
by

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A thesis submitted in conformity with the requirements for the degree of Masters of Arts
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0-612-58682-0
Abstract

Is the attachment behavior observed in the strange situation the manifestation of a psychological trait internal to the infant, or is it merely an artifact of the immediate caregiving context? The present study seeks to tackle this question empirically by comparing the process of distress regulation in dyads where the characteristics of the infant’s real-time behavioral communication (as the infant’s attachment category suggests) is not congruent with quality of the immediate caregiving context wherein reunion occurs (as inferred from the mother’s state of mind). Rather than supporting the argument in either extreme, the result of this study suggests that the attachment behavior observed in the strange situation is the result of dyadic co-construction, in which contributions from both parties converge in real-time. Implication for the continuity of attachment behavior, the mediation model, and the psychometric of attachment are subsequently discussed.
We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
- T.S. Eliot

Many thanks to my intellectual secure-base, Dr. Leslie Atkinson, who has shown me the wisdom of slowing down and looking back, and to my mother, who has given me the courage to go on.
Introduction

*A Real-time Observation, a Far-reaching Vision*

The theory of attachment was inspired by the observation on a mother-infant dyad: when the mother seeks to distance herself from the infant, the latter, compelled by an emerging sense of separation anxiety, responds in a way that deters her mother from disengaging and thus re-establishes an optimal distance between herself and the mother, which in turn feeds back to pacify the infant's initial state of distress (Bowlby, 1969). Borrowing ideas from the study of cybernetics, Bowlby contextualizes such distress regulating processes in the notion of a feedback control system, wherein the infant's moment-to-moment communication of distress (or the lack of it) is as much the result as it is the cause of the mother's real-time nurturing behaviors. Thus, according to this line of thought, the moment-to-moment vicissitude of distress should reflect the manner of which the mother and her infant interact across time (c.f. Sroufe, 1996; Reite & Capitanio, 1985). Hence, as construed by the founding father of attachment theory, what lies at the heart of such a “goal-corrected partnership” is the attempt to regulate distress.

Fuelled by the desire to systematize such real-time observation, Bowlby and his intellectual descendants have proposed different postulations to account for the mechanism through which distress is regulated when the optimal distance between the mother and her infant is breached. In particular, contention arises as to exactly where the locus of distress regulation observed within the dyadic control systems lies. Three major lines of argument have been put forth, each attributing the processes of distress regulation observed during the separation between the mother and her infant to a different source: 1)
internal to the infant, as argued by the proponents of the theory of the Internal Working Model (Bowlby, 1969; Cassidy, 1994), 2) internal to the mother, as the skeptics of the theory of the internal working model suspect (Atkinson, Niccol, et al., in press), and 3) nurtured in the shared space of mother-infant interaction, where the contributions from the mother and the infant converge (Fogel, 1994; Pederson & Moran, 1995; Pederson, Gleason, Moran & Bento, 1998).

However, as we shall see, the lack of direct empirical supports and conflicting circumstantial evidences seem to deprive any theoretical preference of an empirical basis. Hence, this study constitutes an attempt to elucidate the locus of attachment by observing the real-time vicissitude of distress, as a reflection of the characteristic manner the mother interacts with her infant, in a situation where the breached optimal distance is being re-established within the dyad.

*The Theory of the Internal Working Model*

Bowlby, coming from a tradition of psycho-analytic theorizing which emphasizes the contribution of early developmental history to subsequent personality consolidation, dresses the psycho-analytic concept of "internalization" in a contemporary cognitivistic outlook, and puts forth the theory of the "Internal Working Model" (Bowlby, 1969, 1973, 1980; for reviews on the history of attachment theory, see Greenberg & Mitchell, 1983; Goldberg, Muir, & Kerr, 1995; Cassidy & Shaver, 1999). According to Bowlby (1969), the availability and the responsiveness of an attachment figure is not appraised by the infant completely afresh every time. Through early infant-caregiver interaction, an individual develops conservative mental representations "of the [social] world and of
himself in it, with the aid of which he perceives events, forecasts the future and constructs his plans" (Bowlby, 1973). Bowlby’s theoretical innovation, according to Bretherton (1985; Bretherton & Munholland, 1999), was actually inspired by Craik, who holds that an individual “carries a small-scale model of external reality and of [her] own possible actions within [her] head.” Hence, the individual could “utilize the knowledge of past events in dealing with the present and future, and in every way to react in ... more competent manner to the emergencies which face [the individual]” (cited in Bretherton, 1985). Equally influential to Bowlby’s idea is the Piagetian concept of “assimilation” (Piaget, 1953; Inhelder & Piaget, 1958), which describes how the internal scheme biases our perception of the immediate external environment in such a way that we could register only the information that we are ready for (for a review, see Bretherton & Munholland, 1999).

Since the model filters perceptions of one’s immediate reality from one’s own developmental history, such conservative mental representation has a tendency to self-perpetuate through first interpreting, and subsequently eliciting, expected responses from the environment (c.f. Atkinson, Niccol, et al., in press). In light of this theoretical postulation, an infant’s moment-to-moment expression of distress within the real-time cybernetic regulatory control that Bowlby observes in the mother-infant dyad, is in fact engendered by the internal working model that the infant appropriated from the habitual manner of interaction the mother constantly engages her infant in. As the theory goes, the conservative nature of such internal reality shelters the infant from the vicissitude in his/her external environment, and is therefore making the real-time observation on the infant’s behavior within the dyadic interaction a potent instrument to “characterize
human being from the cradle to the grave” (Bowlby, 1979; see Cassidy & Shaver, 1999 for a review).

As it turns out, continuity of attachment behavior across time and situations (“from the cradle to the grave”) is not only considered as the contribution of an internal working model. For Atkinson and his colleagues, the short-term continuity within laboratory settings is in fact the minimal criterion for validating the very claim that such theoretical construct does exist (Atkinson, Niccol, et al., in press). The merit of such minimal criterion for validation could hardly be over-emphasized, especially when Bretherton has refined Bowlby’s original speculation in such a way that the generalization of behavior across time and space has become part and parcel of the internal working model theory itself. In her attempt to explicate the idea of the internal working model in terms of contemporary theory and research, Bretherton (1985, 1987, 1991) tears out three different components that constitute the psychological construct: a model of the self, a model of the other, and a model of self-other interaction. Social cognitive models of this kind, in fact come under the rubric of “relational schemas” (Baldwin, 1992). In light of Baldwin’s review on the recent development in the area of social cognition, the three aspects of the internal working model that Bretherton highlights in her writing are said to conjoin with one another to form a unifying whole – such that activation of any one component in the conjoining triad would lead to the activation of the entire relational schema. In addition, according to Bretherton (1985, 1990), the conjoining internal working model is “a multilayered hierarchical network of representations,” which constitutes a “generalized representation of the events experienced” within the context of attachment relationship (Main, Kaplan, & Cassidy,
1985). Or in Baldwin’s terms, relational schemas are hierarchically organized, with individual “event schemas” (Mandler, 1983, 1984) serving as the basic building blocks. In other words, the theory of the internal working model holds that it is the hierarchical organization that gives attachment behaviors continuity across time and situations: at the bottom of the hierarchy is the context-specific and interactant-specific form of relating (the equivalent of Mandler’s “event schema”); going up the hierarchy of generalization, the form of relating exists in a more and more abstract manner, and thus becomes more and more de-contextualized - so much so that the individual could generalize what is learned in one specific context with a specific interactant across time and situations.

