QU, JIN, Ph.D. Identify Effective Emotion Regulation Behaviors in Infancy. (2017). Directed by Dr. Esther Leerkes. 152 pp

The goal of this study was to identify the subset of emotion regulation behaviors that were effective in both short-term (associated with a reduction in observed negative affect within a 2-s window at 6 months, 1 year, and 2 years of age), and long-term (associated with fewer externalizing and internalizing behavior at 1 year, 2 years and 4.5 years of age) as main effects and/or by buffering the link between temperamental reactivity and later behavior problems). Infants and their mothers participated in a series of observational tasks and mothers completed questionnaires when infants were 6 months old, 1 year and 2 years old and the sample size was 245. The results from the sequential analyses illustrated that looking away behavior at 6 months during the fear task was reliably associated with reductions in negative affect. In addition, looking at mom behavior and withdrawing to mom behavior at 1 year were associated with reduction in negative affect in both the anger and fear context. Overall, emotion regulation behaviors that involved the mother seemed to be more effective in alleviating infant distress, compared to similar emotion regulation behaviors that did not involve the mother. In terms of long-term effectiveness, early looking away and looking at mom behavior were associated with fewer behavior problems at 2 years. Looking at mom behavior at 6 months also moderated the association between infant temperamental anger at 6 months and externalizing behavior at 2 years. Infants who had higher reported temperamental anger had lower externalizing behavior at 2 years, when they engaged in higher looking at mom behavior at 6 months. In addition, self-soothing and self-soothing with mom

behavior were associated with fewer behavior problems in the anger and fear context respectively. In sum, the current study provided evidence as to short-term and long-term effectiveness of gaze behaviors and self-soothing behaviors. These findings have implications for interventions such that mental health professionals may need to work closely with infants' caregivers to cultivate their awareness and ability to support infant emotion regulation skills during daily interactions, which are important in preventing future behavior problems in young children.

IDENTIFY EFFECTIVE EMOTION REGULATION BEHAVIORS IN INFANCY

by

Jin Qu

A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
2017

Approved by

_____
Committee Chair

APPROVAL PAGE

This dissertation written by Jin Qu has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair_____

Committee Members_____

_____

_____

_____
Date of Acceptance by Committee

_____
Date of Final Oral Examination

ACKNOWLEDGEMENTS

This four-year journey in my Ph.D. program has been one of the most enriching and fulfilling experiences for me. This process not only made me more competent in terms of academic proficiency, but also built my working attitude, and shaped my personal characters. I have been very grateful for having this opportunity to advance my education in the HDFS department at UNC-G. I would like to express my sincere gratitude to my wonderful advisor and the committee chair Dr. Esther Leerkes for her guidance, patience, and warm encouragement while I was preparing for and writing my dissertation. I have learned so much from her conscientious working style as a scholar, from the detailed and prompt feedback that I have received on my writing, and from our weekly meeting discussions on academic skills and professional development. I would also like to extend my gratitude to my committee members Dr. Andy Supple, Dr. Susan Calkins and Dr. Roger Mills-Koonce. Dr. Supple is a great teacher who opened my door to conducting advanced statistical analysis and he has always been responsive to troubleshoot my analysis questions. Dr. Calkins stimulated my curiosity in psychobiology, encouraged us to engage in critical thinking when conducting and consuming research, and provoked my thoughts by asking insightful questions both in her classes and during the committee meetings. Dr. Mills-Koonce brainstormed new ideas with me for my dissertation and for my future research. I am thankful for all your input and feedback for my dissertation and I could not have done it without you.

I would also like to express my appreciation to Dr. Cheryl Buehler, Dr. Jonathon Tudge, Dr. Heather Helms, and Dr. Anne Fletcher. Dr. Buehler reached out to me and provided me with extra guidance in scientific writing. In the supportive academic environment that she created in her classes, I felt motivated to challenge myself and learn. Dr. Tudge encouraged me to participate more in class discussions. I appreciate your efforts to push me further along this path. Dr. Helms instilled hope in students and encouraged us to become future leading scholars in the field. Dr. Fletcher provided me with guidance on the structure of writing. I enjoyed all your classes that have given me a well-rounded perspective of research in child development. My special thanks also goes out to Dr. Roger Bakeman, who selflessly allows researchers to use his software for free and guided me in my process of conducting sequential analysis for my dissertation.

Next, I would like to express my sincere gratitude to my wonderful parents Mr. Qu Shaobin and Ms. Ruan Liping for their love and support especially when I encountered difficulties. You are the main reason that I did not give up easily during this journey. I would also like to acknowledge my late grandfather Mr. Ruan Yongsheng. Your life stories and your character of integrity have inspired me to become a better person every day.

My thanks also goes to all my friends and colleagues who collaborated with me on different projects and lend support to me along this journey, to name a few: Nan Zhou, Hongjian Cao, Elizabeth King, Pamela Norcross, Lindsey Gedaly, Yue Liang, Jinni Su, Dan Wang, Jiayao Li and Selin Zeytinoglu. I am thankful for Sreeni Ram for his

encouragement and support, and for his confidence in me during this sometimes grueling process.

I would also like to express my appreciation to all the principal investigators, research assistants, lab managers and participating families that made the Triad Child Study project possible. I appreciate the efforts and time that it took from these people to design the study, and to collect and code the data that made my dissertation possible.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

Definition of Emotion Regulation

Emotion regulation is defined as "those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions" (Calkins & Leerkes, 2011, p. 355). Better emotion regulation skills during infancy predict better social competence, higher academic achievement, and fewer externalizing and internalizing behavior problems at preschool and school age (Crockenberg & Leerkes, 2006; Graziano, Reavis, Keane, & Calkins, 2007; Hill, Degnan, Calkins, & Keane, 2006). The first three years of life is a crucial period for the emergence and development of young children's emotion regulation. During this time young children transition from relying on others to assist them to gaining more independent regulatory skills, and their regulatory behaviors become increasingly sophisticated and deliberate (Kopp, 1982). Thus, the development of adaptive emotion regulation is an important developmental task for young children (Calkins & Fox, 2002; Kopp, 1982).

Although high positive emotionality can be a risk factor for children's behavior problems (Burnson, Poehlmann, & Schwichtenberg, 2013; Putnam & Stifter, 2005), in

the current study I will focus on emotion regulation of infants' negative emotions given that the tasks were designed to elicit children's frustration and fear. Furthermore, children's poor regulation of negative affect has been consistently identified as a predictor of subsequent children's behavior problems (Calkins & Dedmon, 2000; Calkins & Fox, 2002). Specific negative emotions can be observed within the first few months after birth; specifically, fear can be reliably observed around 6 months of age; and anger can be observed around 2-3 months of age (Braungart-Rieker et al., 2010), and infant regulatory behaviors have been reliably observed as early as the first half year of life (e.g., Rothbart et al., 1992; Stifter & Braungart, 1995).

Studies examining emotion regulation mostly focus on one of two aspects of emotion regulation. Some focus on "emotion as regulatory," referring to the fact that emotions in and of themselves serve to regulate behavior by prompting physiological and behavioral changes in self and others. Others studies that examine emotion regulation focus on "emotions as regulated," referring to the fact that individuals can modify, delay, or redirect their emotional reactions, and adapt them to situational demands (Cole, Michel, & Teti, 1994; Cole, Martin,& Dennis, 2004; Thompson, 1994). However, among studies of emotion regulation, this distinction is not always clarified. Cole et al. (2004) proposed that to use the term emotion regulation (i.e., emotions as regulated), one must demonstrate that the behavior is linked with changes in the intensity or valence of emotions. Cole et al. also noted that the process of emotion and emotion regulation should be separated from each other. For young infants, researchers usually assess the valence and intensity of infants' expressed emotion through the assessment of

temperamental reactivity; on the other hand, emotion regulation refers to the ability to modify the latency and intensity of the emotion through engaging in behavioral strategies such as gaze aversion, self-soothing, or proximity-seeking behavior to a caregiver (Rothbart & Bates, 1998). Therefore, with regards to the methodological directions for research on emotion regulation, Cole et al. proposed using independent assessment of activated emotion and regulatory strategies, and using analysis that is sensitive to temporal relations between emotion and regulatory behavior. By doing this, researchers can avoid confounding emotion reactivity with emotion regulation. Echoing Cole and colleagues' proposal, the first primary goal of the current study is to identify effective emotion regulation behavior by examining whether specific infant behaviors predict a decrease in distress in the next moment using sequential analysis. This question is addressed in frustration-inducing and fear- inducing tasks that were conducted when infants were 6, 14, and 27 months old.

The second primary goal of this study is to examine which of the effective emotion regulation behaviors that were identified from contingency analyses predict children's behavioral adjustment (i.e., low externalizing and internalizing symptoms) at 1, 2 and 4 years of age. Considering the long-term adaptiveness of emotion regulation behaviors is important because it is possible that some behaviors may be adaptive in the moment, but may be maladaptive or have little impact on long-term adjustment. A good deal of evidence demonstrates that adaptive emotion regulation is associated with a range of children's subsequent positive outcomes (Crockenberg & Leerkes, 2006; Graziano et al., 2007; Hill et al., 2006). In previous studies, most investigators focus on either the

short-term (e.g., Buss & Goldsmith, 1998) or the long-term adaptiveness of emotion regulation (e.g., Crockenberg, Leerkes, & Jo, 2008); this study aimed to examine emotion regulation behaviors that are deemed adaptive both immediately and longitudinally in a single sample. To the author's knowledge, this would be the first study that integrates these two goals (concurrent and longitudinal evidence of the adaptiveness of specific regulation behavior) in a single sample and across multiple time points and emotion systems (i.e., fear and anger). Such an approach is important because once a small set of highly adaptive emotion regulation behaviors is found, efforts can be made to identify the individual and environmental factors that appear to predict an infant's likelihood of engaging in these behaviors. This knowledge may be useful in the design and implementation of early intervention efforts aimed at enhancing adaptive infant emotion regulation, and later well-being.

An intermediate goal was included to better understand the stability of emotion regulation behaviors. Specifically, the stability of emotion regulation behavior across the anger and fear context and within a time point, and the stability of emotion regulation behavior across time points and within a context were examined. In addition, as part of the exploratory analyses, whether emotion regulation behavior at a previous time point was associated with emotion regulation behavior at later time points was examined. This goal would facilitate the understanding of the longitudinal patterns of emotion regulation behaviors and the relations between early emotion regulation behaviors and subsequent more complicated forms of behaviors.

CHAPTER II

CONCEPTUAL PERSPECTIVES

The Functionalist Perspective of Emotion and Emotion Regulation

Cole's discussion of emotion as regulated and as regulating was drawn from the functionalist perspective (Cole et al., 2004). According to the functionalist perspective, emotion is perceived as a person's attempt to create, carry on, adjust, or end the relation between the person and the environment based on individuals' evaluation of whether this action or event is important to the person (appraisal); in other words, it is a way a person adapts to the environment in order to achieve a goal (action-promoting tendencies) (Campos, Mumme, Kermoian, & Campos, 1994, Cole et al., 2004). Thus, rather than emphasizing the automatic feeling or expression, this theory emphasizes the motivational process involved during the generation of emotion, and its adaptiveness (Campos et al., 1989). For example, anger may prompt individuals to remove the obstacle that has blocked their goal; fear may prompt individuals to run away from danger to seek safety, both of which are adaptive (Campos et al., 1989). The functionalist theory of emotion has three components: how the person evaluates the importance of the event, how they think of their ability to adjust or cope with the event and how they manage to do it (Campos et al., 1989). Given the developmental stage of infants, the current study focuses on the latter: how infants manage to regulate or cope.

Multiple forms of behaviors can be considered emotion regulation behaviors. Generally, emotion regulation behaviors involve initiating, adjusting, and/or terminating one's own or others' actions (Campos et al., 1989). To illustrate, in a context that is designed to elicit fear, young children may stop playing and pay attention to the threat (terminate action when the situation is dangerous), push away the aversive stimulus or step back from it (promote desirable action tendencies), stop their caregivers from leaving them (adjust the tendencies of the other), or ask the experimenter for help when the mother cannot offer help (modify their behavior).

Additionally, emotion regulation can occur at three levels: at the level of sensory receptors (input regulation), at the level where information is processed (central regulation), and at the level of response selection (output regulation) (Campos et al., 1994). Input regulation can occur through manipulating attention by distracting oneself from the aversive environment or avoiding it, which may avoid generating undesired emotions (Campos et al., 1994). The central processing level of emotion regulation refers to the interpretation and reappraisal of the event and ones' goal. At the level of output regulation, emotion responses can be modulated through inhibition, or expressed through a more subtle behavior, or transformed through language rather than overt emotion expression (Campos et al., 1994). The current study will focus on how emotion regulation is operated at an output level by examining whether the behaviors modulate infants' distress, and some of the examined behaviors (e.g., attentional control, withdrawal) are likely to operate via input regulation. In contrast, the central processing level is not the focus of the current study as appraisal and re-appraisal cannot be readily

assessed among infants. Next, the developmental pattern of emotion regulation behavior during the first 3 years of infancy was discussed.

The Developmental Patterns of Emotion Regulation Behaviors in Young Children

Infants' emotion regulation abilities develop rapidly during the first 3 years of life (Kopp, 1982). From 2-3 months, infants are able to engage in automatic reflex like operations to prevent them from experiencing overarousal (Kopp, 1982). By the age of 6 months, thanks to the development of the frontal lobe, infants are able to engage in selective attention and to make temporal association between emotional state and selective stimuli (Dawson, 1994). By the age of 12 months, infants can use complicated sequence of gaze aversion, more active visual search and engage in sustained attention (Dawson, 1994). They are more likely to communicate their needs to the caregivers (Kopp, 1989). From 12 to 18 months and older, infants start to initiate behaviors or monitor their own behaviors; they understand others' intention better and their ability to comply to others' request emerges (Kopp, 1989). Also during this period, infants' inhibitory control ability increases, and they begin to use problem-solving behaviors (Dawson, 1994; Kopp, 1982). From the period of 12 to 24 months, children's regulation strategies that involve active engagement increase such as shifting their attention away to focus on other stimulus and seeking help from others; in addition, their ability to delay gratification increases (Bridges & Grolnick, 1995). After 24 months of age, children develop representational abilities and their self-control abilities are moving towards more sophisticated self-regulation skills (Kopp, 1982). Relatively few researchers have

examined if the early use of specific emotion regulation behaviors is associated with other forms of emotion regulation behaviors later on. In one such study, Sethi et al. (2000) reported that infants who employed more distraction strategies at 18 months used more effective delay strategies at age 5 (Sethi et al., 2000), which is consistent with the view that earlier forms of simple emotion regulation behavior may develop into or support the development of other forms of more sophisticated regulation strategies (Kopp, 1989). The current study is a longitudinal study that employed data from three time points, although not as a primary goal, I examined continuity and change of emotion regulation behavior as part of the exploratory analysis. Specifically, I would like to identify earlier emotion regulation behavior that may predict later other forms of emotion regulation behaviors. Drawing from the results of Sethi et al. (2000), I anticipate that looking away and looking at mom behavior would predict more sophisticated adaptive behaviors at 1 year and 2 years (e.g. problem solving).

