ANTECEDENTS TO ATTENTIONAL FLEXIBILITY

IN THE SECOND YEAR

by

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Antecedents to individual differences in attentional engagement associated with emotion regulation have been proposed but rarely studied. In this study, assessments of neonatal reactivity and self-regulation, and maternal responsiveness in the first year, were used to predict attentional flexibility during monthly emotion-eliciting episodes between 14 and 25 months of age. These associations were also examined for discontinuity of relationships across a hypothesized developmental transition at approximately 18-20 months. As expected, neonatal self-regulation predicted second-year attentional flexibility. Maternal responsiveness was found to be an unreliable predictor, with strong associations at some months only. No discontinuity was found across monthly correlations between the three predictors and attentional flexibility. However, results of regression analyses suggest that associations between antecedents and attentional flexibility were enhanced by contributions from maternal responsiveness and present distress starting at 20 months.
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INTRODUCTION

Individual differences in the management and regulation of emotion are often described by terms such as "avoidant", "rigid", "unstable", "flexible", etc. Although definitions vary according to theorists' emphases, the term "emotion regulation" generally refers to the extrinsic and intrinsic processes responsible for monitoring, evaluating, facilitating, and inhibiting emotional reactions (Kopp, 1989; Thompson, 1991). Extrinsic factors have been identified as those related to caregiver style and environmental experience; intrinsic factors include attentional processes, emotional reactivity, and self-regulation (Calkins, 1994; Thompson, 1991). Recent theories of emotion regulation consider individual differences, or regulatory styles, as arising from interactions between sources of internal and external differences as they meet with normative developments in a variety of domains (Thompson, 1993).

Theorists have elucidated various views of emotion regulation as a developmental process, beginning in infancy (e.g. Cicchetti, Ganiban & Barnett, 1991; Barrett & Campos, 1987; Garber & Dodge, 1991; Kopp, 1982, 1989; Sroufe, 1979; Thompson, 1991). Studies of infant emotion regulation suggest early individual differences in skills and strategies to manage negative arousal. Researchers have documented characteristic regulatory patterns in the first years of life in the context of social referencing (Blackford & Walden, 1998; Gunnar & Stone, 1984; Klinnert, 1984; Walden & Ogan, 1988), attachment (Ainsworth, Bell,
& Stayton, 1971; Bretherton & Ainsworth, 1974; Lamb, 1981; Sroufe & Waters, 1977), cognitive development (Case, Hayward, Lewis, & Hurst, 1988; Lewis, 1993; Lewis, Koroshegyi, Douglas & Kampe, 1997), temperament (Calkins & Fox, 1992; Mangelsdorf, Shapiro, & Marzolf, 1995; Rothbart, Ziaie, & O'Boyle, 1992), and toddler coping (Calkins & Johnson, 1998; Mangelsdorf, et al., 1995; Parritz, 1996). Patterns of regulation which originate during these first years of life are thought to develop from the interactions between infants’ predispositions and emerging capacities and caregiver behaviours. Furthermore, early differences in regulatory style are widely held to have potential implications for individual trajectories of emotion regulation across development (Calkins, 1994; Kopp, 1989; Thompson, 1991).

Attentional processes are key among capacities for emotion regulation. Although initially limited in their use of attentional strategies, from birth infants are able to manage negative states of arousal by averting gaze, shutting their eyes, or decreasing perceptual receptivity (Brazelton, Koslowski, & Main, 1974). A growing repertoire of potential regulatory strategies related to attentional processes becomes available with development. Within the first half-year of life, infants are able to cope with negative states by turning away and ignoring aversive stimuli (Kaye & Fogel, 1980), focusing attention on sights of interest (Demos, 1986), or on people in their environment (Rothbart et al., 1992), and scanning the environment without focusing attention (Gianino & Tronick, 1988). By early childhood, preschoolers have been observed to cover their ears or
eyes, engage in various forms of behavioural distraction, and physically move away to manage distress in a variety of contexts (Bretherton, McNew, & Beeghly-Smith, 1981; Eisenberg, Fabes, Bernzweig, Karbon, Poulin, & Hanish, 1993; Raver, Blackburn, Bancroft, & Torp, 1999; Thompson, 1994; Vaughn, Kopp, Krakow, Johnson, & Schwartz, 1986). The rapid development of attentional strategies in these first years of life underlies some of the skills and strategies, such as avoidance, distraction, or redirecting internal thoughts, which are recruited to manage negative emotion across the lifespan.

A good deal of research has been focused on identifying early individual differences in emotion regulation, and the use of attentional strategies available by early childhood, and theorists have posited links between early patterns of regulation and later outcomes. However, few studies to date have directly examined relationships between early sources of variation and subsequent use of attentional strategies for emotion regulation. The present thesis examines data from two previous studies to explore the relationship between some identified intrinsic and extrinsic sources of individual variation in emotion regulation and subsequent styles of attention regulation. Specifically, neonatal reactivity and self-regulation, along with maternal responsiveness during the first year of life, are examined in relation to attentional flexibility in response to emotion-eliciting episodes over the course of the second year.
Thus, the first question guiding this study was: Are individual differences in toddlers' attentional flexibility during stressful episodes predicted by sources of individual variation in early infancy? However, a second question was also addressed: Do relationships between early antecedents and later attentional outcomes remain constant across toddlerhood, or do they vary with developmental age and stage? Individual patterns of attentional engagement are thought to emerge, and to change, over the course of rapid normative change in social, emotional, and cognitive abilities during the first two years of life (Kopp, 1989; Thompson, 1993). Developments in emotion regulation, like other psychological processes, are characterized by marked plateaus, sudden and abrupt progressions, and even temporary regression and loss (Kopp, 1989; Sroufe, 1979; Thompson, 1993). Theorists posit global reorganizations underlying the discontinuities associated with psychological development, and suggest that such reorganizations occur during periods of instability or variability (Fischer, Pipp, & Bullock, 1984; Kagan, 1984; Lewis et al., under review; Mc Call, Eichorn, & Hogarty, 1977). A substantial development in a variety of domains, including general cognition (Case, 1991; Piaget, 1952), self-understanding (Lewis, Sullivan, Stanger, & Weiss, 1989; Sroufe, 1995), social understanding (Repacholi & Gopnick, 1997), and language (Lenneberg, 1966; Menyuk, 1971) occurs midway through the second year of life, suggesting a period of reorganization at this time (Lewis et al., under review). To consider both change and continuity in toddlers' attention regulation, relationships between first-year antecedents and second-year attentional flexibility were examined over the course of twelve months with
the prediction that systematic age-related changes would be observed at
approximately one and a half years of age.

Attentional Flexibility and Emotion Regulation

The ability to flexibly orient and re-orient attention to internal and/or external
stimuli offers a potentially effective means of managing emotion. Attentional
rigidity, on the other hand, has been associated with emotional dysregulation. It
has been suggested that depression in adults is produced by an inability to
redirect attention away from unattainable goals (Carver & Scheier, 1990), and that
a variety of clinical disorders are associated with a heightened degree of self-
focused attention (Ingram, 1990). Indeed, researchers have found the tendency to
perseverate on failure to be linked with depression (Pyszczynski & Greenberg,
1987). In addition, the use of attentional distraction has been associated with
recovery from depression in adults; whereas the tendency to employ ruminative
strategies is associated with prolonged depression (Nolen-Hoeksema & Morrow,
1993). In a recent investigation of the relation between adults' mood and ability
to shift attention, Compton (2000) found that adults who were slower to
disengage attention during a covert attentional orienting task reported greater
increases in negative affect in response to a distressing film clip. Thus, the
evidence suggests a link between deficits in attentional flexibility and sustained
negative emotion.
Not only are attentional strategies recruited to manage emotion, but emotion also is capable of influencing attention. For example, negative emotional states are capable of biasing attention to mood-congruent information (Isen, 1984; Matthews & Wells, 1999; Nasby & Yando, 1982). Researchers have consistently demonstrated a tendency for highly anxious individuals to display an attentional bias to threatening, or negative, information (MacLeod, Mathews, & Tata, 1986; Mogg, Mathews, & Eysenck, 1992; Wells & Matthews, 1994; Williams, Mathews, & MacLeod, 1996). Anxious adults have also been found to have difficulty shifting visual attention away from a negative focus (MacLeod et al., 1986; Derryberry & Reed, 1994). Attention might therefore serve to modulate emotional reactivity, or negative emotion might interfere with attentional flexibility, or both (Ruff & Rothbart, 1996).

**Rothbart and Derryberry's Temperament Model and Research:**

**Individual Differences in Emotion Regulation**

Within the context of temperament theory, Rothbart and her colleagues consider relations between emotion and attention as developing from infancy, and contributing to subsequent individual differences in attentional flexibility (Rothbart & Derryberry, 1981; Derryberry & Rothbart, 1997; Rothbart, Ahadi, & Evans, 2000). Taking a psychobiological approach, Rothbart and Derryberry define temperament as constitutionally based individual differences in reactivity
and self-regulation, influenced over time by heredity, maturation, and experience (Rothbart & Derryberry, 1981). Reactivity refers to the excitability, responsivity, or arousability of the behavioural and physiological systems of an organism. The systems' reactivity is reflected in the response characteristics of threshold, intensity, latency, rise time, and recovery from peak intensity (Rothbart & Derryberry, 1981). Self-regulation refers to the neural and behavioural processes which function to modulate reactivity, such as approach and avoidance, and channelling of attention (Rothbart & Derryberry, 1981; Rothbart & Posner, 1985).

Rothbart and Derryberry (1981) emphasize the self-regulatory aspects of temperament, and the interplay between reactivity of the nervous system and self-regulation of that reactivity. Self-regulation of reactivity is seen to be influenced by a variety of affective-motivational and attentional systems, which interact to determine dimensions of personality development. Affective-motivational systems are those related to fear, frustration, approach, aggression, nurturance, etc. (Derryberry & Rothbart, 1997; Rothbart et al., 2000a). The underlying motivational systems play a part in channelling or regulating attention, and temperamental variability in affective-motivational systems is believed to underlie individual differences in attentional style. For example, Derryberry and Rothbart (1997) cite evidence that trait anxiety in adults is linked to narrow attentional focus and delays in disengaging attention from negative cues (Derryberry & Tucker, 1993; Derryberry & Reed, 1994, 1996). Attention is
considered both to be influenced by the affective-motivational system, and to exert an influence on it, and is considered key to processes of self-regulation of reactivity (Rothbart et al., 2000a).