According to the attachment theorists, behavior observed in laboratory settings is able to predict: behavior observed in the same laboratory six month later (Waters, 1978); preschoolers’ sociability with unfamiliar adult (Main & Weston, 1981; Plunkett, Klein, & Meisels, 1988) and children (Pastor, 1981); preschoolers’ classroom interactions with teachers (Sroufe, Fox, & Pancake, 1983; also see Urban, Carlson, Egeland, & Sroufe, 1991, for a follow up study on the same group of children when they have reached 10-year-old); empathy towards peers (Sroufe, 1983; Lafrerriere & Sroufe, 1985); popularity among peers (Sroufe, et al., 1983); victimization by peers (Troy & Sroufe, 1987); inclusion in group activities (Grossmann, Scheurer-Englisch, & Stephen, 1989, cited in Belsky & Cassidy, 1994); the amount of conflict that arises in play (Howes, Unger, & Matheson, 1990); the quality of intimate friendships in 4-year-olds (Park & Water, 1989), in 10-year-olds (Grossmann, Scheurer-Englisch, & Stephen, 1989), and in adolescents with disadvantaged backgrounds (Hodges and Tizard, 1989); self-esteem and emotional health in preschoolers (Schork, Motti, Lawroski, & LaFreniere, 1984; Kestenbaum.
Farber, & Sroufe, 1989; Sroufe & Egeland, 1991), in 10-year-olds (Elicker, Englund, & Sroufe, 1992), and in adolescents (Weinfield, Sroufe, Egeland, & Carlson, 1999); romantic relationship (Feeney, 1999); and, most importantly, the state of mind regarding attachment that contributes to parenting style (van IJzendoorn, 1995). Since all these subsequent life outcomes can be predicted by observing how distress is managed within the strange situation, attachment behaviors are therefore considered to be capable of extending across time and situations. Thus, there seems to be some support, though indirect, for Bowlby’s rationale in drawing inference from the infant’s behavioral communication within real-time dyadic interactions to confirm the existence of an internal model where the history of parenting is registered.

*When the Working Model Is Not Working*

Such wealth of evidence in demonstrating the inferred presence of the internal working model, be it impressive, is by no means conclusive. As a matter of fact, Thompson (1998, 1999), Belsky and his colleague (Belsky & Cassidy, 1994) managed to gather examples of discontinuity for almost all of the age groups cited above as evidence. It seems that it is not without good reason when Thompson (1999) laments that after two decades of research, the most accurate answer to the question concerning the likelihood of predicting later life outcome from early attachment behavior, and by inference, the presence of the internal working model, is: “it depends.”

To reiterate, the internal working model is supposedly an internal representation of social reality an individual acquired in early caregiving context, and is therefore relatively immune to the vicissitudes of one’s immediate environment later on in life. The
defining characteristic of the internal working model is its capability to instigate attachment behavior across time and space through its hierarchical organization. At the bottom of its hierarchical organization is the context-specific form of relatings, and going up the hierarchy of generalization, the form of relating exists in a more and more abstract manner, and thus becomes more and more de-contextualized. Hence, continuity of attachment behavior across time and situations could be inferred as demonstrating that the locus of attachment lies internally rather than externally in the immediate caregiving context. And because of the hierarchical organization of the model, short-term stability of attachment behavior within the same setting becomes the minimal criterion for subscribing to the hypothesized existence of an internal locus of attachment.

Evidence for continuity notwithstanding, the lack of predictability on future outcome prevails. Lamb (1987) has found that the attachment status of an infant could only predict adult outcomes when the environment is stable; predictability fails when the environments or beliefs change. In the same vein, attachment security tends to change as a response to changing family circumstances, within which the parent-child relationship is renegotiated (for a review, see Laible & Thompson, in press). In fact, it has been found that for infants who come from low-income families or disadvantaged samples, even 6 months are enough to render their attachment behaviors different (Vaughn, Egeland, Sroufe, & Waters, 1979; Egeland & Sroufe, 1981; see also Lamb, Thompson, Gardner, & Charnov, 1985). Having assumed the conservative nature of the mental models, attachment theorists who subscribe to the existence of such hypothetical construct attribute the cause of discontinuity to some substantial changes in the environment during
the course of one's development (Belsky, 1996; Belsky & Isabella, 1988; Belsky, 1999; see also van IJzendoorn & Bakemans-Kranenburg, 1997).

But evidence suggests that even the change of context wherein infant attachment security is assessed has created discontinuity of attachment behavior within a 6-month period (Goossens, van IJzendoorn, Tavecchio, & Kroonenberg, 1986). Even more devastating to the theory of internal working model is that when the attachment behavior of middle-class infants is observed again in the same laboratory only after a 6-month period, instability dominates the picture (Thompson, Lamb, & Estes, 1982, Belsky, Campbell, Cohn, & Moore, 1996). But what seriously puts into question the explanatory power of the internal working model theory is a recent meta-analysis, where Atkinson and his colleagues (Atkinson, Niccols, et al., in press) show that, in and of itself, time (in terms of weeks and months) is enough to predict discontinuity in an infant's attachment behavior. Contrary to the minimal criterion implicated in the hypothesized hierarchical organization of the model itself, and subsequently explicated by Atkinson and his colleagues, these findings caution us not to infer too hastily the existence of an internal locus of attachment from the infant's real-time behavioral communication within a dyadic interaction.

In subsuming the study of attachment relationship as part of the research on early social personality development, Thompson (1998) questions whether social personality indeed emerges as early as the attachment theorists claim in the theory of internal working model. Rather, he argues, infants' behavioral communication of their need for comfort is more susceptible to the vicissitudes of their immediate environment. Surprisingly, even Bretherton, the most enthusiastic advocate of the theory of internal
working model, suspects that infants could not have developed a consolidated representation of their social reality until much later in their lives (Bretherton & Munholland, 1999). In the previously mentioned meta-analysis, Atkinson and his colleagues (Atkinson, Niccol, et al., in press) conclude from the weak relationship between the assessments of maternal behavior and infant attachment security that infant attachment behavior is merely an artifact of maternal behavior, which is itself engendered by the mother's internal representation of her own attachment history (for reviews on the relationship between maternal responsiveness and maternal state of mind, see Main, Kaplan, & Cassidy, 1985, and Cassidy, 1994; see also below). According to this line of thought, the moment-to-moment expression of distress observed in an infant within dyadic interactions is the infant's real-time reactions to the characteristic manner in which the mother behaves toward the infant, which is itself instigated by the mother's own cognitive model of the social reality she had experienced in the past.

**Rapprochement in the Shared Space**

After reviewing examples of discontinuity in attachment behaviors, Lamb and his colleagues, instead of reaching the conclusion that behaviors observed in an infant during dyadic interactions are only artifacts of the environment, remind us that a significant number of infants, even in the under-privileged samples they reviewed, remain within the same attachment pattern for both assessments even though discontinuity is what dominates the picture (Lamb et al., 1985). In fact, developing resilience in the face of devastating environmental factors has always been part and parcel of the study of attachment theory in general, and the theorizing of the internal working model in
particular (Egeland, Carlson, & Sroufe, 1993; Bretherton, 1996; Sroufe, 1997; Weinfield, Sroufe, Egeland, & Carlson, 1999). Hence, Lamb et al. (1985) suggest that we should take an interactionist approach in understanding the continuity and discontinuity of one’s attachment system across the life span, where the manner through which an individual interacts with the environment is studied. However, the question is: Which environmental factors should we consider?

