as disrupted. Furthermore, the mothers in disorganized relationships displayed significantly higher levels of overall disrupted communication, reflected in elevated levels of affective communication errors and withdrawal behavior.

Stability of anomalous maternal behavior. Three studies examined the stability of disrupted maternal behavior, each utilizing Bronfman et al.'s (1992–2004) AMBIANCE coding scheme. Kelly et al. (2003) examined the stability of disrupted maternal behavior over 10 months in a sample of 49 middle-income mother–infant dyads. Disrupted maternal behavior was first observed at 4 months old during a 10-minute face-to-face interaction in the laboratory and again at 14 months old during the Strange Situation paradigm. The authors found that 54% of mothers classified as disrupted at 4 months maintained a stable classification of disrupted at 14 months, whereas 86% maintained a classification of not-disrupted from 4 to 14 months.

Benoit, Voci, Madigan, and Goldberg (2003) examined the stability of disrupted behavior over a 6-year period in a sample of 83 mother–infant dyads. Disrupted maternal behavior was first observed at 12 months during the Strange Situation paradigm and again at 7 years during a mother–child play session conducted immediately following a 1-hour separation. The authors found that 87% of mothers classified as disrupted at 12 months maintained a stable classification of disrupted at 7 years and that 87% also maintained a stable classification of not-disrupted from 12 months to 7 years. Moreover, a significant correlation was revealed between the mothers' level of disrupted communication at 12 months and 7 years.

Forbes, Evans, Moran, and Pederson (2005) examined the stability of disrupted behavior over 12 months in a high-risk sample of 71 adolescent mother–infant dyads. Disrupted maternal behavior was first observed at 12 months during a 6-minute play session and again at 24 month during a 5-minute play period, followed by a 3-minute long introduction of a potentially fear-evoking remote-controlled toy spider. The authors found that 51% of mothers classified as disrupted at 12 months maintained a stable classification of disrupted at 24 months and 67% maintained a classification of not-disrupted from 12 to 24 months. Moreover, a significant correlation was revealed between the mothers' level of disrupted communication at 12 and 24 months.

Meta-analytic review

Several studies in the narrative review were based on overlapping samples of participants. To avoid confounding the meta-analytic results by including the same participants more than once, we chose to use the original report from each cohort. When data from multiple time points existed (e.g., Evans et al., 2003; Kelly et al., 2003), we reported these findings in the stability section of the meta-analysis. The selection procedure for the meta-analysis has yielded six studies that report on all relevant variables, unresolved states of mind, anomalous behavior, and disorganized attachment; one study that reports exclusively on the association between anomalous behavior and unresolved states of mind; three studies reporting exclusively on the association between anomalous behavior and disorganized attachment; and three studies of the stability of disrupted behavior. Of the studies included in the meta-analysis, nine have been published, one study is currently under review and two are unpublished.

Coding system. A standard coding system was used to rate each study on sample, measure, and outcome (see Table I). The following were coded as sample characteristics: (1) sample size; (2) features involving the family (e.g., clinical reference or at high-risk due to a combination of risk factors such as poverty, social isolation and single parenthood). The following were coded as measure characteristics: (1) the observational system used (i.e., FR or AMBIANCE); (2) whether dissociation or maternal sensitivity was also observed;

Table I. Coding system for the studies included in the meta-analytic sample.

N	Sample size for which results on anomalous parental behavior are reported
SES	0 = high/middle 1 = low
Risk	0 = low risk sample 1 = high risk sample
Country	1 = USA 2 = Canada 3 = Europe 4 = Other
Age	Age of child in months when the AAI was administered, when caregivers were observed for anomalous behavior, and when participating in the Strange Situation
Disorganized	Percentage of disorganized attachment in the sample
	Measure
Anomalous behaviour measure	0 = FR coding system (Main & Hesse, 1990) 1 = AMBIANCE coding system (Bronfman et al., 1992–2004)
Observed caregiver	0 = mother 1 = father 2 = other
Setting	0 = during part of the Strange Situation Procedure 1 = not in Strange Situation Procedure
Type of observation	0 = unstructured 1 = structured
Play material	0 = no toys available 1 = toys available

Notes: SES = Socioeconomic Status.