Derryberry and Rothbart (1997) discuss three different attentional systems in their work. The first system they identify follows the work of Posner (Posner & Raichle, 1994; Posner & Rothbart, 1992) and Tucker (Tucker & Derryberry, 1992), and is described as a "vigilance" system associated with states of general alertness, evident early in infancy. The second system identified is the "posterior attentional system", involved in orienting attention from one location to another (thus allowing for disengagement of attention), and in adjusting the breadth of attention. The third attentional system discussed is the "anterior attentional system", considered to be an executive system responsible for regulating other attentional systems. It is suggested that this anterior attentional system is related to the conscious "effortful control" of attention (Derryberry & Rothbart, 1988; Rothbart et al., 2000a).

The maturation of attentional mechanisms related to the systems described above is considered pivotal to the development of self-regulation of reactivity. Young infants are thought to gradually gain control over reactivity with development. Flexibility in attentional engagement, and the ability to disengage attention from one location to another, are seen as particularly important to early self-regulation. Prior to the age of approximately 2 or 3 months, infants
have difficulty disengaging visual fixation from a central stimulus to look at another stimulus -- even a stimulus they find aversive. This phenomenon has been referred to as "obligatory attention" (Stechler & Latz, 1966). Maturational changes in neurophysiological organization of visual control between 3 and 6 months of age allow for voluntary shifting of attention vs. obligatory attention (Rothbart et al., 1990a). Evidence from their work with infants indicates that 4-month-old infants are capable of disengaging attention much more easily than younger infants, suggesting a developmental shift in attentional capacities at this age (Johnson, Posner, & Rothbart, 1991; Rothbart, et. al., 1992). Based on research findings, it is suggested that major development of the anterior attentional system, associated with attentional flexibility, occurs chiefly during the late infancy, toddler, and preschool period (Derryberry & Rothbart, 1997; Rothbart, Derryberry, & Hershey, 2000). Strategies for emotion regulation are thought to undergo development with these advances in attentional capacities.

In addition to outlining normative developments in attentional control, Derryberry and Rothbart (1984) emphasize the extent of individual variability in attentional control seen during early development. They point out that young infants differ in their ability to deflect visual attention away from an arousing or unpleasant stimulus, and thus in their capacity to regulate a rising state of distress (Rothbart & Derryberry, 1981). Some infants appear to be more vulnerable to obligatory attention, and later in development, young children differ in their ability to disengage attention from unpleasant thoughts, shift focus
flexibly between aspects of a situation or different problem-solving approaches, and become distracted (Derryberry & Rothbart, 1984). Flexibly distributing attention between sources of threat and relief allows for implementation of effective coping strategies. Difficulty disengaging and reorienting attentional focus is hypothesized to leave individuals vulnerable to negative emotional states.

Rothbart and colleagues' research with infants offers support for this hypothesis. In the development of the Infant Behaviour Questionnaire (IBQ) (Rothbart, 1981), a parent-report instrument used to assess the frequency of occurrence of temperament-related behaviours over the past two weeks, the ability to disengage attention was found to be negatively correlated with parent reports of fear and frustration, and positively correlated with parent reports of soothability. In the laboratory, children whose mothers described them on the IBQ as more fearful also looked longer, on average, at objects, and looked away less than did less fearful infants, whereas infants whose mothers reported higher rates of smiling and laughter on the IBQ disengaged their attention from presented objects more frequently (Rothbart, Posner & Rosicky, 1994). A series of three studies exploring attentional orienting and soothing in 3- and 6-month-old infants found that shifting of attention was effective in temporarily soothing infants' distress (Harmon, Rothbart, & Posner, 1997). Similarly, 4-month-old infants who were better able to disengage during a laboratory task tended to be less susceptible to negative affect (i.e. fear and distress to limitations), and more
soothable as described by their mothers (Johnson et al., 1991). In addition, Rothbart, Ziaie, and O'Boyle (1992) found laboratory distress was negatively related to a measure of overall tendency to disengage attention ($r = -0.30$) at 13.5 months. Smiling and laughter in the laboratory were positively related to disengagement of attention and active avoidance in the context of emotion-eliciting stimuli (both $r_s = 0.29$, $p < 0.05$) (Rothbart et al., 1992). Thus, Rothbart provides consistent evidence linking attentional flexibility with better regulated negative affect in infants.

Derryberry and Rothbart (1997) argue that, with development of the anterior attentional network during the toddler period, effortful control increasingly facilitates the regulation of negative affect. Effortful attention (in a Stroop-like task) has been associated with lower negative emotionality at 24 to 36 months of age (Gerardi, Rothbart, Posner, & Kepler, 1996). There is evidence that children rated by adults as high in effortful control tend to be low in negative affectivity (Ahadi, Rothbart, & Ye, 1993). In adults, responses to questionnaire data indicate that capacities for attentional control (i.e. attentional shifting and focusing) are negatively related to fear, frustration, and sadness (Derryberry & Rothbart, 1988; Evans & Rothbart, 1999). These data suggest an inverse correlation between effortful control of attention and negative affect.

Following Rothbart and her colleagues, Kochanska has undertaken investigations of the development of effortful control, and identifies a capacity
for effortful or sustained attention as one component of the construct (Koshanska, Murray, & Coy, 1997; Kochanska, Tjebkes, & Forman, 1998; Kochanska, Coy, Tjebkes & Husarek, 1998; Kochanska, Murray & Harlan, 2000). Kochanska and colleagues (1998) report modest correlations between infants’ (approximately 9-months of age) capacities for focused attention to toys and expressions of negative affect during administration of emotion-eliciting stimuli, with infants who display longer, or more intense attention to toys showing less discomfort and less angry distress. Sustained attention to toys is taken to reflect better attentional control, and the findings are interpreted as supportive of Rothbart’s work linking attentional control with better regulated negative affect. In a recent investigation into the contributors to effortful control in 22- to 33-month-old children (Kochanska, Murray, & Harlan, 2000), toddlers with higher effortful control were found to modulate both their joy and anger more, and to be more restrained.

The ability to willfully focus and disengage attention is considered both integral to the process of self-regulation, and subject to the influence of emotional reactivity. Rothbart and Derryberry stress the bi-directional influence between emotion and attention: "...inadequate attentional control may leave an individual vulnerable to a variety of negative emotions..." , or in the opposite direction, "...chronic negative affect may disrupt the flexible utilization of attention..." (Derryberry & Rothbart, 1984, p.159). Individual differences in reactivity are posited to influence the flexibility and ease with which attentional
focus is disengaged and reoriented. Attentional flexibility, in turn, is associated with better-regulated negative affect. Chronic negative affect is seen as potentially disruptive to the flexible use of attention in the long-term (Derryberry & Rothbart, 1984). Rothbart's theory thus postulates a bi-directional influence between emotion and attention, such that, over time, the two become interwoven. According to Rothbart and her colleagues, allowing for either or both direction of influence, attentional flexibility should be linked to better regulated negative affectivity, and early difficulty with distress regulation should predict difficulty with later attentional flexibility.

Rothbart's hypothesis linking early recurrent distress to later attentional rigidity has been advanced by others in the field (see Fox & Calkins, 1993; Kopp, 1989; Lewis, 1993), but rarely investigated. Rothbart and colleagues' (1992) longitudinal study of 49 infants at 3, 6.5, 10, and 13.5 months of age provides some evidence for associations between early distress and later attentional flexibility. Distress at 3 months of age was found to predict a tendency toward overall disengagement of attention ($r = -0.27, p < 0.10$), with earlier high distress predicting lower disengagement of attention from a series of emotion-eliciting stimuli at 13.5 months. In a recent follow-up study of temperamental stability in the same participant sample, frustration in the laboratory at 10 months of age was found to negatively predict attentional control and soothability at 7 years of age ($rs = -0.35$ and -0.37, respectively, both $p < 0.10$, $N = 26$) (Rothbart et al., 2000b).
Additional support for Rothbart's hypotheses are provided by Matheny and colleagues. In investigations of infant temperament, Matheny and colleagues report correlations between focused and sustained attention to play activities and toys and better-regulated negative affect in 9-month-olds (Matheny, Riese, & Wilson, 1985), 12-month-olds (Wilson & Matheny, 1983), and 18- and 24-month-old toddlers (Matheny, Wilson & Nuss, 1984). Toddlers who were more attentive at 18 months evidenced better regulated negative emotion at 24 months, and vice versa. Higher distractibility, perhaps reflecting poorer attentional control, at 18 months of age was found to be associated with poorer ratings of mood at 24 months (Matheny et al., 1984).

In sum, Rothbart and her colleagues consider personality differences related to emotion regulation as arising from initial differences in reactivity and self-regulation, influenced by maturation and environmental factors over the course of development. Attentional processes are considered key to the regulation of reactivity, and seen to undergo considerable development, becoming increasingly flexible and organized over the first two years of life. Rothbart's model proposes an inverse relation between attentional flexibility and negative emotion, and empirical work by Rothbart and others supports this proposition. Studies with infants aged approximately 3 to 33 months show moderate correlations between both tendencies and abilities to disengage attention and better regulated negative affect. Evidence similarly links attentional control with better regulated negative affect in both children and adults.
Rothbart also suggests that early recurrent distress contributes to the development of later attentional rigidity associated with emotion regulation. There is some evidence that distress at 3 months of age predicts poorer attentional control at approximately one year, that distress at 18 months predicts better attentional control at 24 months, and that frustration at 10 months predicts poorer attentional control and soothability at 7 years of age. Although Rothbart postulates both immediate and long-term associations between attentional flexibility and affect, few investigations have been undertaken to offer support for predictions from one period of development to the next. Those that have been reported tend to consider either very short (18 to 24 months, and 3 to 12 months), or very long (10 months to 7 years) age ranges, and consider attentional flexibility in the context of assessing attentional control, rather than styles of emotion regulation.