According to Belsky’s (1984) model of distal and proximal influences, there is no single personal, interpersonal, or broader environment factor that acts in isolation to determine the attachment outcome. Nevertheless, Atkinson, Paglia, et al. (2000) suggest that such multiplicity of influences only impacts on the development of infant attachment security through the interface of maternal behavior (such as responsiveness). According to the authors, adverse environmental factors could affect the optimal development of infant attachment security only if it also compromises the mother’s capacity to allocate her attention to her infant’s expression of distress, and as a consequence hinders her from behaving attentively toward the infant’s demand.

The effort to empirically define the factor that constitutes the immediate caregiving context out of which infant attachment security develops began with Ainsworth and her colleagues (Ainsworth, Blehar, Waters, & Walls, 1978). Searching for the root of individual differences in attachment security, the authors have found that mothers who respond sensitively to their infants’ expression of distress at home are more likely to have infants that are categorized as secure. On the contrary, mothers who respond in insensitive or inconsistently sensitive manners, are more likely to have insecure infants. In conclusion, they argue that what nurtures the development of infant
attachment security is the sensitivity and responsiveness of the mother to the infant’s expression of distress. More recently, as an attempt to further elucidate the intimate relationship between maternal responsiveness and infant attachment security, Goldberg, MacKay-Soroka, & Rochester (1994) have shown that mothers of infants whose behaviors have been categorized as secure behave responsively even within the same context in which the infant’s behaviors are categorized. While, on the other hand, mothers of insecure infants behave insensitively within real-time dyadic interactions. So it seems that these findings have supplemented Bowlby’s initial observation on the real-time mother-infant feedback control with a developmental dimension. But unlike Bowlby, at least in his initial stage of theorizing, these authors emphasize the contribution of the mother in pacifying the infant’s moment-to-moment communication of distress at the expense of the other party within this cybernetic control system.

Cherishing the same tradition that champions maternal contribution to the supposedly cybernetic system, Main, Kaplan, & Cassidy (1985) argue that the extent to which the mother is able to respond sensitively to the infant’s emotional cue is hinged upon the degree to which the mother is able to integrate a wide range of information when processing the infant’s behavioural communication of his/her need for attachment. And such ability to integrate attachment related information is reflected in the coherence of their narration (George, Kaplan, & Main, 1985). Along a similar vein, Bretherton (1987, 1990) suggests that different patterns of attachment behavior are in fact different communicative strategies infants acquired from the habitual manner through which their mothers communicate with them. Cassidy (1994) supplements such insight and holds that it is the mother’s state of mind that renders possible her perception as well as
communication of emotional cue, which, according to Main et al. (1985), is the prerequisite of her sensitive responses toward the infant. This relationship among psychological traits, overt behaviors, and the lasting impact of one's action on the environment, is best captured in van IJzendoorn's mediation model, which holds that maternal responsiveness is necessitated by the mother's state of mind, and in turn, maternal responsiveness has an important contribution to the development of infant attachment security (van IJzendoorn, 1995).

Despite its intuitive appeal, again and again, the mediation model has been seriously challenged. While both maternal state of mind and maternal sensitivity contribute significantly to the development of infant attachment security, they are only moderately related to one another (van IJzendoorn, 1995). And when the relationships among the three components are evaluated against the statistic criteria for mediation, the model could no longer hold (Atkinson, Goldberg, et al., manuscript in preparation). In fact, Atkinson and his colleagues have found that maternal sensitivity accounts for a significant amount of variance in infant attachment security that could not be explained by the contribution of the maternal state of mind (see also Pederson, Gleason, Moran, & Bento, 1998). However, since the mathematical assumption built-in to the mediation model precludes any contribution to infant attachment security that is not shared by the maternal state of mind, as a result, even though the statistical relationship between infant attachment security and maternal sensitivity has been strengthened because of improved methodology (Atkinson, Paglia, et al., in press), there will always be a "transmission gap" to be filled (Atkinson, Goldberg, et al., manuscript in preparation). Thus, the contribution
of the maternal state of mind to the instigation of responsive behavior seems to be less substantial than we once thought.

In observing that non-autonomous mothers of secure infants are more sensitive than non-autonomous mothers of insecure infants, Atkinson and his colleagues speculate the possibility of the infants’ own contribution toward the development of responsive behaviour in their mothers. Such a position is in agreement with the postulation of Pederson & Moran (1995; Pederson, et al., 1998), who argue that, although maternal sensitivity and infant attachment security are measured under different circumstances, they should not be considered as two separate entities. Rather, according to the authors, maternal sensitivity and infant attachment security should be treated as two aspects of the same “co-regulating” system developed out of a single history of mother-infant interaction. In a similar vein, Biringen and Robinson (1991) construe that the infant’s responsiveness to the mother when the latter initiates and provides scaffolding for interaction is a critical aspect of the real-time interaction observed within any mother-infant dyads. So critical is the role of the infant in maternal behavior that Del Carmen, Pedersen, Huffman, and Bryan (1993) lament that our lack of understanding regarding maternal influences on infant attachment behavior is precisely due to our underestimation of the intricate relationship between the two. The inseparability of a mother’s behavior and her infant’s is best exemplified by Fogel’s (1993) theory of co-regulation. The author holds that the behavioral communication shared within a mother-infant dyad constitutes a “consensual frame,” wherein the behavior of one partner is as much the cause as it is the result of the behavior of another, so much so that any attempt to understand one outside of the context of the other would be quite futile.
Hence, the process of real-time regulatory feedback control within a mother-infant dyad, which was first observed by Bowlby naturalistically and later staged by Ainsworth inside laboratory settings, is as much reflecting the infant’s attempt to elicit nurturance from her mother as her mother’s willingness to offer it. While the former is engendered by the infant’s attachment strategy, the latter is for the most part determined by the mother's mental representation of her own attachment history. The outcome of this cybernetic control system is the distress regulating process Bowlby observed in a dyad. In other words, if the infant-mother interaction that inspires Bowlby in the first place is in fact a dyadic construction wherein contributions from both parties converge in the process of real-time distress regulation, the vicissitude of distress an infant expresses within the strange situation should not only be determined by the style of the infant's real-time behavioral communication (on which the infant’s attachment category is based); nor should it be solely hinged on the mothers’ state of mind (from which real-time caregiving behavior could be inferred). Rather, the real-time vicissitude of distress within the context of infant-mother interaction should be a function of both the infant attachment category and the maternal attachment classification. However, since only dyads with congruent classifications (the “matched” dyads) are usually considered as relevant to our understanding of mother-infant interaction, the relative contribution of the mother and the infant during real-time distress-regulation remains concealed. While the high percentage of matched dyads in the literature indeed justifies the consideration of the matched dyads as the norm (van IJzendoorn, 1995), yet concordance itself tells us nothing about the locus of attachment behavior, much less the reason behind such apparent concordance – secure infant may seem secure only because of his/her immediate reaction to a real-time
autonomous caregiving context, rather than the manifestation of a developmentally transmitted model internal to the infant. Therefore, the study of matched dyads, while it is theoretically congruent, remains an empirical dead-end (Atkinson, personal communication).