(3) whether the observation took place in the home or in the laboratory; (4) whether it was the mother or father being observed; (5) whether the observation was unstructured or structured; and (6) whether the observation session occurred with or without the use of play material. All studies were coded independently by two out of three coders (SM and either MBK or MHVIJ). Reliability was adequate, intraclass correlations ranged from .84 $\sim$ 1.00 (mean .98). Disagreements were discussed and the final coding reflected the consensus of the two coders.

Data analysis. The outcomes of all studies included in the meta-analysis were re-computed with Mullen's (1989) Advanced BASIC Meta-analysis program, and when necessary transformed into *r*. The resulting set of effect sizes were inserted into Borenstein, Rothstein, and Cohen (2004) Comprehensive Meta-Analysis (CMA) program that computed fixed as well as random effect model parameters. CMA also computed confidence intervals around the point estimate of an effect size. The 95% confidence boundaries are presented in Figure 1.

Significance tests and moderator analyses in fixed effects models are based on the assumption that differences between studies leading to differences in effects are not random, and that, in principle, the set of study effect sizes is homogeneous at the population level. Significance testing is based on the total number of participants, but generalization is restricted to other participants that might have been included in the same studies of the meta-analysis (Rosenthal, 1995). Statistical inferences may be regarded as applying only to the specific set of studies at hand (Cooper & Hedges, 1994). In random effects models this assumption is not made (Hedges & Olkin, 1985), and they allow for the possibility that each separate study has its own population parameter. In random effects models significance testing is based only on the total number of studies and generalization is to the population of studies from which the current set of studies was drawn (Rosenthal, 1995). It has been argued that random effects models more adequately mirror the heterogeneity in behavioral studies, and use non-inflated alpha levels when the requirement of homogeneity has not been met (Cooper & Hedges, 1994).

The Q-statistics are presented to test this homogeneity of the specific set of effect sizes (see Table II), and also to test the significance of moderators (Borenstein et al., 2004; Mullen, 1989; Rosenthal, 1995). Asterisks for *Q* indicate heterogeneity of the specific set of effect sizes. From Table II it can be derived that several sets of outcomes were heterogeneous. In these cases, the random effects model parameters (significance, confidence intervals) were presented (see Table II); they are somewhat more conservative than the fixed effects parameters. When one of the subsets of outcomes was heterogeneous, the significance of the moderator tests were also based on the random effects model. When both subsets of outcomes were homogeneous (e.g., contrasting the setting in which anomalous parenting had been observed), effect sizes, confidence intervals, and moderator tests were presented in the context of fixed effects models.

Potential publication bias was estimated using the Duval and Tweedie (2000) trim-and-fill method that is available in CMA. In a funnel plot each study's effect size is plotted against its precision (1/SE). The plot is shaped as a funnel if there is no publication bias. However, small studies or studies with negative or non-significant results tend to be unpublished, and this is shown in an absence of studies in the bottom left-hand corner of the funnel plot. In the trim-and-fill method, the studies located right from the funnel are considered to be symmetrically unmatched and their missing counterparts are input as mirror images of the trimmed outcomes. A new, adjusted combined effect size (with confident intervals) can be computed, reflecting the combined effect size when no publication bias would have been present. The robustness of the combined effect size was

also examined by computing the fail-safe number, that is the number of studies with null results that would be needed to change the effect size into a non-significant outcome (Mullen, 1989; Rosenthal, 1991).