Maternal Contributions to Early Attentional Processes

Caregiver behaviour has been identified as one external factor influential to the development of regulatory style. Much early emotion regulation is thought to be provided by caregivers, who are capable of soothing infants, employing techniques aimed at altering an over-arousing environment and controlling opportunities for distress, or arousal, and its management (Kopp, 1989; Thompson, 1991). Caregivers also influence emotion regulation by explicitly
teaching self-regulation behaviours and strategies (Garber & Dodge, 1991; Kopp, 1982, 1989; Stern, 1985). Caregiver responses to infant distress are widely held to have both immediate and long-term effects, and to contribute to the development of individual differences in emotion regulation (Field, 1985; Gable & Isabella, 1992; Gianino & Tronick, 1988; Kopp, 1989; Lamb, 1981; Sroufe, 1995; Stern, 1985; Thompson, 1991).

Studies of videotaped face-to-face interactions between caregivers (usually mothers) and infants document the significance of caregiver contributions to infant regulation of arousal. In their analysis of videotaped data, Gianino and Tronick (1988) describe how the infant and adult interact to create a single affective regulatory unit, and suggest that interactions characterized by mutual positive engagement teach the child to modulate emotional arousal. Early studies of mother-infant face-to-face interaction show interactions made up of positive and negative cycles of attention and affect, and identify individual differences in these patterns of interaction as early as 3 months of age (Brazelton, Koslowski, & Main, 1974; Trevarthen, 1979; Tronick, Ricks, & Cohn, 1982). In the context of these interactions, caregivers offer extrinsic regulatory opportunities by re-directing their infant's attention to maintain optimal levels of arousal in response to infants' signs of disinterest, fatigue or distress (Brazelton et al, 1974; Field, 1985). Manipulations of mothers' responsiveness to their infants during face-to-face interactions have also been shown to impact on
infants' patterns of engagement and arousal, and to have enduring effects (Cohn & Tronick, 1983; Field, 1977, 1994).

The results of these studies of face-to-face interactions serve to highlight the role of early maternal behaviour in the development of attentional strategies of regulation. Optimal maternal responsiveness is suggested to be neither too over-controlling nor too under-controlling of infants (Tronick et al., 1982). Responsive mothers are thought to accurately interpret infants' signals (Ainsworth et al., 1971). Bornstein and Tamis-LeMonda (1989) define optimal maternal responsiveness as prompt, contingent, and appropriate behaviour that has identifiable antecedents in the behaviour of infants. Maternal responsiveness is thought to interact with intrinsic factors, such as infants' self-regulatory capacities and emotional reactivity, to influence early experiences of distress, and contribute to success in managing arousal.

Evidence that maternal responsiveness in the first year predicts cognitive competence throughout the preschool years (Ainsworth & Bell, 1974; Bornstein & Tamis-LeMonda, 1989; Lewis, 1993; Olson, Bates, & Bayles, 1984) suggests that maternal behaviour influences infant attention. Mother-infant interaction at 6 months has been found to predict general cognitive competence and language at 24 months (Olson et al., 1984). Bornstein (1985) and Tamis-Lemonda and Bornstein (1989) found significant correlations between the amount of encouragement mothers gave their infants to attend to objects and properties in
the environment and infants' abilities to process visual information. Maternal responsiveness to infants has also been found to predict attention span and symbolic play at 13 months (Bornstein & Tamis-Le Monda, 1997), and cognitive competence at 4 years (Bornstein & Tamis-LeMonda, 1989). Lewis (1993) found 3 to 5 month maternal responsiveness predicted higher perceptual, verbal, and motor abilities at 4 years. These results point to the potential effects of maternal behaviour on developing cognitive competencies, including attention.

How might maternal behaviour influence the development of attentional flexibility? The responsiveness of mothers, and other caregivers, can be expected to influence the development of attentional styles related to emotion regulation over the course of infancy in two ways. First, the responsive caregiver prevents the recurrence of extreme distress, postulated to interfere with the development of effective regulatory strategies, including attentional strategies (Lewis, 1993; Thompson, 1991). Second, responsive caregivers are thought to directly provide infants with strategies for managing distress, such as distraction or the redirection of attention (Kopp, 1989; Brazelton et al., 1974). It has been hypothesized that children internalize the strategic distraction provided by responsive caregivers as they gain increasing regulatory self-control in early childhood (Kopp, 1989). Thus, responsive mothers, by taking measures to promote soothing, offer not only immediate relief from distress, but also support the development of strategies for successful emotion regulation in future by structuring the infants' environment such that occurrence of intense distress is
minimized, and increased opportunities for successful self-regulation are provided (Thompson, 1991). In sum, the development of attentional flexibility is thought to be influenced both by infants’ reactive and regulatory behaviour, and by caregivers’ responsiveness in meeting their infants’ regulatory needs.

**Attention and Emotion Regulation During the Second Year**

The second year is considered a critical period in the development of emotion regulation and related attentional strategies. Although still reliant upon the support of caregivers, toddlers increasingly attempt to cope with negative affect more independently (Karraker, Lake, & Parry, 1994; Mangelsdorf et al., 1995; Parritz, 1996). A range of behaviours is recruited to manage distress, including self-distraction and orienting attention to mother, and by 18 months toddlers take an active role in directing their own attention, and attempting to control stressful situations (Calkins & Johnson, 1998; Mangelsdorf et al., 1995; Parritz, 1996). Increasing consistency and stability of coping behaviours, and increased use of problem-focused behaviours have been observed from 12 to 18 months of age (Parritz, 1996). Studies of coping during the toddler period suggest the use of increasingly active (Mangelsdorf et al., 1995), specific (Parritz, 1996), and planful (Van Lieshout, 1975) strategies to manage distress.
Substantial developments in a variety of domains coincide during the second year to provide a range of new causes for distress and avenues for coping with it (Case, Hayward, Lewis, & Hurst, 1988; Kopp, 1989; Lewis, under review). At 18 to 24 months, advances in the areas of symbolic representation and self-concept are seen as giving rise to the sense of self as a separate and active agent, and a willful being (Piaget, 1952; Mahler, Pine & Bergman, 1975; Sroufe, 1995). Developmental issues related to independence, control, and identity apart from caregivers surface at this time (Dunn, 1988; Lewis, et al., 1989; Mahler et al., 1975). Cognitively, the middle of the second year is thought to mark the beginning of a major stage change (Case et al., 1988; Fischer, Shaver, & Carnochan, 1990; Piaget, 1970). According to Case's neo-Piagetian theory, at 18 months infants move from the sensorimotor to interrelational stage, and become capable of coordinating higher-order representations of inter-connected relationships (Case, 1991). The middle of the second year is thought to bring new awareness of the desires and intentions of others (Repacholi & Gopnick, 1997; Tomasello, 1995). Also, at approximately 18 months, toddlers gain the ability to create two-word sentences and rapidly expand their vocabulary, bringing new capacities for communication (Lenneberg, 1966; Menyuk, 1971). Within Case's theory, each cognitive shift is associated with transitions in the interpersonal domain. At 18 months, for example, the ability to relate one relationship to another allows for jealousy to emerge (Case et al., 1988). Developmental gains in a variety of domains in the second year thus may interact to provide
opportunities for new styles of regulation to emerge and preferred strategies to consolidate.

Few studies have sought to examine the development of individual differences in coping during the toddler period. However, both temperament and maternal influences have been found to predict differences in toddler coping. Differences in fussiness, proximity-seeking, gaze aversion, and self-stimulation have been reported as a function of wariness (Mangelsdorf et al., 1995; Parritz, 1996). Calkins & Johnson (1998) presented 18-month-old toddlers with frustrating events, and found that the tendency to be distressed was negatively related to the use of coping strategies such as distraction, seeking out mother, and constructive coping. Temperamentally difficult toddlers are reported to experience stressful events more frequently and respond with more distress to stressors (Karraker et al., 1994). In addition, toddlers whose mothers tend to provide positive feedback and guidance have been found to use distraction and constructive coping more than aggression and acting out in response to frustration (Calkins & Johnson, 1998). Maternal responsiveness at 22 months has also been associated with more effortful control in toddlers' responses to emotion-eliciting stimuli at both 22 and 33 months of age (Kochanska et al., 2000). Thus, there is evidence that both temperament and maternal factors contribute to developing differences in regulatory style during toddlerhood. However, few studies have examined these factors as antecedent to individual differences in attentional flexibility during the second year.
Summary and Rationale for the Present Study

Individual differences in styles of attentional engagement associated with the regulation of negative affect, evident in the first years of life, are thought to emerge from the joint influence of early tendencies toward emotional reactivity, capacities for self-regulation, and caregiver characteristics. Past theory and research suggest that attentional flexibility is associated with better regulated negative affect, and points to bi-directional influences between attentional processes and emotion as working, over time, to shape styles of attentional deployment associated with emotion regulation. The work of Rothbart and her colleagues offers a theoretical framework for examining these associations, and provides empirical evidence linking attentional flexibility with better regulated negative affect. Other investigations in the areas of temperament and effortful control similarly suggest associations between flexible attention and better-regulated negative affect. Although early experiences of distress are postulated to predict later patterns of attentional engagement, little research to date has examined long-term associations between affect and attention. Furthermore, studies that have addressed associations between early affect and attention have, for the most part, examined attentional capacities rather than patterns of attentional engagement associated with emotion regulation. Moreover, there is reason to believe that maternal behaviour influences both infant distress and the development of attentional capacities, yet maternal responsiveness has not been studied as a contributor to individual differences in attentional flexibility. The
first two years are considered critical to the development of emotion regulation, and to the development of associated attentional processes, yet there have been few longitudinal investigations of these processes spanning the first two years.

The present study was essentially exploratory in nature, and sought to address gaps in the research outlined above. Data from two previous longitudinal investigations were analyzed to examine the contributions of some identified intrinsic and extrinsic sources of individual difference in emotion regulation. The first study examined emotion-cognition interactions across development in the first year, and included a standard neonatal assessment and ratings of maternal responsiveness (Lewis et al., 1997). Measures from the neonatal assessment afforded the opportunity to tap the earliest contributors to attentional outcomes in development. The second study followed a subsample of participants from the first investigation with the goal of examining a hypothesized stage transition from a dynamic systems perspective (Lewis et al., under review). For this study, toddlers were exposed to emotion-eliciting episodes involving a frustrating toy, on a monthly basis, from the ages of 14 to 25 months. Toddlers' attentional engagement during the emotion-eliciting episodes was assessed, providing a dataset for examining discontinuities in attentional flexibility across the second year.