"In the Variations Lay the Insight"

The present study constitutes an attempt to systematically examine the observation that has inspired the tradition of attachment research, and thus put under scrutiny different theories advanced throughout the years to interpret the infant-mother interactions that once captured the imagination of Bowlby. Bowlby observes that the infant’s behavioral communication of attachment elicits corresponding reaction from the mother, which in turn pacifies the infant’s expression of distress. To recapitulate his observation in a modern context, the intensity and the duration of distress an infant expresses in the reunion episode of the strange situation is considered as the function of both the strategy employed by the infant in re-establishing optimal distance with the mother, and the quality of the mother’s behavioral response. While the former is suggested by the attachment category an infant is assigned to, the latter could be inferred from the mother’s state of mind according to the dominant view in attachment research.

However, in situations when the infant’s demand of attention and the mother’s likelihood of responding are congruent with one another, there is no way to tear apart the relative contribution of the infant and her mother to the process of distress regulation observed in real-time. As such, we could not differentiate whether a low level of distress expressed during reunion is the result of the infant’s own initiative in eliciting nurturance
from the mother, or the mother’s own orchestration. Only in cases when the infant attachment category and maternal attachment classification are incongruent with one another, could we juxtapose different patterns of behavioral strategies observed in infants with different qualities of the immediate caregiving contexts within which the infants attempt to re-establish the breached proximity. Hence, by observing the vicissitude in the intensity of distress infants of different attachment categories express within either an optimal or non-optimal immediate caregiving context, the mothers’ contribution to the process of distress regulation is thus torn apart from the infant’s own effort in the process.

The present study predicts that the process of distress regulation reflected in the duration and the intensity of distress expressed by infants during real-time infant-mother interactions will adhere to the model that recognizes contributions from both parties. In particular, we hypothesize that not only will the process of distress regulation observed in reunion episodes be different from one another in cases where infants employ different attachment strategies, it will also be different from one another according to the mother’s state of mind as well – even for infants who share the same strategies. For our prediction to be correct, the pattern of real-time distress regulation should rank in an order according to both the infants’ real-time attachment behavior, as suggested by their attachment category, and the qualities of the immediate caregiving environment inferred from the mothers’ AAI classification, rather than clustering only according to the infants’ attachment strategies or the mothers’ states of mind alone.

Specifically, this study hypothesizes that: 1) Avoidant infants of NonAutonomous mothers will be the least expressive in terms of distress; 2) Avoidant infants of Autonomous mothers will be slightly more expressive of the distress they experience
despite their own tendency to suppress the expression of distress because of an optimal immediate caregiving environment provided by their Autonomous mothers. 3) Ambivalent infants of NonAutonomous mothers will have the highest level of distress across time because their characteristically high demand of attention could not be met by their inattentive mothers; 4) Ambivalent infants of Autonomous mothers will have the second highest distress level across time, but lower than the Ambivalent infants of NonAutonomous mothers because of the optimal immediate caregiving environment their mothers provide. 5) Secure infants will lie between the two extremes. 6) Infants of NonAutonomous mothers will rank a little higher in terms of the level of distress sustained across time because of the non-optimal immediate caregiving context. For a diagrammatic summery of these hypotheses, see Fig. 1 below.

**Fig. 1. A Schematic Summary of the Hypotheses Advanced in This Study**
Method

Participants

Recruitment. Expectant mothers were recruited during the second or third trimester of pregnancy from 79 prenatal education classes (27 classes were held at hospitals in a large urban center, and 52 classes were run by the public health department) for a longitudinal study covering the first two years of life. A member of the research team visited each class and asked for volunteers to complete the Attachment Screening Questionnaire (ASQ; Benoit & Parker, 1994). Of the 680 mothers attending these classes, 357 (52%) completed the questionnaire and were informed that they might be contacted to participate in the study. In fact, 233 (65%) were invited to participate based on their screening scores. Preference was given to those whose score suggested they might be either dismissing or preoccupied. Of 233 women contacted, 139 (60%) agreed to participate. These women gave informed consent to their participation and their infants’, as approved by the Research Ethics Board of our institutions, at their first prenatal visit.

Attrition. Of 139 participants, 7 withdrew during prenatal data collection, 19 before the 6-month visit, and 8 before the 12-month visit. Reasons for discontinuing participation were: mother being “too busy,” family moving away from the city; and illness of the baby or the mother. The “discontinuers” did not differ from the continuing participants on demographic variables such as age, indicators of socio-economic status, maternal employment status, or ethnic background (for a review, see Raval, et al., submitted). Some of the withdrawing mothers did not complete the AAI and the AAIs of the mothers who withdrew later were not transcribed because of the labor-intensive
demands of this process. However, prior analysis of data from the screening questionnaire suggested that mothers who were possibly dismissing were less likely to agree to participate and mothers who might be preoccupied were more likely to withdraw in the early stages of the study (Myhal & Goldberg, 1997). The present study includes 56 mother-infant dyads with complete data on the relevant measures available to the author by the time the analysis was conducted. There were no maternal attachment group differences in the aforementioned demographics.

Measures

Adult Attachment Interview. Maternal state of mind with respect to attachment was assessed with the AAI (George et al., 1985). The AAI is a 1-hour semi-structured interview that queries childhood relationships with one's own attachment figures, attachment relevant experiences from early childhood, and the impact of these experiences on development, current functioning and parenting. According to George and her colleagues, the differences in how individuals narrate their attachment history, rather than what they narrate, reflects their cognitive or even meta-cognitive representation regarding attachment. In the sample employed by this study, interviews were audio-taped, transcribed verbatim, and coded using manualized guidelines (Main & Goldwyn, 1994). The coding emphasizes qualitative aspects of the narrative rather than factual information. Each transcript was rated on seventeen 9-point scales that assess experiences with each attachment figure (5 experience scales) and current state of mind with respect to those experiences (12 state of mind scales). Based on these rating, each transcript was then classified as autonomous (F), dismissing (Ds), preoccupied (E), or unresolved (U).
As discussed above, it is widely held that the maternal state of mind predisposes a mother to behave and perceive accordingly. Thus, one should be able to infer from the maternal state of mind the quality of the immediate caregiving environment infants experienced in the reunion episode of the strange situation, within which they attempt to elicit appropriate behaviors from their mothers to re-establish the optimal distance. In this study, the four different classifications of the maternal states of mind are collapsed into “Autonomous” (F) versus “Non-autonomous” (D, E, U) groups for the purpose of qualifying the immediate caregiving environment that interacts with the infant’s attachment strategies as either optimal or non-optimal.

**The Strange Situation.** The Strange Situation is a standardized laboratory observation consisting of eight brief and increasingly stressful episodes that involve mother, infant, and a female stranger, wherein stressful episodes are interspersed with opportunities for recovery. The room where observation is taken place is equipped with toys of interest to a 12 to 18-month-old infant. Experience of stress should activate the infant’s attachment behavior, while new interesting toys should activate exploratory behavior. Hence, the Strange Situation provides the researcher an opportunity to observe how the infant balances these two systems (exploration and attachment), and how the attachment figure is used as part of the strategy for coping with stress.

