Mother-child adrenocortical attunement in relation to behavioral sensitivity: A study of stress response in an at-risk sample.

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Abstract

Synchronization of behavior, emotions and physiology in mother-child dyads appears to be related to adaptive functioning in children. While non-human research has repeatedly demonstrated synchrony (i.e. attunement) of mother and offspring physiological response to a stressful situation, only one study has examined this phenomenon in human dyads. The present study aimed to replicate the finding of mother-child adrenocortical attunement in a human population, as well as examine the relation between adrenocortical attunement and individual differences in behavioral sensitivity.

Sixty-three mother-child dyads, participated in two home visits. The first visit included a mother-child interactive free-play task, used to measure mothers' and children's behavioral sensitivity; the second visit consisted of a child IQ test, included as a potentially stressful situation for both mother and child. Salivary cortisol samples were collected from mother and child before and after the IQ test. Results indicated the existence of mother-child adrenocortical attunement in reaction to a stressful situation. Further, attunement varied as a function of behavioral sensitivity (mother's, child's and dyad's behavioral sensitivity). Findings suggest that physiological attunement may co-exist with behavioral sensitivity in at-risk populations, and that child behavioral sensitivity and mother behavioral sensitivity are equally related to adrenocortical attunement. In conclusion, measures of behavioral sensitivity containing information on both partners may be more informative than measures based exclusively on one partner's behavior when examining dyadic interactions in relation to psychophysiological responses to stress.

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Behavioral and physiological synchrony between mothers and children has become the focus of a growing number of studies over the past decade. Mother-child "interaction synchrony" refers to the matching of behavior, affective states and biological rhythms within the dyad (Feldman, 2007). Feldman suggests that synchrony allows for an uninterrupted exchange of information between mother and child that facilitates communication as well as cognitive and emotional development. A large proportion of the early research on mother-child dyads suggests that maternal behavior largely directs mother-child interactions (Gross, 1983; Kaye & Charney, 1980; Schaffer & Crook, 1979, 1980) and many consider maternal sensitivity to her child's motivational state and behavior to be the driving force behind synchronous relationships. Alternatively, researchers are increasingly considering how characteristics of the child may be related to various maternal responses suggesting that the child is also an influential agent in dyadic interactions (see Isabella, Belsky & von Eye, 1989).

While researchers have repeatedly linked individual behavioral differences to synchronous behaviors in mother-child dyads (Carpenter, Nagell, & Tomasello, 1998; Criss, Shaw & Ingoldsby, 2003; Fletcher, Perez, Hooper & Claussen, 2005; Isabella, Belsky & von Eye, 1989; Rocissano, Slade & Lynch, 1987; Skuban, Shaw, Gardner, Supplee & Nichols, 2006; Tomasello & Farrar, 1986), only one study (Sethre-Hofstad, Stansbury, & Rice, 2002) has linked individual behavioral differences to synchronous physiological changes in mother's and child's adrenocortical levels. This study examined the relationship between individual differences in behavioral sensitivity and synchronous changes in mother's and child's adrenocortical levels (referred to as "adrenocortical attunement") in response to a potentially challenging situation. However, the Sethre-

Hofstad et al. (2002) study only examined adrenocortical attunement in relation to individual differences in *mother's* behavioral sensitivity. The relationship between individual differences in behavioral sensitivity and mother-child adrenocortical attunement to potentially challenging situations remains unclear. In the present study we examined mother's, child's, and dyad's behavioral sensitivity in relation to synchronous changes in mother's and child's adrenocortical response.

Maternal Sensitivity and Child Outcomes

The quality of one-on-one interactions with significant others is crucial to children's survival and development. Infants depend on the primary caregiver for protection and fulfillment of the needs essential for optimal growth and development. A mother's ability to identify, attend to, and fulfill the needs of her child is largely dependant on her sensitivity level. Sensitive caregiving in the context of secure attachments has been shown to be an antecedent of children's adaptive functioning and contributes to individual cognitive (e.g., Beckwith, Rodning, & Cohen, 1992; van IJzendoorn, Dijkstra & Bus, 1995) and social development (e.g., Berlin, Cassidy & Belsky, 1995; Donovan & Leavitt, 1978; van IJzendoorn et al., 1995). Additionally, several caregiver characteristics associated with sensitive caregiving have been shown to influence child emotion regulation (see Thompson, 1994, for a review) and protect against the effects of negative life events and stress. This effect seems to be particularly salient in risk populations (Ben-Dat Fisher, Serbin, Stack, Ruttle, Ledingham & Schwartzman, 2007; Feldman, Eidelman, & Rotenberg, 2004; Ostfeld, Smith, Hiatt, & Hegyi, 2000; Stams, Juffer & van IJzendoorn, 2002).

The effects of caregiver sensitivity are most markedly observed in children exposed to early adverse care including maltreatment, neglect and/or abuse. Children reared in such conditions are typically delayed in several aspects of cognitive, emotional and social development and possess abnormal neurobiological structures (for reviews see Glaser, 2000). Additionally, several studies have found that children exposed to abuse and neglect demonstrate signs of altered physiological mechanisms including those involved in the stress response (Ashman, Dawson, Panagiotides, Yamada & Wilkins, 2002; Carlson & Earls, 1997; Cicchetti & Rogosch, 2001; Fisher, Gunnar, Chamberlain & Reid, 2000; Gunnar, Morison, Chisholm, & Schuder, 2001; Hart, Gunnar & Cicchetti, 1996; Kaufman, 1991).

Similar profound physiological alterations have also been demonstrated in children reared in less severe, but nonetheless unfavorable, conditions including a sub-sample of children from disadvantaged backgrounds who are currently participating in a longitudinal study on the inter-generational transfer of risk for psychopathology (Concordia Longitudinal Research Project; Ben-Dat Fisher et al., 2007). This study examined mother-child dyads and found maternal support and stimulation to be factors in offsprings' development of atypical adrenocortical patterns. Such findings demonstrate the profound impact of caregiver behavior on the developing child's neurological and physiological functioning.

Several non-human studies examined the activity of mother's and offspring's stress response. These studies report that mother and offspring tend to demonstrate similar adrenocortical responses following exposure to stressful situations (Champoux & Suomi, 1994; Coe, Mendoza, Smotherman, & Levine, 1978; Smotherman et al., 1977;

Stanton & Levine, 1985; Vogt & Levine, 1980). To date, however, only one study has examined the association between maternal and child adrenocortical response to stress in a human population. Sethre-Hofstad and colleagues (2002) examined attunement of mother and child adrenocortical response to a potentially challenging situation in sixty-four mother-child dyads. Attunement of adrenocortical response was considered to occur if a significant correlation existed between mothers' and children's cortisol responses. The procedure involved two separate tasks: a mother-child teaching task and a potentially challenging situation. The teaching task was included to provide a measure of mothers' behavioral sensitivity to their child and involved mothers teaching their child how to play a board game. The potentially challenging situation was included to elicit a cortisol response and involved children (ranging in age from 2 to 4.5 years) walking on a balance beam while their mothers watched from a different room.

Salivary cortisol samples were collected from mother and child immediately upon arrival to the lab (baseline sample) and again 30 minutes after the beginning of the balance beam task (reactivity sample). Findings suggest the occurrence of mother-child adrenocortical attunement in a human population. Furthermore, degree of adrenocortical attunement varied as a function of ratings of maternal sensitivity during the teaching task. These findings are the first of their kind to be identified in a human population and replication of such findings is essential to lend further support to the notion of adrenocortical attunement between mother and child in a human population. While the research conducted by Sethre-Hofstad and colleagues (2002) was pioneering, it only examined mother's behavioral sensitivity in relation to adrenocortical attunement to a

stressor. The potential role of child behavioral sensitivity during interactions with mother in adrenocortical attunement has yet to be examined.