The second study used state space grid analysis, a new dynamic systems' method (see Lewis, Lamey & Douglas, 1999), to measure attentional engagement. State
space grids can be used to simultaneously code any segment of behaviour along two scales, on a grid of cells, each cell representing a unique coordinate pair of the values on the two variables. For the second study, state space grids used two 5-point scales, each representing levels of attentional engagement to either an unavailable toy or an unavailable mother. Thus, toddlers' attentional engagement during the administration of an emotion-eliciting episode could be charted on a 5x5 grid of 25 cells, each representing variations in attention to mother and toy. This method provided measures of occurrence and duration of attentional engagement, range of attention, and shifts in attention, which were used to assess attentional flexibility.

For the current study, measures available from these two investigations were adopted to examine relations between self-regulation, distress, and maternal behaviour in the first year, and attentional flexibility in the second year. A brief description of these measures is provided here: details are provided in the following chapter. Two cluster scores from the Brazelton Neonatal Assessment Scale (NBAS; Brazelton, 1984) -- "Range of State" and "Regulation of State" -- closely parallel Rothbart's concepts of reactivity and self-regulation (Derryberry & Rothbart, 1984). These neonatal measures were selected to index infant distress proneness. Ratings of maternal responsiveness, assessed at two periods in the first year, and averaged, were also examined to index maternal contributions to later attentional flexibility. Three measures of attentional engagement were examined. Each measure of attentional engagement reflected a different aspect of
attentional flexibility during the administration of an emotion-eliciting task. Toddlers' "range of attention" measured the number of cells on the state space grid representing unique attentional states. "Attentional shifting" measured frequency of movement from one cell to another, or one state to another. "Attentional heterogeneity" made an unconventional use of traditional variance measures, in order to measure the variability in the incidence of attentional states derived from sum durations for each cell on the grid. Measures of distress during second-year task administration were also included in the present analyses, so that changes in the relationships under study could be assessed in relation to distress elicited by the tasks presented. Thus, three potential antecedents (emotional reactivity, self-regulation, and maternal responsiveness) were examined in relation to three measures of attentional flexibility in toddlerhood. Relationships between antecedents and attentional flexibility were examined for flexibility scores, aggregated across the second year, and also on a monthly basis, to index change in the relationships, expected to occur at about 18 to 20 months.
Research Questions and Hypotheses

The current study addresses the following questions and hypotheses:

1) Do early capacities for self-regulation of distress predict later patterns of attentional engagement associated with emotion regulation?

It was expected that better regulation of emotional state in the neonatal period would be associated with more flexible attention during emotion-eliciting episodes in the second year.

2) Do early tendencies for reactivity, or proneness to distress, predict patterns of attentional engagement associated with emotion regulation?

More reactive infants might be expected to experience recurrent levels of high distress, and thus be at a disadvantage in developing flexible attentional strategies for coping. Alternately, the effects of higher reactivity during the neonatal period might be moderated by capacities for self-regulation, or by maternal responsiveness. No specific predictions regarding this question were advanced.
3) Does early maternal responsiveness influence later patterns of attentional engagement associated with emotion regulation?

Higher maternal responsiveness in the first year was expected to predict greater attentional flexibility in response to emotion-eliciting episodes in the second.

4) Finally, does the pattern of relationships between early predictors and later attentional engagement associated with emotion regulation remain constant over the course of the second year, or does it shift with other developmental milestones?

Given rapid developments in a variety of domains over the second year, a change in relationships between antecedents and regulatory outcomes might be expected. Evidence from the previous investigation of toddler coping (Zimmerman, 2000), from which data for this study were drawn, suggests increased variability and the emergence of novel coping strategies at approximately 18 to 20 months of age, the timing of other developmental acquisitions described earlier, and of a hypothesized developmental stage transition. The profile of relationships, measured monthly, between 14 and 25 months, was therefore expected to show discontinuity after the middle of the second year, at approximately 18 to 20 months.
METHOD

Participants

Participants were 24 mother-infant dyads, recruited for two previous longitudinal studies (Lewis, Koroshegyi, Douglas & Kampe, 1997; Lewis, Zimmerman & Lamey, under review). Of the participants included in both the first and the second study, neonatal assessments for 16 participants and assessments of maternal responsiveness for 23 participants were completed. Some variability in the number of subjects across different longitudinal analyses is reported since sessions were occasionally missed due to infant fatigue or illness.

For the first study, forty-seven volunteers were initially recruited through radio announcements, flyers distributed to clothing and toy stores, presentations to pre- and postnatal fitness classes, help from physicians, and newspaper advertisements. In most cases, families were contacted prior to the birth of the infant, the research was outlined, and consent was obtained in a preliminary visit. Criteria for inclusion in the first study stipulated that the infant be born close to term (within 2 weeks), both parents live at home, the mother function as the primary caretaker, and the mother remain at home at least part time within the first year of the infant's life. Nineteen infants in the sample were first-born, most were Caucasian and 82% were middle class. The first five mother-infant
dyads were used to pilot-test measures, and three were lost to attrition, leaving a total of 17 male and 22 female infants. During the course of data collection, seven mothers decided to return to work full-time, and one dropped out for medical reasons. Data for these participants was included.

Twenty-four of the dyads from the first study participated in the second. Nine infants from the first study were ineligible to participate because they were too old by the time the second study began, two had to be excluded because their homes lacked a suitable space for conducting the study, one participant was eliminated because her mother did not adhere to the instructions, and a further two were lost to attrition.

**Procedure**

**General Overview**

The current study examines data previously collected for two research projects. The first longitudinal study was designed to examine the relationship between socio-emotional and cognitive development over the first year of life (Lewis, Koroshegyi, Douglas & Kampe, 1997). An initial neonatal assessment at approximately 10 and 17 days was followed by alternate assessments of socioemotional and sensorimotor functioning at 2, 4, 6, 8, 10 and 13 months. Maternal behaviour was also rated at two sampling periods at 2 to 4 and 10 to 13
months. Infants' emotional reactions, during and following a separation with their mother, were used to predict cognitive performance from one period to the next and across all periods. The measures of interest for the current study derive from the neonatal assessment and ratings of maternal behaviour.

The second study followed a subsample of the infants recruited for the first study, longitudinally, over the course of their second year. This study examined a developmental transition, or reorganization, in the middle of the second year, from a dynamic systems perspective (Lewis, Zimmerman, & Lamey, under review). Each mother-infant dyad was visited on a monthly basis between 14 and 25 months of age, and presented with four emotion-eliciting tasks. Upon preliminary analyses of the data, it was discovered that one task elicited too much distress, and another very little. These two tasks were left uncoded, since they were deemed unlikely to provide useful data. Measures of infants' attentional engagement and distress during the administration of the two remaining tasks was compared across months to index variability, periods of fluctuation, and tendencies or patterns of engagement. Thus, for the current study, the measures of interest were measures of infants' range of state and regulation of state during the neonatal assessment, along with measures of maternal behaviour during the first year. These were examined in relation to measures of attentional flexibility during emotion-eliciting episodes over the second year.
Neonatal Assessment

A standard neonatal assessment scale, the Brazelton Neonatal Behavioural Assessment Scale (NBAS; Brazelton, 1984) was administered by a trained examiner at approximately 10 and 17 postnatal days, at the infants' homes. The NBAS was designed to assess state, attention, motor, and autonomic responses, which include indexes of infant reactivity and regulation in the newborn period. Of the 24 items in the scale, 14 items describing emotional behaviour were administered. The manual instructs the examiner to attempt to elicit the best reaction from each infant. Two visits were therefore conducted for each participant in order to best establish an optimal score, -- the first between 8 and 13 days and the second between 14 and 21 days. Since it was difficult to predict fussiness, and the exam was highly sensitive to infant state, up to four visits sometimes had to be scheduled in order to complete two administrations. Five of the participants received only one completed assessment despite these efforts. When two assessments could not be completed, usually due to fussiness, scores for the one completed assessment were considered optimal, since they represented the least fussy session.

To assess inter-rater reliability, 10% of the sessions were scored concurrently by two examiners, and Pearson-product moment correlations between scores calculated for each of the six items selected for use in the present study. The r's ranged from .85 to .98, with a mean r of .90.
Optimal scores were obtained for 6 of 14 items administered and scored according to instructions provided in the manual (Brazelton, 1984) were obtained. The NBAS manual (Brazelton, 1984) suggests the use of a clustering scheme for the individual test items, based on research by Lester and colleagues (1982). Two of the suggested clusters were of interest for the present study: "Range of State" and "Regulation of State". The "Range of State" cluster includes items labelled "peak of excitement", "rapidity of buildup", "irritability", and "lability of state", which parallel Rothbart's concept of emotional reactivity. In a departure from Brazelton's suggestions for the range of state cluster, rather than converting raw scores into a nonlinear scale which collapsed extreme values, raw scores were retained since they provided an unambiguous estimate of irritability. The "Regulation of State" cluster, as outlined in the manual, includes, "consolability", "self-quieting", and "cuddliness". In a recent study using confirmatory factor analysis to assess the Lester behaviour clusters, items included in the range of state cluster were found to be correlated, but the "cuddliness" item failed consistently to load onto the "Regulation of State" factor (McCollam, Embretson, Mitchell & Horowitz, 1997). For this reason, and because the item is intended to measure "the infants' response to being held in an alert state" (Brazelton, 1984, p.38), rather than a capacity for self-soothing, the "cuddliness" item was excluded from the regulation of state cluster. Orientation measures collected for the first study were not of interest and also excluded from the present analyses. The two cluster scores for range of state, or reactivity, and
regulation of state, or self-regulation, were simply the mean values of the items which made up each cluster, as recommended.