In the first and second episodes, the dyad is introduced to the room, and the mother is instructed to start reading a magazine and refrain from initiating any interaction with the infant. In the third episode, the stranger comes into the room. After a moment of silence, the stranger begins to interact with first the mother and subsequently the infant. In the fourth episode, the mother departs and leaves the stranger and infant alone in the
room. The stranger is instructed not to interact with the baby unless she is being engaged by the baby, but to comfort the latter if s/he is in distress. In the fifth episode the mother returns, greets and comforts the infant if necessary. The mother is instructed to return to the chair and read after the infant settles. The sixth episode is again the separation, wherein the infant is being left alone in the room. In the seventh episode the stranger comes in, comfort the baby if necessary, otherwise sits in the chair. For the final episode, the mother returns again, greets and comforts the infant when needed, and is then free to interact with her infant as she chooses (for detailed descriptions of the Strange Situation, see Goldberg, 2000, and Solomon & George, 1999).

The standard procedure for coding the Strange Situation involves a trained coder forming an overall clinical judgement based on molecular behaviour such as proximity-seeking, contact-maintaining, avoidance of the mother, resistance to comforting, search behavior during separation, and distance interaction (looking and vocalizing) with the mother (for reviews, see Lamb, Thompson, Grandner, & Charnov, 1985, and Richter, Waters, & Vaughn, 1988). Infants who are assigned to the Secure category (B) use their mothers as a secure base for exploration. For Secure infants, they explore the environment freely when their mothers are present, with occasional visual, verbal or physical contact with the mothers. When their mother departs, the exploration diminishes. These infants might or might not cry, but when the mother returns, these infants greet her positively, and if these infants are visibly upset, they would go to her, and would be comforted easily and return to exploration. Infants who are assigned to the Avoidant category (A) explore with little reference to the mother, show minimal distress at her departure, and overtly ignore or snub her when she returns. Infants belonging to this
category may be even more sociable and friendly to strangers than to their mothers.

Infants who are being categorized as Ambivalent (C) seem to be preoccupied with their mothers. They are reluctant to explore even in the presence of the mother, and are extremely distressed by her departure. At reunions they made strong efforts to make contact with her, but at the same time resist any comfort she offers. They may squirm when being picked up, reject the toy offered, or simply continue their displays of distress. These behaviors had an either angry or passive emotional quality (for reviews on how the Strange Situation is coded, see Goldberg, 2000, and Solomon & George, 1999).

Ever since Ainsworth has postulated the three patterns of attachment, again and again, researchers are confronted by a small number of infants whose behaviors could not be classified in the three-category scheme. What these infants had in common is not new patterns of behavior, but rather sequences of odd behavior which lack an obvious goal or explanation. These unusual behaviors make more sense if they were interpreted as signs showing that these infants are having confused expectations or are fearful of the caregiver. These infants are described as “disorganized/disoriented” (D) with respect to attachment (Main & Solomon, 1986). However, since the category of disorganization is not an distress-regulating strategy per se (Main & Solomon, 1990; Goldberg, 2000), and is therefore irrelevant to our present purpose in understanding the process of distress regulation in the Strange Situation, infants who were assigned to this category are excluded from this study.

**Graphing the Emotion Contour.** In light of our attempt to understand the differences in the manner distress is regulated among dyads that involve different combinations, infants’ expression of distress in the first reunion episode of the strange
situation is recorded every 3 seconds in addition to the traditional classification of strange situation observations. According to van IJzendoorn, Tavecchio, Goossen, Vergeer, & Swaen, 1983, the first reunion episode, unlike the second one, accurately reflects the way an infant interacts with the caregiver in everyday life. Infants' expression of distress in every 3-second window is recorded in terms of "no observable expression of distress" (0), "negative vocalization" (1), and "crying" (2) (see Fig. 2. for an example).

![Subject 076](image)

**Fig. 2. An Example of an Infant’s Emotional Contour across the First Reunion Episode.** The distress level is recorded every 3 seconds in terms of "no observable expression of distress" (0), "negative vocalization" (1), and "crying" (2).

**The Area Under Curves.** In the present study, distress regulation is operationally defined as the area covered by the curve that graphed the vicissitude of distress level across time. The curve from which area is derived is obtained by plotting the four quarterly sub-totals of the distress score recorded in the aforementioned emotional contour against time. In other words, after recording the level of distress an infant expresses every 3-second across the entire reunion episode, a sub-total is derived from each quarter of the reunion episode by adding up the total distress score within each quarter of the time series. The four quarterly sub-totals are then plotted against time. Consequently, the area covered by the graph (Distress X Time) is construed as describing mathematically the process of distress regulation observed in this particular reunion episode (see Fig. 3). The quarterly sub-total is a necessary means for conducting population statistic without compromising too much the temporal dimension, and for
standardizing the unit of comparison. The latter is particularly important for reunion episodes that are shorter than 3-min because of technical difficulties.

**Fig. 3. An Illustration of the Area Under the Curve for the Same Infant in Fig. 1.** For each quarter of the 3-min reunion episode, a sub-total of the distress score recorded was calculated. The four sub-totals were then plotted against time. The area covered by the curve mathematically describes the process of distress regulation observed in this particular reunion episode.

**Procedure**

The AAI was administered during the last trimester of pregnancy; infant attachment was assessed at 1 year of age.

**Statistical Analysis**

The unit of analysis employed in this study is the Area Under Curve, which is the area covered by the graph-line of four quarterly sub-totals of distress scores recorded in each reunion episode of the strange situation plotted against time. The Area Under Curve for each episode will be calculated by simple trigonometry. The areas resulted are grouped according to different types of infant-mother dyad: 1) Secure-Autonomous, 2) Secure-NonAutonomous, 3) Ambivalent-Autonomous, 4) Ambivalent-NonAutonomous, 5) Avoidant-Autonomous, and 6) Avoidant-NonAutonomous. Since each group has a different size and is not normally distributed, non-parametric statistic is required. The Kruskal-Wallis statistical test was first conducted, and the six groups were considered as distinct from one another (with respect to the Area Under Curve) only if the result could
reach a significant level of 0.05. Mann-Whitney statistical test was subsequently conducted among dyads that shared the same infant attachment categories to weigh the relative contribution between infant and her mother in the process of distress regulation.

To reiterate in operational terms, the current study hypothesized that 1) the Avoidant-NonAutonomous group would have the lowest mean AUC, and 2) the Avoidant-Autonomous group would rank just above it; 3) the Ambivalent-NonAutonomous group would rank the highest in terms of mean AUC, 4) followed by the Ambivalent-Autonomous group; 5) the two groups that involve Secure infants would lie between the two extremes, 6) with the Secure-NonAutonomous group ranking higher.
Result

Table 1 summarizes the sample size for each of the six groups of infant-mother dyads. Table 2 summarizes the mean Area Under Curve (AUC) and the standard deviation for each group of dyads.

Table 1

<table>
<thead>
<tr>
<th>Infants' Category</th>
<th>Mothers' Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Autonomous</td>
</tr>
<tr>
<td>Avoidant</td>
<td>3</td>
</tr>
<tr>
<td>Secure</td>
<td>23</td>
</tr>
<tr>
<td>Ambivalent</td>
<td>3</td>
</tr>
</tbody>
</table>

Sample size for each group of infant-mother dyads

Table 2

<table>
<thead>
<tr>
<th>Types of Infant-mother Dyads</th>
<th>Mean Area Under Curve</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure-Autonomous</td>
<td>4.1522</td>
<td>5.5625</td>
</tr>
<tr>
<td>Secure-NonAutonomous</td>
<td>4.7143</td>
<td>4.5477</td>
</tr>
<tr>
<td>Ambivalent-Autonomous</td>
<td>5.3333</td>
<td>2.8431</td>
</tr>
<tr>
<td>Ambivalent-NonAutonomous</td>
<td>17</td>
<td>13.1415</td>
</tr>
<tr>
<td>Avoidant-Autonomous</td>
<td>0.6667</td>
<td>1.1547</td>
</tr>
<tr>
<td>Avoidant-NonAutonomous</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The mean Area Under Curve and the standard deviation for each group of dyads
When Kruskal-Wallis statistical test was conducted, our result suggests that the six groups of infant-mother dyads (Secure-Autonomous, Secure-NonAutonomous, Ambivalent-Autonomous, Ambivalent-NonAutonomous, Avoidant-Autonomous, and Avoidant-NonAutonomous) are significantly different from one another with respect to their Areas Under Curves (Chi-Sq. = 21.650, p < 0.001). The mean-rank values for the six groups are reported in table 3.