The Child as an Influential Agent

Interactions within a parent-child dyad are generally accepted to be bi-directional, with the child's behavior and characteristics influencing the mother's behavior and vise-versa, rather than simply unidirectional (i.e., mother's behavior influencing the child's development). As highlighted above, maternal behaviors have a profound impact on child behavior and development, but child behavior can also influence parent behavior. Initially, theorists and researchers considered infants and young children to be passive participants in interactions with their mothers; however, more recent theories depicting young children as active contributors to their social world and development (Stern, 1977) have prompted researchers to examine the role of the child in mother-child interactions.

From early on, children have been shown to influence parental behaviors. Parke and Collmer (1975) suggested that infant behavior such as certain forms of crying may contribute to the development of child abuse. This controversial statement sparked a series of studies including one conducted by Frodi and Lamb (1980) which suggested that abusers find all infant social elicitation (i.e. smiling, crying) to be aversive thus confirming this suggestion. Moreover, infant characteristics including gestational age at birth and temperament have been shown to influence maternal sensitivity levels postpartum (Diener, Nievar, Wright, 2003; Shin, Park & Kim, 2006) such that mothers demonstrate less sensitivity towards infants with lower gestational ages and more difficult temperaments. While there is some debate concerning the importance of the

mother's versus the child's role during interactions, most researchers examining such dyadic interactions perceive them to be mutually influenced.

Dyadic Behavior

The offspring-mother relationship begins very early in child development and continues throughout the lifespan. As children grow and develop their influence on mother-child interactions increases until both partners play an equally important role. The notion of bi-directionality in the mother-child relationship is fundamental to understanding such dynamic interactions and researchers are becoming increasingly aware of the value of studying the behaviors of both parent and child, even in infancy (Tronick, 1980). One such study examining the roles played by infants and their mothers in predicting attachment security was conducted by Braungart-Rieker, Garwood, Powers & Wang (2001). They found that mothers judged as being more sensitive were more likely to have secure attachments later on with their child but how security was expressed depended on the infant's ability to regulate emotion. Studies which examine the behaviors of both partners in a dyadic context are better able to capture how partners influence each other and avoid attributing the majority of the influential power to one or the other.

While studying the behavior of each partner during dyadic interaction is important, some argue that studying the separate behaviors of each partner is not sufficient in explaining the intricacies associated with dyadic interactions. In other words, that the behavior of each partner should be viewed as an entity, and the interaction of both partners together should be conceptualized as a whole. Daniel Stern (1977) metaphorically describes such interactions as a "dance" with the changes in each

individual's behavior being a product of prior behaviors and a cause of future behaviors. Both the mother and child act in a manner contingent on their partner's previous behavior as they interpret their partner's behavior and adapt their response accordingly. The transactional model (Sameroff, 1983, 1993) posits that outcomes cannot be attributed solely to the individual but rather must be viewed as the combined result of the individual and his or her experiences. Interactional effects between partners may affect individual as well as dyadic behaviors. From this perspective, focusing exclusively on the behavior of one partner at a time may obscure the meaning of exchanges and interactions.

In light of such models of development, researchers are currently examining how interactive dyadic behaviors predict individual outcomes. For example, joint attention, which involves coordination of attention between self, other, and a third object (Tomasello, 1995), has been linked a variety of child competencies including language (Carpenter et al., 1998; Fletcher et al., 2005; Tomasello & Farrar, 1986), cognition (Carpenter et al., 1998), and self-regulation (Raver, 1996). Other dyad-related behaviors have been shown to predict not only child-related outcomes but also parent-related outcomes. Mother-child interactive positivity (defined as the quality of exchanges and shared affect between the mother and child) has been shown to predict later socialization behaviors in both mother *and* child (Kochanska, Forman, & Coy, 1999). Moreover, variables reflecting the level of sensitivity within dyads, such as mutuality and reciprocity of behavior, have been shown to promote child behaviors similar to those promoted by maternal sensitivity (i.e. cooperation and compliance) (Maccoby, 1983; Maccoby & Martin, 1983; Rocissano, Slade & Lynch, 1987).

Dyadic Physiological Attunement

While several human studies have examined the matching of *behavioral* responses in dyads, the majority of studies examining the matching of *adrenocortical* responses have been conducted with non-human mother-offspring dyads. An elevated adrenocortical reaction in response to separation has been reliably found in both mother and offspring of non-human primates (Champoux & Suomi, 1994; Coe et al., 1978; Stanton & Levine, 1985; Vogt & Levine, 1980). Additionally, research examining the physiological reaction to separation in rat pups and their mothers has revealed similar results (Smotherman et al., 1977; Stanton & Levine, 1990). While these studies neglected to identify individual differences associated with physiological reactivity, other studies examining physiological reaction have identified various differences in behavior that correspond to physiological functioning in non-human mammals and their offspring (Champoux, Bryne, DeLizio & Suomi, 1992). As previously mentioned, only one study (Sethre-Hofstad et al., 2002) has examined adrenocortical attunement in humans. The present study aimed to replicate these findings and to extend our understanding of the dyadic nature of cortisol attunement by examining the possible relationship between child behavior and adrenocortical attunement. In addition, the relationship between dyad behavior and dyad physiological attunement as a whole was explored.

Accordingly, the first goal of the present study was to add support to the occurrence of mother-child physiological attunement in the face of challenge. In an attempt to replicate the findings of Sethre-Hofstad et al. (2002), the present study intended to demonstrate attunement as a function of mother's behavioral sensitivity. The second goal was to examine the role of child behavior in adrenocortical attunement by determining whether attunement varied as a function of child's behavioral sensitivity.

The third goal was to determine if, by simultaneously examining the behaviors of the mother and the child, a factor could be created that was more strongly correlated with degree of mother-child adrenocortical attunement than either mother's or child's behavior sensitivity alone.

It was hypothesized that: (1) attunement of mother and child adrenocortical levels would occur in response to a potentially challenging situation, such that matching responses would occur regardless of whether cortisol levels increased or decreased in response to the stressor, (2) adrenocortical attunement would be greater in dyads containing more behaviorally sensitive *mothers*, (3) adrenocortical attunement would be greater in dyads containing more behaviorally sensitive *children*, (4) a factor combined of both mother and child sensitive behaviors (e.g. behaviorally sensitive dyads) would be more strongly related to adrenocortical attunement than either mother behavioral sensitivity or child behavioral sensitivity alone.

Method

Participants

The participants in this study were drawn from the Concordia Longitudinal Risk Project. This large three generation research program began in Montreal, Quebec, Canada between the years of 1976-1978. This community-based sample involved over 4000 children (and their families) in grade 1, 4, or 7 at French-language public schools, serving economically disadvantaged urban neighborhoods. For a complete description of the original sample population and procedures, see Ledingham (1981) and Schwartzman, Ledingham & Serbin (1985).

Current Sample

Data for this study was collected between September, 1996 and April, 1998. Although both male and female original participants were contacted, all of the testing involved mother-child dyads and included a total of 75 mothers and their children. They were selected based on the appropriateness of their child's current age for the specific procedure. Only one child per family was included in the study and age of the child had to be within a pre-school range (approximately 12 to 72 months). The participants in the current study were Caucasian and francophone, living in the greater Montreal area. Mothers ranged in age from 20.73 to 35.91 years (M=30.84, SD 2.87). Reports of marital status and family composition indicate 13 (17.3%) participants were not married (single, separated, or divorced) and 62 (82.7%) were married or cohabitating. The 75 children included 37 females and 38 males. Females ranged in age from 1.3 to 6.06 years (M=4.27, SD=1.30) and males ranged in age from 2.59 to 6.12 years (*M*=4.76, *SD*=.95). The median family income was CND$ 41,600 per year (range CND$ 8,430-152,885; *M*=$43,918). Level of mothers' education attainment ranged from 4 to 18 years with an average of 12.00 years. Eighteen participants had less than 11 years of schooling, the number of years needed to complete a high school degree in Quebec.