**Maternal Responsiveness Assessment**

Various dimensions of maternal behaviour were assessed by means of a scale designed for use in this study. Six items were selected from a Q-sort developed by Pederson and his colleagues (1990) linking contrasting behaviours which most differentiated sensitive from insensitive mothers. Some modifications were made to the wording, and the items were arranged as opposite poles on 5-point Likert scales, randomly ordered, with positive and negative poles scrambled. Each item assessed a different aspect of maternal behaviour, for example, consistency and timing of response to babies' signals, intrusiveness, control of pace and content of interactions (see appendix A for a sample of Maternal Behaviour Scale). Maternal behaviour ratings were assigned by the socioemotional and sensori-motor examiners independently, at 2 and 4 months, and again at 10 and 13 months, to tap maternal sensitivity at the beginning and end of the infant's first year. Examiners completed the rating form after the first of their visits at each socioemotional or sensori-motor assessment, and then revised their entries as required after each succeeding visit, based on their impressions of infant-mother interactions over the entire time they spent in the home.
Over the course of data collection, six mothers were rated collaboratively to maintain good agreement. Fifteen percent of the independently rated subjects' scores were randomly selected for inter-rater reliability comparisons. Reliability was calculated for each of the six items according to the per cent concordance between examiners (i.e. matches/total number of observations). Reliability quotients ranged from .84 to .96, with a mean of .88.

**Scoring Maternal Responsiveness**

Ratings on the six scales were averaged to obtain a responsiveness score for each mother at each period of data collection. Then an Early Responsiveness score was derived from the average ratings of two examiners (as well as collaboratively rated protocols) at 2 and 4 months, and a Late Responsiveness score was derived across the 10 and 13 month assessments. Since no particular age period for maternal responsiveness was hypothesized to predict later attentional flexibility, the two scores for each mother were also averaged, to yield one score for average maternal responsiveness over approximately the first year. All three maternal responsiveness scores were retained.

**Toddlers’ Attentional Flexibility**

Measures of toddler's attentional flexibility during the administration of an emotion-eliciting task were collected and coded for the purposes of investigating a developmental transition in the second year from a dynamic systems perspective. Data available from two of the four tasks administered were
analyzed for the present study, and the procedures and scoring pertinent only to
the current study will be described here. A detailed description of the toddler
study is available elsewhere (see Zimmerman, 1999; Lewis, Zimmerman &
Lamey, under review).

Each mother-infant dyad was visited in their home on a monthly basis between
the age of 14 and 25 months, and videotaped during four emotion-eliciting tasks.
The video camera was set up across the room on a tripod so that both mother
and infant were taped. All episodes were administered in a fixed sequence every
month.

Episodes began with a play period lasting long enough for the infant to become
engaged. Timing began at the onset of each emotion-eliciting event and the
infant’s reaction was recorded for 60 seconds. If the child approached the mother
or made some overt gesture directed toward her, the mother was asked to limit
her response to one standard phrase and then continue reading her magazine.
Episodes were discontinued after 15 seconds of moderate to high distress. A
semi-standardized play period followed each task episode to mitigate any
negative memory of the experimental toys. During this time, the mother
enabled the child to resume the activity interrupted by the emotion-eliciting
event. The examiner then presented a second toy and allowed the child to play
with it for as long as desired. This play period generally lasted 3 to 5 minutes.
Play periods were extended up to 10 minutes whenever the previous episode had been discontinued due to distress.

The two emotion-eliciting tasks coded for this study were as follows:

1) Jack-in-the-box. The mother and infant were seated on the floor, while the examiner remained outside the room. Following the play period, the mother introduced a jack-in-the-box out of which popped a puppet's head after the crank was turned several rotations. However, the crank of the jack-in-the-box was shortened so that the turning motion would be impossible for an infant. The mother was instructed to operate the toy twice but not teach the infant how to do it. Once the infant was engaged, the mother stopped working the jack-in-the-box and moved to a designated area 1-6 feet behind the infant to read a magazine, at which point timing began. If the infant made an overt attempt to re-engage the mother, she responded, "I'm busy now. You try it."

2) Enclosed-toy. The initial play period began with the mother seated 4-6 feet behind the infant, and pretending to read a magazine. The examiner emptied three toys from a clear plastic container (a cake container) and placed them in front of the infant. When the infant had focused on one particular toy for 10-15 seconds, the examiner took it from the infant, placed it in the container, and snapped on the lid. The container was virtually impossible for the infants to open. The other two toys remained outside the container and continued to be
accessible. After one toy was placed in the container, timing began and the
examiner left the room. Again, the mother was instructed not to initiate
involvement and to respond, "Find something else to play with", if the infant
approached or requested help.

Episodes were terminated early or considered spoiled for the following reasons:

1) The infant left the room.
2) The infant met the distress criterion (15 seconds of intense or continuous
distress).
3) The mother made an error, for example, instructing the baby to access the toy,
   moving next to the baby, soothing or helping the baby.
4) The toy became accessible to the infant (e.g., the jack-in-the-box opened).
5) Outside interference caused the baby to become distracted.
6) The infant would not participate by refusing to interact with the experimental
toys during the initial play period.

Based on these criteria, 12 jack-in -the-box and 10 enclosed-toy episodes were
excluded from the analysis. A total of 16 missed sessions occurred during all
months of data collection. Missed sessions were due to cancellations which
could not be rescheduled. Missing or spoiled sessions were distributed evenly
across the age span except for a steep increase in the final two months. At these
ages, missing sessions were primarily due to loss of commitment on the part of
the participants and spoiled sessions were often due to practice effects. A total of 253 completed emotion-eliciting episodes were included in the analysis.

**Coding Procedures for Attentional Flexibility and Distress**

Infant behaviour was coded on two ordinal scales representing level of engagement with the toy and level of engagement with the mother. These scales reflected infant attention to the two frustrating elements within each episode. Each scale had 5 levels of engagement, with level 1 representing no engagement at all, levels 2 and 3 representing degrees of passive engagement, and levels 4 and 5 representing degrees of active engagement. Each second of videotaped behaviour was coded on both scales simultaneously. Thus, attentional engagement for each second could be graphically depicted on a 5x5 grid with 25 cells representing variations in infant attention to both toy and mother. The levels for each scale and the behavioural guidelines used to identify them can be found in Appendix B.

Infant vocal distress was also coded from the audio portion of each videotaped session. Although facial expression is a commonly used index of infant distress, in this study the use of a stationary camera with increasingly mobile toddlers provided limited opportunities for continuous facial coding, and vocal expressions of negative emotion were therefore coded instead. Each second of an emotion-eliciting episode was scored either as "distress" or "nondistress", regardless of the intensity of vocalizations. Negative vocalizations ranged from
mild discomfort (e.g. whimpering, whining) to extreme distress (e.g. crying, screaming). Mild to moderate distress were most common, and extreme distress usually met the criterion for termination of the session. No infant reached the distress criterion on more than two occasions.

All data were coded by two assistants who remained blind to the hypotheses until the coding was completed. Fifty-six sessions (19.5%) were coded by both assistants. To assess inter-rater reliability, a subset of infants were randomly selected, and for these infants one episode was selected randomly from each of three age periods, early, middle, and late. The final count was an approximate proportion of the total number of coded episodes for each task: 25 jack-in-the-box episodes (21% of total) and 31 enclosed-toy episodes (18% of total).

Inter-rater reliability was assessed using two methods:

1) Concordance was calculated as the proportion of seconds in which there was agreement on the code on both toy and mother scales. A disagreement on one or both scales for a given second was designated a mismatch. Concordance was calculated as 75.9% for the jack-in-the-box task and 80.8% for the enclosed-toy task, with an overall mean of 78.5%.

2) Reliability on the toy and mother scales was also calculated independently. Using two 5-by-5 interrater tables, one for each scale, Cohen's kappa, combined
over both tasks, was .79 for the toy scale and .80 for the mother scale. Inter-rater reliability for all incidences of infant distress in each session was calculated as a kappa coefficient of .77.

**Scoring Attentional Flexibility**

At each month, for each task, three measures of attentional flexibility, scored previously for the prior investigation, were obtained. The first two measures were straightforward. Attentional range was calculated as the number of cells, on the 5x5 grid, occupied during the emotion-eliciting episode. Episodes of less than 50 seconds in duration were excluded from the analysis. Attentional shifting measured the number of cell changes, or events. For episodes which were cut short, scores were standardized to 60 seconds by dividing the total number of cell changes by episode length, and multiplying by 60.

Attentional heterogeneity was a more complicated measure, designed to be sensitive to both the magnitude and distribution of cell-to-cell differences in duration. For this measure, durations for each cell on the grid were summed, and the variance of cellular cumulative durations was calculated for each grid. Heterogeneity scores thus reflected variance in the incidence of attentional states on the state space grid. Higher heterogeneity reflected greater differences among fewer cells on the grid, indicating the pooling of behaviour, or stability of attentional engagement; whereas low to moderate scores indicated a higher degree of dispersion across cells, or attentional flexibility. Because high scores for
both attentional range and attentional shifting reflected more, rather than less attentional flexibility, heterogeneity scores were multiplied by -1, for ease of comparison with other attentional flexibility scores.

The jack-in-the-box and enclosed-toy tasks were scored separately for each month and then averaged. For those cases where monthly episodes were available for only one task, scores for that task alone were used. This occurred for 45 out of 253 months and 13 of the 24 participants.

Scoring Distress

Monthly distress was calculated as the sum duration of seconds of distress per episode. In order to compensate for shortened episodes, total distress was divided by episode length and multiplied by 60, providing a proportional score corrected to 60 seconds.
RESULTS

The data were analyzed in four steps. First, preliminary analyses were conducted to determine associations among neonatal measures and maternal responsiveness in the first year, and associations among measures of attentional flexibility and distress over the course of the second year. Correlational analyses were then used to test the hypothesized relations between neonatal and maternal predictors in the first year and attentional flexibility in the second year. Next, to index change over the course of the second year, profiles of monthly associations between first-year predictors and second-year attentional flexibility were examined. Finally, multiple regression analyses were conducted to ascertain the independent contributions of predictor variables and to investigate whether distress in the second year moderated the relationship between first year predictors and second year attentional flexibility.

