

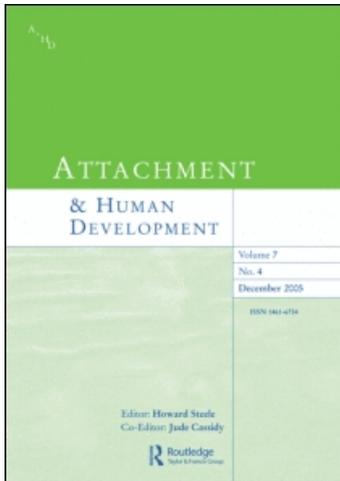
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### Maternal responsiveness to infants: comparing micro- and macro-level measures

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## COMMENTARY

### Maternal responsiveness to infants: comparing micro- and macro-level measures

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The detailed study of mother–infant interactions to uncover the dyadic origins of attachment as presented in this monograph by Beebe et al. (2010, p. 3–138, this issue) represents a major contribution to attachment research. The sheer multitude of data, the fine-grained analysis of mother and infant behaviors are truly impressive, and the inclusion of different interactive modalities provide new insights into the specific aspects of mother–infant interactions that are relevant to attachment formation. Out of the many fascinating findings presented in this monograph, the results regarding the relative influences of four different components of mother–infant interactions are of special interest. These components are maternal and infant interactive contingency and mother and infant self-contingency. Beebe et al. report that maternal interactive contingency (contingent coordination with infant behavior) shows significant but fewer predictive associations with future attachment than the other three components of mother–infant interaction. The authors state that their findings regarding maternal interactive contingency in relation to attachment are “opposite” the literature’s emphasis on maternal responsiveness. However, I would like to argue that their findings are not so much opposite but rather *supplemental* to the existing literature, considering the important conceptual differences between the micro-level approach to maternal responsiveness used by Beebe et al. and the macro-level approach that is more common in the attachment literature to date.

#### Micro-level and macro-level coding of maternal behavior

When it comes to observing mother–infant interactions, researchers have to decide whether to use a micro-level or a macro-level approach to coding mother (and infant) behavior. *Micro-level coding* refers to procedures in which maternal behavioral states are coded in very small time segments (e.g., real-time coding of

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each video frame or coding time units of 1 second). Because of the time-consuming nature of micro-coding, the total observation time is generally around 5 minutes. In *macro-level coding*, a global score for maternal behavior is assigned based on the observation of the total interaction time, generally ranging from 5 to 15 minutes. There is also a *mixed approach* in which maternal behaviors are coded in small time intervals of about 10 seconds. Either global ratings of maternal behaviors during those 10 seconds are applied, or the presence of predefined behaviors is coded. In research to date, studies that employ both micro- and macro-level analysis of mother–infant interactions are extremely rare. Contrary to what one may expect, the few studies that did use both approaches showed that the micro- and macro-level assessments of maternal behaviors are not actually related. For instance, Voelker, Keller, Lohaus, Cappenberg, and Chasiotis (1999) reported that maternal responsiveness as measured with the Ainsworth rating scale (Ainsworth, Bell, & Stayton, 1974) was not related to micro-analytically assessed maternal contingency. Both were measured during face-to-face interaction. In another study by the same group global ratings of maternal responsiveness using the Ainsworth scale during free play and caregiving were not related to micro-level assessments of maternal contingency to positive or negative infant signals during face-to-face interaction (Lohaus, Keller, Ball, Elben, & Voelker, 2001).

These findings suggest that micro-level maternal contingency and macro-level maternal responsiveness are independent constructs that do not reflect a common underlying variable. At first glance this is surprising, as the micro-level construct of maternal contingency seems to include key components of macro-level sensitivity, namely prompt and appropriate responsiveness, but measured on a different time scale. However, the difference between these two approaches goes far beyond the way that time is used. To explain the lack of association between micro- and macro-level measures of maternal responsiveness, we need to examine two important additional differences between the two approaches: (a) the role of infant behaviors as context, and (b) underlying processes in terms of intuitive versus planned maternal behavior.

### **The role of infant behaviors as context**

In micro-level approaches, maternal behavior is coded irrespective of context in terms of infant behaviors, using a predefined set of specific behaviors or facial expressions. The link with infant behaviors is made post hoc by merging the maternal codes with the infant codes using the timeline to synchronize each partner's behaviors. This linkage can be used to calculate probabilities of the (sequential) co-occurrence of specific maternal and infant behaviors, leading to maternal responsiveness variables such as contingency (Watson, 1979), matching (Tronick & Brazelton, 1980), and dyadic synchrony (Harrist & Waugh, 2002). In macro-level coding, mothers' behaviors are evaluated explicitly in the context of infant behaviors. For instance, in the widely used Ainsworth rating scales (Ainsworth et al., 1974), the coder has to rate the mothers' ability to perceive infant signals, to interpret these signals correctly, and to respond to them promptly and appropriately. Thus, the context (infant signals) is an inherent part of the global maternal responsiveness score. This difference has important implications for the meaning of the appropriateness of maternal behavior in the two approaches, which is key part of the maternal responsiveness construct. In micro-level coding appropriateness is