Salivary Cortisol Samples

Saliva samples were collected from both mother and child at three time points during the home visit: immediately prior to, during, and immediately after administration of an IQ test. However; in an attempt to replicate the findings of Sethre-Hofstad et al. (2002), only the first two cortisol samples were used in analyses. Collection time of each saliva sample was recorded. A strip of filter paper (65mm x 25mm) was placed under the participant's tongue and removed after it was saturated with saliva. The filter paper was

then air dried, placed in individual containers, and kept frozen at -20 degrees Celsius until assay. Saliva samples were assayed for cortisol at the Douglas Hospital Research Laboratories (DHRL). Cortisol levels were established using competitive protein binding radioimmunoassay (Krey et al., 1975).

Participants were able to schedule researchers' visits at their convenience; therefore, 48 children were tested in the morning (time of first sample *M*= 9:39am, *SD*= 20 minutes) and 25 were tested in the afternoon (time of first sample *M*= 1:44pm, *SD*= 36 minutes). Time of sampling was not recorded for three participants therefore the average time of sampling of the first and second saliva samples was used (first sample *M*=11:05; second sample *M*=11:49). Protocol instructed to collect the first sample after establishing rapport with the mother and child but before administration of a child intelligence test and to collect the second sample after IQ testing (approximately 30-60 minutes after collection of the first sample). However, some children were not able to complete the entire IQ test and others took longer than expected to finish therefore the time interval between the first and second saliva samples ranged from 16 minutes to 1 hour and 25 minutes (*M*=43 minutes, *SD*=12 minutes). Although timing of collection was variable, the sample represents the likely response of a young risk population to an "ecologically valid" procedure for salivary cortisol sampling and data collection.

Due to the nature of the research question, both partners of the mother-child dyad were required to produce a valid first and second saliva sample. Sixty-three mother-child dyads were able to meet this requirement. These dyads did not differ significantly from the full eligible sample (N=75) on any of the demographic measures or other study variables of interest. Analyses were conducted with the remaining 63 dyads.

Each member of the dyad provided two sequential salivary cortisol samples: one before administration of the IQ test to the child and one after the IQ test. As previously mentioned, the collection time of these samples somewhat differed due to individual variations in amount of time needed to complete the various components of the IQ test. The values of the children's first sample ranged from .01 to 1.87 (M=.38, SD=.43) and the values of the mothers' first samples also ranged from .01 to 2.37 (M=.38, SD=.50). The values of the children's second sample ranged from .01 to 2.01 (M=.38, SD=.44) whereas the values of the mothers' second samples varied slightly less, ranging from .01 to 1.32 (M=.30, SD= .30).

Procedure

Potential participants were contacted by telephone and, upon consenting to participation, the Demographic Information Questionnaire (DIQ; see Appendix A) was administered via phone. Two home visits, lasting approximately three hours each and separated by a week interval, were then scheduled. Home sessions included a child intellectual assessment, naturalistic observations, interviews, questionnaires and saliva sampling.

At the beginning of the first session, mothers were asked to read and sign a consent form (see Appendix B). Following this, a variety of mother-child interaction tasks were videotaped including the interactive free-play and interference task used for the purpose of the present study. This task involved two four-minute unstructured free play sessions separated by a three-minute interference task. During the interference task mothers were asked to fill out questionnaires and not directly attend to their child. If the

questionnaires were not fully completed in the first session, participants were allotted time to finish these measures during the second session.

Interactive free-play and interference task.

Before commencement of the free play and interference tasks, the examiner selected an appropriate room in the house and spread out a blanket (12.5 cm length x 16 cm width) on the floor. Specific toys, selected based on age-appropriateness and appeal, were spread out on the blanket in a standardized format. Participants were instructed to limit their activities to the blanketed area. A beeping timer indicated the start and end of each section of the task. During the free play sessions, mothers were instructed to interact with their children as they would typically at home whereas during the interference task mothers were instructed to fill out the questionnaire and not directly attend to their child. Upon completion of the three tasks mothers were asked to rate on a scale of one to four how natural their interactions with their child had felt (1=not at all natural, 4= very natural). Those who viewed their interaction as unnatural, rating it a 2 or below (n=1) repeated the interaction task at during the second visit. Interaction sessions were videotaped and later coded with the Emotional Availability Scales (Third Edition: Biringen, Robinson & Emde, 1998) to provide observational measures of maternal variables (support, stimulation, and hostility) as well as child variables (responsiveness and involvement).

The second visit involved administration of a child intelligence assessment and maternal interviews. One examiner conducted an age-appropriate cognitive assessment, either the Stanford-Binet Intelligence Scale (Fourth Edition: Thorndike, Hagan, & Sattler, 1986) or the Bayley Scales of Infant Development (Second Edition: Bayley, 1993), while

the other examiner administered a series of interviews and questionnaires to the mother assessing various aspects of her child's behavior, health, and temperament as well as her own parenting behaviors. Both mother and child were in the same room during the IQ testing and aware of the other's activities but focused on their own task. Additionally, participants provided saliva samples during this visit. See Appendix C for a complete protocol of both home visits.

Measures

All of the measures used in the current study were written or conducted in French. Translated versions of English measures were used if original French versions were not available.

Socio-demographic information.

The Demographic Information Questionnaire was administered during the initial telephone conversation upon consent of participation.

Child's cognitive abilities.

Child intelligence was measured either by the *Bayley Scales of Infant Development* (Second Edition, Bayley, 1993) (N=7) or the *Stanford Binet Intelligence Scale, Fourth Edition* (SB IV: Thorndike et al., 1986) (N=56) depending on the age of the child. To standardize the measures, child IQ scores were transformed into z-scores. Scores ranged from -0.382 to 2.49 (M=0.09, SD=1.06). Both IQ instruments are well-standardized; however the Stanford-Binet subtest measuring memory for sentences was eliminated in calculating the total IQ score due to overall weak performance which was likely attributable to penalization for responding in Quebecois phrases to a Parisian French test.

Behavioral sensitivity.

The Emotional Availability Scales (Biringen et al., 1998) are global rating scales designed to assess the quality of caregiver-child interactions, with an emphasis on the affective side of sensitive responsiveness. The scales are organized into three dimensions for the mother and two dimensions for the child, all measuring a various aspects of emotional availability.

The maternal dimensions include: 1) maternal sensitivity- quantifies mother's ability to be emotionally responsive toward her child (1= insensitive, 9= highly sensitive); 2) maternal structuring/intrusiveness- measures the degree to which mother appropriately guides and sets limits to her child's behaviour (1= none, 7= optimal, 9= overly high); and 3) maternal covert and overt hostility- measures the degree to which mother's behaviour is aggressive, insensitive, or unreceptive (i.e.: overt hostility- irritated/annoyed vocalizations; covert hostility- impatient behaviour) (1= not hostile, 5= overly hostile).

Child dimensions include: 1) child responsiveness- measures the degree to which the child responds to the mother's attempts to engage the child and pleasure child derives from the subsequent interaction (1= unresponsive, 7= optimal, 9= overly responsive); and 2) child involvement- measures the degree to which the child attempts to engage the mother in interactions (1= uninvolving, 7= optimal, 9= overly involving). These scales assess mother-child behaviours in an interactional situation and together are used to quantify the trait of emotional availability in both the mother and child. Coders demonstrated excellent inter-rater reliability on all subscales, with correlations ranging from .84 to .99.

Mother's and child's scales were recoded so behaviors were rated on a continuum ranging from least optimal to most optimal. For example, on the mother's subscale measuring structuring/intrusiveness, a score of 7 indicated optimal level of structuring and scores of 8 and 9 were considered to represent too much structuring or intrusiveness on the mother's behalf. Scores of 8 and 9 were recoded as 6 and 5 respectively to create a 7-point scale ranging from least optimal to most optimal levels of structuring. The recoded subscales were used in all further analyses.

Data Reduction

Maternal behavioral sensitivity.