Results

Stability. The stability of anomalous parental behavior was assessed in three studies (Benoit et al., 2003; Forbes et al., 2005; Kelly et al., 2003). The combined effect size ($k = 3$, $N = 203$) for the stability over a period ranging from 10 to 72 months was $r = .56$ ($p < .01$) in a heterogeneous set of outcomes (CI .35 ~ .71). All studies used the AMBIANCE measure.

Unresolved trauma and anomalous parental behavior. The overall combined effect size for the association between unresolved trauma and anomalous parental behavior ($k = 7$, $N = 553$) was $r = .26$ ($p < .01$) in a heterogeneous set of outcomes (CI .10 ~ .40), see Figure 1. The fail-safe number for this combined effect size was 46, that is, 46 studies with null results would be needed to cancel out the combined effect size. The funnel plot showed that there was some publication bias. With the trim-and-fill procedure, one study was trimmed and replaced ($L_O = 1$), resulting in an adjusted effect of $r = .23$ ($p < .05$; CI .08 ~ .38). Four

Table II. Meta-analytic results for the associations between unresolved loss, anomalous parental behavior, and disorganized infant attachment.

	k	*N*	*R*	95% CI	*Q*	*p*
Anomalous parenting						
stability	3	203	.56***	.35 ~ 71	6.70*	
U – Anomalous parenting						
Total group	7	553	.26**	.10 ~ .40	17.29**	
Coding system						
FR	4	242	.28*	.03 ~ .50	14.20**	
Ambiance	3	311	.20***	.09 ~ .30	3.09	
Anomalous parenting – D						
Total group	9	644	.34***	.23 ~ .44	17.04*	
Coding system					0.11[1]	.74
Fr	6[2]	325	.32***	.17 ~ .46	16.65**	
Ambiance	4[2]	384	.35***	.26 ~ .44	0.39	
Sample						
Low risk	7	497	.33***	.19 ~ .46	16.68*	
High risk	2	147	.37***	.22 ~ .50	0.29	
Percentage disorganized					0.78[1]	.38
Less or equal to 25%	4	326	.30***	.20 ~ .40	5.49	
More than 25%	5	318	.39***	.23 ~ .52	9.87*	
Setting					2.47[1]	.12
SSP	4	352	.30***	.20 ~ .39	5.23	
Not in SSP	5	292	.41***	.31 ~ .50	9.35	
U – D						
Total Group	6	495	.21*	.05 ~ .36	11.87*	

Notes: k = number of studies; r = effect size; CI = confidence interval of the effect size. Contrasts were tested for subgroups with more than three studies; U = unresolved; D = disorganized; SSP = Strange Situation Procedure; U-D = Unresolved-Disorganised.

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

[1]Q for the contrast.

[2]Lyons-Ruth, Bronfman, & Parsons (1999) included.