Table 3

<table>
<thead>
<tr>
<th>Types of Infant-mother Dyads</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambivalent-NonAutonomous</td>
<td>48.67</td>
</tr>
<tr>
<td>Ambivalent-Autonomous</td>
<td>36.17</td>
</tr>
<tr>
<td>Secure-NonAutonomous</td>
<td>31.61</td>
</tr>
<tr>
<td>Secure-Autonomous</td>
<td>27.41</td>
</tr>
<tr>
<td>Avoidant-Autonomous</td>
<td>16.33</td>
</tr>
<tr>
<td>Avoidant-NonAutonomous</td>
<td>10.50</td>
</tr>
</tbody>
</table>

The mean rank (with respect to the Area Under Curve) of the six groups of infant-mother dyads after running the Kruskal-Wallis statistical test (Chi-Sq. = 21.650, p < 0.001).

As shown in table 3, the mean Area Under Curve of the six groups of dyads are ranked in the predicted order, with the Ambivalent infants of non-Autonomous mothers at the top and Avoidant infants of non-Autonomous mothers at the bottom. Ambivalent infants of Autonomous mothers have the second highest AUC score, but it is substantially lower than that for Ambivalent infants whose mothers are non-Autonomous. At the other extreme, Avoidant infants of Autonomous mothers have a higher AUC than the group of
Avoidant infants whose mothers are non-Autonomous. Dyads that involve Secure infants lie in the middle of the two extremes, with Secure infants of non-Autonomous mothers ranking higher than Secure infants whose mothers are Autonomous. According to Binomial Statistics, the odds of getting such order by chance is $0.5 \times 6 = 0.015625$. Thus, such rank order is not likely to be a chance event.

In order to highlight the contribution of the mother to the process of real-time distress regulation in relation to each category of infant, Mann-Whitney statistical test was subsequently conducted among infants who shared the same attachment categories. As Table 4 suggests, so far as infants who shared the same attachment categories are concerned, only Ambivalent-Autonomous dyads are significantly different from Ambivalent-NonAutonomous dyads ($Z = -1.945$, $p < 0.052$). Even though there is no significant difference between subgroups of Secure dyads or of Avoidant dyads, the two subgroups of Avoidant dyads (Avoidant-Autonomous vs. Avoidant-NonAutonomous) are relatively more distinct from one another ($Z = -1.528$, $p < 0.127$) compared to the two sub-groups of Secure dyads ($Z = -0.810$, $p < 0.418$).

**Table 4**

<table>
<thead>
<tr>
<th>Types of Infant-mother Dyads (collapsed by infants' category)</th>
<th>Z score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambivalent</td>
<td>-1.945</td>
<td>&lt;0.052</td>
</tr>
<tr>
<td>Secure</td>
<td>-0.810</td>
<td>&lt;0.418</td>
</tr>
<tr>
<td>Avoidant</td>
<td>-1.528</td>
<td>&lt;0.127</td>
</tr>
</tbody>
</table>

The result of Mann-Whitney statistical test conducted among dyads that shared the same infant attachment categories.
In sum, as predicted by the theory which argues that the process of distress regulation within a goal-corrected partnership is a dyadic construction, dyads that entertain different combinations of maternal attachment classifications and infant attachment categories should be considered as distinct from one another because of the differential contribution from both parties. It holds true even in cases when infants were assigned to the same attachment categories, so long as their mothers’ states of mind diverge. However, while the fact that the six groups of dyads are significantly different from one another suggests a confluence of contributions from both parties during the process of distress regulation, the maternal contribution has the greatest effect within Ambivalent dyads and the smallest effect within Secure dyads.
Discussion

As Bowlby observed, what lies at the heart of the "goal-corrected partnership" between an infant and her mother, is the effort to regulate the distress evoked by separation, be it threatened or real. In championing the importance of Bowlby's insight, this study was designed to invoke once again the concept of distress regulation in order to put under scrutiny different theoretical claims that seek to locate within such partnership the locus of the infant's attachment behavior. While converging evidences have thrown into doubt any claim that highlights only the contribution of any one participant within such partnership at the expense of the other, the promise of a middle road remains thus far a speculation. In fact, attempts to explain the instigator of the attachment behavior observed during dyadic interaction relies at best on circumstantial evidence, if not pure theoretical conjecture. Part of the reason for such an empirical void rests on the fact that, conventionally, only matched dyads are being taken as the subject matter whenever interaction between the infant and her mother is concerned. Mismatched dyads, where contributions from the two parties are different, are usually treated as noise or coding error, and are altogether excluded from consideration. While the high percentage of matched dyads in the literature indeed justifies the consideration of the matched dyads as being the norm (van IJzendoorn, 1995), yet concordance between the mother's and the infant's classifications itself tells us nothing about the locus of attachment behavior, much less the reason behind such apparent concordance -- a secure infant may seem secure only because of his/her immediate reaction to a real-time autonomous caregiving context, rather than the manifestation of a developmentally transmitted model internal to the infant. However, only when the quality of real-time contributions from both parties
are distinct from one another, as reflected in dyads with non-congruent classifications, could we start to differentiate their influences. In other words, by comparing the outcome of “goal-corrected partnerships” of dyads that involve different combinations of infant categories and maternal classifications, the contributions from the two parties during real-time interaction could be discriminated.

The dynamic that is shared between an infant and her mother characterizes the goal-corrected partnership each dyad entertains, which is in turn reflected in the process of distress regulation when the proximity between the two parties is breached. In this study, the manner through which distress is regulated is described mathematically as the area covered by the curve when the intensity of distress expressed by the infant is plotted against time. We hypothesize that if the process of distress regulation observed during mother-infant interaction involves real-time contributions from both ends of the partnership, the vicissitude of distress within the dynamic of infant-mother interaction should be a function of both infant attachment categories and maternal attachment classifications.

As predicted, our result suggests that dyads with different combinations of maternal attachment classifications and infant attachment categories are significantly different from one another because of the differential contributions elicited from both parties. It holds true even in cases when infants are assigned to the same attachment categories, so long as their mother’s classification differs. In particular, different dyads are ranked in an order that reflects directly the co-constructive nature of how distress is regulated within the goal-corrected partnership. We found that Avoidant infants of NonAutonomous mothers are the least expressive in terms of distress, while Avoidant
infants of Autonomous mothers are slightly more expressive of the distress they experience despite their own tendency to suppress its expression because of an optimal immediate caregiving environment provided by their Autonomous mothers. Ambivalent infants of NonAutonomous mothers sustain the highest level of distress across time because their characteristically high demand for attention is not met by their inattentive mothers. Ambivalent infants of Autonomous mothers, although they rank the second highest in mean Area Under Curve, are much less distressed than the Ambivalent infants of NonAutonomous mothers because of the optimal immediate caregiving environment their mothers provide. Secure infants lie between the two extremes, with the infants of NonAutonomous mothers ranking a little higher in terms of the intensity of distress sustained across time because of the non-optimal immediate caregiving context. Small sample sizes notwithstanding, the result of the statistical test indicates that the rank order of these different groups is unlikely to be a chance event.