Three measures of maternal behavior (sensitivity, structuring/intrusiveness and hostility) were coded using the Emotional Availability Scales (Biringen et al., 1998) while the dyads were engaging in free play activity. In order to create a variable that best captured mother's affect and behaviors toward her child during the interactive free-play activity, the three sub-scales were examined in a factor analysis. When examining the correlations among sub-scales, the correlations involving the subscale of maternal hostility [maternal hostility and maternal sensitivity ($r(63)=.612$, $p<.001$); maternal hostility and maternal structuring/intrusiveness ($r(63)=.532$, $p<.001$)] were lower than the correlation between maternal sensitivity and maternal structuring/intrusiveness ($r(63)=.767$, $p<.001$). Additionally a principal component factor analysis revealed that the subscale of maternal hostility had the weakest factor loading of the three subscales [maternal sensitivity= .918; maternal structuring/ intrusiveness=.886; maternal hostility= .807]. The correlations and loadings involving the maternal hostility subscale were the lowest of comparable results and therefore it was removed from further analyses. Further

support for the exclusion of the hostility subscale is reported below. The resulting factor representing level of maternal behavioral sensitivity was comprised of the subscales "maternal sensitivity" and "maternal structuring/ intrusiveness".

Child behavioral sensitivity.

Two measures of child behavior (responsiveness and involvement) were coded using the Emotional Availability Scales (Biringen et al., 1998). A principle component factor analysis revealed that both subscales loaded on the same component (child responsiveness= .919; child involvement= .919), suggesting that both sub-scales measure a similar construct and should be combined for subsequent analyses. The resulting factor representing level of child behavioral sensitivity was comprised of the subscales "child responsiveness" and "child involvement".

Dyadic behavioral sensitivity.

A factor containing information pertaining to mother behavior and child behavior may provide a clearer picture of the interaction displayed by the dyads. To examine this possibility, all of the Emotional Availability subscales were examined in a correlation matrix. This analysis revealed that maternal hostility subscale was not significantly related to the child involvement subscale ($r(63)=.19$, p=n.s.). This finding suggests that these two subscales do not measure the same construct and should not be combined together. Furthermore, a principal component factor analysis of all the subscales revealed that the subscale of maternal hostility had the weakest factor loading of the five subscales [maternal sensitivity= .838; maternal structuring/intrusiveness=.691; maternal hostility= .444; child responsiveness=.676; child involvement=.515], therefore the maternal hostility subscale was removed from further analyses. The resulting factor representing

the level of dyadic behavioral sensitivity was comprised of the mother subscales of "sensitivity" and "structuring/ intrusiveness" as well as the child subscales of "responsiveness" and "involvement".

Adrenocortical function.

Due to individual variability, the cortisol scores of both mother and child were skewed. After ensuring differences between samples were an accurate reflection of the HPA axis and not due to laboratory error or contamination, all outliers more than three standard deviations above the mean were reduced to half a standard deviation above the next highest participant for the appropriate time of sampling and respective category (e.g. mother or child). This has been shown to be an appropriate means of normalizing the distribution of data and controlling for outliers in skewed data sets (Tabachnick & Fidell, 2001). In order to quantify the adrenocortical responses evoked by the IQ task, difference scores (post-IQ test minus pre-IQ test) were computed for both mother and child. The resulting scores were an indication of cortisol reactivity to the IQ test. Positive reactivity scores indicated increases in cortisol and negative reactivity scores indicated decreases in cortisol.

Results

Preliminary Analyses

Relations between demographic variables and outcome variables. In order to examine the effect of any demographic variables on raw cortisol or sensitivity variables, bivariate correlations were conducted. These examined the relations between six demographic variables- mother's level of education, marital status, family income, age of child, sex of child, and child IQ and the five study variables- mother's cortisol reactivity

score, child's reactivity score, mother's behavioral sensitivity, child's behavioral sensitivity and dyad's behavioral sensitivity. Family income was significantly related to

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Insert Table 1 about here

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mother's behavioral sensitivity (r=.35, p<.01), child's behavioral sensitivity (r=.29, p<.05), and dyadic behavioral sensitivity (r=.35, p<.01). Additionally, child IQ was significantly correlated with child's behavioral sensitivity (r=.29, p<.05). There were no other significant associations between the demographic variables and the study variables of interest.

Individual reactivity. To examine if amount of change in cortisol reactivity was influenced by the initial cortisol level of the individual, correlations between baseline and amount of change was calculated separately for both mothers and children. Difference scores were created by subtracting each individual's cortisol sample time 2 scores from his or her cortisol sample time 1 scores. These difference scores were then correlated with baseline scores. Child's amount of change in cortisol was highly correlated to both their own baseline cortisol level (r=.59, p<.001) and mother's baseline cortisol (r=.56, p<.001). Mother's amount of change in cortisol was also highly correlated with their own baseline cortisol (r=.84, p<.001) as well as significantly correlated, but to a lesser degree, with child's baseline cortisol (r=.28, p<.05). Mother's and child's amount of change scores were also correlated (r=.29, p<.05).

Effects of time of testing. Additional preliminary analyses were performed to examine if time of testing influenced cortisol time 1, time 2 or reactivity scores. First, no

association was found between any variable related to time (i.e. time of sampling, sampling in afternoon or morning, and time between samples) and the level of cortisol, either in the first or second sample or reactivity scores, for either child or mother.

Insert Table 2 about here

Furthermore, no relationship was found between time of day and behavioral sensitivity for mothers, children or dyads. Thus, any differences in cortisol between maternal

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Insert Table 3 about here

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sensitivity groups, child sensitivity groups and dyad sensitivity groups could not be due to time of sampling. Due to the lack of any relationship between time of sampling, cortisol levels or sensitivity group, time of sampling variable was not used as a covariate in subsequent analyses.

Main Analyses

Mother-child cortisol attunement. The first hypothesis was that attunement of mother and child adrenocortical level would occur in response to a potentially challenging situation. It was expected that attuned responses would occur regardless of whether cortisol levels increased or decreased in response to the stressor. Mother-child cortisol attunement was determined to have occurred if a significant correlation existed between mother and child cortisol reactivity scores. Mothers' cortisol reactivity scores and children's cortisol reactivity scores were significantly correlated ($r(63)=.26$, $p<.05$).

Mothers' behavioral sensitivity and mother-child cortisol attunement. The second hypothesis was that adrenocortical attunement would be greater in dyads containing more behaviorally sensitive mothers. The effect of family income was controlled when examining this relation as it was related to the combined variable of mother's behavioral sensitivity ($r(63)=.35$, $p<0.01$). A factor representing mother's overall behavioral sensitivity towards her child was derived by combining mothers' sensitivity and structuring/intrusiveness subscales. A *z*-score indicating mother's level of behavioral sensitivity in relation to mother mothers was created for each dyad. Dyads were assigned to either a "high maternal sensitivity" group or a "low maternal sensitivity" group by a median split. When examining the relationship between mother-child cortisol attunement for dyads in the low sensitivity group ($n=31$), the correlation between mother and child's amount of cortisol change was non-significant ($r(28)=.06$, p=n.s.). When examining the relationship between mother-child cortisol attunement for dyads in the high sensitivity group ($n=33$), the correlation between mothers' and children's amount of cortisol change was significant ($r(29)=.38$, $p<.05$). In other words, the hypothesis of mother-child adrenocortical attunement in response to a potentially challenging situation was supported by these analyses as was the hypothesis that adrenocortical attunement would be greater in dyads containing more behaviorally sensitive mothers.

Children's behavioral sensitivity and mother-child cortisol attunement. The third hypothesis was that adrenocortical attunement would be greater in dyads containing more behaviorally sensitive children. It was expected that attuned responses would occur regardless of whether cortisol levels increased or decreased in response to the stressor.

The effect of family income was controlled when examining this relation as it was related to the combined variable of child's behavioral sensitivity ($r(63)=.29$, $p<0.05$). Child's overall measure of sensitivity was derived by combining the child subscales of responsiveness and involvement. A z-score was then created by combining the scores of these subscales for each child. Dyads were assigned to either a "high child sensitivity" group or a "low child sensitivity" group by a median split.