In addition, the stability of a specific emotion regulation behavior across time points and within a context, and the stability of a specific emotion regulation behavior across emotion contexts and within a time point were addressed in this study. This goal is important to understand the longitudinal patterns of development of emotion regulation behaviors in early infancy. Infants go through a rapid period of development from within the period of 6 months and 24 months of age (Kopp, 1982). Specifically, infant mobility, muscular control and language skills develop rapidly after the 1st year of age (Bornstein, 2002). Therefore, the stability of behavior in the same domain may be low given that the development in other domains (e.g., motor, language) may facilitate the development of

infant social and emotional development as well, via the process of developmental cascade (Cox, Mills-Koonce, Propper, & Gariépy, 2010) and infants would have a greater repertoire of behaviors to draw from. Furthermore, due to the task differences over time, infants may experience different intensity of emotions during each task; therefore, the stability of a specific emotion regulation behavior across time points was not expected in the current study. In terms of the stability of emotion regulation behavior within one time point and across tasks, none of the previous studies have reported the stability of emotion regulation behavior across contexts within a time point. Due to possible differences in task demands at each time point, I did not expect that emotion regulation behavior would be stable.

Emotion Regulation and Psychopathology

When children typically engage in emotion regulation behaviors that are not adaptive in their environment, they may develop symptoms of early psychopathology. Early psychopathology seems to manifest in mainly two different forms; To better understand the etiology of early psychopathology, Achenbach (1978) differentiated between "externalizing" and "internalizing" disorders as two broad factors that characterize child psychopathology symptoms. Externalizing symptoms refer to children's behaviors that manifest outwardly and act on the external environment in a negative way (Campbell, Shaw, Gilliom, 2000; Eisenberg et al., 2001; Liu, 2004). This includes disruptive, hyperactive, and aggressive behavior (Hinshaw, 1987). In contrast, internalizing behaviors are usually directed towards the self and away from the external

environment; children's excessive sadness, fear, anxiety, depressed affect and social withdrawal are commonly considered internalizing behaviors (Achenbach, 1978).

According to Hay (2005), externalizing behavior during infancy could manifest in the forms of engaging in conflicts with adults and other children. In addition, during early infancy, before they learn to crawl and walk, infants may exhibit aggressive behavior by looking away from the caregiver, pushing away the hands or face of the caregiver. Infants' behavior shifts from "passive resistance" to "active defiance" between 9 and 12 months of age, accompanied with increased mobility in infants (Hay, 2005). With the advances in infant cognitive development, infants start to better understand others' intentions and engage in more conflicts with peers who take away their toys. Around 2 years of age, toddlers understand the caregivers' request better and they are able to engage in compliant behavior or defiant behavior with their caregivers (Kopp, 1989). Empirical findings showed that children's aggressive behaviors peak around 2 years of age and decline after 30 months of age (Calkins & Dedmon, 2000; Sroufe, 1996). From a developmental perspective, young children's aggressive behaviors may phase out as they become older, but these early aggressive behaviors could also be a strong predictor of behavior problems at school age (Hay, 2005). Compared to externalizing behaviors, not much literature has documented the developmental trend of internalizing behaviors. Not engaging with their caregivers and showing withdrawal symptoms are considered common early symptoms of infant depression (Guedeney & Puura, 2011). In addition, infants who show higher behavior inhibition towards novel stimuli and strangers are more susceptible to develop anxiety symptoms (Terjesen & Kurasaki, 2009).

Identifying the specific factors and mechanisms that divert individuals away from a normal developmental pathway toward a maladaptive one is a key goal in the field of developmental psychopathology (Cicchetti, 1993). From a developmental psychopathology perspective, psychopathology stems from genetic and/or biologically controlled child characteristics such as negative temperamental traits, and environmental influences, such as parenting quality, child maltreatment, and mothers' mental health problems, as well as their interplay over time (Cicchetti & Rogosch, 1996; Sroufe & Rutter, 1984). Among the many considered factors, early patterns of emotion regulation difficulties (e.g., overcontrol, undercontrol, poorly modulated affect expression) have been noted as critically important because early emotion regulation abilities provide a foundation for subsequent more complex functioning such as social competence, children's well-being and adjustment, whereas children's failure to develop adaptive emotion regulation abilities early on may divert them from the course of normal development and launch them onto maladaptive developmental trajectories (Calkins & Fox, 2002; Cicchetti, 1993; Sroufe & Rutter, 1984). For example, children with poor emotion regulation difficulties may not be able to control their anger during peer interactions, and may have a difficult time developing good peer relationships (Hay et al., 2011). Also, children who have trouble regulating fear may avoid novel situations, which may lead them to develop more anxious behaviors (Calkins & Fox, 2002). These children may experience excessive fear in novel situations, but they may not have opportunities to practice regulating fear in novel situations because they avoid those situations. Gradually they may develop more unrealistic negative perceptions of novel

situations, which may lead them to experience anxiety (Maner & Schmidt, 2006). Therefore, examining early emotion regulation ability as an antecedent for subsequent disorders is important to elucidate the developmental trajectory of children's behavior problems.

Consistent with the view that psychopathology stems from multiple risk factors, the dual-risk model, also called the diathesis-stress model, theorizes that negative developmental experiences will likely impact individuals who already carry risk factors, which may be hidden at first, and would be activated by poor negative experiences (Roisman et al., 2012). Negative emotionality or temperamental reactivity combined with poor emotion regulation ability can be considered a dual-risk (Crockenberg & Leerkes, 2006). The reactivity component of temperament can be divided into positive and negative emotionality. Negative emotionality refers to the frequency and intensity of fear, sadness, anger and discomfort (Rothbart, Ahadi, & Evans, 2000). Infants who become easily distressed experience greater arousal in stressful situations, and have a low threshold of becoming distressed. Chronic stress reactivity is believed to undermine adaptive development because chronic stress will lead to negative physiological and health consequences (e.g., asthma attack), weakened brain functioning (e.g., poor working memory), and permanent structural changes in vital organs (Evans & Fuller-Rowell, 2013; Sandberg et al., 2000; Thoresen & Eagleston, 1983). In terms of children's psychosocial functioning, infant fear is a risk factor for internalizing symptoms (Colder, Mott, & Berman, 2002), whereas infant anger is an antecedent for the development of both internalizing and externalizing symptoms in early childhood

(Edwards & Hans, 2015). Adaptive emotion regulation behaviors may buffer the risk of children who have high negative emotionality from developing behavior problems because they are better able to manage their distress. This should reduce the frequency and intensity of experienced distress, which allows them to engage more adaptively in the environment, and this may also elicit more positive responses from social partners. On the other hand, maladaptive emotion regulation behaviors may exacerbate children's risk of behavior problems by escalating children's negative affect or increasing their use of behavior that others find aversive. Therefore, emotion regulation likely plays a moderating role in the association between negative emotionality and children's behavior problems.

CHAPTER III

LITERATURE REVIEW

Temporal Effects of Emotion Regulation on Affect

A number of empirical studies have examined the links between specific regulation behaviors and infant affect during distress-eliciting tasks in an effort to identify effective regulatory behaviors. Initial work in this area focused on correlations between regulatory behaviors and concurrent affect (e.g., Diener, Mangelsdorf, McHale, and Frosch, 2002; Golnick, Bridges, & Connell, 1996). To illustrate, among 12-months old infants in the Strange Situation task, negative affect was inversely related to toy exploration and people orientation but was positively associated with object orientation (Braungart & Stifter, 1991). It could be that infants who engaged in exploration and people orientation had low negative affect; it could also be that children who had lower negative affect engaged in more toy exploration and people orientation behavior. In another study, greater distress was associated with more self-soothing, less distraction, and the use of leave-taking in 13 month-old infants; in addition, engaging parent, social referencing, and distraction tended to be more common strategies among infants who expressed positive affect than among those who did not (Diener et al., 2002). Seeking help from parents and distracting themselves from the aversive stimulus seems to be adaptive compared to trying to escape and self-soothing behavior. In addition, self-soothing and self-soothing with mothers were positively associated with distress during

separation with mothers and when mothers could not be involved during the waiting task (Grolnick et al., 1996). The problem with this correlational approach is that the associations are essentially uninterpretable because the manner in which these behaviors unfold over time is not considered. That is, the positive link between self-soothing and distress could reflect that self-soothing is ineffective, or that self-soothing is more likely to occur when infants are distressed. If the latter is the case, it becomes important to consider whether the use of soothing when distressed is reliably linked with subsequent reductions in distress. The use of contingency or sequential analysis allows for such consideration. Below, I focus primarily on studies that have utilized this technique emphasizing emotion regulation behaviors relevant to the proposed study. In doing so, I note relevant differences in the effectiveness of behaviors across frustration-inducing and fear-inducing tasks and based on infant age.

Distraction or Gaze Aversion Behavior

Infants develop the ability to disengage their gaze from a stimulus between 3 and 4 months of age (Johnson, Posner, & Rothbart, 1991). Children's ability to disengage gaze from the aversive stimulus to other objects or persons (mothers or experimenters) has found to be associated with more positive affect and better ability to be soothed (Rothbart, Ziaie, & Boyle, 1992). Additionally, infants engage in looking at mother behavior to seek information about the stressor and as a possible source of comfort (Feinman, 1992). In prior research, infants' looking toward mother behavior showed a gradual increase during novel situations, from 6.5 months to 10 months of age, then a

decrease from 10 to 13.5 months of age; looking away (not towards mothers) behavior decreased from 6.5 to 13.5 months (Rothbart et al., 1992).

From literature that employed contingency analysis, gaze orientation towards mother or other objects reduced infants' distress for 5-month-old infants (Stifter & Braungart, 1995) and for 12-month-old and 18-month old infants during anger tasks (Buss & Goldsmith, 1998). Likewise, looking away behaviors (both at other objects or at mother) have been linked with reduced distress in fear tasks (novel toys) among 6-month-old and 18 month old infants (Buss & Goldsmith, 1998; Crockenberg & Leerkes, 2004). Therefore, infants as young as 5 months old are able to use gaze aversion to distract themselves during distressing situations; and these gaze behaviors, specifically looking away from the stressor, effectively alleviate infants' distress in both fear and anger contexts. Thus, I predicted that looking away (both at mother or at other objects) behaviors would reliably reduce infant distress at all time points in both frustration and fear contexts.

Bodily Approach and Withdrawal Behavior

Approach behaviors refer to infants leaning toward, reaching, or moving towards the stimulus; withdrawal behaviors refer to moving away from the stimulus, arching back, arm retraction, pushing back, withdrawing hand, and so forth (Rothbart et al., 1992). Infants' motor skills increase rapidly within the first year of life and forms of withdrawal behaviors showed a different pattern of change: Infants' active avoidance and arching back showed no change from 6.5 to 13.5 months; in contrast, leaning away and withdrawing hand from the stimulus increased between 6.5 to 13.5 months; and pushing a

toy away behavior increased between 6.5 and 10 months (Rothbart et al., 1992). In Rothbart's et al. study, infants were placed in an infant seat or a high chair during the tasks at different time points. In the current study, infants were free to move around at 1- and 2-year visit, thus the infants in the current study may be able to use more moving-away (active avoidance) withdrawal behavior. In addition, in the current study, withdrawing to mother and other withdrawing behavior were distinguished from each other.

Mixed evidences have been reported for the adaptiveness of withdrawal behavior. In an anger context, withdrawal behavior had a regulatory effect for 5-month-old infants (Stifter & Braungart, 1995). In a fear context, withdrawing from the scary stimulus alleviated infants' fear for 6-month-old and 18-month-old infants (Buss & Goldsmith, 1998). However, in other studies, withdrawal behavior was effective in alleviating 6-month-old infants' distress only when mothers were not involved in the context, but not when mothers were involved (Crockenberg & Leerkes, 2004). In addition, Diener and Mangelsdorf (1999) found that withdrawal behavior was effective in a fear context, but not in an anger context for infants who were 18 months and 24 months old. In comparison to that, approach behavior was generally found not to be effective in tasks where an aversive stimulus was presented, except in a hidden toy task for 12- and 18-month-old infants reported in Buss and Goldsmith (1998). It seems plausible that withdrawal behaviors may be more adaptive in fear-eliciting contexts than in anger-eliciting contexts if the goal is to seek security and stay away from the aversive stimulus in the presence of a threat. In contrast, approach may be more common and adaptive in

frustration-eliciting tasks if it reflects children's efforts to remove goal blockage (e.g., accompanies problem solving). However, in frustration tasks that are impossible to solve, withdrawal behavior may be adaptive. Thus, I predicted that withdrawal would reliably reduce distress in the fear context at all time points.

Self-Soothing

Self-soothing behaviors usually refers to infants gaining comfort from hand-mouth activities, such as thumb-sucking, or gentle repetitive activities such as twirling hair, touching ear or head (Rothbart et al., 1992). Infants' use of hand-mouth activities peaked at 3 months, but showed a steady decrease from 3 months to 13.5 months of age, indicating that this form of behavior may serve as a primitive form of regulatory behavior for infants and later may be replaced by more sophisticate regulatory strategies (Rothbart et al., 1992). In the current study, in addition to self-soothing, self-soothing with the mother (e.g., rubbing mother's arm, holding mothers' hands) will also be examined as such behaviors are relatively frequent among young infants and often initiated and or maintained by the infant.

Using contingency analysis, it was reported that self-soothing behavior was effective in decreasing anger in 10-month-old infants (Stifter & Braungart, 1995). Self-soothing also reduced 6-month-old infants' distress in a fear context, but only during the portion of the task where mothers were asked not to get involved, but not when mothers were able to get involved (Crockenberg & Leerkes, 2004). Compared to gaze aversion, self-soothing seems to be a less effective emotion regulation behavior for older infants (Stifter & Braungart, 1995). When infants engaged in self-soothing behavior, they may

still focus on the frustrating task. However, when infants engage in distracting strategies, they are able to move away from the frustrating situation and to focus on other activities; therefore the distraction strategy may serve as a more effective emotion regulation strategy (Buss & Goldsmith, 1998). For 18- and 24-month olds, self-soothing behavior was not found to be an effective regulatory strategy in either the anger or fear context (Diener & Mangelsdorf, 1999). This behavior was not assessed in Buss and Goldsmith's (1998) study. Thus, I predicted that self-soothing (both related to self and the mother) would reliably reduce infant distress in both the frustrating and fear task at 6 months only.