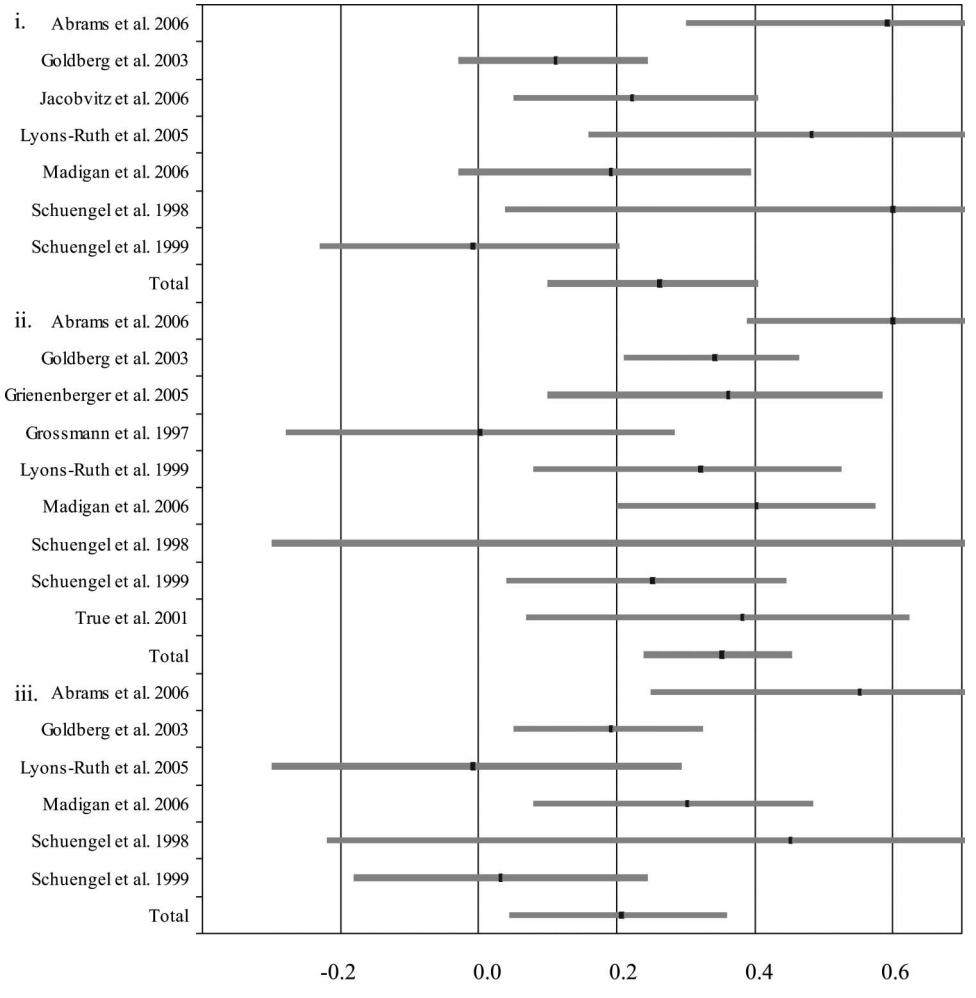

Figure 1. Association between: (i) unresolved states of mind and anomalous behavior; (ii) anomalous behavior and disorganized attachment; and (iii) unresolved states of mind and disorganized attachment: effect sizes and confidence intervals.

studies (Abrams et al., 2006; Jacobvitz et al., 2006; Schuengel et al., 1998, 1999) with a total of 242 parent–child dyads used the FR measure. The combined effect size for these studies was $r = .28$ ($p < .05$) in a heterogeneous set of outcomes (CI .03 ~ .50). The three studies (Goldberg et al., 2003; Lyons-Ruth et al., 2005; Madigan et al., 2006) using the AMBIANCE showed a similar combined effect size ($N = 311$), $r = .20$ ($p < .01$), but in a homogeneous set of outcomes (CI .09 ~ .30).

Anomalous parental behavior and infant disorganized attachment. The combined effect size for the association between anomalous parental behavior and infant disorganized attachment was based on the largest set of outcomes ($k = 9$, $N = 644$), and it amounted to $r = .34$ ($p < .01$) in a heterogeneous set of outcomes (CI .23 ~ .44), see Figure 1. The fail-safe number for this combined effect size was 152, that is, 152 studies with null results would be needed to cancel out the combined effect size. The funnel plot showed that there was no publication bias.

Six studies (Abrams et al., 2006; Buettner et al., 1997[2]; Lyons-Ruth et al., 1999; Schuengel et al., 1998, 1999; True et al., 2001) with a total of 325 parent–child dyads used the FR coding system. The combined effect size for these studies was $r = .32$ ($p < .01$) in a heterogeneous set of outcomes (CI .17 ~ .46). Separate effect sizes for the use of both coding systems could be derived from one of the studies (Lyons-Ruth et al., 1999). The combined effect size for the studies using the AMBIANCE was thus based on four studies (Goldberg et al., 2003; Grienenberger, 2005; Lyons-Ruth et al., 1999; Madigan et al., 2006), with a total of 384 parent–child dyads. The combined effect size for these studies was $r = .35$ ($p < .01$), in a homogeneous set of outcomes (CI .26 ~ .44). The contrast between the studies using the two different coding systems was not significant ($Q = 0.11$, $p = .74$).