When examining the relation between mother-child cortisol attunement for dyads in the low child sensitivity group ($n=28$), the correlation between mother and child amount of cortisol change was non-significant ($r(25)=.09$, p=n.s.). When examining the relation between mother-child cortisol attunement for children in the high sensitivity group ($n=35$), however, the correlation between mothers' and children's amount of cortisol change was significant ($r(32)=.37$, $p<.05$). Child sensitive behavior was significantly correlated with child IQ ($r(63)=.29$, $p<.05$). After controlling for family income and child IQ, analyses produced results similar to those when only family income was controlled for in both the low and high child behavioral sensitivity groups ($r(23)=.09$, p=n.s.; $r(31)=.38$, $p<.05$, respectively). These analyses confirmed the original predictions that adrenocortical attunement would also be greater in dyads containing more behaviorally sensitive children.

Dyad's behavioral synchrony and mother-child cortisol attunement. The final hypothesis concerned the relation between dyadic behavioral sensitivity and mother-child adrenocortical attunement. It was predicted that a factor combined of both mother and child sensitive behaviors (e.g. dyadic behavioral sensitivity) would be more strongly related to adrenocortical attunement than either mother behavioral sensitivity or child

behavioral sensitivity alone. The effect of income was controlled when examining this relation as it was related to dyad's level of behavioral sensitivity ($r(63)=.36, p<0.01$). Dyad's overall measure of sensitivity was derived by combining the subscales pertaining to maternal sensitivity and structuring/intrusiveness with child subscales of responsiveness and involvement. A z-score was then created by combining the scores of these subscales for each dyad. Dyads were assigned to either a "high dyadic sensitivity" group or a "low dyadic sensitivity" group by a median split. When examining the relationship between mother-child cortisol attunement for dyads in the low dyadic sensitivity group ($n=31$), the correlation between mothers' and children's amount of cortisol change was insignificant ($r(28)=.03$, p=n.s.). When examining the relationship between mother-child cortisol attunement for mothers in the high dyadic sensitivity group ($n=32$), the correlation between mothers' and children's amount of cortisol change was significant ($r(29)=.46, p<.01$).

The final hypothesis, that dyadic sensitivity would be more highly correlated with cortisol change synchrony more than either mother sensitivity or child sensitivity alone, appears to be supported by these results. The magnitude of the correlations between behavioral sensitivity and adrenocortical attunement by group is as follows: mothers high in behavioral sensitivity: $r(29)=.38, p<.05$, children high in behavioral sensitivity: $r(32)=.37, p<.05$; dyads high in behavioral sensitivity: $r(29)=.46, p<.01$. To examine if the dyadic variable accounted for significantly more variance than either individual measure alone, a Fisher's r to z transformation was conducted. The group of mothers high in sensitivity account for 16% of the total variance in cortisol attunement and the group of children high in sensitivity accounts for 15% percent of the total variance

whereas when we examine sensitivity level in both the mothers and the children we find that dyads rated as being high in sensitivity account for 25% of the total variance in cortisol attunement. Although the differences between the groups are not significant, the amount of variance accounted for by each group varies when examining the individual groups compared to the dyad group. These findings indicate that mother and child each contribute substantially to the factor. Additionally, the coefficient representing the correlation between adrenocortical attunement and behavioral sensitivity is larger than the coefficient representing this relation for either mothers or children alone which partially supports the hypothesis that the factor combined of mother and child behaviors is a stronger predictor of adrenocortical attunement than the behavior either mother or child alone.

Discussion

The results from this study support the notion of adrenocortical attunement between mother and child in response to a potentially challenging situation. Adrenocortical attunement was associated with differences in sensitivity in mother, child and dyad measures of behavioral sensitivity. Dyads with at least one member high in behavioral sensitivity demonstrated more physiological attunement suggesting that dyads high in sensitivity are not only more behaviorally synchronized but also display a level of physiological synchrony not demonstrated by less sensitive dyads.

Adrenocortical attunement varied as a function of mother's level of behavioral sensitivity suggesting that sensitive mothers are more behaviorally and physiologically synchronized with their child. Furthermore, this association was also found when examining the relation between adrenocortical attunement and child's behavioral

sensitivity. This suggests that the child plays an equally important role in achieving and maintaining behavioral and physiological synchrony as the mother. Sethre-Hofstad et al. (2002) give three possible explanations regarding the mechanisms involved in adrenocortical attunement: 1) being sensitive allowed mothers to perceive their child's signals correctly and then empathize; 2) all mothers perceived their child's signals correctly but only the physiology of the sensitive mothers was affected; and 3) less sensitive mothers are less able to perceive their child's signals and thus their physiology was not affected. Similar explanations could also be argued for sensitive and less sensitive children in response to the anxiety felt by their mother regarding their performance on the IQ test. Two additional explanations may account for these findings. The first is that mothers of reactive children may worry more or, alternately, reactive mothers raise children who are hyperaware of their surroundings. The second involves the possibility of a genetic or temperamental influence, more specifically, it is possible that mothers are biologically disposed to react to stressors in a certain manner and this biological trait is then passed on to their child.

Importantly it should be noted that, the combined factor of dyadic behavioral sensitivity was more highly correlated with adrenocortical attunement that either mother's or child's independent measure of behavioral sensitivity. That is, when mother's and child's behavioral sensitivity measures were combined to represent the dyad's behavioral sensitivity, this factor was more highly correlated with physiological attunement than either mother's or child's behavioral sensitivity alone. This suggests that mother and child both add their unique characteristics to the dyadic measure of behavioral sensitivity. Similar results have been found in more recent research on

mother-child dyads (for a review see Field, 1994). These studies strongly encourage studying both partners' behaviors simultaneously in order to fully understand dynamic interactions.

The present findings can be used to better understand the parent-child relationship. Children who are less behaviorally and physiologically attuned to their parents may not be able to effectively communicate the level of help they need in various situations. Similarly, parents who are not attuned with their child may not be able to demonstrate proper coping mechanisms to teach their child how to deal with stressful situations (Sethre-Hofstad et al., 2002). Failure to effectively deal with the stressor may lead to surges in child adrenocortical levels and ineffective, or even harmful, coping mechanisms (i.e. withdrawal and aggression). These ineffective coping mechanisms may evoke maladaptive parental responses (i.e. anger and aggression) which may induce more stress in both parent and child. Additionally, lack of attunement may cause the parent to perceive the child to be stressed even though he or she is not. This would lead the parent to offer unnecessary help which may prove to be frustrating to the child and increase levels of stress. Furthermore, the implications of these findings may be considered in parenting intervention programs that often focus on changing parental behaviors and neglect to consider the role of the child. By demonstrating the equally important role of the child's behavior, it elucidates the need to examine both partners' actions when dealing with parent-child dyads. Future parenting interventions may need to involve both child and parent in order to be optimally effective.

Limitations

The main limitation of this study is regarding the sampling of cortisol. First, time of sampling was not held constant for all dyads. Diurnal cortisol (the naturally occurring amount of cortisol in an individual's body) demonstrates a circadian rhythm, characterized by peak levels shortly after awakening and then decreasing throughout the course of the day. While it is possible that this pattern of secretion may have influenced reactive cortisol levels, no association was found between time of day and cortisol level for either sample one or two for mother or child. Second, there was no record or control for time of awakening which influences the circadian release of cortisol (Sapolsky, 1992). Third, samples were not collected at equal time intervals throughout the administration of the IQ test due to the individual variability in completion of the subtests. Although sampling was not standardized, time of day and time between samples was not significantly correlated with cortisol levels. Furthermore, imposing multiple time constraints would certainly increase the response burden (and likely attrition) within this type of socially and behaviorally diverse sample of families with young children.

Another limitation is the small sample size of this study. While the main hypotheses were supported by the data, no significant differences were found when comparing the amount of variance accounted for in individual versus dyad sensitive behavior. It is possible that this comparison would have been significant if the study had more participants. Consequently, results need to be replicated with a much larger sample size.

The age range of the current study is a potential limitation as it spans more than one developmental period. Due to the large age range, findings do not provide information regarding the developmental period in which attunement of physiological

synchrony may begin or if there is a peak in such attunement during a specific developmental period. Studies wishing to address these questions would require examination of both younger and older children within more restrictive age ranges.