These findings suggest that the process of distress regulation observed in situations where the optimal distance between the infant and his/her mother has been breached, involves confluence of contributions from both parties. Contrary to the argument advanced by the proponents of the theory of the internal working model, which holds that the real-time infant-mother interaction observed in the strange situation should be taken as reflecting the self-sustaining and self-perpetuating nature of the infant’s own internalized caregiving history, our result argues that what is being observed in the strange situation involves real-time contribution from both the mother and her infant. By the same token, the view from the other extreme, which claims that the real-time dyadic interaction observed is orchestrated by the mother alone, is again not supported by our
findings. While the infants' behavior is not immune to the influence of their immediate caregiving context, and the mothers' contribution alone fail to determine the course of the infant's real-time behavior, our result favors the interpretation that real-time distress regulation is a process of dyadic construction.

In addition, our analysis also suggests that, although the six groups of dyads are significantly different from one another, the disparity between the two sub-groups of Ambivalent dyads is particularly prominent. The degree of divergence is the smallest between the two groups of dyads that involve secure infants. Avoidant dyads lie between the two. Such differences in the degree of disparity between dyads that share the same infant attachment categories reflect the role in distress regulation assumed by infants of different attachment categories in relation to the role their mothers play. As our result suggests, the Ambivalent infants seem to play a minimal role during the process of distress regulation relative to their mothers. Secure infants, on the other hand, seem to have the most substantial contribution relative to their mothers as compared to the other two categories of infants.

Implication for Understanding Continuity

As reviewed above, the strategies by means of which infants regulate their distress in the strange situation lacks consistency. In light of the model advanced here, what is being observed within the strange situation is the cybernetic feedback control between the infant's real-time behavioral communication and the mother's immediate response. The form that such goal-corrected partnership assumes in any moment is determined by the quality of the contributions both parties make in real-time. Thus, the
extent to which the same dyad would assume the same mode of interaction in the next laboratory visit depends on the confluence of their corresponding behaviors at the moment when observation takes place. While only the infant's behaviors are of interest to the discussion of continuity or to the coding of the strange situation in general, they are nonetheless observed within a dyadic context, within which real-time contributions from both parties reciprocally influence one another's behavioral communication in nurturing the process of distress regulation. Although the dynamic of dyadic interaction may be stable, only the infant's behavior is focused. As a result, the consistency of the infant's behavioral strategy across laboratory observations becomes less obvious since only infant behavior is studied. According to this logic, observed inconsistency should be exacerbated in situations where the infants' contribution to the process of distress regulation is less weighty relative to their mothers' contributions.

This line of argument, which is favored by the result presented in this study, is also supported by research on the stability of infant attachment. While converging evidence reviewed above suggests that infant attachment behavior lacks stability, there is nonetheless consensus on the claim that Secure infants are usually more stable in their attachment behavior compared to Insecure ones (for review, see Lamb, et al., 1985; Thompson, 1998). In light of the results presented here, we suggest that the relative stability of the Secure infant's attachment behavior could be attributed to their more weighty contributions to the process of dyadic interaction compared to their Insecure counterparts. Within a goal-corrected partnership, distress that arises from separation is regulated by the infant's strategic endeavor in eliciting nurturance, as well as the mother's perception of it, and subsequently, the response to it. The behavioral strategies
that Secure infants employ are more explicit, and less likely to be misunderstood, and even harder to ignore. Thus, although their behaviors are still in some degree influenced by the quality of their immediate caregiving environment, they are more capable of eliciting nurturance from non-optimal caregiving context compared to their Insecure peers, which is reflected in the small disparity between Secure-Autonomous dyads and Secure-NonAutonomous dyads.

Our result regarding the ambivalently attached infant also mirrors their unstable, if not transient, nature. Besides the fact that ambivalently attached infants are rare (only around 10% of the North American population, van IJzendoorn and Kroonenberg, 1988), research has repeatedly shown that this category is the most transient one when compared to the others. Most notably, while the majority in Youngblade and Belsky's (1990) sample of infants who have experienced neglect are classified as ambivalent, the majority of these one-year-olds become avoidant six-month later. Mirroring Youngblade's study, Belsky and his colleagues (Belsky, et al., 1997) later have found in a middle-class sample that, when a second Strange Situation is conducted only six-months after the first one, 86% of the ambivalent infants go to the other two categories, with the majority of them becoming secure. As inferred from the result presented here, such instability could be attributed to the relatively trivial role that the ambivalent infant has assumed during the process of distress regulation within the strange situation compared to the role their mothers play. One defining characteristic of Ambivalent infants is that their behavioral communication regarding their needs for attachment is ambiguous. On one hand they exhibit extensive contact seeking behaviors, but on the other hand, they either resist the comforting that is subsequently offered or act passively to being held despite it being
what they were so desperately striving for just a moment ago. In general, in order for the

distress elicited by the strange situation to be regulated, both the infant’s strategy for
capturing the mother’s attention and the mother’s own attentiveness are required.
However, the mixed messages conveyed by the ambivalently attached infant are easily
misunderstood by the mother, and they are therefore insufficient to capture her attention
which is in fact what the infant desperately needs. For this reason, only mothers who are
able to acknowledge the infant’s internal state and provide an optimal immediate
caregiving context for the infant could ensure, at least to certain extent, that the need of
the infant is being met.

In sum, the result of this study suggests that the processes of distress regulation
observed in the strange situation are dyadic constructions, wherein real-time
contributions from both parties are required in regulating distress. Thus, during real-time
dyadic interactions, the infant’s behavior is at least in part determined by the immediate
response of the other party of the goal-corrected partnership. While the dynamic of
dyadic interaction maybe stable, only the infant’s behavior is taken as the subject matter
when stability of attachment is concerned. Furthermore, as the result presented in this
study proposes, what accounts for the disparity in the extent to which the three patterns of
attachment are stable across time, is the difference in their contributions to the process of
distress regulation in relation to their mother’s.

Implication for Developmental Theorizing

As reviewed above, the dominant view in attachment research holds that infant’s
attachment security is developed from the context created by the mother’s sensitive
behavior (or the lack thereof), which is an artifact of her own state of mind regarding attachment. While contention arises as to whether sensitivity is the best candidate in mediating the contribution of the mother’s state of mind to her infant’s development of attachment security, the linear logic of the model remains unchallenged. Recently, more and more findings suggest that maternal behavior, in and of itself, accounts for a significant amount of variance in infant attachment security that is not predicted by the maternal state of mind, and therefore puts into question the logic behind such linear model (see above). Contrary to the conception of linear causal links between maternal state of mind and maternal behavior, and between maternal behavior and the development of infant attachment security, the result of this study suggests that maternal behavior and infant's attachment behavior reciprocally influence one another in real-time to engender the process of distress regulation within the context of the goal-corrected partnership observed within the strange situation. Hence, our real-time observation seems to suggest a model of development that is quite divergent from the traditional account.