The risk status of the sample appeared not to affect the strength of the association between anomalous parental behavior and disorganized attachment. The combined effect size of .37 ($p < .01$) in at risk samples including multiproblem and adolescent mothers ($k = 2$, $N = 147$) was similar to the combined effect size in low risk samples ($k = 7$, $N = 497$) of .33 ($p < .01$). In the same vein, the percentage of disorganized attachment in the sample was not associated with the effect size. The combined effect size of .39 ($p < .01$) in samples with more than 25% disorganized attachments ($k = 5$, $N = 318$) was not significantly different from the combined effect size of .30 ($p < .01$) in samples with less disorganization ($k = 4$, $N = 326$).

Since the set of studies did not show sufficient variance regarding caregiver (father or mother) and type of observation (structured or unstructured, with or without play material available), the moderating effects of these variables could not be tested. Two types of settings of the observation of anomalous parenting behavior were distinguished, studies with observations of anomalous parenting in episodes of the Strange Situation, and studies with observations of independent parent–infant interaction settings (e.g., during free play in the lab, or during home visits). The studies using observations during the Strange Situation ($k = 4$, $N = 352$) showed a combined effect size of $r = .30$ ($p < .01$) in a homogeneous set of outcomes (CI .20 ~ .39), and the studies with observations of anomalous parenting in other settings ($k = 5$, $N = 292$) showed a combined effect size of $r = .41$ ($p < .01$), also in a homogeneous set of outcomes (CI .31 ~ .50). The contrast was not significant ($Q = 2.47$, $p = .12$).

Unresolved trauma and disorganized attachment. In six studies, the full model of unresolved trauma, anomalous parental behavior, and disorganized attachment was tested, see Figure 2. The overall combined effect size for the association between unresolved trauma and disorganized attachment in this set of studies ($k = 6$, $N = 495$) was $r = .21$ ($p < .01$) in a heterogeneous set of outcomes (CI .05 ~ .36). The combined effect size of $r = .31$ reported in the van IJzendoorn et al. (1999) meta-analysis on unresolved trauma and disorganized attachment was somewhat larger but within in the boundaries of the confidence interval of the effect in the current set of studies. The failsafe number for the combined effect size in the current study was 21, that is, 21 studies with null results would be needed to cancel out the combined effect size. The funnel plot showed that there was no publication bias. All studies used the same instruments.

Discussion

Through a meta-analysis of 12 studies including 851 families, we examined the associations between the expression of anomalous parental behavior, unresolved states of mind, and

disorganized attachment relationships. We found moderate effect sizes for the associations for unresolved state of mind with anomalous parenting ($r = .26$) and disorganized attachment ($r = .21$), and for anomalous parenting with disorganized attachment ($r = .34$). A sense of the magnitude of these associations can be obtained by considering that the combined effect size of $r = 0.34$ generates an Odd's Ratio of 3.7 (CI 2.3 $\sim$ 6.0), suggesting that a child who has experienced anomalous parental behaviors is almost four times more likely to form a disorganized attachment than a child whose mother does not display such behavior. By way of comparison, the association between a genetic risk factor and disorganization, the correlation between the presence of the 7-repeat polymorphism of the dopamine D4 receptor gene (DRD4) and disorganized attachment was found to be $r = .16$ in two combined samples ($N = 227$) (van IJzendoorn & Bakermans-Kranenburg, 2004).