The final limitation concerns the methodology of the current study. In order to examine the relationship between and attunement mother, child and dyad measures of sensitivity were divided into high and low groups by a median split. By splitting these variables into groups, the data is not utilized to its full extent and it may be a contributing factor to lack of significant correlations therefore in the future measures of sensitivity should be examined as continuous variables.

Concluding Comments and Future Directions

In conclusion this study supported the notion of adrenocortical attunement in mother-child dyads by replicating previous findings (Sethre-Hofstad et al., 2002) as well as extended the literature in this area by examining behavioral sensitivity in both partners separately and then as combined in the dyad. The association between mother's level of sensitivity and dyadic outcomes, such as attachment, has been well-established in previous literature (Bowlby, 1969; De Wolff & van IJzendoorn, 1997; NICHD Early Child Care research Network, 2006; Pederson & Moran, 1995); however the association between child's level of sensitivity and dyadic outcomes has been less thoroughly examined. Demonstrating that both child behaviors and mother's behaviors are equally related to adrenocortical attunement illustrates the important role assumed by the child in mother-child interactions. While one may interpret the present findings as behavior influencing physiology, it is possible that reacting in a certain physiological manner influences subsequent behavior. Future studies should attempt to determine if one

mechanism is primarily influencing the other or if the effect is interactional. Furthermore, the benefits of physiological attunement between mother-child dyads remain to be established. Future studies examining physiological attunement in mother-child dyads should seek to determine outcomes predicted by level of attunement in various cognitive and social domains as physiological attunement may be associated with mother's teaching and child's learning abilities. Additionally, attunement between mother and child may not always be beneficial such that if one partner of the dyad is psychologically unwell (i.e. suffering from depression), it may be advantageous for the other partner to not be attuned behaviorally or physiologically. Future studies should examine behavioral and physiological attunement in relation to well-being in diverse populations to investigate this possibility.

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Table 1.

Correlations between the variables in the model (N=63)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Mother's behavioral sensitivity	1.00	.63**	.93**	.00	.35**	.06	.09	-.06	.02	.09	-.07
2. Child's behavioral sensitivity		1.00	.84**	.11	.29*	.17	.22	.03	.29*	.00	-.05
3. Dyadic behavioral sensitivity			1.00	.08	.35**	.07	.15	-.02	.16	.07	-.07
4. Mother's education (years)				1.00	.34**	.01	-.10	-.01	.13	.02	-.01
5. Family income					1.00	.36**	.04	-.15	.16	.11	-.14
6. Marital status						1.00	.38**	-.18	.06	.22	-.05
7.Sex of child							1.00	-.25*	.06	-.01	-.19
8. Age of child								1.00	.15	-.03	.11
9. Child IQ									1.00	-.10	.02
10. Child cortisol reactivity										1.00	.26*
11. Mother cortisol reactivity											1.00

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

Table 2.

Correlations Among Time and Cortisol Variables (N=63)

	Time 1	Time 2	Time between Samples	Tested in Morning or Afternoon
Mother Time 1 Cortisol	-.07	-.06	.10	-.06
Mother Time 2 Cortisol	-.15	-.16	-.12	-.12
Child Time 1 Cortisol	-.09	-.09	-.02	-.03
Child Time 2 Cortisol	.02	.01	-.06	.07
Child cortisol reactivity	.09	.09	-.04	.09
Mother cortisol reactivity	-.21	-.04	-.21	-.02

Note: correlations did not reach significance level of .10

Table 3.

Correlations Among Time and Sensitivity Variables (N=63)

	Time 1	Time 2	Time between Samples	Tested in Morning or Afternoon
Mother Behavioral Sensitivity	-.12	-.11	.02	-.10
Child Behavioral Sensitivity	-.01	-.01	-.03	.00
Dyad Behavioral Sensitivity	-.08	-.08	-.01	-.06

Note: correlations did not reach significance level of .10

Appendix A

Demographic Information Questionnaire (DIQ)

Mai 1996

N° d'identification _____
Date: _____

L'INDIVIDU DANS SON MILIEU

Renseignements sociodémographiques

Tous ces renseignements sont traités de façon totalement confidentielle

1. **Sexe** ☐ M ☐ F

2. **Âge** _____ ans Date de naissance AN MO JR ____ ____ ____

3. **État civil**

***Note*:**"Conjoints de fait": désigne deux personnes qui vivent ensemble comme si elles étaient mariées. Il s'agit de ton état actuel; même si tu es légalement divorcé(e) ou autre, mais que tu vis avec un(e) conjoint(e) présentement, inscris conjoint de fait.

☐ Célibataire	☐ Conjoint de fait
☐ Marié(e)	☐ Séparé(e)
☐ Divorcé(e)	☐ Veuf/veuve

Depuis quelle date?

AN MO JR
____ ____ ____

4. **Nombre d'enfants** _____

Si enceinte (ou conjointe enceinte), bébé attendu pour: ____ ____
AN MO

Pour chaque enfant:

1 -Inscrire le nom, le sexe, la date de naissance

2 -Encercler"**TE**" si c'est ton enfant (tu es le parent biologique)
"**EC**" si l'enfant du conjoint (le conjoint actuel est le parent biologique)
"**EA**" si c'est un enfant adopté /"**FA**" en foyer d'accueil et qui vit chez toi
Si "TE" et "EC" sont vrais, encercler les deux.

3 -Indiquer si l'enfant vit avec toi, **OUI** ou **NON** ou **GP** (garde partagée)

4 -Inscrire l'année scolaire (si applicable) ainsi que si l'enfant fréquente une classe ou une école spéciale.

(Si tu as plus de quatre enfants, pourrais-tu inscrire leurs informations sur une feuille séparée.)

1 NOM _____ SEXE ☐ M ☐ F AN MO JR ____ ____ ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP ☐

Année scolaire: _____ Classe spéciale: _____

2 NOM _____ SEXE ☐ M ☐ F AN MO JR ____ ____ ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP ☐

Année scolaire: _____ Classe spéciale: _____

3 NOM _____ SEXE ☐ M ☐ F AN MO JR ____ ____ ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP ☐

Année scolaire: _____ Classe spéciale: _____

4 NOM _____ SEXE ☐ M ☐ F AN MO JR ____ ____ ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP ☐

Année scolaire: _____ Classe spéciale: _____

5. **Ta scolarité** complétée (dernière année terminée):
En quoi? (spécialisation/général): _____

Étudies-tu présentement? OUI : Temps plein ☐ partiel ☐ NON ☐
Si oui, quel diplôme postules-tu _____ pour quand?
____/____/____/

6. **As-tu un emploi** (rappel: renseignements gardés confidentiels)?

OUI ☐

Occupation: _____
_____

Tes tâches: _____
_____
_____

Combien d'heures/sem.? _____

NON ☐

As-tu déjà eu un emploi?

Oui ☐ Non ☐
⇩
En quoi?

Pendant combien de temps?
____ an(s) ____ mois

Salaire de l'heure _____ $

Depuis quand es-tu à cet emploi? inscrire la date
AN MO
____/____/

Quand as-tu arrêté de travailler:
date: ____/____/
AN MO

Au cours des 12 derniers mois, as-tu bénéficié de:

Oui ☐ Non ☐ l'Assurance chomâge?
Oui ☐ Non ☐ Prestations d'aide sociale?
Oui ☐ Non ☐ la CSST? (préciser:_____)

7. **Informations sur le conjoint (renseignements gardés confidentiels):**

AN MO JR

a) Son nom:_____ Date de naissance ____ ____ ____

Son occupation:_____

Ses tâches:_____

Son salaire: _____ $/ heure Nombre d'heures _____ / semaine

AN MO

Il/Elle travaille là depuis: date ____ ____

b) Au cours des 12 derniers mois, a-t-il/elle bénéficié de:
Oui ☐ Non ☐ l'Assurance chomâge?
Oui ☐ Non ☐ Prestations d'aide sociale?
Oui ☐ Non ☐ la CSST? (préciser:_____)

c) Sa scolarité complétée (dernière année terminée):