Preliminary Analyses

Intercorrelations among infancy measures and measures of maternal responsiveness in the first year can be found in Table 1. The regulation of state (self-regulation) and range of state (reactivity) clusters were inversely, but not statistically significantly, correlated. Early and late maternal responsiveness were found to be highly correlated \( r = .65, p = .001 \), and the mean maternal
responsiveness was therefore viewed as a valid measure for subsequent analyses. Interestingly, maternal responsiveness was inversely related to range of state ($r = -.61, p < .01$) at both ages.

**Table 1. Correlations between Neonatal Measures and Maternal Responsiveness**

<table>
<thead>
<tr>
<th></th>
<th>Range of State</th>
<th>Early Responsiveness</th>
<th>Late Responsiveness</th>
<th>Mean Responsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation of State</td>
<td>-.38</td>
<td>.24</td>
<td>.58 *</td>
<td>.44</td>
</tr>
<tr>
<td>Range of State</td>
<td>--</td>
<td>-.57 *</td>
<td>-.51 *</td>
<td>-.61 **</td>
</tr>
</tbody>
</table>

* $p \leq .05$  ** $p \leq .01$  N= 16

**Table 2. Correlations Between Second-Year Attentional Flexibility and Distress Measures**

<table>
<thead>
<tr>
<th></th>
<th>Attentional Shifting</th>
<th>Attentional Heterogeneity</th>
<th>Distress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional Range</td>
<td>.73***</td>
<td>.80***</td>
<td>.50*</td>
</tr>
<tr>
<td>Attentional Shifting</td>
<td>--</td>
<td>.69***</td>
<td>.54**</td>
</tr>
<tr>
<td>Attentional Heterogeneity</td>
<td>--</td>
<td>--</td>
<td>.49*</td>
</tr>
</tbody>
</table>

* $p \leq .05$  *** $p \leq .001$  N= 23

As shown in Table 2, intercorrelations among measures of attentional flexibility, aggregated across months, were all found to be significant. To further determine whether the individual measures of attentional flexibility were valid, monthly correlations among all three were calculated. Correlations were generally found
to be satisfactory, with the exception of two of the months. Correlations for month 16 and month 25 were low among all measures, ranging from .12 to .44. For all other months, correlations tended to be higher, ranging from .30 to .83 with a mean of .60. Since all three measures of attentional flexibility apparently tapped a similar aspect of attentional behaviour, factor analyses were performed to combine these items into one score for attentional flexibility. Monthly factor loadings ranged from .32 to .93 for attentional shifting, .68 to .93 for attentional range, and .85 to .98 for attentional heterogeneity, with mean loadings of .70, .89, and .91 for attentional shifting, range, and heterogeneity, respectively.

Distress, aggregated across the two tasks and across all months, was also found to be significantly correlated with attentional flexibility, such that higher distress during emotion-eliciting episodes was associated with more attentional shifting and movement, and less stability.

Associations Between Neonatal Measures, Maternal Responsiveness, and Second-Year Attentional Flexibility

The current study sought to examine early self-regulation, early reactivity, and maternal responsiveness in the first year, as contributors to attentional behaviour associated with emotion regulation in the second year. To address this goal, correlations between neonatal measures of reactivity and regulation,
maternal responsiveness in the first year, and toddlers' attentional flexibility were computed. For this set of analyses, all attentional flexibility scores were aggregated across tasks and across months, yielding a summary score for the period between 14 and 25 months. As can be seen in Table 3, early regulation of state was highly correlated with attentional flexibility in the second year, as hypothesized. Infants who were better able to regulate distress during the neonatal period thus evidenced more attentional flexibility in response to an emotion-eliciting episode as toddlers. Both early range of state and maternal responsiveness, however, were found to be unrelated to aggregated second-year measures of attentional flexibility.

Table 3. Correlations between First-Year Predictors and Second-Year Attentional Flexibility and Distress

<table>
<thead>
<tr>
<th></th>
<th>Regulation of State</th>
<th>Range of State</th>
<th>Maternal Responsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional Flexibility</td>
<td>.71**</td>
<td>-.16</td>
<td>.17</td>
</tr>
<tr>
<td>Distress</td>
<td>.47</td>
<td>-.14</td>
<td>.20</td>
</tr>
</tbody>
</table>

* *p ≤ .05 N=16

Neonatal regulation of state also tended to predict toddlers' level of distress during administration of the emotion-eliciting tasks (r = .47, p = .07), such that better regulatory abilities in early infancy were associated with more distress in response to the presented tasks in the second year. The correlation failed to meet
the .05 level of significance, but approached it closely. This finding was unexpected, and no hypotheses regarding this relationship had been put forward.

**Monthly Associations between Infancy Measures and Second-Year Attentional Flexibility**

To explore the pattern of relationships between predictors from the first year and attentional flexibility over the course of a developmental transition in the second year, correlations among measures were calculated on a monthly basis and graphed in Figure 1. Correlations were significant at 14, 17, and 18 months, and approached significance at 15, 21, and 22 months. The correlations for months 16, 23, and 25 were found to be very low. The N for the 25th month was only 11, substantially lower than that of other months. Preliminary analyses of attentional measures at both 16 and 25 months also revealed low intercorrelations among the attentional measures combined to yield the attentional flexibility score.
Although no specific hypothesis was advanced regarding the relationship between range of state and attentional flexibility over the months of the second year, it was expected that if the two were correlated at all, an inverse relationship would be found. That is, higher reactivity in the neonatal period was expected to predict lower, rather than higher, flexibility in the second year. In order to more easily compare the profile of correlations between range of state and flexibility with the other profiles, all correlations for range of state were multiplied by -1 and graphed in Figure 1. Monthly correlations between the two measures were negligible to low. However, at month 21, the $r$ of $.62$ reached significance at the $p < .05$ level, and at month 17, a moderate correlation of $.42$ was found. Again, the correlation at month 25, with an $N$ of only 11, departed markedly from the rest of
the profile. Thus, in general, early range of state was found to be unrelated to
attentional flexibility in the second year.

Monthly correlations between maternal responsiveness and attentional
flexibility revealed only two statistically significant relationships out of a possible
12, congruent with findings for aggregated scores. Correlations of .50 and .63 at
months 17 and 21 reached statistical significance at the .05 level. As with the
correlations for regulation of state, months 17, 18, and 21 revealed the strongest
relationships in the expected direction, with correlations of .39, .37, .25 and .28
respectively. At month 23, and once again at month 25, the profile takes an
uncharacteristic turn toward a moderate negative correlation (r s = -.38 and -.56,
respectively). For month 25 the correlation, for 11 participants, approached but
did not meet significance (p = .07). Maternal responsiveness therefore proved to
be an unreliable predictor of attentional flexibility when considered on a
monthly basis.

Relationships between early predictors and later outcome measures were
generally low across all three of the monthly profiles. However, consistent with
findings for aggregate scores, correlations between early regulation of state and
later attentional flexibility were the highest. Inspection of scatterplots revealed a
positive linear relationship, with no outliers, for the months with the strongest
correlations (months 17, 18, 21 and 22). Comparison of the profiles indicates
some convergence of moderate to strong relationships for all measures at
months 17 and 21, and for regulation of state and maternal responsiveness at month 18 as well. Relationships between neonatal regulation of state and toddler's attentional flexibility were particularly strong at these months.

It was hypothesized that some change in the profile would be apparent at approximately 18-20 months, the time of a developmental transition. In fact, some of the stronger relationships were found at 17, 18, and 21 months. Interestingly, although the profiles fail to reveal any clear longitudinal pattern, a parallel profile presents itself for all three of the hypothesized relationships. Fluctuations across the months follow a similar contour, suggesting the possible influence of a mediating factor.

**Multiple Regression Analyses**

The relationships of early regulation of state and maternal responsiveness with attentional flexibility were also assessed within a multiple regression framework in order to determine the relative weight of each predictor and to look for overlap among predictors. Moreover, since distress during emotion-eliciting tasks was found to be positively correlated with attentional flexibility for aggregated scores, and inversely correlated with neonatal regulation of state, the possibility that distress was a mediating influence on the relationships was also explored by entering it into the equation.
Because of the relatively low $N$, two, rather than all three first-year predictors were entered into the regression analyses with distress. Maternal responsiveness and self-regulation (the best predictor of the two neonatal measures) were entered to index both intrinsic and extrinsic contributions to attentional flexibility. Regression analyses were first performed for the variables, to determine the relative influence of neonatal regulation of state and maternal responsiveness on later attentional flexibility while accounting for the effects of distress. As shown in Table 4, just over half of the variance in attentional flexibility was accounted for by the two predictors, regulation and responsiveness. The relative contribution of regulation of state was, as expected, far greater than that of maternal responsiveness, which added no independent contribution. This pattern of relationships remained the same even after distress was added as a second step in the regression analyses, with the combination of the predictors and distress explaining only an additional 2% of the variance, and distress providing no significant contribution on its own.