Problem-Solving

Problem solving behaviors refer to infants' attempt to solve the problems either by themselves, by seeking help from their mothers, or by seeking help from the experimenter (Schieche & Spangler, 2005). This is considered a more advanced form of regulation because infants need to understand what the cause of the problem is before attempting to solve it (Diener & Mangelsdorf, 1999; Schieche & Spangler, 2005). The current study will examine infants' problem-solving behaviors by themselves, by seeking help from experimenter and by seeking help from mother.

Problem-solving behaviors were not assessed in majority of the contingency studies that examined infants' emotion regulation, possibly because most of the tasks were designed to be unsolvable (e.g., arm restraint, spider task, wait task). In tasks where an attractive toy was hidden behind a barrier or infants' arms were being restrained from touching toys, reaching for toy behavior can be considered a problem-solving behavior.

Reaching for toy has been found to decrease anger for 12-month and 18-month old infants (Buss & Goldsmith, 1998). Help-seeking from mother can also be considered a problem-solving behavior; however, it was not associated with a decrease in distress either in the anger or the fear context (Diener & Mangelsdorf, 1999). In correlational studies, seeking help or getting parents' attention was associated with more positive affect in a competing-demand task (Diener, Mangelsdorf, McHale, & Frosch, 2002). Engaging in problem-solving behavior demonstrates infants' moving from relying on their caregiver for regulation to a more independent form of regulation; in addition, not focusing attention on the task in toddlers was associated with emotion dysregulation (Calkins & Dedmon, 2000). Seeking others' assistance to solve problems by using verbal language or gestures is also a more sophisticated form of regulation (Diener & Mangelsdorf, 1999; Schieche & Spangler, 2005). Thus, I predicted that problem-solving, bidding to mother, and bidding to experimenter would reliably reduce infant distress at 1 year and 2 years during the anger but not fear task (because fear task is not a problem-solving task and not many problem-solving behaviors were observed except for infants asking to leave the room or to go home).

Stimulation/Play

Stimulation includes self-stimulation (arm movement, banging, body movement, kicking, and repeated hand movement) and play behavior (Crockenberg & Leerkes, 2004; Rothbart et al., 1992). In the current study, play behavior with mother and play behavior by the child alone would be assessed. Playing with other toys when presented with a frightening or frustrating stimulus may alleviate infant distress effectively by distracting

them from the stressor. However, none of the prior contingency studies reported stimulation behavior to be effective in decreasing distress for 6-, 18-, or 24- month-old infants (Crockenberg & Leerkes, 2004; Diener & Mangelsdorf, 1999). It is possible that stimulation may be more effective as children age and when they can engage in more complex and imaginative forms of play. Also, the frequency of stimulation behaviors may depend on whether or not other toys were available in each study. Additionally, the definition of stimulation also differed across studies. Buss and Goldsmith (1998) defined stimulation behaviors as repetitive manipulation of body parts or clothing, which is part of the definition of stimulation behaviors for infants at 6 months old in the current study, but not for older infants who are able to engage in more play behavior. In correlational studies, for 12- and 24- month- old infants, engaging with toys other than the aversive stimulus was inversely associated with negative distress during anger and waiting tasks (Braungart & Stifter, 1991; Grolnick, Bridges, & Connell, 1996). Thus, the effectiveness of stimulation behaviors for infants at different ages may need to be further explored. Because stimulation behaviors serve a distraction purpose for infants during frustrating and fear tasks, I predicted that stimulation behaviors (by oneself or with mother) would reliably reduce infant distress at 1 and 2 years in both the fear and anger tasks, but not at 6 months of age. The reason is that at 6 months of age, infants were strapped on a seat and the stimulation behavior that they engaged in (e.g., banging table, kicking legs) may not distract them from the aversive stimulus.

Venting

Venting behaviors is a tension release strategy and include infants banging objects, stomping the floor and throwing a tantrum (Diener & Mangelsdorf, 1999). Venting behaviors are rarely examined in contingency studies possibly because the frequency of occurrence is low. In one study that examined venting behavior, it was found to be effective in decreasing anger, but not fear for 18 or 24 months old infants (Diener & Mangelsdorf, 1999). Despite its short-term effectiveness, it was associated with externalizing behaviors in toddlers (Calkins & Dedmon, 2000), perhaps because children who resort to venting behavior are more frustration-prone. Also, when venting occurs in social situations, it may elicit aversive reactions from their peers and parents, which may reinforce children's use of these behaviors, thus creating a negative feedback loop (Taylor, Manganello, Lee, & Rice, 2010; Wilson & Lipsey, 2007).

Taken together, these studies illustrated that infants are able to employ a variety of emotion regulation strategies to modulate their distress. The effectiveness of the emotion regulation behaviors may vary depending on the nature of the task (anger or fear context), the presence of the caregiver, and infants' ages. In the proposed study, I examined whether emotion regulation behaviors would be effective in reducing distress in the next moment in both anger and fear context at 6 months, 1 and 2 years when mothers were involved in the task.

Emotion Regulation Behaviors and Subsequent Psychopathology

Empirical evidence has illustrated that there is a direct link between emotion regulation behaviors and behavior problems in both concurrent and longitudinal studies.

To illustrate, 2-year-old children who showed more dysregulated behavior such as negative affect, venting, low attention to the task, greater distraction and more defiance, scored above the cut-off on externalizing symptoms on the Child Behavior Check List (Calkins & Dedmon, 2000). In other longitudinal studies, children's affect dysregulation, characterized by high negative affect and defiance when interacting with their mothers at 24 months of age was associated with lower social skills and more externalizing problems reported by both mothers and teachers at 36 months (NICHD ECCRN, 2004). Consistent with these findings, toddlers' undercontrolled behavior, characterized by short latency during a wait task and mother-reported emotion dysregulation at 2 years predicted their externalizing symptoms at 4 years of age (Rubin, Burgess, Dwyer, & Hastings, 2003). In terms of internalizing behaviors, young children who were low on effort control, which was characterized as low attention and low problem solving, had higher internalizing symptoms (Robinson et al., 2009). However, the construct of emotion regulation behavior was coded heterogeneously in these studies. Some studies included children's negative affect as part of their emotion regulation abilities (Calkins & Dedmon, 2000; NICHD ECCRN, 2004), and some other studies included children's latency of waiting during the wait task (Robinson et al., 2009; Rubin et al., 2003), which may tap more into children's effortful control rather than emotion regulation abilities in emotionally-charged contexts. In the current study, emotion regulation behaviors were coded in the tasks aimed to illicit frustration and fear in infants, and were coded independently from infant observed affect.

Relatively fewer studies have examined the link between specific regulatory behaviors and subsequent outcomes independent of observed affect. In one such study, infants' distress during the frustrating events and infants' attention to the frustrating stimulus at 6 months of age both predicted mother-reported aggressive behavior at 2.5 years old, suggesting that the inability to disengage from an anger-inducing stimuli is maladaptive in the long term (Crockenberg et al., 2008). In addition, for females, but not males, there was a strong trend for looking away during a frustration task at 6 months to be negatively associated with aggressive behavior at 2.5 years (Crockenberg et al., 2008), suggesting gender may play a moderating role. Likewise, Hill, Degnan, Calkins, and Keane (2006) examined the profiles of externalizing behaviors from age 2 to age 5 in a sample that was over-selected for externalizing problems. Four profiles were found: chronic-clinical, subthreshold, normative and low profile of externalizing symptoms. For girls, emotion regulation ability and inattention distinguished their membership in the chronic-clinical profile with all the other profiles in that lower levels of emotion regulation were associated with the highest likelihood of being in the chronic-clinical profile. However, for boys, only inattention predicted their profile membership (Hill et al., 2006). These studies may provide a clearer picture regarding the association between emotion regulation and children's behavior problems. For both boys and girl who have problems with attention mechanism or regulating, they may exhibit more behavior problems. However, the specific pathways of the associations among boys and girls may differ. Thus, gender was included as a possible covariate.

Other literature supports the view that emotion regulation functions as a moderator in the association between children's negative emotionality and psychopathology. For example, infants' frustration distress at 24 months was positively associated with their concurrent peer conflict behavior, only when their venting behavior and focusing on the focal object behavior were high (Calkins et al., 1999). Infants who were more prone to frustration may have more frequent negative peer interactions; however, their tendency to use tension reduction strategies may intensify their conflict with peers. Children who resort to distractive strategies in frustrating situations may be better able to dampen their arousal first, and later find better solutions to solve their conflicts with their peers (Crockenberg et al., 2008). Likewise, based on a person-centered analysis, young children with high disruptive behavior were characterized by high negative reactivity and low emotion regulation (indexed by physiological regulation), along with low maternal control (Degnan, Calkins, Keane, & Hill-Soderlund, 2008). Thus, it is the combination of high irritableness, frustration or fearfulness with poor regulation that places children at highest risk for later problematic behavior.

With regards to internalizing behaviors, young children's social anxiety has attracted researchers' attention as a possible predictor of such behaviors. To illustrate, infants' emotion regulation behavior during a fear task (i.e., look away and withdrawal) at 5 months of age moderated the link between infants' reactivity and their mother-reported anxious behavior at 2.5 years old (Crockenberg & Leerkes, 2006). Specifically, when infants' looking away behavior was low during the novel toy task, their temperamental trait of distress to novelty was positively associated with anxious

behavior, whereas when looking away behavior was high, distress to novelty was negatively associated with anxious behavior at 2.5 years old (Crockenberg & Leerkes, 2006). In addition, for infants who withdrew during their exposure to the novel toy, their distress to novelty was positively associated with anxious behavior at 2.5 years if they were also highly active (Crockenberg & Leerkes, 2006). Thus, certain emotion regulation behaviors may buffer children with negative emotionality from developing internalizing symptoms, whereas others may exacerbate it. Notably, withdrawal behavior is an example in which a specific regulatory behavior was adaptive in reducing arousal in the moment (Crockenberg & Leerkes, 2004), but maladaptive in the long term, at least for certain children (Crocekneberg & Leerkes, 2006). Likewise, venting behavior reduced anger in the next moment (Diener & Mangelsdorf, 1999), but it was associated with emotion dysregulation and was a risk factor for externalizing symptoms (Calkins & Dedmon, 2000). This demonstrates the utility of conducting both sequential and longitudinal associations to address the adaptiveness of specific emotion regulation behaviors.

Prior research has demonstrated that externalizing and internalizing behavior correlate with distinct characteristics and temperamental traits (Lahey, Waldman, & McBurnett, 1999; Rubin & Mills, 1991). Children who were high on internalizing behaviors were less likely to engage in aggressive behaviors (Lahey et al., 1999). Specifically, children who were high on aggression were characterized as high on behavioral activation trait, referring to their behaviors being motivated by obtaining rewards and avoiding punishment and frustration. In contrast, children who were high on

internalizing behavior were often characterized as high on behavioral inhibition trait and engaging in withdrawal behavior. In other words, these children tend to inhibit behaviors when facing novel stimuli and tend to avoid punishment and frustration (Gray, 1987; Rubin & Mills, 1991). In addition, children who were rated high on behavioral inhibition engaged in lower aggressive behaviors at school age, compared to children who were rated lower on the trait (Lahey et al., 1999). During social interactions, rather than being aggressive with their peers, children who were high on behavioral inhibition and withdrawal behavior were more dependent on adults, more unassertive, and were more compliant in response to social conflicts compared to their peers (Rubin & Mills, 1991). Some children who exhibited higher externalizing behavior may also experience internalizing symptoms, especially if they experience peer rejection and parental conflict (Cicchetti & Toth, 1991; Kim & Cicchetti, 2010); furthermore, children's feelings of anxiety may manifest in acting out behavior (Bubier & Drabick, 2009). However, this comorbidity of externalizing and internalizing behavior was not the focus of the current study. In terms of specific temperamental traits as predictors of externalizing and internalizing behaviors, high fear during infancy was associated with later internalizing symptoms and high anger/frustration predicted more externalizing symptoms (Deater-Deckard, Petrill, & Thompson, 2007; Gartstein, Bridgett, Rothbart, Robertson, Iddins, Ramsay, & Schlect, 2010; Gilliom & Shaw, 2004). Children who experience high fear may experience anxiety when facing novel situations; in contrast, children who exhibit high anger/frustration may have a lower threshold of becoming frustrated and they experience frustration more frequently, so they are more likely to resort to acting-out

behaviors when they experience high negative arousal. Thus, when predicting externalizing symptoms in the current study, mother-reported infant proneness to frustration and emotion regulation behaviors that occurred in the frustration context were used as predictors. When predicting internalizing symptoms, mother-reported infant proneness to fear and emotion regulation behaviors occurred in the fear context were used as predictors. Maternal reports of temperament at 6 months were used because this is the earliest measure available, and as such best reflects children's biologically-driven traits (Rothbart & Bates, 2006), as it is less affected by the parenting environment/socialization experiences than later maternal reports (Bridget et al., 2009; Kiff, Lengua, & Zalewski, 2011).

The Current Study

In the current study, I focus on emotion regulation behaviors that are most adaptive for infants at various ages (6 months, 1 year, 2 years) and in different emotion contexts (frightening and frustrating) during the portion of the task where the mother was able to engage with the infants (3 minutes each task). This is likely more ecologically valid as it is somewhat unlikely that mothers are present, proximal and non-responsive in daily life when infants become distressed. In addition, the portion where mothers were uninvolved during the task was only 1 minute, compared to 3 minutes of mother involved portion, where more emotion regulation behaviors and changes in affect can be observed. In other words, the uninvolved periods may be too brief and result in too few behaviors and changes in affect to conduct meaningful analyses.

In contrast to prior research, I identified the behaviors that are deemed adaptive both immediately and longitudinally in a single sample. To my knowledge, this is the first study that focused on both research questions in a single sample and across multiple time points and emotion contexts. The first primary question related to immediate reductions in distress was addressed using sequential analysis. Then, a series of exploratory/descriptive analyses, that were primarily correlational, were used to examine the stability of emotion regulation behavior within context and over time, and the stability of emotion regulation behavior across contexts and within one time point, and whether emotion regulation behavior at an earlier time point is associated with other emotions regulation behaviors at later time points. These were used to guide decisions about the possibility of testing models in which earlier time point of emotion regulation behavior may be associated with later time point of emotion regulation behaviors. The second primary research question related to longitudinal prediction was addressed using path analyses. In these analyses, I examined the main effects of emotion regulation behaviors on the selected outcomes as well as interactive effects with infant temperamental anger and fear.