En quoi? (spécialisation/général):_____

Étudie-t-il (elle) présentement? OUI : Temps plein ☐ partiel ☐ NON ☐

Si oui, diplôme postulé?_____ pour quand?
(date)____/____/

8. **Informations sur le père (si n'habite pas avec la mère)**

AN MO JR

a) Son nom:_____ Date de naissance ____ ____ ____

Son occupation:_____

Ses tâches:_____

Son salaire: _____ $/ heure Nombre d'heures _____ / semaine

AN MO

Il/Elle travaille là depuis: date ____ ____

b) Au cours des 12 derniers mois, a-t-il/elle bénéficié de:

Oui ☐ Non ☐ l'Assurance chomâge?
Oui ☐ Non ☐ Prestations d'aide sociale?
Oui ☐ Non ☐ la CSST? (préciser:_____)

c) Sa scolarité complétée (dernière année terminée):

En quoi? (spécialisation/général):_____

Étudie-t-il (elle) présentement? OUI : Temps plein ☐ partiel ☐ NON ☐

Si oui, diplôme postulé?_____ pour quand?
(date)____/____/

9. **Disponibilité pour le test parent-enfant**

☐ Le matin ☐ L'après-midi
☐ La semaine ☐ La fin de semaine

10. **Vision des couleurs**: Il y a une section de la recherche qui porte sur les couleurs. Est-ce que tu as de la difficulté à percevoir certaines couleurs?

☐ Oui (préciser: _____) ☐ Non

S.V.P. Vérifier l'adresse et les numéros de téléphone.

_____ _____
No Rue app.

_____ _____ _____
Ville Code postal

Téléphones: Personnel: (_____) _____ - _____
Travail: (_____) _____ - _____
Parents: (_____) _____ - _____
Autre _____: (_____) _____ - _____

Ton numéro de téléphone personnel est à quel nom dans l'annuaire téléphonique: Nom complet et lien avec toi:

_____

Adresse des parents:

Appendix B

Consent Form

"L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants"

Directeurs du projet: - Lisa A. Serbin, Ph.D.
- Dale M. Stack, Ph.D.
- Alex E. Schwartzman, Ph.D.

FORMULAIRE DE CONSENTEMENT

Je,_____, m'engage volontairement avec mon enfant, _____, à participer à l'étude "L'individu dans son milieu: Les parents et leur enfant" de l'Université Concordia. Les buts du projet m'ont été expliqués. L'étude comprend une série de questionnaires, une évaluation du fonctionnement intellectuel de mon enfant, ainsi que trois périodes de jeux lors desquelles nous serons observés et filmés. L'étude comporte deux sessions d'une durée maximale de 3 heures chacune et une rémunération totale de $50.00 me sera allouée aussitôt que les questionnaires seront remis. En signe de courtoisie, les résultats sommaires de l'évaluation de mon enfant me seront communiqués par téléphone. De plus, les chercheurs seront prêts à effectuer une ou deux visites additionnelles, au besoin, pour terminer l'évaluation, discuter de résultats problématiques, ou m'offrir un service de référence.

Je comprends que toutes les informations que nous fournissons, qu'elles soient écrites ou filmées, sont strictement confidentielles et qu'elles ne serviront qu'à des fins de recherche. Dans toutes les circonstances, je suis assuré(e) que l'anonymat sera conservé. Cependant, selon la loi sur la protection de la jeunesse, toute information indiquant de l'abus physique ou sexuel devra être divulguée à l'Office de la Protection de la Jeunesse.

Je comprends aussi que je suis libre de cesser notre participation à n'importe quel moment. Comme le projet "L'individu dans son milieu" est à long terme, je comprends que je pourrais être appelé(e) dans l'avenir pour participer à d'autres étapes de ce projet. Je me réserve le droit de décider, à ce moment, de donner suite ou non à la demande de participation.

Signature:_____

Nom:_____ Date:_____

Assistant(e) de recherche:_____

Appendix C

Home Visit Protocol

PARENT-CHILD/HEALTH CANADA:
Full Protocol

May 15, 1996

DAY 1 PROTOCOL:

1- Examiner: - takes care of introductions,
- builds rapport with child,
- explains general Day 1 procedures to Ss,
- makes sure mother has read and signed consent form,
- administers HOME interview items as part of the warm-up conversation,
- explains **saliva sampling** and obtains a sample from both of them **immediately before standard testing** (record the time that all samples are taken on the appropriate form).

Interviewer: - chooses the most appropriate room for interaction series,
- sets up camera and materials for Series 1 in the standard order (see toy lay-out sheet),
- removes all other unnecessary materials,
- unplugs that room's telephone if present,
- and attempts to remain as invisible to the child as possible until Series 2. **(±20 min.)**.

2- Examiner: - begins administering Bayley II or SB4.

Interviewer: - **a)** if mother does not need to stay with child (for SB4): Interviewer begins administering the demographic, obstetric, temperament and health questionnaires to her;
- **or b)** if mother needs to stay with her child, the Interviewer can supervise siblings, do HOME observation items, score/enter data, or read a good book!!!

(30-60 min. or whatever the child can handle)

BREAK (±10 min.) - **The 2nd saliva sample** is taken from both mother and child immediately following standard testing. Examiner asks mother to come, if she's with Interviewer.
- Make sure you ask Ss if they need to go to the bathroom or get a change of diaper.
- If needed, Interviewer informs Examiner of interaction setup location.

3- Before bringing Ss to the interaction room, the Examiner gives mother the following Series 1 instructions.

Série 1

"Maintenant, on aimerait vous voir jouer ensemble. Comme tu sais, on va enregistrer ça sur vidéo. Donc, pour être sûr que vous restiez tous(tes) les deux bien en vue pendant qu'on filme, c'est très important que vous restiez assis(es) tous(tes) les deux sur le tapis qu'on a mis par terre. Moi, je vais rester silencieuse derrière la caméra pour être bien sûr qu'elle fonctionne bien. Donc, essayez d'être le plus naturels possible et faites comme si je n'étais pas là. Alors, la première chose qu'on aimerait que tu fasses est simplement de jouer avec (ENFANT) comme vous le faites d'habitude pendant environ 15 minutes. Vous pouvez prendre n'importe quel des jouets sur le tapis. Puis, quand tu entendras l'alarme sonner, tu pourras arrêter de jouer. As-tu des questions? C'est très important aussi que tu attendes mon signal avant de commencer à jouer, OK?"

Examiner then gets Ss settled on the carpet and instructs child (if s/he can understand such instructions) to remain within its limits; e.g.:

"Maintenant, (CHILD), tu vas jouer avec maman, mais j'aimerais que tu restes sur le tapis. Fais comme si le tapis était ton carré de sable et que c'est défendu de sortir du carré de sable..." etc.

Examiner goes behind the camera and tells mother they can begin. Examiner is responsible for timing Series 1,2, and 3. The beeper should be started and stopped over the microphone so the coders are clear about when to begin and end coding that episode. [If there is an interruption of filming during the **first** half of the series (e.g., bathroom), reset the timer to 15 min. and start over. If the interruption occurs in the **second** half of the series **and** lasts less than 2 min., just pause and restart timer when the interaction resumes; but if the trip takes **more** than 2 min., Series 1 will have to be repeated at the end of Day 2.]

At the end of Series 1, Examiner administers "Maternal perceptions" questionnaire. If mother reports a score of 1 or 2, thus indicating that either her or her child's behavior was not natural, Series 1 should be repeated on Day 2.

(±20 min.)

BREAK - Everybody leaves interaction room during break so that the (±10 min.) Interviewer can reposition materials for Series 2, and position a barrier (e.g., Fisher Price gate, a playpen) that will safely prevent 12-36 mo. child from leaving interaction room during separation episode.

- Bathroom check

4- While the Examiner supervises the child away from the interaction room, she asks mother to join the Interviewer there. The Interviewer will then give mother the following Series 2 instructions so as not to be heard by child. (If child becomes upset about his/her mother's departure, Examiner will give her the instructions in the child's presence.)