Thus, the model originally proposed by Main and Hesse (1990) derives considerable support from our meta-analytic findings. Nevertheless, much of the variance in disorganized attachment still remains to be explained. In Figure 2 we summarize the meta-analytic associations. It can be seen from this figure that only a small part of the variation in disorganized attachment is accounted for by anomalous parenting or unresolved state of mind. Furthermore, the results indicate that anomalous parental behavior mediates a similarly small portion of the association between unresolved states of mind and disorganized attachment ($.26 * .34 = .09$).

This meta-analytic finding of a transmission gap between unresolved state of mind and infant disorganized attachment is analogous to the transmission gap in organized attachment strategies (van IJzendoorn, 1995). Thus other factors yet to be uncovered must mediate the influence of unresolved states of mind on disorganization of attachment. Genetic factors may be relevant, although behavior genetic evidence does not point in that direction (Bokhorst, Bakermans-Kranenburg, Fearon, van IJzendoorn, Fonagy, & Schuengel, 2003). As an alternative, the interplay between genetic vulnerability and experiences with anomalous parenting may be important in explaining why some children are affected by anomalous parenting whereas others remain resilient. Investigation of interactions between infant factors (e.g., temperamental characteristics), family variables (e.g., marital discord), and parental factors (e.g., mental health), may also constitute valuable domains for further exploration.

It is noteworthy that the association between unresolved state of mind and disorganized attachment of $r = .21$ observed in the current analysis was based on considerably fewer studies than were examined in the previous meta-analysis (van IJzendoorn, 1995). That analysis of non-overlapping studies obtained a somewhat larger correlation, $r = .31$, between the same two variables (van IJzendoorn, 1995). If we were to insert this larger effect size as an estimate of the association in the mediator model, the transmission gap clearly would increase. Additionally, Hesse and Main (2006) have recently reported that since van IJzendoorn's (1995) meta-analysis, there have been at least 12 further studies documenting a link between parental unresolved state of mind and disorganized infant attachment status.

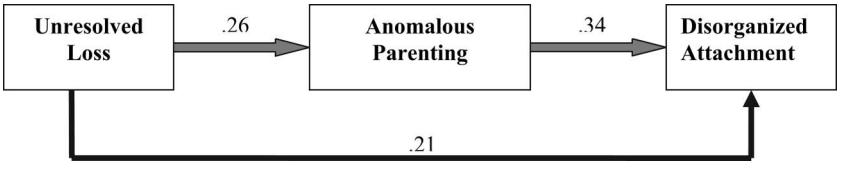

Figure 2. Unresolved loss, anomalous parental behavior, and disorganized infant attachment: A meta-analytic model of the transmission gap.

Consideration of these studies in an estimation of the unresolved/disorganization link may contribute even further to its strength and to the size of the unexplained gap in transmission.

We also tested the influence of sample, context, and assessment characteristics on these associations, and found that the associations are robust. The strength of the associations does not differ significantly whether or not the study was conducted in families at risk, whether the percentage of disorganized infants in the sample was higher or lower, or whether the AMBIANCE or FR coding system is used. Thus, the meta-analyses do not allow for an evidence-based choice between the AMBIANCE and FR system. The combined effect sizes of both systems are small to moderate and do not differ significantly. From a statistical point of view, then, one may use both systems with equal success.

Despite the absence of an empirical basis for discriminating between the two systems, there are two issues of validity that deserve consideration. First, the AMBIANCE incorporates and extends the FR system with the goal of better predicting attachment disorganization. Haynes and Lench (2003) emphasized the role that incremental validity (Sechrest, 1963) should play in the evaluation of such an instrument, that is, the degree to which the instrument provides assessments that are more valid than existing measures of the same construct. Ideally, the narrow measure and the broader measure should be completed in the same study, and hierarchical regression should make clear whether and how much unique additional variance is predicted above and beyond the more narrow instrument. Such an analysis has not been conducted in the only study that used both coding systems for predicting disorganized attachment (Lyons-Ruth et al., 1999). They reported identical effect sizes for both systems. In the same vein, the fact that we did not find a significant meta-analytic difference between the FR and AMBIANCE systems in favor of the latter, whereas both systems appear to be correlated, seems to be incompatible with strong incremental validity.