Hypotheses

Primary Research Question 1: Which emotion regulation behaviors are adaptive in the moment as evidenced by reductions in infant distress?

1a) Gaze away (both at mother or at other objects) would reliably reduce infants' distress at all time points and in both frustration and fear contexts.

1b) In terms of body behaviors, withdrawal behavior would reliably reduce distress in the fear context at 6 months, 1 and 2 years of age.

1c) Self-soothing (both related to self and the mother) would reliably reduce infant distress in both the frustrating and fear task at 6 months only.

1d) Problem-solving, bid to mother, and bid to experimenter would reliably reduce infant distress at 1 year and 2 years during the anger but not fear tasks.

1e). Stimulation (by oneself or with mother) would reliably reduce infant distress at 1 and 2 years in both the anger and fear tasks.

Exploratory Research Questions: The following exploratory questions were also addressed: 1) Is infants' use of specific emotion regulation behaviors stable across contexts and within time point?; 2) Is infants' use of specific emotion regulation behaviors within context stable over time?; and 3) Does infants' early use of less sophisticated or mother-oriented behaviors correlate with later use of more sophisticated or independent forms of emotion regulation behaviors?

Primary Research Question 2: Which emotion regulation behaviors are adaptive in the long-term in relation to children's adjustment (i.e., externalizing and internalizing symptoms) as main effects or by moderating the relationship between infant temperamental anger/fear and children's behavior problems?

2a) Looking away behavior (to mother or other objects) at all time points during the anger and fear task would predict fewer externalizing and internalizing behaviors.

2b) Stimulation/play and problem-solving behaviors at 1 and 2 years during the anger and fear task would predict fewer externalizing and internalizing behaviors.

2c) I predicted that looking away (all time points), problem solving (1 and 2 years), and stimulation/play (1 and 2 years) during the frustration task, would moderate the link between high mother reported anger and later externalizing symptoms. Specifically, high temperamental anger would only be positively associated with externalizing symptoms among infants who used low levels of looking away behaviors, problem solving behaviors, and stimulation/play.

2d) I predicted that looking away (at all time points) and withdrawal behavior (at all time points) during the fear task, would moderate the link between high mother-reported fear and later internalizing symptoms. Specifically, high mother-reported fear would only be positively associated with internalizing symptoms among infants who used low levels of looking away behavior, or engaged in high levels of withdrawal behaviors.

CHAPTER IV

METHODS

Participants

Participants in the current study were drawn from a prospective longitudinal study investigating the origins of maternal sensitivity during infancy. The initial sample consisted of 259 primiparous mothers (128 European American, 131 African American) and their infants. At recruitment, participants ranged in age from 18 to 44 years (M = 25 years). Twenty-seven percent of the participants had a high school degree or less, 27% had some college, and 46% had a 4-year college degree or beyond. The majority (71%) of mothers were married or living with their child's father, 11% were dating but not living with their child's father, and 18% were single or not living with the child's father. Annual family income ranged from less than $2000 to over $100,000; median income was $35,000. All participating children were healthy; 52% were female. Of these, 211, 208, and 198 mothers and infants participated in observational assessments of reactivity and regulation at 6, 14, and 27 months respectively, and 223, 212, and 204 provided maternal reports of behavior problems when children were 14, and 27 months, and at 4.5 years old, respectively. Thus, the analytic sample will vary between research questions and across waves.

Procedure

Expectant mothers were recruited during their third trimester from childbirth education classes, breastfeeding classes, obstetric practices and via word of mouth. Mothers completed a demographic questionnaire during the prenatal period. Mothers and infants visited campus when their infants were approximately 6 months, 14 months (referred to as 1 year), and 27 months old (referred to as 2 year). Each visit began with a free play procedure, followed by a series of tasks designed to elicit distress as described below. Mothers were mailed and completed the Brief Infant-Toddler Social and Emotional Assessment (BITSEA), prior to the 1-year and 2-year visits. Likewise, they completed the Infant Behavior Questionnaire (6 months and 1 year visit) and The Early Childhood Behavior Questionnaire (2-year visit) prior to visits. When children were approximately 4 ½ years old, mothers completed an online survey including Child Behavior Checklist 1.5-5. At the conclusion of each data collection wave, mothers were compensated $50 to $125, and children received a small gift at each visit. All procedures were approved by the university's institutional review board.

6-Month Observation

During the 6-month visit, the first distress task was a 4-minute *arm restraint* procedure designed to elicit infant frustration. The experimenter knelt in front of the infant seat and gently held the infant's forearms immobile while keeping her head down and not interacting with the infant. The second distress task was a *novel toy approach* designed to elicit infant fear. The infant was tucked into a table with a barrier that prevented the toy from touching the infant. A remote control-operated dump truck with

flashing lights, motion, and sound and an action figure seated on top approached the infant three times. Then, the truck's horn, ignition and a voice sounded, and music played while the truck vibrated and its lights flashed. During the first minute of both tasks, the mother was instructed to remain uninvolved unless she wanted to end the activity. Then, the experimenter signaled the mother that she could interact as she pleased.

1-Year Observation

The first distressing task was a 4-minute *attractive toy in a jar* procedure designed to elicit infant frustration. The researcher offered the infant an interactive toy phone. Once the infant was interested in the phone, the researcher placed it in a clear plastic jar and closed the lid so the infant could see but not touch the toy. The researcher prompted the infant to open the jar; but the lid was too big for the infant to do so. After 4 minutes, the researcher opened the jar and allowed the infant to play with the phone. Next, during the *novel character approach* that was designed to elicit fear, the researcher left the room and a research assistant dressed in a green monster costume entered the room and engaged in a series of approaches toward and attempts to interact with the infant for 4 minutes. During the first minute of both tasks, the mother was instructed to remain uninvolved unless she wanted to end the activity. Then, the experimenter signaled the mother that she could interact as she pleased.

2-Year Observation

During the 2 year visit, the first distressing task was the *attractive toy in a locked box*, designed to elicit frustration. Children selected one of two attractive toys. After

being allowed to play with it for a moment, the experimenter locked it in a clear container, and gave the child a set of keys with the instruction that they could play with the toy when they opened the box. The correct key was not on the key ring. For 4 minutes, the experimenter prompted the child to use the keys to open the box. The second task, was the *spider approach*, designed to elicit fear. The experimenter left the room and placed a stuffed spider attached to a remote control car immediately inside of the door to the observation room. For 20 seconds, the spider remained still near the door. Then, the spider repeatedly approached to within 2 feet of the child, retreated from the child and paused until 3.5 minutes had passed. During the last 30 seconds the experimenter returned to the room and asked the child to touch the motionless spider 3 times in a neutral voice. During the first minute of each task, the mother was instructed to remain uninvolved unless she wanted to end the activity. Then, the experimenter signaled the mother that she could interact as desired for the remaining 3 minutes.

Measures

Infant Affect (6 months, 1 year and 2 years)

Infant affect during the interactive tasks was continuously rated from digital media files during the emotion-eliciting tasks using INTERACT 9 (Mangold, Arnstorf, Germany). Infant affect was rated on a 7-point scale ranging from (1) high positive affect (open mouth, intense smile, can be laughing or squealing) to (7) high negative affect (screams, wails, sobs intensely; mouth wide), adapted from Braungart-Rieker and Stifter (1996) based on infants' vocalizations, facial expressions, and body tension. Event based

coding was used, meaning once a code was activated, it remained active until another code was selected.

For all behavioral coding, coders were blind to other data, reliability cases were selected at random, and disagreements were resolved via consensus. Double-coded tapes ranged from 30-34 cases at each time point. Inter-rater reliability for child affect was: .76 (weighted kappa) at the 6-month-visit, .75 at the 1-year visit, and .81 at the 2-year visit.

Following procedures outlined by Crockenberg and Leerkes (2004), one new code reflecting changes in infant affect will be created using Bakerman and Quera's (1995) Generalized Sequential Querier (GSEQ) program. The new variable "Reduce" will reflect any moment when there is a change from a higher to a lower state of distress or to neutral affect (i.e., 7 to 6or less; 6 to 5 or less; 5 to 4 or less).

The Infant Behavior Questionnaire – Revised Very Short Form (IBQ – RVSF) (6 months)

The IBQ-RVSF (Putnam, Helbig, Gartstein, Rothbart, & Leerkes, 2014), is a shortened version of the Infant Behavior Questionnaire-Revised, a commonly used parent-report measure of infant temperament (IBQ-R; Garstein & Rothbart, 2003). In this study, a hybrid version of the IBQ was administered: The entire very short form (37 items) was administered, and 14 additional items from the fear and distress to limitations subscales of the short form were also administered so those scores could be calculated. *Fear* (7 items) measures the baby's startle or distress to sudden changes in stimulation, novel physical objects or social stimuli, and a more general inhibited approach to novelty (e.g., When introduced to an unfamiliar adult, how often did the baby cling to a parent) (α

= .81). *Distress to Limitations* (7 items) measures the baby's fussing, crying, or showing distress while in a confining place or position, when involved in caretaking activities, or when unable to perform a desired action (e.g., How often did the baby cry or fuss before going to sleep for naps) (α = .73). There was a strong empirical support for the validity of the IBQ- RVSF with test-retest reliability highly similar to those of standard forms averaging .72 and ranging from .54 to .93; convergent validity of the IBQ-RVSF with observational measures of temperamental reactivity was comparable to those observed for the standard IBQ-R scales and suggest that the IBQ-RVSF is a valuable tool for examining infant temperament (Putnam et al., 2014; Parade & Leerkes, 2008). In this sample, mother reported distress to limitation/frustration and mother reported fear were stable over time in that scores at 6 months correlated significantly with scores at 1 year (r = .40 and .48, $p < .01$ for frustration and fear respectively) and 2 years (r = .36 and .31, $p < .01$ for frustration and fear respectively), supporting the decision to use the 6-month measure as the primary measure of temperament.

Infant Emotion Regulation (6 months, 1 year, 2 years)

Four categories of emotion regulation behaviors were coded at all time points: gaze behavior, body position, self-soothing, and stimulation. Two additional categories, problem-solving and venting, were coded at 1 and 2 years only. Within a category, all codes were mutually exclusive; thus, evidence of interrater reliability is presented for each category and was based on 20-27 double-coded videos at each time point. Across categories, multiple behaviors were coded simultaneously (e.g., looking at mother and self-soothing could co-occur). Four types of gaze behaviors were coded: inspecting the

stimulus (e.g. the toy used during the novelty task or the arms being held by experimenter), looking away from the stimulus (but not at mother), looking at mother, and eyes closed (only coded at 6 months); (K = .86 at 6 months, K = .89 at 1 year, K = .94 at 2 years). Five types of body position behaviors were coded: normal/neutral position, approaching (e.g. leaning or crawling/walking toward, reaching for, or touching aversive stimulus), resisting (only coded during the arm restraint task at the 6-month visit; includes struggling or tugging to free arms), withdrawing from stimulus (arching, walking/crawling/turning away from aversive stimulus), and withdrawing towards mom (reaching for, leaning/straining/crawling/walking toward mother); (K = .83 at 6 months, K = .82 at 1 year, K = .76 at 2 years). Three types of soothing were coded: no self-soothing, self-soothing (e.g. thumb/finger sucking, sucking objects, gumming), and self-soothing mother-related (e.g., sucking mother's finger, holding mother's hand, rubbing mother's arm with hands or feet, sitting/leaning on mother, allowing mother to hug, stroke, etc.) (K = .74 at 6 months, K = .80 at 1 year, K = .82 at 2 years). Three types of stimulation/play behaviors were coded: no stimulation, stimulation (e.g. banging or rubbing table, shaking toy, kicking legs, rubbing feet together, banging table with toy, blowing spit bubbles, watching own hand movements, touching or playing with toys in basket, singing songs) and stimulation with mother (only coded at 1 year and 2 year; e.g., any of the stimulation behavior including touching or playing with toys in basket, singing songs where the mother was also engaged) (K = .69 at 6 months, K = .79 at 1 year, K = .70 at 2 years). Venting was coded as no venting or venting (e.g., throw or stomp on jar; yell at or push experimenter; tantrum on floor, etc.) (K = .71 at 1 year, K = .82 at 2

years). Finally, three types of problem-solving behaviors were coded: bidding to mother (ask mother for help verbally or by gesture), bidding to experimenter, and problem solving-object oriented (e.g., trying to open the jar, asking/telling the character to leave, trying to open the door to leave the room) were coded (K = .88 at 1 year, K = .76 at 2 years).

For sequential analyses, emotion regulation behaviors were considered discrete events. That is, the probability that a reduction in affect occurred while any emotion regulation behavior was active was considered. For longitudinal analyses predicting child outcomes, the percent of observation time during which an infant engaged in a specific emotion regulation behavior within a specific task (fear or anger) was calculated at each time point.

The Brief Infant-Toddler Social and Emotional Assessment (1 and 2 years)

When infants were 1 and 2 years of age, mothers completed the 42-item Brief Infant-Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006). Thirty-one items assess problem behaviors reflecting externalizing and internalizing behaviors. Items were scored on a 3 point scale from 0 = Not True/Rarely to 2 = Very true/Often and are summed within domain. In the sample, the internal reliability was .85 and .81 for problem behaviors and .62 and .64 for competence at 1 and 2 years respectively. Although initially designed to only yield a total problem scale, more recently Briggs-Gowan et al. (2013) provided evidence on the validity of the BITSEA's externalizing (7 items) and internalizing subscales (14 items). In this sample,

for the externalizing scale, α is .69 at 1 year, and .59 at 2 year; for the internalizing symptoms scale, α is .73 at 1 year and .70 at 2 years.

The Child Behavior Checklist 1.5-5 (CBCL) (4.5 years)

The CBCL 1.5-5 (Achenbach & Rescorla, 2000) is a parent-rated form including 99 items that describe the child`s behavioral, emotional, and social problems, over the past 2 months. Items are rated on a 3-point scale (0= not true, 1=sometimes or somewhat true, 2=very true or often true). Internalizing symptoms are the sum of 36 items describing emotionally reactive behavior, anxious or depressed behavior, somatic complaints and withdrawn behavior (e.g., Gets too upset when separated from parents) (α = .84). Externalizing symptoms are the sum of 24 items describing attention problems and aggressive behavior (e.g., Hurts animals or people without meaning to) (α = .89). Raw scores reflecting the sum of items were used in analyses (Kristensen, Henriksen, & Bilenberg, 2010).