Série 2

FREE PLAY (4 MIN)

"La prochaine période de jeux va aussi être filmé mais va avoir 4 parties: En premier, tu va recommencer à jouer avec (ENFANT) comme tantôt, mais juste pour une couple de minutes jusqu'à ce que tu entendes l'alarme sonner, comme tantôt."

PUZZLES (7 MIN, 4 MIN for 12-36 cohort)

"A ce moment-là, pousse les jouets de côté et choisis un casse-tête à faire avec (ENFANT). (FOR OLDER COHORT, EXPLAIN TO MOTHER THE LABELLED BAGS OF PUZZLE PIECES AND THEIR CORRESPONDING BOARDS). Si vous finissez ce casse-tête-là, vous pouvez travailler sur un autre. Après quelques minutes, l'alarme va sonner de nouveau et je vais entrer pour m'asseoir ici." (PRESS BEEPER WHEN THEY BEGIN WORKING ON THE PUZZLE)

Interviewer comes in at the beep and waits next to the door until mother has left. Then s/he puts the barrier in place (for 12-36 mo. cohort) and sits down on a chair so as not to face child directly. Interviewer then gets busy with paperwork interacting as little as possible with child (i.e., s/he should not look at, speak to, or touch the child unless s/he is in danger of harming him/herself).

SEPARATION AND REUNION (2+4=6 MIN)

"A ce moment-là, tu sortiras de la pièce pour laisser (ENFANT) jouer tout seul avec les jouets. Et pour être sûr qu'il/elle ne te suivra pas quand tu va sortir, je vais placer une barrière en travers la porte/arche. Bien sûr, si (ENFANT) devient trop dérangé par ton absence, ou si tu te sens mal à l'aise, on arrêtera puis tu pourras le/la rejoindre. Sinon, après une couple de minutes, je vais sortir pour te dire que c'est le temps d'aller rejoindre (ENFANT) sur le tapis. Puis, tu passera 3-4 minutes de plus avec lui/elle et on te laissera savoir quand tout est fini."

Examiner programs beeper for 6 min. and presses "start" when mother exits the room. Then, after 2 minutes, she signals Interviewer to go get mother by pressing "pause" and presses "start" again when mother comes in. Examiner should keep child in view during separation and reunion episodes.

"Donc, pour résumer, commencez par jouer ensemble comme vous le faites d'habitude; puis, quand tu entendras l'alarme, pousse les jouets de côté et choisis un casse-tête. Quand tu me verras entrer, sors de la pièce jusqu'à ce que je te dise te rejoindre (ENFANT). J'ai une petite liste qui pourra t'aider à te souvenir des étapes, et je vais la placer juste ici. As-tu des questions? J'aimerais juste te rappeler encore de rester sur la couverture pour que vous puissiez rester bien en vue. J'aimerais aussi quand tu sortiras que tu restes invisible pour (ENFANT), mais assez près pour entendre l'alarme. N'oublie pas d'attendre le signal avant de commencer, OK?"

At the end of Series 2, Interviewer takes cortisol sampling and **then** administers "Maternal perceptions" questionnaire If mother reports a score of 1 or 2,

Series 2 should be repeated on Day 2. The interviewer then takes the final saliva sample from both the parent and her child.

(±25 min.)

5- At the end of Day 1, Interviewer administers Day 1 Touch Questionnaire, gives instructions for mother and father questionnaire packages, and summarizes Day 2 procedures.

N.B. If child needs to nap during Day 1, Interviewer can take that opportunity to begin interviews with mother.

Total time, 2-3 hours

Fill out the VideoTape log sheet. Clean Bayley II and toys between each visit

DAY 2 PROTOCOL:

1- Examiner reconnects with child. Rapport building between Interviewer and mother, this includes Day 2 general instructions.

(±15 min)

2- Examiner finishes Bayley II or SB4. If mother does not need to stay with child, Interviewer answers any questions she might have about the questionnaires and finishes interviewing her. But if mother still needs to stay with child, Interviewer can set up Series 3 materials.

BREAK **- Series 3 setup, if not done already**

(±10 min.)

- Bathroom check

3- While Examiner supervises child away from interaction room, she tells mother to go to the interaction room to meet Interviewer who gives her the following Series 3 instructions so as not to be heard by child. If child becomes upset about mother's departure, the Examiner gives her the instructions in the child's presence.

Série 3

FREE PLAY (4 MIN)

"C'est la dernière fois qu'on va vous filmer, et il y a 4 choses qu'on aimerait que vous fassiez ensemble. D'abord, comme l'autre jour, on aimerais que tu joues avec (ENFANT) comme vous le faites d'habitude avec les jouets jusqu'à ce que tu entendes l'alarme sonner.

COMMAND TASK (3 MIN) NOT DONE FOR 12-24 MO. CHILDREN

A ce moment-là, vous aller arrêter de jouer pour faire quelque chose de complètement différent. Pour les 2-3 prochaines minutes, j'aimerais que tu demandes à (ENFANT) de faire quelques petites tâches pour toi. Tiens, voilà une liste de tâches que tu peux utiliser (GIVE HER THE PAD). Comme tu peux voir, il y en a qui sont plus difficiles

que d'autres; c'est parce qu'on visite différentes familles avec des enfants d'âges différents. Celles du début sont plus faciles que celles de la fin (READ FIRST 3 AND LAST 3). On aimerais que tu prennes au moins 4 ou 5 des tâches de la liste. Tu peux en prendre plus si tu veux et tu peux même inventer tes propres tâches, mais pourvu que (ENFANT) n'ait pas à sortir de la pièce. Le pad sera placé tout près du tapis. (PRESS BEEPER WHEN MOTHER BEGINS INTRODUCING TASK)

INTERFERENCE TASK (3 MIN)

Quand tu entendras l'alarme sonner, vous arrêterez pour faire autre chose encore. On aimerais voir comment (ENFANT) réagit quand tu es très occupée. Tu sais comment c'est des fois quand tu es au téléphone ou bien en train de faire à manger et que c'est pas possible de lui donner toutes l'attention qu'il/elle demande. Pour observer ça, on aimerais que tu tournes la page sur ton pad pour remplir les questionnaires qui sont juste en-dessous (SHOW HER). Et pendant que tu les remplis, on aimerait que tu te retournes un peu pour lui faire comprendre que ce que tu fais est trés important. (ENFANT) pourra continuer à jouer avec les jouets pendant ce temps-là; mais assure-toi encore qu'il/elle reste assis(e) sur le tapis. Tu continueras de travailler sur les questionnaires jusqu'à ce que tu entendes une autre alarme. (PRESS BEEPER WHEN MOTHER BEGINS QUESTIONNAIRE)

FREE PLAY (4 MIN)

A ce moment-là, mets le pad de côté et recommence à jouer avec (ENFANT) comme vous le faites d'habitude jusqu'à ce l'alarme te dise que c'est fini. N'oublie pas de rester à l'intérieur des limites du tapis pour que la caméra puisse vous garder tous les deux bien en vue.

Donc, en résumé, commencez par jouer avec (ENFANT) comme vous le faites d'habitude; ensuite, quand tu entends la 1ère alarme, prends le pad et fais-lui faire des tâches; puis, à la 2e alarme, commence à travailler sur le questionnaire jusqu'à ce que tu entendes la 3e alarme. A ce moment-là, tu recommences simplement à jouer avec (ENFANT). Comme la dernière fois, on a une petite liste qui va t'aider à te rappeler des étapes. As-tu des questions? N'oublie pas d'attendre le signal avant de commencer, OK?"

At the end of Series 3, Interviewer administers "Maternal perceptions" and "Touch" questionnaires.

(±25 min.)

BREAK
±10 min.

4- Examiner administers the "Parenting Practices Interview", investigate any clinical concerns that might have arisen through other questionnaires, administers the remaining HOME interview items and the SCID modules (if required). Meanwhile, the Interviewer administers the Peabody to the child. When Examiner is done with her interviews, the Interviewer joins her for the wrap-up.

(±60 min. or more, as needed)

Total time, 2-3 hours.
Fill out the VideoTape log sheet. Clean Bayley II and toys between each visit.