More specifically, the issue concerns content validity. That is, anomalous parenting as measured with the FR system and disorganized attachment as assessed with the Main and Solomon (1990) system have dissociative tendencies in common, albeit at different levels of development (Hesse & Main, 2006). With equal predictive validity, the principle of Occam's razor (Boyd, Gasper, & Trout, 1991) favors a measure that includes the smallest number of dimensions connected in the most coherent way because it implies a more frugal explanatory model of, in this case, disorganization of infant attachment based on dissociative and otherwise frightening dimensions of parenting. However, for both systems it remains crucial to demonstrate their discriminant validity. The important question here is whether they are equally effective in differentiating disorganized attachments, not only from secure attachments, but also from the various types of organized, insecure attachments, in particular from insecure-resistant attachments (for a review of this issue, see Hesse & Main, 2006). The current database of pertinent studies is too small to definitely address these validity issues.

Recent studies have underscored the importance of observing caregiver–infant dyads in conditions of stress (e.g., play without the use of toys) in order to increase the likelihood of observing collapses in the caregivers' behavioral strategies and idiosyncrasies during brief periods of time (Abrams et al., 2006; Madigan et al., 2006). Although the Strange Situation is an ideal paradigm for the observation of the activation and collapse of the attachment system, its suitability for assessing both infant and caregiver behavior can be questioned. It has been suggested that observing anomalous parental behavior *during* the Strange Situation procedure raises the possibility of common method variance that could lead to contamination with the observation of infant attachment behavior during the same procedure, as the interaction that forms the basis for the assessment of anomalous parenting (see Lyons-Ruth et al., 1999) includes the reunion episodes that are critical for

assessing the attachment relationship. Such a situation is open to the suggestion that the assessment of maternal behavior could be unintentionally influenced by the fact that the coder unavoidably witnesses disorganized infant behavior throughout the procedure. Contrary to expectations that would arise from this logic, the current meta-analysis found that associations between anomalous parenting and disorganized infant attachment tended to be weaker rather than stronger in studies using the Strange Situation procedure for the assessment of both than that observed in studies using distinct coding venues.

The current investigation suggests a number of lines of research that might profitably be followed on the basis of hypotheses emerging from its results. First, our findings indicate that only a small portion of the variation in disorganized attachment is explained by anomalous parenting behavior. The FR and AMBIANCE measures are comprehensive coding systems that cover a wide range of anomalous parenting behaviors. Paradoxically, however, this breadth may actually diminish their ability to explain the association between unresolved states of mind, anomalous behavior and disorganized attachment. Their explanatory power will be enhanced by investigations that identify those components or behavioral indices of anomalous behavior that are most directly implicated in the development of disorganized attachment relationships. Promising studies by Abrams et al. (2006), Schuengel (1997; see also Schuengel et al., 1999), and Madigan et al. (2006), have suggested that behavioral displays of dissociation (FR system) and fearful/disorientation behaviors (AMBIANCE system) are the components most likely to play this role. However, these authors have also found associations, although less robust, between disorganization and other aspects of anomalous behavior. Further exploration and more vigorous analyses of the categories and dimensions of anomalous behavior are particularly warranted then, to enhance our understanding of the patterns of anomalous behavior associated with disorganized attachment.

Second, although coding systems for anomalous parenting appear to be rather stable and reliable, the measurement of these elusive behaviors needs to be further improved, for example in stressful and demanding settings (such as in Abrams et al., 2006, and Madigan et al., 2006) separate from the assessment of disorganized attachment. Standardization of the setting may be important to the more systematic accumulation of knowledge and insight.