CHAPTER V

ANALYTIC PLAN AND RESULTS

Descriptive Statistics on Key Variables

Please see Table 1 for the descriptive statistics for emotion regulation behaviors (percent and frequency), and descriptive statistics for reductions in negative affect (reduce variable). Please see Table 2 for the descriptive statistics for mother-reported temperament, observed negative affect and behavior problems.

Adaptiveness of Emotion Regulation in the Moment: Sequential Analyses

Analytic Plan

I used sequential analyses to calculate the probability of reductions in negative affect being preceded by each regulation behavior for infants. The Generalized Sequential Querier (GSEQ) software was used to conduct sequential analysis and the approach described in Bakeman and Quera (2011) was followed. First, I programed GESQ to create a new behavioral code named reduce that includes any instance in which an infant's observed affect rating shifted from a distress state to a lower distress rating/or neutral or positive affect (e.g., 7 to 6, 6 to 4, etc). For descriptive purposes, the frequency with which each infant demonstrated reductions in negative affect for the anger and fear task at each time point (6m,1y,2y) was calculated. Then, I calculated the frequencies of co-occurrence (within 2 s) of the onset of reductions in affect within each regulatory behavior (e.g., gaze, body position) pooled across all participants. In other words, the

unit of analysis was the coded behavior. Then, odds ratio tests were conducted to determine if the frequency of observed co-occurrence of reductions in affect given a specific regulation behavior was more or less likely than chance, relative to other behaviors in that category (e.g., inspect, looking away, looking at mom in the gaze category) for the sample as a whole. If the odds ratio was larger than 1.25 and the confidence interval of the odds ratio did not include 0, then the result was considered to be significant, indicating that the likelihood of a reduction in negative affect co-occurring within 2 seconds of that emotion regulation behavior was significantly more likely than chance. Odds ratio that was larger than 3 indicates a large effect size, between 2-3 indicates a moderate effect size, and between 1.25 to 2 indicates a small effect size (Bakeman & Quera, 2011).

Next, comparable sequential analysis was calculated at the individual level. For each participant, frequencies of co-occurrences (within the 2-s time window) of reductions in distress and each regulation behavior and the related odds ratio test were calculated. The number of individuals with an odds ratio larger than 2, considered a moderate positive odds ratio, and the number of individuals with an odds ratio smaller than .5, considered a moderate negative odds ratio, were calculated (Bakeman & Quera, 2011). Then, sign tests were employed to determine if a significant number of infants show the expected pattern of co-occurrence, which was, more infants having a positive odds ratio compared to those having a negative odds ratio. The most reliable evidence that an emotion regulation behavior was linked with reductions in negative affect existed when both the pooled and the individual-level test for the same co-occurrence were

significant. The goal of the research question was to determine whether each emotion regulation behavior was adaptive in the short-term, meaning associated with a reduction in negative affect within a 2-s window at greater than chance levels using sequential analysis.

Results

From the sequential analysis (see Table 3), at 6 months, consistent with the hypothesis, looking away from the stimulus was associated with a reduction in negative affect at both a pooled and an individual level in the fear context. Somewhat contrary to the hypothesis, inspecting the stimulus, and body position-resistance were associated with a reduction in negative affect but only at a pooled level in the anger task. In addition, closing the eyes was associated with a reduction in negative affect at the pooled level in both the anger and fear task.

At 1 year, consistent with the hypothesis, looking at mother and bodily withdrawing to mother were associated with reductions of infant distress in both contexts at both the pooled and individual level. In addition, consistent with the hypothesis, bodily withdrawing behavior (a weak effect) and self-soothing with mother (a moderate effect) were linked with distress reduction in both contexts, but only at a pooled level. Self-soothing was weakly linked with reductions in distress at a pooled level in the anger context. Contrary to the prediction, venting behavior was strongly linked with distress reduction at a pooled level in both tasks.

At 2 years, surprisingly, none of the behaviors were associated with a reduction in distress at the individual level. At a pooled level, consistent with the hypothesis, looking

at mother, bodily withdrawing, bodily withdrawing to mother, self-soothing with mother, self-soothing, and bidding to mother for help were all associated with reductions in negative affect in both the anger and fear context. Furthermore, independent problem solving behaviors (e.g., infant turning the door knob and trying to escape from the spider) were significantly associated with reductions in negative affect at the pooled level in the fear context. Looking away from the aversive stimulus was linked with reductions in distress in the anger context. Contrary to the prediction, venting behavior was linked with reducing infant distress in the anger context (strong effect) and in the fear context (weak effect) at the pooled level.

Summary and Data Reduction for Subsequent Analyses

More emotion regulation behaviors were associated with a reduction in negative affect at a pooled level, rather than at an individual level. Overall, emotion regulation behaviors that involved the mother seemed to be more effective in alleviating infant distress compared to similar emotion regulation behavior that did not involve the mother. Seven out of the 12 results from the sequential analyses were significant for both looking at mom and withdrawing to mom behavior, compared to 3 out of 12 and 5 out of 12 significant analyses for looking away behavior and withdrawing behavior respectively (see Sum in Table 3). In addition, 4 out of 12 analyses and 4 out of 8 analyses were significant for self-soothing with mom behavior and problem-solving with mom behavior respectively, compared to 3 out of 12 and 1 out of 8 significant analyses for self-soothing behavior and independent problem solving behavior respectively.

So far the hypothesis in research questions 1 aimed to examine whether a specific emotion regulation behavior would be linked with reductions in negative affect, and there is also a possibility that it is infants' ability use any of the emotion regulation behaviors that matters for their short-term and long-term outcomes, rather than using a specific type of behavior. Therefore, to examine if the number of "effective" emotion regulation behavior matters for children's later behavior problems, six "variety" variables were created; one for the anger and one for the fear task at each time point (6m,1y, 2y). "Variety" reflects the sum of distinct types of "effective" emotion regulation behaviors that each infant engaged in during each task at each time point. Effective emotion regulation behaviors refer to those behaviors that were significantly linked with reductions in infant negative affect at a pooled level in each context at each time point based on the sequential analyses results. Venting was not considered an adaptive emotion regulation strategy and it was associated with maladaptive long-term outcomes (Calkins & Dedmon, 2000), thus it was not included in the "variety" variable. Furthermore, venting behavior was used by a small percent of infants at each time point. A summary of the behaviors included in variety at each time point and task was summarized in Table 4. Because the number of "effective" behaviors varies across task and time, the proportion of effective behaviors was calculated, so the measure was on the same scale across tasks and time points. So for example, if an infant at 1 year engaged in looking at mom, withdrawing and self-soothing behavior in an anger task, then her variety score would be 3 out of the possible 7 which is .43 (43% of distinct possible effective behaviors employed). To summarize the descriptive statistics of the variety

variable (see Table 1), at 6 months, infants used an average of 57% and 56% out of the 4 effective emotion regulation behaviors in the frustration and fear task respectively, and 0 infant engaged in none during the anger task; 1 infant engaged in none during the fear task. At 1 year, infants on average used 59% out of the 7 total behaviors in the frustration tasks and out of 6 behaviors in the fear task, and 0 infants engaged in none. At 2 years, toddlers on average used 50% out of 8 total behaviors in the frustration task, and 68% out of 9 total behaviors in the fear context, and 0 used none.

Stability of Emotion Regulation Behavior and Other Exploratory Analyses

Analytic Plan

Next, for the exploratory research questions, correlations between emotion regulation behavior across tasks and within a time point were analyzed to examine the stability of emotion regulation across emotion contexts (anger and fear) and within a time point. Next, correlations between emotion regulation behaviors within a task and across time points were analyzed to examine the stability of emotion regulation behavior within a task (anger or fear) and across time points (6m and 1y, 1y and 2y, 6m and 2y). In addition, exploratory analyses regarding whether emotion regulation behavior at one time point was associated with other emotion regulation behaviors in future time points were examined via correlations.

Stability of Emotion Regulation Behavior Across Tasks, Within Time (see Table 5)

The stability of emotion regulation behaviors including variety across emotion contexts and within time point was examined via simple correlations summarized in Table 5. The results showed that at 6 months, 6 out of 11 (54.5%) correlations were

positive and significant. At 1 year, 9 out of 15 (60.0%) correlations were positive and significant. At 2 years, 2 out of 16 (12.5%) correlations were positive and significant. The average size of the significant correlations was .21 at all three time points. The average size of the overall correlations including the non-significant correlations was .10 at 6 months, .14 at 1 year, and .03 at 2 years. Therefore, infants' use of specific emotion regulation behaviors appeared to be more differentiated/less consistent across the anger and fear contexts at 2 years than at 6 months and 1 year of age. The average size of significant associations among mother-oriented behavior (including look at mom, withdrawing to mom, self-soothing with mom, stimulation with mom and bidding to mom) was .18. The average size of significant associations for non-mother oriented (including looking away, bodily withdrawing, self-soothing, self-stimulation, independent problem-solving) behavior was .20. The average size of all associations for mother oriented behavior was .07. The average size of all associations for non-mother oriented behavior was .13. Thus, mother-oriented behaviors were not more stable than non-mother oriented behaviors.

Stability of Emotion Regulation Behaviors over Time, Within Emotion Context (see Table 6)

The extent to which infants' use of specific regulatory behaviors within a specific type of task (anger of fear) was stable over time was also examined via correlations summarized in Table 6. One out of 33 associations was positive and significant, and one association was negative and significant during the anger tasks (arm restraint, locked box, and lock box). Two out of 36 associations were positive and significant during the fear

tasks (fire truck, green monster, spider task). Therefore, the emotion regulation behaviors that infants used within a particular emotion context were not stable over time. The average size of all associations for mother-oriented behavior was .003 in the anger tasks. The average size of all associations for mother-oriented behavior was .02 in the fear tasks. The average size of all associations for non-mother oriented behavior was -.02 in the anger tasks. The average size of all associations for non-mother oriented behavior was .03 in the fear tasks. Mother-oriented behaviors was not more stable than non-mother-oriented behaviors.

Longitudinal Associations Between Different Emotion Regulation Behaviors (Table 7)

As part of the exploratory analysis, the correlations between a specific emotion regulation behavior at one time point and other emotion regulation behaviors in the future time points were examined to see if earlier use of a specific regulatory behavior would be associated with subsequent use of other emotion regulation behaviors. In reviewing these associations, displayed in Table 7, particular attention was paid to gaze behaviors because both looking away and looking at mom behavior were linked with other behaviors in the future time points. During the frustration tasks, looking away behavior at 6 months was associated with higher self-soothing with mom behavior and more variety at 1 year. Looking at mom behavior at 6 months was associated with more bidding to mom behavior at 1 year. In the fear context, looking away behavior at 6 months was associated with more independent problem solving behavior at 1 year, and with higher variety at 2 years. In addition, looking away behavior at 1 year also was associated with higher

bidding to the experimenter behavior at 2 years. Also, looking at mom behavior at 6 months was associated with higher bidding to mom at 1 year and higher self-soothing with mom at 2 years. Looking at mom behavior at 1 year was also associated with higher withdrawing to mom at 2 years. Therefore, early looking away and looking at mom behavior seemed to be associated with later adaptive emotion regulation behaviors. Specifically, looking at mom behavior at an early age was associated with a greater use of later emotion regulation behavior of other types that involved the mother.

Variety during the anger task was not associated with emotion regulation behavior at later points; however, variety in the fear context was. Variety at 6 months was positively associated with bodily approaching and self-stimulation behavior at 1 year; whereas variety at 1 year was negatively associated with looking at mom at 2 years and positively associated with bodily withdrawing at 1 year. Generally, variety was not linked with infants' use of a specific emotion regulation behavior in the future time points.

Out of the 144 associations for mother-oriented behavior or non-mother oriented behavior in each task, in the anger task, only 2 associations (1 was in the expected direction) using mother-oriented behavior predictors were significant, compared to 6 associations (5 were in the expected direction) using non-mother oriented behaviors. In the fear task, 7 associations (all in the expected direction) using mother-oriented behaviors were significant, compared to 9 associations using non mother-oriented behaviors were significant. Therefore, mother-oriented behaviors did not predict other

forms of emotion regulation behavior in the future time points moreso than non-mother-oriented behaviors.

Generally, relatively few of the longitudinal associations across behaviors were significant (5.50%). Compared to that, among the analyses that involved the gaze behaviors (i.e., look away and look at mom), 8.70% of the analyses were significant, and in the fear context, 12% of the analyses that used variety as a predictor were significant.

Longitudinal Analyses

Analytic Plan

The third research question was to examine whether the emotion regulation behaviors that were shown to be effective in the short term (answered by research question 1) would predict children's lower behavior problems (externalizing and internalizing behavior) in the long term. First, efforts were made to reduce the number of emotion regulation behaviors under consideration by examining the extent to which any particular behavior was linked with reductions in negative affect across time and tasks (see the "sum" variable in Table 3). Behaviors that were linked with reductions in affect at an individual or a pooled level at near chance levels (e.g., 1/12 times = .08) or not at all were removed from further consideration. These include: inspecting the stimulus, body position-approaching, stimulation with self, stimulation with mother, independent problem solving, and bidding to experimenter. The remaining behaviors were retained for further consideration. In addition, it was possible that the variety of effective regulatory behaviors that an infant draws from might predict long-term adaptation, so the variety variable was tested as well. The key goal of research question 3 was to identify

which emotion regulation behaviors would be associated with fewer behavior problems as a main effect or in conjunction with infant temperament (i.e., frustration and fear). Specific emotion regulation behaviors, including variety, were examined separately.