Table 4. Regression of Two First-Year Predictors on Attentional Flexibility

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$N=16$
Finally, multiple regression analyses were calculated on a monthly basis, to explore the profile of change in relationships when both regulation of state and maternal responsivity were considered together, and the effects of distress considered as a mediator. Results of this analyses are indicated in Table 5. Beta weights indicate that for the first months, all predictors tended to be overlapping. Starting at month 20, however, individual predictors contributed to the variance independently. Beta weights for maternal responsiveness, without distress, were significant at the .10, and .08 levels for months 20 and 21. For regulation of state, beta weights were significant at $p < .05$ for months 14, 18, and 19. The multiple Rs, with distress, at months 18, 20, 21, 22, and 23 were all significant at $p < .05$. As can be seen in Figure 2, starting at month 20, distress made a considerable independent contribution to the multiple correlation, whereas, prior to month 20, it did not. The results of the monthly multiple regression analyses suggest that distress was indeed a mediating influence, but only after month 20. In addition, after month 20, early regulation of state, maternal responsiveness, and distress during task administration were found to contribute independently to the variance in attentional flexibility. Thus, these findings suggest that the pattern of relationships between early predictors and attentional outcomes was altered following a developmental transition at approximately 18 months of age, consistent with expectations of the fourth hypothesis of this study.
Table 5. Monthly Regression of Two First-Year Predictors on Attentional Flexibility

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<td>.38</td>
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Table 5. Monthly Regression of Two First-Year Predictors on Attentional Flexibility (continued)

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<td>( t )</td>
<td>( p )</td>
<td>( R )</td>
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Fig. 2. Multiple Correlations for Two Predictors, with and without Distress
DISCUSSION

The first goal of this study was to identify antecedents to individual differences in attentional flexibility associated with emotion regulation. Infants' emotional reactivity, self-regulation, and maternal responsiveness within the first year were examined in relation to toddlers' attentional flexibility in response to emotion-eliciting episodes. A second goal of the study was to explore whether associations between antecedents and attentional outcomes shifted over the course of the second year, a period marked by rapid development in a variety of domains, most notably at 18 to 20 months. As expected, the data demonstrate relations between capacities for self-regulation within the first weeks of life and toddlers' attentional flexibility in the second year. However, no association between neonatal reactivity and later attentional behaviour was found. Maternal responsiveness proved to be an unreliable predictor, with associations at some months stronger than others. No clear pattern of associations between early antecedents and later attentional engagement was indicated over the months of the second year, even when distress was entered as a potential mediator. Nevertheless, associations between antecedents and patterns of attentional flexibility appeared to be enhanced by contributions from maternal responsiveness and present distress starting just after the time of a hypothesized developmental transition period.
Associations Between Neonatal Regulation and Toddlers' Attentional Flexibility

As expected, infants who demonstrated better capacities for self-regulation in the neonatal period also demonstrated more flexible attentional engagement in response to stress during the second year. Infants who evidenced difficulty with self-regulation of arousal in the neonatal period responded to emotion-eliciting events with less attentional flexibility, directing their attention across a narrower range, and shifting attention less frequently. This finding is congruent with theoretical claims that early experiences of recurrent distress contribute to the development of a more rigid attentional style in response to stress (Fox and Calkins, 1993; Kopp, 1989; Lewis, 1993; Derryberry & Rothbart, 1984), and extends the small body of empirical evidence linking early distress to later difficulty with attentional flexibility in infants (Harmon et al., 1997; Johnson et al., 1991; Kochanska et al., 1998; Matheny et al., 1984, 1985; Rothbart et al., 1992, 1994).

Extreme distress in infancy is postulated to limit opportunities for successful self-regulation of negative affect (Lewis, 1993; Thompson, 1991), and to disrupt the flexible utilization of attention (Derryberry & Rothbart, 1984). Repeated recruitment of inflexible attentional tendencies associated with chronic distress is thought to reinforce the development of attentional rigidity in response to negative affect (Kopp, 1989). Thus, recurrent episodes of distress might disrupt the development of attentional flexibility, and contribute to more rigid styles of attentional engagement associated with emotion regulation.
Alternatively, individual differences in attentional capacities might account for the observed correlation between early self-regulation and later attentional rigidity. Poorer self-regulation during the neonatal period might reflect early attentional capacities, which underlie both poor regulatory abilities in the neonatal period and attentional difficulty in toddlerhood. Rothbart and Derryberry (1981) point to individual differences in attentional capacities within the first months of life as shaping emotional experience. For example, some infants appear to be more susceptible than others to obligatory attention (Derryberry & Rothbart, 1984). Infants who have greater difficulty disengaging and reorienting attentional focus are hypothesized to be more vulnerable to negative emotional states (Rothbart & Derryberry, 1981; Derryberry & Rothbart, 1997). Neonatal measures of self-regulation might, therefore, tap variability in precursors to attentional capacities, which then manifest themselves in later attentional styles of emotion regulation.

**Associations between Neonatal Reactivity and Toddlers' Attentional Flexibility**

Emotional states have been observed to be capable of influencing attention (Isen, 1984; Mathews & Wells, 1999; Nasby & Yando, 1982), and negative emotion has been associated with deficits in attentional flexibility (Carver & Scheier, 1990;
Compton, 2000; Derryberry & Reed, 1994; MacLeod et al., 1986). As mentioned, repeated experience with negative emotion has been hypothesized to interfere with attentional flexibility. Although no specific hypotheses were advanced, it was reasoned that early tendencies toward emotional reactivity might contribute to later patterns of stress-related engagement. However, results suggest that neonatal reactivity, or range of state, was unrelated to toddlers' attentional behaviour in response to emotion-eliciting episodes over most of the second year.

Infants' range of state, or reactivity, was unrelated not only to patterns of attentional engagement, but also to levels of distress in the second year, suggesting that neonatal reactivity might not reflect temperamental predispositions toward negative affect. The range of state cluster is intended to measure "the general arousal level or arousability of the infant" (NBAS, Brazelton, 1973, p.89). The items that comprise the range of state cluster in the NBAS closely parallel the response characteristics of reactivity outlined by Derryberry and Rothbart (1984), including latency, rise time, and peak intensity, and were chosen for that reason. However, arousability is very much dependent upon environmental stimulation, and measures of early arousability might not index experiences of distress very well, since arousal underlies both positive and negative emotional state. Negative emotion, rather than general arousal, is usually postulated to interfere with flexibility. More specific measures of both intensity and frequency of experienced negative emotion in early infancy would
perhaps offer a clearer assessment in future attempts at identifying antecedents to attentional flexibility.

According to Rothbart's model, self-regulation and reactivity are closely linked and subject to mutual influences (Derryberry & Rothbart, 1984). The low correlation between neonatal measures of regulation and range of state found in the present analysis suggest substantial independence in the measures. Indeed, the extent to which self-regulatory capacities were able to mediate the effects of reactive tendencies in early development was not addressed in this study. The processes of self-regulation and reactivity are conceptualized, by Rothbart and others, as becoming interwoven with development and recurring emotional experience (Derryberry & Rothbart, 1984; Kopp, 1989; Lewis, 1993). Teasing apart the relative contribution of each remains a formidable task for future research efforts.

Contributions of Maternal Responsiveness

Maternal influences, like self-regulatory capacities, are proposed to mediate the effects of early reactivity (Brazelton et al., 1974; Gianino & Tronick, 1988; Trevarthen, 1979). Maternal responsiveness is widely held to influence the development of emotion regulation in general (Ainsworth & Bell, 1974; Kopp, 1989; Garber & Dodge, 1991; Thompson, 1991), and attentional behaviour
specifically (Brazelton et al., 1974; Bornstein, 1989; Cohn & Tronick, 1983; Field, 1977, 1985). Higher ratings of maternal responsiveness in the first year were therefore expected to predict more flexible deployment of attention during the toddler period. The data provide partial support for this hypothesis. Although maternal responsiveness and attentional flexibility were unrelated for the aggregated measures across the second year, month by month analyses revealed some moderate to strong relationships in the hypothesized direction. However, moderate relationships in the other direction, although they did not reach levels of statistical significance, were also observed. This unexpected finding is not easily explained, but gives reason to exercise caution in interpretation of findings related to maternal responsiveness.

Another unexpected finding regarding maternal behaviour was that maternal responsiveness in the first year was inversely related to measures of neonatal range of state. That is, infants who were more irritable, excitable, and labile in the first two weeks of life had mothers who were judged to be less responsive to their infants between approximately 3 and 12 months. This finding supports claims that, not only do mothers influence infant behaviour, but, in the other direction, infant temperament influences maternal responsiveness (Goldsmith & Campos, 1982), and frequent negative affect may influence responsiveness of caregivers (Fox & Calkins, 1993; Kopp, 1989). It might be argued that maternal influences are unlikely to affect infant behaviour as early as the first few weeks of life, when neonatal range of state was assessed, and that the observed inverse
relation between early distress and later maternal behaviour thus taps infants' effects on their mothers. The nature of this relationship was not addressed in the present investigation, and awaits further research.

**Associations between Distress and Attentional Flexibility**

Because the goal of the current study was to index attentional engagement in response to stress, an unavoidable potential confound of distress presented itself across the analyses. To address this problem, the relationship of distress to all measures, including attentional flexibility in the second year, was examined, both directly and within a regression framework. Distress might work not only as a confound, but also to potentially obscure the relationship between antecedents and attentional outcomes through an immediate influence on the attentional processes under investigation. High levels of distress are postulated to interfere with attentional control (Compton, 2000; Derryberry & Rothbart, 1984; Fox & Calkins, 1993; Kopp, 1989). No hypothesis was put forward regarding immediate associations between toddlers' level of distress and attentional engagement in response to the emotion-eliciting conditions. However, the results indicate that higher levels of distress during task administration were associated with less attentional rigidity, and more attentional shifting, across a wider range of foci. This finding appears to contradict previous findings and the small body of literature linking negative
emotion with deficits in attentional flexibility in early development (Johnson et al., 1991; Matheny et al., 1984; Rothbart et al., 1992, 1994; Wilson & Matheny, 1983).

Upon closer examination, the contradiction might be explained by the nature of the measures chosen to describe attentional behaviour in this study. Previous findings, for the most part, link capacities for attentional control with better regulated negative affect. However, this study measured attentional flexibility in response to emotion, in an effort to tap characteristic styles, or patterns of engagement recruited during experiences of negative affect. Although factors related to attentional control might influence the development of these patterns, attentional control was not directly assessed. Attentional control allows for voluntary shifting and disengagement of attention. However, higher flexibility, in the context of emotion-eliciting events, may reflect the opposite effect -- the loss of attentional control that might be used to regulate experiences of distress.

Patterns of Associations between Antecedents and Attentional Flexibility

Having explored relations between postulated antecedents and later styles of attentional engagement in response to stress, the second goal of the current research was to explore patterns in the associations between the two over the course of the second year. As with investigations of early reactivity, no specific
hypotheses were advanced, but expectations were guided by past theory and research. Since the middle of the second year is host to well-documented developmental transitions in a variety of domains, including cognition, emotion, and social understanding, it was expected that patterns of associations between antecedents and outcomes would show some discontinuity at 18 to 20 months. Monthly associations were therefore graphed and profiles examined to investigate this possibility. No pattern, or clear point of discontinuity, was evident for direct relationships between self-regulation, reactivity, or maternal responsiveness and attentional flexibility. However, all three antecedents were judged to follow a similar contour over the course of the second year, rising and falling in roughly parallel fashion.