Pederson & Moran (1995), in their attempt to argue that maternal sensitivity and infant attachment security are sharing a common developmental history and are in fact two sides of the same coin, invoke the concept of “co-regulation,” a term used by Allen Fogel (1993) to describe how, given time, the behavior of one partner within a relationship would gradually reduce the degree of freedom in the behavioral repertoires of the other person. For Fogel, the way an infant behaves is both the results of her mother's previous behaviors as well as the cause for her future ones. In other words, the history of infant-mother interaction itself biases all future interaction in such a way that the same pattern of interactions tends to perpetuate. Interestingly, when Fogel tries to
explicate the process of reciprocation in the development of a co-regulating "consensual frame" of interaction, he cites Moran’s earlier research (Moran, Fentress, & Golani, 1981) on the relational patterns of movement during ritualized fighting in wolves to explain how an interactant could be both a leader and a follower at the same time.

The history of attachment theory has therefore come full circle when the idea of "control system" (Bowlby, 1969), wherein mother and infant serve as co-regulating components of the same control system, is once again invoked to account for how an infant’s emotional demand is being met. But in its recent reincarnation, the real-time reciprocity that Bowlby observed comes to have significant influences on an infant’s subsequent development. One of the insights Fogel offered us is that the infant-mother interaction observed at any given moment in time is biased by a history of the co-regulating relationship that has come to develop, and such real-time co-regulation further sets the momentum for all future interactions. As a proponent of the dynamic system theory, Fogel shares the principle that repeated real-time interactions among different individual components would entrench a system with a history, which in turn constrains the activities of any individual component at any given moment and thus biases the manner through which interactions among different components will occur in the future (for reviews on dynamic system principle, see Kelso, 1995, and Thelen & Smith, 1994).

However, in a recent study, Raval and her colleagues (submitted) study the contribution of 6-month old infants to their own development of attachment security at 1 year of age, and find that the frequency of signaling and the intensity of distress fail to predict the attachment strategy they come to employ 6 months later. On the other hand, maternal responsiveness to ambiguous signals measured when the infant was 6-month old
nevertheless predicts infant attachment strategy when the infant has reached his/her first birthday. Thus, Raval’s study seems to grant support to the traditional linear model, especially since prospective assessments of maternal responsiveness and infant behavior are involved. Yet, there are areas that may deserve careful consideration, e.g., should the frequency of signaling and the expression of distress at 6-month be in any way related to the attachment strategy an infant develops at 1-year? According to Lester (1984; Lester & Boukydis, 1992) and Thompson (1998), signaling and the expression of distress in general could not be instrumental before an infant’s first birthday. In other words, they are mere reflexes in response to the environment. Thus, it is doubtful that infants would reveal their strategic propensity through the frequency of vocalization at the age of 6-month. Nevertheless, further research is needed to explicate the observation on real-time reciprocity in developmental terms.

Implication for Assessment

As our result suggests, observations derived from the strange situation, rather than clustering around the three categories of attachment, marshal a gradient according to the intensity and duration of distress expressed by infants from dyads that involve different combinations. Such graded differences among strange situation observations, particularly among observations that would have been conventionally assigned to the same category, seem to be incompatible with a categorical system that suggests distinct boundaries among categories. Rather, it seems that only a scalar system that is able to fine tune to the minute differences among different Strange Situation observations could do justice to the richness of infants’ behaviors. Interestingly, when Ainsworth postulated the 3-category
system, she is also compelled by the need for sub-categorizations within each major category. These sub-categories, according to Goldberg (2000), in fact constitute a continuum that reflects the threshold for activating attachment behaviors, with A₁ having the highest threshold and C₂ the lowest, and the four sub-categories of Secure infants in the middle.

Many researchers that follow share the same dissatisfaction with the categorical system, and venture to organize their assessment schemes into what Goldberg (2000) calls the “linear security scale.” These researchers include Crittenden (1985), Cassidy & Marvin (Cassidy, Marvin, and the MacArthur Working Group, 1987), and Schneider-Rosen (1990). Differences notwithstanding, what these researchers have in common is their effort in modeling attachment behavior along a continuum. In concert with these authors’ top-down schematic approaches, Lamb and his colleagues (1985) conduct cluster analysis on infants’ molecular behaviors observed in the strange situation and discover that the data points distribute along a continuum rather than clustering into three distinct groups as the classical theory of attachment predicts. In light of the result shown in this study, these graded differences in infant’s attachment behaviors seem to be partly a function of the immediate caregiving context the mother provides.

This line of thought is epitomized by Pederson-Moran’s Attachment Q-sort. While the Q-sort sensitivity scale has been considered as the most powerful measurement of maternal sensitivity because of its impressive correlation with the Strange Situation (Atkinson, Paglia, et al., 2000), the authors of the instrument themselves attribute the strong relationship to the fact that both the Q-sort and the Strange Situation are actually addressing one and the same thing – i.e. the same dyadic interaction in its entirety – only
with different emphases (Pederson & Moran, 1995; see also above). While it remains unclear whether the graded differences in attachment security focused by the aforementioned researches coincide with the matched/mismatched combinations in dyads that belong to different classifications, the result of this study nevertheless invites the imagination of future research on this topic.
Conclusion

The idea that infants have acquired from their early caregiving context a subjective means to represent the immediate reality has a long history of its own. In its recent reincarnation, it takes the form of the theory of internal working model, which holds that infants entertain cognitive representation of their social world, through which event is perceived, future forecasted, and plan constructed. By definition, such model is conservative, and hence self-perpetuating through the interpretation of reality that it orchestrates. The present study seeks to authenticate the existence of the internal working model by juxtaposing different qualities of the immediate caregiving context with the infants’ real-time behavioral communications that are supposedly necessitated by the internal working model rather than the immediate environment. Our result suggests that the attachment behavior observed in the strange situation is a co-construction between behavior that an infant acquired from his/her caregiving context and the infant’s immediate caregiving environment. Therefore, the theory of the internal working model is not supported by the result of this study, nor is the view on the other extreme, which holds that infant behaviors are merely artifact of the immediate caregiving context.

However, in this study, the real-time infant’s behavior, the immediate caregiving context provided by the mother, and the interaction between the two are all inferences, though legitimate in their own rights. While the infant’s moment-to-moment behaviors are inferred from his/her attachment category and the immediate caregiving context from the mother’s AAI classification, the interaction of the two are inferred from the vicissitude of distress levels expressed by the infant across the reunion episode. A more precise experimental design would involve also recording the moment-to-moment
molecular behaviors of both the mother and her infant, and applying sequential analysis to study how the behaviors of both parties interact with one another and with the vicissitude of distress levels across time. Some attempts have been made to study empirically mother-infant real-time interaction in terms of the temporal synchronicity of dyad’s engaging versus disengaging behaviors (Brazelton, Tronick, Adamson, Als, & Wise, 1975; Brazelton, 1979; Penman, Meares, Baker, & Milgrom-Friedman, 1983; Del Carmen, Pedersen, Huffman, & Bryan, 1993; Crandell, Fitzgerald, & Whipple, 1997; Feldman, Greenbaum, & Yirmiya, 1999). The next step would be to contextualize what we have already known about the temporal synchronicity of dyadic engagement into our current understanding of attachment relationship, such that the locus of attachment would hopefully be deciphered by means of a more empirically precise study.

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