In order to fully capitalize on the longitudinal data, cross-lagged models were used to control for possible stability in emotion regulation behavior and behavior problem over time and to examine the concurrent and longitudinal associations between (a) emotion regulation behavior, (b) temperament, and (c) temperament X emotion regulation and behavior problems. The main effects of each emotion regulation behavior were examined as well as the extent to which each emotion regulation behavior moderated the relationship between temperament and behavior problems. For the emotion regulation behavior variables, other than variety, the percent of task time an infant engaged in a particular emotion regulation behavior was used. For the "variety" variable, the percent was used: The number of behaviors used divided by the number of effective behaviors during that particular task. Mother-reported frustration and fear, and observed emotion regulation behavior were centered; then product terms between maternal reports of temperament (i.e., frustration or fear) and emotion regulation behavior were created. Using the model in the fear context to illustrate which specific paths were tested, first, the 2 stability coefficients of emotion regulation behavior/variety from 6 months to 1 year, from 1 year to 2 years, and the 2 stability coefficients of internalizing behavior from 1 year to 2 years, and from 2 years to 4.5 years were examined. The three paths from emotion regulation behavior/variety at 6 months to internalizing behavior at 1 year, at 2 years and at 4.5 years were tested. And the two

paths from emotion regulation behavior/variety at 1 year to internalizing behavior at 2 years and at 4.5 years were tested. In addition, the paths from emotion regulation/variety at 2 years to internalizing behavior at 4.5 years were examined. The path from internalizing behavior at 1 year to emotion regulation behavior/ variety at 2 years was tested to illustrate the cross-lagged effect. In addition, the 3 moderating effects of emotion regulation behavior at 6 months on the association between mother-reported temperament at 6 months and behavior problems at 1 year, 2 year and 4.5 years were examined. In addition, the 2 moderating effects of emotion regulation behavior at 1 year on the association between mother-reported temperament at 1 year and behavior problem at 2 year, and at 4.5 years were examined. Also, the moderating effect of emotion regulation behavior at 2 years on the association between mother-reported temperament at 2 year and behavior problem at 4.5 years was examined. Informed by the exploratory analysis from research question 2 (see Table 7) and to better illustrate the developmental patterns of emotion regulation behaviors, for the model that used bidding to mom as the focal predictor in the anger context, looking at mom at 6 months was included in the model as a predictor of bidding to mom at 1 year; in the fear context, looking at mom at 6 months and withdrawing to mom at 1 year were used as predictors for bidding to mom at 1 year in the fear context.

Path analyses were conducted using Mplus 7.31 (Muthen & Muthen, 2015). The model fit indices were examined and significant moderating effects were probed by examining the simple slopes between mother-reported temperament (i.e., anger or fear)

and behavior problems when emotion regulation behavior was 1 standard deviation above and below the mean.

The total number of models that were run was 18. Nine models predicting externalizing behavior and nine models predicting internalizing behavior were examined. Venting behavior in the fear context at 1 year was not included in the analysis (99.5% infants did not use it). When predicting externalizing behavior, emotion regulation behavior during the frustration task and mother reported temperamental anger were used. The nine predictors include looking away, looking at mom, withdrawing, withdrawing to mom, self-soothing with mom, self-soothing, bidding to mom, venting and variety of emotion regulation behaviors. When predicting internalizing behavior, emotion regulation behavior during the fear task and mother reported fear were used. The same nine emotion regulation predictors mentioned above were used.

Identifying Covariates

Next, possible covariates including infant race and gender for research question 2 were examined. The results indicated that infant race was associated with behavior problems (see Table 9). Specifically, European American children had fewer mother reported externalizing and internalizing behavior problems at 1 year and 2 years, compared to African American children. When examining the associations between race and emotion regulation behaviors, race was correlated with emotion regulation behaviors in 5 out of 90 analyses. Child gender was only associated with behavior problems in 1 out of 8 analyses and was associated with emotion regulation behaviors in 8 out of 90 analyses. In both cases, the associations were small in magnitude and did not

demonstrate a consistent pattern. Therefore, race and gender were not included as a covariate in the path analysis.

Simple Correlations Among Observed Distress, Emotion Regulation Behaviors, Mother Reported Temperament, and Behavior Problems

Next, simple correlations among observed negative affect, emotion regulation behavior, mother-reported temperament and behavior problems were calculated. Across time points, there was a pattern that infants' observed negative affect was positively associated with looking at mom, withdrawing to mom, withdrawing, self-soothing with mom behavior and bidding to mother behavior within the same task (see Table 8). In addition, infants' observed negative affect was negatively associated with bodily approaching, stimulation, and independent problem solving behavior. Infants' observed negative affect was also positively associated with variety in 5 out of 6 associations (see Table 8). Infants' distress was also positively associated with reductions in negative affect in 6 out of 6 associations. Therefore, as would be expected, infants who experienced higher distress were more likely to use more emotion regulation strategies and also experienced more reductions in negative affect. In addition, as expected, the results showed that mother reported infant temperamental anger was positively associated with externalizing behavior at 1 year and 2 years and internalizing behavior at 2 years. Mother reported infant temperamental fear was positively associated with mother reported internalizing behavior at 2 years, as expected (see Table 9).

With regard to the simple associations between emotion regulation behavior and behavior problems, consistent with the expectation, early looking away behavior was

linked with fewer behavior problems in 3 out of 18 associations in the anger task and 1 out of 18 analyses in the fear task, whereas inspecting the stimulus was linked with more behavior problems in 4 out of 36 analyses (see Table 10). Inconsistent with the expectation, bodily withdrawing behavior during the frustration context was linked with more externalizing behavior in 4 out of 18 analyses. Differential findings between stimulation and stimulation with mom behavior emerged. Stimulation behaviors were linked with higher internalizing behaviors in 5 out of 18 analyses in the fear context, whereas stimulation with mother behaviors were linked with lower behavior problems in 6 out of 36 analyses across the two emotion contexts. In addition, as expected, higher variety at 1 year was associated with lower behavior problems at 1 year and 2 years.

Frustration Context Predicting Externalizing Behavior

Across all the models, the stability path coefficients of externalizing behavior across time points were positively associated with each other. In addition, mother-reported temperamental anger at 6 months was positively associated with externalizing behavior and at 1 year.

The path model predicting externalizing behavior from infant looking away behavior had good model fit: N=245, X (15) = 17.61, p= n.s. *RMSEA*=.027, 90% C.I.: .000 .069, probability RMSEA <= .05: .781, *CFI*=.98, *TFI*=.96, *SRMR*=.039 (see Figure 1). In terms of the path coefficients, looking away behavior at 6 months was negatively associated with externalizing behavior at 1 year, consistent with the prediction. This was not the case for looking away behavior at 1 and 2 years and later externalizing behavior.

Additionally, looking away behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

The model in which looking at mom during the frustration context was the focal regulation behavior to predict externalizing behavior had good model fit: N=245, X (15) = 18.77, p= n.s. *RMSEA*=.032, 90% C.I.: .000 .072, probability RMSEA <= .05: .728. *CFI*=.98, *TFI*=.95, *SRMR*=.037 (see Figure 2). In terms of the path coefficients, looking at mom at 6 month was negatively associated with looking at mom at 1 year, an unanticipated finding. Looking at mom behavior at 6 months and 1 year (but not 2 years) were negatively associated with externalizing behavior at 2 years, as predicted. One moderating effect emerged. Mother-reported infant temperamental anger interacted with looking at mom behavior at 6 months, and this interaction effect predicted externalizing behavior at 2 years. Simple slopes analyses indicated that when looking at mom behavior was 1 standard deviation above the mean, there was a significant negative association between temperamental anger and externalizing behavior, whereas when looking at mom behavior was 1 standard deviation below the mean, the association between temperamental anger and externalizing behavior was positive, but not significant. This finding indicates that higher temperamental anger was associated with fewer externalizing behaviors, when looking at mom behavior was high.

The path model predicting externalizing behavior from infant self-soothing behavior was examined next. The model had poor model fit: N=245, X (15) = 139.59, p= .00, *RMSEA*=.18, 90% C.I.: .16 .21, probability RMSEA <= .05: .00, *CFI*=.53, *TFI*=-.11, *SRMR*=.094 (see Figure 3). When examining the path coefficients, self-soothing

behavior at 1 year (but not 6 months or 2 years) was negatively associated with externalizing behavior at 2 years. Interestingly, externalizing behavior at 1 year was positively associated with self-soothing behavior at 2 years, which was contrary to the expectation. Additionally, self-soothing behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

Next, the path model predicting externalizing behavior from self-soothing with mom behavior was examined. The model had good model fit: N=245, $\chi(20) = 27.48$, p= n.s. *RMSEA*=.04, 90% C.I.: .00 .07, probability RMSEA <= .05: .67, *CFI*=.95, *TFI*=-.91, *SRMR*=.05 (see Figure 4). Self-soothing with mom behavior was not associated with later behavior problems. Additionally, self-soothing with mom behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

Next, the path model predicting externalizing behavior from bodily withdrawing behavior was examined. The model had good model fit: N=245, $X(9) = 11.64$, p= n.s. *RMSEA*=.04, 90% C.I.: .00 .08, probability RMSEA <= .05: .63, *CFI*=.98, *TFI*=.96, *SRMR*=.034 (See Figure 5). Bodily withdrawing behavior was not associated with later externalizing behavior. Additionally, bodily withdrawing behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

The model in which bodily withdrawing to mom during the frustration context was the focal emotion regulation behavior to predict externalizing behavior was examined (see Figure 6). The model had poor model fit: N=244, $\chi(9) = 156.41$, p= .00, *RMSEA*=.26, 90% C.I.: .22 .30, probability RMSEA <= .05: .00, *CFI*=.49, *TFI*= -.26,

SRMR=.12. Bodily withdrawing to mom behavior was not associated with later behavior problems. Additionally, bodily withdrawing to mom behavior did not moderate the link between infant anger at 6 months and later externalizing symptoms.

The model in which bidding to mom during the frustration context was the focal emotion regulation behavior to predict externalizing behavior was examined and it had good model fit (see Figure 7): N=245, X (19) = 30.22, p= .049, *RMSEA*=.049, 90% C.I.: .00 .08, probability RMSEA <= .05: .48, *CFI*=.93, *TFI*=-.88, *SRMR*=.047. Looking at mom behavior was positively associated with bidding to mom behavior at 1 year. Bidding to mom behavior was not associated with later externalizing behavior. Additionally, bidding to mom behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

The path model predicting externalizing behavior from venting behavior was examined and it had good model fit (see Figure 8): X (26) = 35.39, p= .10, *RMSEA*=.038, 90% C.I.: .00 .07, probability RMSEA <= .05: .71, *CFI*=.94, *TFI*= .91, *SRMR*=.054. Venting behavior was not associated with later externalizing behavior. Additionally, venting behavior did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

The path model predicting externalizing behavior from variety was examined and it had acceptable model fit (see Figure 9): N=245, X (23) = 38.34, p= .02, *RMSEA*=.052, 90% C.I.: .019 .080, probability RMSEA <= .05: .42, *CFI*=.90, *TFI*= .85, *SRMR*=.055. Contrary to the expectation, variety at 6 months was positively associated with

externalizing behavior at 4.5 years. Variety did not moderate the link between infant temperamental anger at 6 months and later externalizing symptoms.

Fear Context Predicting Internalizing Behavior

Across all the models, mother-reported temperamental fear at 6 months was positively associated with internalizing behavior at 1 year in all models.

The path model predicting internalizing behavior from looking away behavior was examined (see Figure 10a). The model had good model fit: N=245, X (15) = 17.98, p= n.s., *RMSEA*=.028, 90% C.I.: .000 .070, probability RMSEA <= .05: .764, *CFI*=.97, *TFI*=.94, *SRMR*=.034. In terms of the path coefficients, looking away behavior at 2 years (but not 6 months or 1 year) was negatively associated with internalizing behavior at 4.5 years. Two moderating effects emerged. Mother-reported infant temperamental fear interacted with looking away behavior at 6 months, and this interaction effect predicted internalizing behavior at 2 years. In addition, mother-reported fear interacted with looking away behavior at 1 year, and this interaction effect predicted internalizing behavior at 4.5 years. Simple slopes analyses indicated that, when looking away behavior was high at 6 months, higher mother-reported temperamental fear at 6 months was associated with higher internalizing behavior at 2 years (see Figure 10b). When looking away behavior was at mean level or 1 standard deviation below the mean, the associations between mother-reported temperamental fear and internalizing behavior were not significant. Similarly, when looking away behavior was 1 standard deviation above the mean at 1 year, higher temperamental fear was associated with higher internalizing behavior at 4.5 years (see Figure 10c). When looking away behavior was 1

standard deviation below the mean, higher temperamental fear was linked with lower internalizing behavior at 4.5 years. When looking away behavior was at the mean level, the association between temperamental fear and internalizing behavior was not significant. These moderation effects were contrary to the expectation.

The path model predicting internalizing behavior from looking at mom behavior was examined and it had acceptable model fit (see Figure 11): N=245, X (18) = 29.68, p= .04, *RMSEA*=.05, 90% C.I.: .01 .08, probability RMSEA <= .05: .43, *CFI*=.90, *TFI*=.81, *SRMR*=.048. Looking at mom at 1 year (but not 6 months or 2 years) was negatively associated with internalizing behavior at 2 years. Internalizing behavior at 1 year was positively associated with looking at mom behavior at 2 years, which was contrary to the expectation. Additionally, looking at mom behavior did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

The path model predicting internalizing behavior from self-soothing behavior was examined and it had poor model fit (see Figure 12): N=245, X (17) = 40.952, p= .00, *RMSEA*=.076, 90% C.I.: .046 .106, probability RMSEA <= .05: .07, *CFI*=.81, *TFI*=.61, *SRMR*=.05. Self-soothing behavior was not associated with subsequent internalizing behavior. Additionally, self-soothing behavior did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

Next, the model in which self-soothing with mom behavior during the fear context was the focal regulation behavior to predict internalizing behavior was examined (see Figure 13). The model had acceptable model fit: N=245, χ (19) = 33.30, p= .03, *RMSEA*=.052, 90% C.I.: .016 .082, probability RMSEA <= .05: .42, *CFI*=.90, *TFI*=.82,

SRMR=.047. Self-soothing with mom at 1 year (but not 6 months or 2 years) was negatively associated with internalizing behaviors at 4.5 years. However, self-soothing with mom behavior did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

Next, the model in which bodily withdrawing behavior during the fear context was the focal regulation behavior to predict internalizing behavior was examined (see Figure 14). The model had poor model fit: N=244, χ (12) = 29.20, *p*= .00, *RMSEA*=.08, 90% C.I.: .04 .11, probability RMSEA <= .05: .10, *CFI*=.85, *TFI*=.73, *SRMR*=.055. Bodily withdrawing behavior was not associated with later internalizing behavior. Additionally, bodily withdrawing behavior did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

The path model predicting internalizing behavior from bodily withdrawing to mom behavior was examined (see Figure 15) and it had poor model fit: N=244, χ (12) = 29.20, *p*= .00, *RMSEA*=.08, 90% C.I.: .04 .11, probability RMSEA <= .05: .10, *CFI*=.85, *TFI*=.73, *SRMR*=.055. Bodily withdrawing to mom behavior was not associated with later behavior problems. Additionally, bodily withdrawing to mom behavior did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

The path model predicting internalizing behavior from bidding to mother was examined. The model had poor model fit (See Figure 16): N=245, χ (20) = 69.10, *p*= .00, *RMSEA*=.10, 90% C.I.: .08, .13, probability RMSEA <= .05: .01, *CFI*=.69, *TFI*=.53, *SRMR*=.08. Withdrawing to mother at 1 year was associated with bidding to mother at 2

years. Bidding to mother was not associated with later internalizing behavior. Additionally, variety did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

In terms of the path model predicting internalizing behavior from venting behavior, venting behavior at 1 year was not included in the analysis due to low occurrence (see Figure 17). The model had acceptable model fit: N=244, χ (6) = 13.18, *p*= .04**,** *RMSEA*=.07, 90% C.I.: .014 .122, probability RMSEA <= .05: .21**,** *CFI*=.94, *TFI*=.85**,** *SRMR*=.044. The moderating effect of venting behavior on the association of temperamental fear and internalizing behavior at 4.5 years was significant. Simple slope analyses indicated a trend level association such that when venting behavior is 1 standard deviation above the mean, infants' temperamental fear was negatively associated with internalizing behavior (see Figure 16a). When venting behavior was 1 standard deviation below the mean and at the mean level, the associations between temperamental fear and internalizing behavior at 4.5 years were not significant. This moderation effect was contrary to the expectation.