predefined in terms of specific mother and infant behavior pairings that do not allow for a more specific interpretation of the match between the two. Consider the case of “infant positive vocalization – mother positive vocalization”. Because only the affective quality of the vocalizations is assessed, the content of the positive vocalizations could vary widely. For instance, if an infant gestures to mother’s nose and vocalizes in a positive way, the maternal positive vocal response could be many things like “yes, that’s my nose”, “you’re so cute”, or “we’re going to the park later”. Assuming these are all uttered with positive affect, these different statements would lead to the same final code of positive vocalization in micro-level coding. In macro-level coding however, the first response would be evaluated much more positively than the second or third responses, as it shows that the mother follows the infant’s focus of attention and that she tries to interpret the meaning of the infant’s signal. The other two responses may be positive, but do not seem particularly related to the infant’s behavior in this case. This issue is related to another crucial difference between micro-level and macro-level maternal responsiveness. As Beebe et al. stated, micro-level contingency is a neutral term that only has meaning in relation to some outcome, like attachment. They also note that higher contingency levels are not even necessarily better than lower levels. This means that maternal micro-level contingency may show curvilinear associations with pertinent outcome variables. Conversely, macro-level maternal responsiveness does have inherent meaning and higher levels are always considered to be better than lower levels, resulting in linear associations with outcomes such as attachment security.

Thus, an advantage of the macro-level approach is that it allows for the incorporation of a wider range of content cues to evaluate the meaning and appropriateness of maternal behavior. However, the micro-level approach has the advantage of allowing for a more objective assessment of the association between infant behavior and maternal responses, as it calculates probabilities across time. This is not something that can be done on a macro-level. Regarding the use of infant behavior as context to assess maternal appropriateness, the mixed approach is similar to macro-level coding when global ratings are used in small time intervals. When the presence/absence of maternal behaviors is coded in small time intervals, the mixed approach is similar to micro-level coding in the more limited use of context. Both the calculation of objective probabilities of predefined behavioral matches used in micro-level coding and the interpretation of all relevant context and content information used in macro-level coding represent valuable approaches to maternal responsiveness. However, the difference in how infant behaviors are used to define maternal responsiveness means that one of these approaches can not be used as a representative of the other.

### **Underlying processes: intuitive versus planned behaviors**

There are also differences between micro- and macro-level coding with respect to the underlying processes of the behaviors that are coded. Micro-level contingency (e.g., infant smiles, mother smiles) is not something that mothers tend to do consciously or deliberately as it occurs within fractions of a second (e.g., Malatesta & Haviland, 1982). Rather, this part of maternal behavior is likely to be intuitive. Conversely, macro-level aspects of maternal responsiveness (e.g., picking up the infant when he cries) are likely to be deliberate and to represent a conscious behavioral manifestation of a mother’s beliefs about adequate caregiving. Indeed, maternal

attitudes about contingent caregiving have been found to be related to macro-level responsiveness, but not to micro-level contingency (Keller, Lohaus, Voelker, Elben, & Ball, 2003). Intuitive parenting as reflected by micro-level maternal contingency is thought to be part of humans' psychobiological preadaptedness to facilitate the conveyance of preverbal social information to infants (Papousek & Papousek, 1987). The micro-level contingencies involved in intuitive parenting provide structure and predictability to mother–infant interaction that have been proven important to infant social and cognitive development (Tarabulsky, Tessier, & Kappas, 1996). In the micro-level approach, intuitive parenting is to some extent elicited by the structured face-to-face interaction setting that is generally used in this type of research. This interaction setting is preferred in micro-level coding because video recordings of more naturalistic settings will often contain large sections of inadequate visibility for second-to-second coding. The structured setting of face-to-face interaction (mother on chair facing infant strapped in baby seat, not allowed to pick infant up) limits the mother's options in terms of more elaborate and consciously planned actions. Mothers can decide to sing a song, or play a game, but can not engage in a wider variety of activities. The appropriateness and contingency of her behaviors in this setting is largely dependent on the intuitive temporal match of affect and attention with the infant, and the face-to-face setting is ideal to assess this matching process.