Third, there is a notable dearth of knowledge and research regarding the role of the father's state of mind and behavior in the development of attachment relationships. Researchers have demonstrated that the mechanisms involved in the development of attachment relationships may differ for mothers and fathers. For example, it has been well documented that sensitivity is implicated in the development of secure mother–infant patterns of attachment, however, sensitivity is a weaker predictor of secure infant–father attachment (Easterbrooks & Goldberg, 1984; Volling & Belsky, 1992; see van IJzendoorn & De Wolff, 1997, for a meta-analysis). It is imperative that we enhance our understanding and conceptualization of father–infant attachment relationships, including how it relates to the display of anomalous behavior and the subsequent development of disorganized attachment. Only one of the studies available for this meta-analysis included fathers (Abrams et al., 2006). Clearly, involving both parents would provide a particularly welcome window on the broader complexities of the origins of disorganized attachment relationships.

Finally, the search for other parental factors or influences from the wider environment should be addressed in order to more fully understand the mediating process between unresolved states of mind and disorganized attachment relationships. The large role of the unique environment suggested by the results of recent behavior genetic studies of disorganization (Bokhorst et al., 2003) calls for a particular focus on child-specific experience in development. Molecular genetic studies may also prove fruitful, especially

with a focus on gene-environment interactions, for example between DRD4 polymorphisms and anomalous parenting (Bakermans-Kranenburg & van IJzendoorn, 2004, 2006). It is also possible that elaborations of existing assessments of maternal representations of attachment, such as hostile/helpless parental states of mind with respect to attachment (Lyons-Ruth, Yellin, Melnick, & Atwood, 2003; Lyons-Ruth et al., 2005), may augment our understanding and provide further insight into the transmission between states of mind and attachment relationships. Additional directions for the investigation of the role of related representational processes in the transmission of attachment are suggested by the work on reflective function (Fonagy & Target, 2005) and mind-mindedness (Meins, Fernyhough, Fradley, & Tuckey, 2001) that may involve somewhat different behavioral implications than observed in the FR and AMBIANCE systems.

Limitations

The current set of meta-analyses has some limitations. The number of studies was small and its power to find significant moderator effects correspondingly low. More studies are needed to settle issues around caregiver and context of assessment. The study designs diverged, and sub-sets defined by moderators consequently included even smaller numbers of participants and studies. The current review and meta-analysis provide a description of the momentary state-of-the-art, and should be considered heuristic.

Clinical implications

The studies reviewed here are correlational and causal inferences are therefore logically precluded. Attempts to experimentally manipulate anomalous parenting in a random manner to better understand such processes clearly are out of the question. Therapeutic intervention, however, can sometimes serve the secondary purpose as a quasi-experimental analysis of causal mechanisms. There is some suggestion, for example, that the probability of the emergence of disorganization can be reduced by sensitivity-focused interventions (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2005). These authors have speculated that such interventions teach the parents to focus on their child's behavior more closely, thus leaving less room for absorption or dissociation into past traumatic experiences in the presence of the child.

In extensions of this line of research, recent studies have begun to demonstrate that coding systems measuring anomalous behavior serve as potent tools for assessing clinical efficacy in attachment-based interventions (Benoit, Madigan, Lecce, Shea, & Goldberg, 2001; Madigan, Hawkins, Benoit, & Goldberg, in press). There is currently, however, a dearth of intervention-based research targeting the caregiver's propensity to engage in anomalous behavior (Bakermans-Kranenburg et al., 2005). The most intriguing area for future investigation, then, is the development and evaluation of an intervention program aimed specifically at reducing the caregivers' display of anomalous behavior to mitigate the risk of disorganized attachment. This will be of particular import in high-risk and clinically-based populations, where infants are at a substantial risk of developing disorganized attachment relationships with their caregivers.

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Notes

1 Data on Strange Situation behavior was missing for one dyad.
2 Sample size was estimated. Inclusion of this study does not alter the meta-analytic findings.

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Note: Publications preceded by an asterisk indicate studies included in the meta-analysis.

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