The path model predicting internalizing behavior from the "variety" was examined. The model had poor model fit (See Figure 18): N=245, χ (22) = 41.02, *p*= .01, *RMSEA*=.059, 90% C.I.: .030, .087, probability RMSEA <= .05: .268, *CFI*=.836, *TFI*=.739, *SRMR*=.053. Variety was not associated with later behavior problems. Additionally, variety did not moderate the link between infant temperamental fear at 6 months and later internalizing symptoms.

Summary

Across contexts, looking away and looking at mom behavior seemed to predict long-term outcomes moreso compared to other behaviors. Looking away behavior was associated with fewer behavior problems in 2 out of 12 analyses (1 predicting lower externalizing, 1 lower internalizing) and looking at mom was associated with fewer behavior problems in 3 out of 13 analyses (2 predicting lower externalizing, 1 lower internalizing) as main effects (see Table 11). In addition, the moderating effect of looking at mom on the association between temperamental fear and internalizing behavior was also consistent with the view that looking at mom was an effective emotion regulation behavior in the long-term. Unexpected finding also emerged regarding looking away behavior in the fear context, such that mother reported temperamental anger was associated with higher internalizing behavior, when looking away behavior was high at 6 months. Furthermore, self-soothing behavior predicted fewer externalizing behavior in 1 out of 6 analyses in the frustration context and self-soothing with mom behavior predicted fewer internalizing behavior in 1 out of 6 analyses in the fear context. Therefore, it seemed that when considering the effectiveness of specific emotion regulation behavior, the nature of the context needs to be taken into consideration.

CHAPTER VI

DISCUSSION

From the functionalist perspective, an emotion regulation behavior serves its function to prompt the individuals to cope with the event and manage their distress levels (Campos et al., 1994). In addition, emotion regulation behavior can be defined if it is associated with a distress reduction in the next moment (Cole et al. 2004). Children's emotion regulation behavior is also a precursor of subsequent behavior problems (Calkins & Fox, 2002). However, none of the previous studies have examined whether the same emotion regulation behavior that is associated with a short-term reduction in negative affect would lead to fewer behavior problems in the long run as well. The goal of this study was to identify the subset of emotion regulation behaviors that were effective in both the short-term (associated with an affect reduction within a 2-s window at 6 months, 1 year, and 2 years of age) and long-term (predicting fewer externalizing and internalizing behavior at 1 year, 2 years and 4.5 years of age as main effects and/or by buffering the link between temperamental reactivity and later behavior problems). Identifying the most adaptive regulatory behaviors has practical implications because future efforts could be made to identify predictors of infants' use of these behaviors. In addition, educational or intervention programs could be designed in an effort to bolster infants' use of these behaviors. In the following sections, I summarize the results and

implications of the sequential and longitudinal analyses organized by types of behavior (e.g., gaze, body position, etc).

Gaze Behaviors

Infants' ability to use attentional control to regulate their arousal are well in place by 6 months, which can prevent them from becoming over-stimulated from the environmental stimulus (Dawson, 1994; Johnson, Posner, & Rothbart, 1991). Thus, infant gaze behaviors, believed to reflect attention, may be an important early regulatory behavior. Prior empirical literature showed that disengaging attention from an aversive stimulus could alleviate infant distress in the next moment (Buss & Goldsmith, 1998) and was associated with fewer behavior problems over time (Crockenberg et al., 2008). In the current study, looking away behavior was associated with lower behavior problems from simple correlations and moreso in the anger task, which is consistent with the literature (Crockenberg et al., 2008). Looking away behavior was also associated with later adaptive emotion regulation behaviors. Specifically, looking away behavior at 6 months was positively associated with withdrawing to mom behavior at 1 year. Looking at mom behavior at 6 months was positively associated with bidding to mom behavior at 1 year.

Adaptiveness in the Moment

Consistent with the hypothesis and prior research (Buss & Goldsmith, 1998), the results from sequential analysis showed that looking away behavior predicted a reduction in negative affect at both a pooled level and at an individual level in the fear context at 6 months. Looking away behavior was also associated with a reduction in negative affect

in the 2-year anger task at a pooled level. Next, looking at mom behavior was associated with distress reduction in both the 1 year anger task and fear task. Looking at mom behavior was also associated with a reduction in negative affect at 2 year tasks at a pooled level. Therefore, looking at mom behavior seems especially useful in the fear context compared to in the anger context at 2 years; furthermore, looking at mom behavior can be considered more effective compared to looking away to other stimuli. This finding indicates that the caregiver may play an important role in alleviating infant fear in the fear context, which is consistent with the view that at an early age, the external support from the caregiver plays an important role in helping infants to downregulate their arousal levels (Kopp, 1989). This finding is also consistent with the view from the attachment theory that infants need their caregivers the most when they are sick, hungry and scared (Bowlby, 1980). As expected, maintaining attention on (i.e., inspecting) the aversive stimulus in both contexts was not associated with a negative affect reduction.

Longitudinal Adaptiveness in Relation to Externalizing Behavior

In the frustration context, most of the models in which looking away and looking at mom were the focal behavior had good model fit. Consistent with the expectation, looking away and looking at mom behavior were linked with fewer externalizing behaviors (Crockenberg et al., 2008; NICHD ECCRN, 2004). Higher look-away behavior at 6 months was linked with fewer externalizing behavior at 1 year, after infants' temperamental anger was taken into account. Higher looking at mom behavior at 6 months and at 1 year both predicted fewer externalizing behavior at 2 years. In addition, there was a moderating effect such that looking at mom behavior interacted with

mother-reported temperamental anger, and this interaction effect predicted externalizing behavior at 2 years. When looking at mom behavior was high, higher temperamental anger was associated with fewer externalizing behavior. This was different from the hypothesis, which was when looking at mom behavior was low, higher temperamental anger would be associated with higher externalizing behavior. Infants with a difficult temperament may have more chances of practicing regulating their emotions, such as seeking information or support from their caregivers by looking at mom, which may actually be adaptive and prevent them from developing externalizing behaviors in the future (Calkins & Leerkes, 2011). In other words, these infants may have become "super-regulators" over time preventing externalizing symptoms. In addition, the emotion regulation behaviors that children engage in during infancy (i.e., 6 months old) are important precursors for the development of behavior problems a few years later. As toddlerhood is an important period in which children start to become more autonomous, and to exhibit more compliant behavior and self-control (Sroufe, 1996), their early ability to use mother as a source of support seems to lay the foundation for their later development of behavioral regulation (Calkins & Leerkes, 2011). In addition, internalizing behavior at 1 year was positively associated with looking at mom behavior at 2 years. Infants who were easily frightened may turn to their parents more for help.

Longitudinal Adaptiveness in Relation to Internalizing Behavior

In the fear context, most of the models involving gaze behavior had good model fit. Consistent with prediction, higher looking-away behavior at 2 years was linked with fewer internalizing behavior at 4.5 years. In addition, there was a moderating effect of

looking away behavior at 6 months on the association between temperamental fear and internalizing behavior at 2 years. When looking away was high, temperamental fear was positively associated with internalizing behavior at 2 years, which was contrary to the expectation. Considering the nature of the task at 6 months (fire truck task), it is possible that looking-away behavior in a relatively benign context may be considered as an avoidance behavior and may not be adaptive, e.g., engaging in clinical withdrawal (a form of physiological regulation) during a relatively safe peer interaction task was associated with reoffending in a sample of delinquent male adolescents (Hastings, Nuselovici, Utendale, Coutya, McShane, & Sullivan, 2008). Therefore, higher looking away response during the fire truck task may be an overreacting response, whereas looking away behavior during the 2-year spider task may be more adaptive. Also, when infants looked away from the fire truck, it was possible that they were looking in the opposite direction from their mom (mother sat to the right of the infant). An overt use of this behavior during this task may indicate that infants were intentionally not seeking help from their mother during the fearful task, which may infer a non-optimal mother-infant relationship. Consistent with expectation, looking at mom behavior at 1 year predicted fewer internalizing behavior at 2 years. Therefore, infants who engaged in looking at mom behavior during a fearful task tended to have lower future internalizing behavior.

Self-Soothing Behaviors

Self-soothing behavior refers to infants gaining comfort using hand-mouth activities (Rothbart et al., 1992) or similar activities that involved the mother. Self-

soothing behaviors were effective in alleviating infant distress within the first year of life, but not afterwards (Diener & Mangelsdorf, 1999; Stifter & Braungart, 1995). Fewer studies have examined longitudinal effects of self-soothing on later behavior problems and the study that examined it reported non-significant findings (Crockenberg & Leerkes, 2006).

Adaptiveness in the Moment

From the sequential analysis, self-soothing behavior was associated with a reduction in distress during the 1 year anger task and during both of the tasks at 2 years at a pooled level. Self-soothing with mom behavior was associated with a reduction in distress at a pooled level during the 1 year fear task, and during both of the tasks at 2 years. Therefore, it seems that in the fear context, self-soothing with mom may be more effective compared to independent self-soothing behavior; whereas in the anger context, independent self-soothing behavior was effective in alleviating frustration distress at 1 year and 2 years. This again supports the view that caregivers play an important part in facilitating children's self-regulation (Kopp, 1989) and without external assistance, toddlers had fewer effective strategies to alleviate their fear, compared to regulating anger (Diener & Mangelsdorf, 1999). These findings are inconsistent with the prediction that self-soothing behavior would only be effective at 6 months, but not at the future time points. Importantly, the nature of the task, at 6 months, infants' arms were being restrained during the anger task, which may limit their ability to engage in self-soothing behavior (e.g., thumb-sucking, body touching). In addition, though self-soothing behavior at 1 year and 2 years were significant at a pooled level, the finding was not

significant at an individual level. Therefore, more research may be needed to examine the effectiveness of self-soothing behavior during late infancy and toddlerhood.

Longitudinal Adaptiveness in Relation to Externalizing Behavior

Consistent with prediction, independent soothing behavior at 1 year was linked with fewer externalizing behavior at 2 years. However, although not predicted, externalizing behavior at 1 year was linked with higher self-soothing behavior at 2 years. That children with higher externalizing symptoms engaged in more self-soothing behavior over time is in line with the view that self-soothing is a relatively unsophisticated regulatory behavior for older children and its use, particularly if at the expense of or in the absence of more sophisticated behaviors, may be maladaptive (Diener & Mangelsdorf, 1999).

Longitudinal Adaptiveness in Relation to Internalizing Behavior

No main effect of self-soothing on internalizing behavior was significant. However, self-soothing with mom at 1 year was negatively associated with internalizing behavior at 4.5 years. It seemed that in the fear context, self-soothing with mom behavior had a more powerful effect compared to self-soothing behavior. Self-soothing with mom behavior primarily involved sitting on mom's lap, may reflect more secure attachment, which could explain the link with lower internalizing (Groh et al., 2012). These results also support the pattern of finding that emotion regulation behaviors that involved the mother seem to be more effective compared to similar behaviors that do not involve the mother.

Body Position

Infants tend to increase their distance between their body and the stimulus when they find the stimulus aversive, for example, pulling their body away from the frustrating stimulus or walking away from it. Mixed evidences exist regarding the effectiveness of bodily withdrawing behavior. Generally, withdrawing behavior has been found to alleviate distress in the next moment in the fear context (Buss & Goldsmith, 1998; Diener & Mangelsdorf, 1999), but it has been argued that, and somewhat supported empirically, that withdrawal behaviors may be maladaptive in the long-run (Crockenberg & Leerkes, 2006).

Adaptiveness in the Moment

Bodily withdrawing behavior was associated with a reduction in negative affect in all the tasks across the time points at a pooled level. Withdrawing to mom was reliably linked with a reduction in negative affect in both the anger and fear task at 1 year at both the pooled and individual level. Withdrawing to mom was also linked with a short-term decrease in negative affect at 2 years at a pooled level. Thus, the effect of withdrawing to mom seems stronger than the effect of withdrawing to other places generally. Although I had hypothesized that withdrawing behavior would predict a reduction in negative affect in the fear context only; this was not the case. In the frustration context at 2 years, the locked box task was designed to be unsolvable, thus withdrawing from the task and starting something else may be adaptive in this context and may reflect infants' ability to disengage from a frustrating situation (Leerkes, 2010). Consistent with the hypothesis, approaching behavior was not linked with reductions in negative affect in any of the

analyses. In addition, from the path analysis, bodily withdrawing behavior did not predict behavior problems in the long term. In contrast to prior research (Crockenberg & Leerkes, 2006), withdrawing was not maladaptive in the long-run, but it was also not linked with positive adjustment. Thus, bodily withdrawing and withdrawing to mom behavior are best viewed as adaptive in the moment.

Stimulation Behaviors

Stimulation behaviors in the current study refer to infants engaging in playful behavior with their body or toys or engaging in playful behavior with their mothers. Although previous studies have reported that distress was not contingent upon infant stimulation behavior (Crockenberg & Leerkes, 2004; Diener & Mangelsdorf, 1999); however, the definition of the stimulation behavior is different across studies, making it difficult to directly compare the findings. In the current study, stimulation behavior may serve a distractive purpose, thus, it was hypothesized as one of the behaviors that would be associated with a reduction in distress and with fewer behavior problems. Simple correlations showed a pattern that stimulation during the fear context was linked with higher internalizing behavior, but stimulation with mother was linked with lower externalizing and internalizing behavior problems. From the attachment literature, infants with avoidant attachment used lower emotion regulation strategies that involved the caregivers (Leerkes & Wong, 2012; Sroufe, 1996). Therefore, infants' use of stimulation versus stimulation with mother behavior may reflect the differences in their relationship quality with their mothers, which poses risk for or protection from behavior problems (Groh et al., 2012).