In naturalistic settings such as daily caregiving routines and free play that are generally used in the macro-level approach, the coded behaviors are more global and allow the mothers some time to make a conscious decision about how to respond to their infants' signals. The mother can decide on a response that is not centered on intuitive affect or attention matching at consecutive micro-points in time, but one that involves a more elaborate plan of action that may take some time, but is nonetheless congruent with the infant's signal. For instance, a mother can decide to make a bottle when the infant seems hungry, to go get a toy that the infant is gesturing towards, or to quickly finish washing the baby and take the baby out of the bath if he gets too fussy. The conscious interpretation of what an infant needs and a mother's macro-level responses to these needs are generally thought to originate largely from her socio-cultural background: attitudes and customs regarding daily caregiving activities such as feeding or bathing vary widely between cultures and are transmitted across generations (Bornstein, 1991). Although more immediate responses that can be considered intuitive (e.g., soothing or positive vocalizations) are also taken into account in macro-level coding to some extent, this type of coding is particularly suited for evaluating the "longer-term" responses that show whether a mother adapts her behaviors to the infant's needs on a larger scale. The mixed approach is not easily comparable to either micro-level or macro-level coding when it comes to the difference between intuitive and planned maternal behavior. The small time interval limits the assessment of longer-term planned responses to some extent, and can also not be said to exclusively measure intuitive responses that occur within fractions of a second. Thus, although the mixed approach is often referred to as being micro-level, it can not unequivocally be regarded as such. Because intuitive and planned parenting behaviors represent significant, but apparently independent, aspects of mother–infant interactions, the inclusion of both micro- and macro-level coding will improve the quality of maternal responsiveness assessments. Both approaches provide clues about children's expectations of their efficacy in eliciting maternal responses, with macro-level measures focusing on the more readily visible "bigger responses" and micro-level measures focusing on the underlying

probabilistic structure of the “smaller responses”. Both the smallest of responses elicited by the face-to-face setting and the bigger responses originating in naturalistic settings represent salient aspects of mother–infant interactions and should be considered as potential contributors to infant attachment.

### **Micro- and macro-level responsiveness and attachment**

The central question of this monograph concerns the prediction of infant attachment security from mother–infant interaction. In their meta-analysis, De Wolff and Van IJzendoorn (1997) reported significant but moderate associations between mother–infant interactional quality and infant attachment security. This meta-analysis included predominantly studies using a macro-level approach to measuring maternal interaction. Some studies included in the meta-analysis used the mixed approach, coding the presence of predefined maternal and infant behaviors in 10- or 15-second intervals (e.g., Isabella, Belsky, & Von Eye, 1989; Kiser, Bates, Maslin, & Bayles, 1986; Lewis & Feiring, 1989). The findings that maternal behavior was associated with infant attachment in these studies can not be easily ascribed to micro-level or macro-level maternal responsiveness as defined above. Only one study in the meta-analysis by De Wolff and Van IJzendoorn (1997) used micro-level coding of mother–infant interaction. Wille (1991) defined dyadic synchrony as a concurrent match between mother and infant behavior and found that higher synchrony was related to anxious-resistant attachment. This finding may reflect the notion that higher micro-level matching is not necessarily better (Beebe et al., this issue; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001). A few other studies in the meta-analysis used micro-level coding, but in these studies maternal behavior was assessed with older children, not infants (e.g., Malatesta, Culver, Tesman, & Shepard, 1989).

To my knowledge, only one study published since the meta-analysis by De Wolff and Van IJzendoorn, has examined micro-level maternal interactive behavior in relation to infant attachment. Voelker et al. (1999) reported on micro-level maternal contingency as well as macro-level maternal responsiveness at the infant’s age of 3 months, both assessed in a face-to-face setting. They found that micro-level maternal contingency predicted attachment security at age 12 months ( $r = .28$ ,  $p < .05$ ), whereas macro-level maternal responsiveness did not ( $r = .07$ ). However, the difference in the associations of the two interaction constructs with attachment security was not significant (indicating that their respective confidence intervals overlap), and macro-level responsiveness (but not micro-level contingency) was significantly related to contact seeking, contact maintenance, and contact avoidance during the Strange Situation Procedure. There are some studies using micro-level analysis of mother–infant interaction during the Still-Face Paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978) in relation to future infant attachment, but in these studies the focus is generally on infant behavior rather than on maternal behavior (Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2009). Two studies did report on maternal behavior in the SFP in relation to future attachment (Braungart-Rieker, Garwood, Powers, & Wang, 2001; Kiser et al., 1986), but neither used micro-level coding. The paucity of studies examining micro-level maternal behavior in relation to infant attachment illustrates the major importance of the Beebe et al. study reported in the current monograph.

In sum, given the substantial conceptual differences between maternal responsiveness assessed at the micro-level versus the macro-level as described above, the

two approaches to assessing maternal responsiveness should not be seen as necessarily reflecting the same underlying construct. Micro-level maternal responsiveness reflects more intuitive parenting centered around affect and attention matching, whereas macro-level maternal responsiveness reflects more conscious, planned, and longer-term actions in which the content and context of the behaviors is more prominent. Thus, Beebe et al.'s findings do not mean that the construct of maternal responsiveness is less important to attachment formation than previously thought based on macro-level approaches. It just means that micro-level maternal responsiveness may not be as salient in attachment formation as would be expected based on the literature regarding macro-level maternal responsiveness. The inclusion of both a micro-analytic and a macro-analytic approach in future work will help further the field's understanding of the relative importance and meaning of both aspects of mother–infant interaction in predicting the quality of infant attachment. Beebe et al.'s careful analysis of the micro-level aspect of maternal interactive contingency has provided crucial new information on the meaning of mother–infant interaction in relation to infant attachment. The thorough and sophisticated analyses presented by Beebe et al. will be a tough act to follow, but their work will inspire researchers to investigate attachment formation processes with a fresh perspective.

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