This finding suggested the influence of some mediating factor, or factors. Distress in response to the presented emotion-eliciting conditions was considered a potential mediator, and examined in relation to the proposed antecedents. None of the antecedents were found to be associated with later aggregated distress. Regression analyses also indicated that distress did not account for any significant portion of the variance in attentional behaviour, when aggregated for the second year.

A different pattern emerged when regression analyses were considered on a monthly basis. Results suggest discontinuity in the patterns of associations between antecedents and attentional flexibility following a hypothesized
developmental shift at approximately 18 to 20 months. After approximately the middle of the second year, independent contributions of self-regulation and maternal responsiveness were revealed, and distress in response to the emotion-eliciting events became an occasional additional influence. Thus, associations between antecedents and patterns of attentional flexibility appeared to be enhanced by contributions from maternal responsiveness and present distress starting just after the time of a hypothesized developmental transition period. These findings are viewed as consistent with the expectation that, following a developmental transition in the middle of the second year, patterns of relationships between antecedents and attentional-emotional outcomes would evidence some type of discontinuity.

Instructions given to the mothers may also have contributed to discontinuities in the relationships examined. The procedure for the second-year study stipulated that mothers remain mostly unresponsive to the toddlers. In an effort to standardize the emotion-eliciting conditions, mothers were instructed to respond only with a brief comment that they were unavailable to help, when, or if, they were approached by their toddlers. However, maternal unavailability might be expected to have differential effects, according to toddlers' customary expectations of maternal support for emotion regulation. Infants with more responsive mothers may have come to expect more support from them, and conceivably, be at more of a disadvantage when bids for maternal assistance were thwarted. In fact, a previous examination of the content of toddlers' attentional
engagement using the same data set indicates associations between attentional engagement with mother and displays of negative affect (Zimmerman, 1999). Maternal unavailability would be expected to take on a new meaning at this time, when cognitive gains allow for a new understanding of the intentions of others, and new capacities for communication emerge (Case, 1988; Gopnick & Meltzoff, 1987; Repacholi & Gopnick, 1997; Kopp, 1989; Tomasello, 1995). Discontinuity in the relationships between antecedents and outcomes might thus be linked with this developmental advance.

Speculative support for this interpretation is also offered by the unexpected finding of a relationship, although not statistically significant, between early capacities for regulation and distress in response to emotion-eliciting events in the second year. Better neonatal self-regulation was, surprisingly, found to be linked with more toddler distress. Recall that better regulation was also found to be associated with higher ratings of maternal responsiveness. It may be that infants who were better able to regulate had more responsive mothers, and had developed strategies for emotion regulation which were more heavily reliant on expectable maternal support. For these toddlers, the unavailability of their mother under frustrating circumstances would possibly serve to heighten distress.
Limitations of the Present Study

A number of limitations to the study should be pointed out. As discussed in the previous investigations using the data from second year measures year (Zimmerman, 1999), practice effects and attrition presented unexpected problems over the course of the second). As toddlers became familiar with the emotion-eliciting tasks, reactions toward them changed. In the final month, loss of commitment on the part of the participants resulted in an N of only 11, severely limiting generalizability of findings. Correlations for the last month depart markedly from the rest of the profile for most measures, perhaps as a result. The small sample size also calls into question the validity of results obtained, and particularly for results based upon the multiple regression analyses, interpretations should be viewed as tentative. Of course, issues of causality are a general problem of correlational research, and the present study is no exception. Causal influence between early regulatory capacities and later attentional patterns cannot be assumed: a third variable, for example, capacities for attentional control, might be the source of this association. Finally, although relations between early self-regulation and later attentional engagement were taken to support hypotheses, it should be pointed out that at some months associations were modest, or absent altogether.

This study examined data collected for two previous investigations, and adopted measures as required and as available. Brazelton recommends averaging
multiple assessments using the NBAS to optimize the validity of these measures (Brazelton, 1973). For the current study, however, only two, and occasionally, only one, NBAS assessment could be completed. The validity of measures relating to infants' self-regulation and reactivity, is, therefore, somewhat questionnable.

Although there is little reason to question the validity of the available measure of maternal responsivity, the Maternal Responsiveness Scale measured general, rather than specific, behaviours. Recent research points to specificity of maternal responses, and the importance of differentiating between maternal responses to distress and nondistress (Bornstein & Tamis-LeMonda, 1997). A more specific measure of maternal behaviour in relation to infants' distress and attention might have better detected associations between early maternal influences and toddlers' attentional behaviour.

Conclusion and Future Directions

Despite these limitations, this investigation contributes to an understanding of the developing pathways to individual differences in attentional flexibility. Findings extend the small body of existing empirical evidence for associations between early distress and later difficulty with attentional flexibility (Matheny et al., 1984; Rothbart et al., 1982). Whereas most previous research has examined
short-term, rather than long-term, relations between antecedents and attentional outcomes, this study provides important longitudinal information regarding associations between sources of internal and external individual differences and later individual differences in toddlers' emotion regulation.

As a first step, this study succeeded in examining general factors related to styles of attentional flexibility. More specific measures, related to maternal responsiveness to distress, tendencies to become distressed, and levels of distress associated with particular styles of attentional engagement, would add to the value of future investigations. The nature of reciprocal influences between emotion and attention, postulated to be important to developing regulatory styles, was not examined in the current study, and is a topic for future research. Similarly, the extent to which attentional flexibility is influenced by capacities for attentional control was not addressed, but past research suggests capacities for attentional control are a likely antecedent to developing styles of attentional engagement related to emotion regulation (Rothbart et al., 2000a). The current findings also extend the small body of research related to individual differences in toddler coping (Calkins & Johnson, 1998; Karraker et al., 1994; Mangelsdorf et al., 1995; Parritz, 1996), and highlight the discontinuity characteristic of the second year (see Case, 1991; Dunn, 1988; Fischer et al., 1990; Mahler et al., 1975; Piaget, 1970; Repacholi & Gopnick, 1997; Sroufe, 1995). Relations between antecedents and patterns of attentional engagement were enhanced by contributions from maternal responsiveness and present distress, following, but
not prior to, the time of a hypothesized stage shift. Although associations between antecedents and outcomes were expected to change at 18 to 20 months, the mechanisms related to this change in relationships were not specifically hypothesized, and the current data set did not allow for further investigation. Future research might find such relations through a careful consideration of longitudinal interactions between maternal influences, attentional processes, and distress regulation over the first two years. This would add to our understanding of the emergence of individual differences in emotion regulation at a key period in development, and further elucidate pathways to emotion dysregulation.
REFERENCES


### Appendix A – Maternal Behaviour Scale

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<thead>
<tr>
<th>Item</th>
<th>Scale</th>
<th>Notes</th>
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<tr>
<td>Responds consistently to baby’s signals.</td>
<td></td>
<td>Responds to baby’s communications inconsistently and unpredictably.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interprets baby’s signals according to own wishes and moods.</td>
<td></td>
<td>Interprets cues correctly as evidenced by baby’s response.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough or intrusive in interactions with baby.</td>
<td></td>
<td>Waits for baby’s response in interactions.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitors and responds to baby, even when engaged in some other activity.</td>
<td></td>
<td>Often appears to “tune out” and not notice distress or bids for attention.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responds immediately to cries/whimpers.</td>
<td></td>
<td>Responds only to frequent, prolonged, or intense signals.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content and pace of interactions seem to be set by mother rather than baby.</td>
<td></td>
<td>Interactions revolve around baby’s tempo and current state.</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
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Appendix B – Coding scales for engagement with toy and engagement with mother, showing five ordinal levels for each scale.

**Engagement with Toy**

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<thead>
<tr>
<th>Code</th>
<th>Behaviour</th>
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<tr>
<td>1. No engagement</td>
<td>Complete inattention to toy. No looking at or touching the target toy (may be engaged with other toys in enclosed-toy condition).</td>
</tr>
<tr>
<td>2. Low passive engagement.</td>
<td>Carrying or touching the toy without looking at it or manipulating it.</td>
</tr>
<tr>
<td>3. High passive engagement</td>
<td>Looking at the toy; looking at and touching the toy but not manipulating it; manipulating the toy without looking at it.</td>
</tr>
<tr>
<td>4. Nonspecific engagement</td>
<td>Manipulating the toy in an exploratory manner active while looking at it, e.g., turning the jack-in-the-box around or rolling it on the ground, shaking it, throwing it, or kicking it.</td>
</tr>
<tr>
<td>5. Specific active engagement</td>
<td>Manipulating the toy in a fashion specific to the properties of the toy, e.g., turning the crank of the jack-in-the-box or trying to pull the top open.</td>
</tr>
</tbody>
</table>
Appendix B -- continued

Engagement with Mother

<table>
<thead>
<tr>
<th>Code</th>
<th>Behaviour</th>
</tr>
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<tbody>
<tr>
<td>1. No engagement</td>
<td>No physical proximity to mother, no gaze at mother, no vocalizations to her nor other attempts to get her attention.</td>
</tr>
<tr>
<td>2. Low passive engagement</td>
<td>Sitting near mother without looking at her or otherwise seeking her attention. Approaching mother (Taking up to 2 steps in her direction) but not looking at her.</td>
</tr>
<tr>
<td>3. High passive engagement</td>
<td>Looking at mother. Approaching her while looking at her, but not attempting to engage her in any way. Talking to mother/saying her name but not looking at her (unless this is followed within 3 s by looking at or approaching mother, in which case it is coded as level 4).</td>
</tr>
<tr>
<td>4. Nonspecific active engagement</td>
<td>Approaching mother, or vocalizing to her, while gazing at her. Moving toward mother, or lifting up toy or pointing to it, while vocalizing toward mother. Standing/sitting directly in front of mother, talking to her.</td>
</tr>
<tr>
<td>5. Specific active engagement</td>
<td>Repeated or persistent physical attempts to obtain mother's attention and/or assistance. This code always involves some assertive physical contact with mother. For example, the infant pushes the toy or him/herself at the mother.</td>
</tr>
</tbody>
</table>