Adaptiveness in the Moment

Contrary to the prediction, stimulation with the self or with mom was not associated with a reduction in negative affect in all the analyses. It is possible that infants already completed the process of feeling distressed to calming down and then they could move on and play with some other toys. In addition, stimulation behaviors may prevent the onset of distress, which we are not able to address here. This finding is consistent with the prior studies that did not find stimulation behavior to be effective in decreasing infants' distress for 6-, 18-, or 24- month-old infants (Crockenberg & Leerkes, 2004; Diener & Mangelsdorf, 1999). More research may be needed to examine stimulation behaviors considering the heterogeneous definitions of it across the previous studies. In addition, the accessibility of toys in the room (e.g., distance to the infant, the variety of toys) may also differ across studies, which may impact the likelihood or the duration of infant engaging in stimulation behavior.

Stimulation behaviors were not selected for long-term path analyses because few results from the sequential analyses that involved stimulation behaviors were significant, and the current study aimed to identify behaviors that are effective both in the short-term and in the long-term.

Problem-Solving Behavior

Problem solving behaviors refer to infants' attempt to actively solve the presenting problem. It was considered a sophisticated form of emotion regulation strategy (Schieche & Spangler, 2005). In prior research, it has been found to decrease anger (Buss & Goldsmith, 1998); however, not much research has investigated this

behavior for toddlers, nor considered the longitudinal effects. In the current study, problem-solving behaviors were coded at 1 and 2 years only given this category was not developmentally appropriate for 6 month olds.

Adaptiveness in the Moment

Independent problem solving was linked with a short-term reduction in negative affect in the fear task at 2 years at a pooled level. Bidding to mom was linked with negative affect reduction in all the 1-year and 2-year tasks at a pooled level. Bidding to experimenter was not linked with a negative affect reduction. This was different from the hypotheses that problem solving would only work for infants in the anger context, but not in the fear context. However, problem solving behavior may refer to a different set of behavior in the fear context compared to in the frustration context. An example of independent problem solving behavior is that infants attempting to leave the room by turning the knob on the door. Examples of bidding to mom behaviors in a fear context include "Mom, take the spider away", "Take it out", "Mom, there is a spider there. I am scared," which would elicit support from the mother and provide infants with temporary relief. Thus, in the fear context, problem-solving behaviors refer to that infants actively trying to get rid of /escape from the aversive stimulus or seeking help from others to do so. In comparison, in the frustration context, it is maintaining focus on trying to solve the problem, which is to open the lock box or find others to help. Furthermore, infants' ability to seek others' assistance to solve problems by using verbal language or gestures (e.g., bidding to mother) is also a more sophisticated form of regulation (Diener &

Mangelsdorf, 1999; Schieche & Spangler, 2005), thus problem solving can be considered an effective behavior in both the anger and fear context.

Independent problem solving and bidding to experimenter were not included in the longitudinal analysis because there were few findings with these two behaviors from the sequential analysis. The longitudinal associations between bidding to mother and behavior problems were not significant. Therefore, problem solving did not predict future behavior problems in the current study.

Venting Behavior

Venting behaviors refer to infants throwing a temper tantrum such as throwing objects or stomping on the floor to release their anger or fear. Despite its short-term effectiveness in alleviating distress (Lewis, Ramsay, & Kawakami, 1993), it has been considered a maladaptive emotion regulation strategy in the long-term (e.g., associated with externalizing behavior) (Calkins & Dedmon, 2000; Diener & Mangelsdorf, 1999).

Adaptiveness in the Moment

Contrary to prediction, venting behavior was linked with a negative affect reduction in all the tasks at 1 year and 2 years at a pooled level. Possibly it was used as a tension reduction strategy to alleviate distress in the short-term (Lewis et al., 1993). Furthermore, this finding can also reflect ceiling effects. It seems that most infants engaged in venting behavior while in peak distress, so to recover from the peak distress, their distress would go down in the next moment. It is also an intense behavior that may require momentary rest/quiet before the next behavior. It is possible that it was rarely linked with a return to neutral affect. Also, the nature of the tasks was designed to be

highly aversive; in reality, there was nothing children could do to stop the task or solve the problem in the task, so infants may vent as a last resort. If infants have control over the situation to some extent, they may not engage in venting behavior. Contrary to the prediction, venting was not associated with elevated behavior problems in the longitudinal analyses. Therefore, venting behavior was linked with short-term reductions in negative affect, but not with long-term outcomes.

Variety

Longitudinal Adaptiveness in Relation to Externalizing Behavior

"Variety" reflects the sum of distinct types of "effective" emotion regulation behaviors that each infant engaged in during each task at each time point, and the proportion of effective behaviors was calculated and used as "variety." From the path analyses, the variety of behaviors that infants used during the frustration task at 6 months was linked to more externalizing behavior at 4.5 years, which was contrary to the expectation. In comparison, variety in the frustration at 1 year was associated with lower externalizing at 2 years; and variety in the fear task at 1 year was associated with lower internalizing at 2 years from simple correlation analysis. From a developmental perspective, infants' ability to engage in emotion regulation is limited at 6 months (Kopp, 1982). Perhaps early "variety" reflects rapid shift from one behavior to another, whereas with age variety may reflect more deliberate/controlled shifts from one behavior to another, or reflect multiple behaviors used simultaneously in concert with one another. These possibilities require additional investigation.

Summary and Integration

Integrating the analyses together, looking at mother, self-soothing with mom and self-soothing behavior were consistently associated with reductions in negative affect in the short-term and also predicted fewer behavior problems in the long run. Looking at mom behavior at 1 year was associated with both short-term affect reductions and with fewer long-term behavior problems reliably. Self-soothing behavior at 1 year during the anger task, and self-soothing with mom behavior at 1 year during the fear task were also associated with short-term reduction in negative affect and fewer long-term behavior problems. Overall, it seemed that the behaviors that involved the mother (i.e., looking at mom, withdrawing to mom, and bidding to mom) had a stronger effect in reducing infants' negative affect compared to similar emotion regulation behaviors that did not involve the mother (i.e., looking away, bodily withdrawing, and independent problem solving). One explanation could be that during infancy and toddlerhood, infants' early regulation ability is limited and they rely more on their caregivers' support for external regulation (Calkins, 2011; Kopp, 1989). In addition, bodily withdrawing, stimulation and problem-solving behaviors were not associated with subsequent behavior problems, which is contrary to the expectation.

Strength and Limitations of the Current Study

The current study is the first study that examined the effectiveness of specific emotion regulation behaviors in both short-term using sequential analysis and long-term using path analyses in a single sample. Strengths include the relatively large and diverse

sample with high retention, longitudinal and multi-method (e.g., self-report and observational data) design, and inclusion of anger and fear-inducing contexts.

This is also the first study that coded mother-focused and non-mother-focused behaviors separately: looking away and looking at mom, self-soothing and self-soothing with mom, stimulation and stimulation with mom separately. This differentiation is meaningful because infants who used higher mother-involved emotion regulation behavior may be a different group from infants who used higher independent emotion regulation behaviors in terms of their relationship quality with their mothers. The findings supported this view (e.g., stimulation with mom and stimulation behavior were associated with children's adjustment in different directions). The previous studies that examined emotion regulation behaviors have coded them as one category (e.g., Buss & Goldsmith, 1998; Crockenberg et al., 2008).

The coding and analytic approaches are not however without limitation. Emotion regulation behaviors were coded and analyzed by categories (e.g., gaze, body position), but behaviors in different categories could co-occur. For example, withdrawing to mom could co-occur with bidding to mom. Therefore, it is not clear that it was a single behavior that was effective or a combination of emotion regulation strategies that included withdrawing to mom was. Future analyses could take a person-oriented approach; however, doing so longitudinally in the current sample would be challenging because the nature of the frustrating and fear task was different at each time point. Thus, the intensity of emotions that infants experienced in each task may also differ, and the extent to which each task lends itself to the use of specific regulatory behaviors also

varies. Given task differences over time, it is not surprising that from correlation analyses, the stability of emotion regulation behavior was low across the three time points within the same context. On the other hand, it is quite difficult to design emotion-eliciting tasks that would be appropriate across the age period examined in the current study given infant rapid development during the first 3 years of life. Likewise, it would be ideal to see if particular emotion regulation behaviors predict patterns of growth/change in behavior problems over time, but mothers' reports of behavior problems were only assessed on 3 occasions and were based on 2 different measures (the BITSEA at age 1 and 2 and the CBCL at age 4). In addition, the reliability of the externalizing scale on the Brief Infant-Toddler Social and Emotional Assessment is below .70. For the number of analyses, the measurement error may inflate chance findings. Therefore, for future studies, measures with better reliability should be used, or statistical analyses that can better account for measurement error should be considered.

Implications for Practice and Future Research

The findings have recommendations for future preventions and interventions such that clinicians may need to work with caregivers to increase their awareness of their role in supporting infant anger and fear regulation. In addition, clinicians could educate the parents to respond to infants when they try to engage with their parents in any way (e.g., looking at parent, withdrawing to parent, etc) during frustrating or fearful situations. This assistance from the caregiver could provide infants with opportunities to practice down-regulating their distress in emotionally-charged contexts, which provides the foundation

for the emergence of future more independent and sophisticated forms of regulation in infants (Kopp, 1989).

The current study illustrated that emotion regulation behaviors that involved the mother seemed to be more adaptive both in terms of infant short-term and long-term outcomes. Maternal behaviors during the emotionally-charged tasks may directly influence infants' use of regulation behaviors and the duration of using them. For future research, I would like to identify specific maternal behaviors that support looking away/looking at mom and self-soothing behavior in the moment and over time, which may shed light on the individual differences in infants' use of emotion regulation.

Future research also needs to uncover the relations between early forms of emotion regulation behaviors and later more sophisticated forms of emotion regulation behaviors. For example, the current study showed that looking at mom behavior at 6 months was associated with bidding to mother behavior at 1 year in the frustration context. Future research could illustrate the mechanism of how early gaze behavior provides the foundation for subsequent more sophisticated forms of emotion regulation behaviors.

Additionally, the exploratory analysis in the current study showed that the stability of emotion regulation behavior across contexts (anger and fear) was high at 6 months and 1 year compared to at 2 years. Perhaps infants' behaviors became more differentiated/sensitive to contextual demands with age, which can be examined in the future research.

Next, further research also needs to consider the possibility of early behavior problems predicting emotion regulation behavior over time. In the current study, two such associations emerged as significant: Internalizing behavior at 1 year was positively associated with looking at mom behavior at 2 years; and externalizing behavior at 1 year was positively associated with self-soothing behavior at 2 years. Thus, the relations between infants' emotion regulation abilities and their behavior problems may be bidirectional. It seems that infants who showed earlier signs of internalizing behaviors relied more on primitive regulation strategies, rather than using more sophisticated strategies at 2 years. Future research may elaborate on how early behavior problems may impede infants' grasp of more sophisticated forms of regulation behavior.

In sum, this study examined the effectiveness of emotion regulation behavior in the short-term and long-term using sequential and path analyses. The results indicated that emotion regulation behaviors that involved the mother and gaze behaviors were particularly effective in both relieving distress in the short term and in the prevention of behavior problems in the long-term. This study has implications for preventions and interventions that target young children's emotion regulation abilities.

REFERENCES

Achenbach, T. M. (1978). The Child Behavior Profile: I. Boys aged 6–11. *Journal of Consulting and Clinical Psychology, 46*, 478-488. doi:10.1037/0022-006X.46.3.478

Achenbach, T. M., & Rescorla, L. A. (2000). *Manual for the ASEBA Preschool Forms & Profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth, and Families.

Bakeman, R. & Quera, V. (1995). *Analyzing interaction: Sequential analysis with SDIS & GSEQ*. New York: Cambridge University Press. (BQ)

Bakeman, R., & Quera, V. (2011). *Sequential Analysis and Observational Methods for the Behavioral Sciences.* Cambridge, UK: Cambridge University Press.

Bowlby, J. (1980). *Attachment and loss*. New York, NY, US: Basic Books.

Bornstein, M. H. (2002). Parenting infants. In M. H. Bornstein, M. H. Bornstein (Eds.) , *Handbook of parenting: Children and parenting, Vol. 1, 2nd ed (pp. 3-43).* Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Braungart-Rieker, J. M., Hill-Soderlund, A. L., & Karrass, J. (2010). Fear and anger reactivity trajectories from 4 to 16 months: The roles of temperament, regulation, and maternal sensitivity. *Developmental Psychology, 46*, 791-804. doi:10.1037/a0019673

Braungart, J. M., & Stifter, C. A. (1991). Regulation of negative reactivity during the Strange Situation: Temperament and attachment in 12-month-old infants. *Infant Behavior and Development, 14*, 349-364. doi: 10.1016/0163-6383(91)90027-P

Braungart-Rieker, J.M., & Stifter, C.A. (1996). Infants' responses to frustrating situations: Continuity and change in reactivity and regulation. *Child Development, 67*, 1767-1779.doi: 10.1111/j.1467-8624.1996.tb01826.x

Bridges, L. J., & Grolnick, W. S. (1995). The development of emotional self-regulation in infancy and early childhood. In N. Eisenberg, N. Eisenberg (Eds.) , *Social development* (pp. 185-211). Thousand Oaks, CA, US: Sage Publications, Inc.

Bridgett, D. J., Gartstein, M. A., Putnam, S. P., McKay, T., Iddins, E., Robertson, C., & ... Rittmueller, A. (2009). Maternal and contextual influences and the effect of temperament development during infancy on parenting in toddlerhood. *Infant Behavior & Development, 32*, 103-116. doi:10.1016/j.infbeh.2008.10.007

Briggs-Gowan, M. J., & Carter, A. S. (2006). *BITSEA: Brief Infant-Toddler Social and Emotional Assessment. Examiner's Manual*. Harcourt Assessment.

Briggs-Gowan, M. J., Carter, A. S., McCarthy, K., Augustyn, M., Caronna, E., & Clark, R. (2013). Clinical validity of a brief measure of early childhood social–emotional/behavioral problems. *Journal of Pediatric Psychology, 38*, 577-587. doi:10.1093/jpepsy/jst014

Bubier, J. L., & Drabick, D. G. (2009). Co-occurring anxiety and disruptive behavior disorders: The roles of anxious symptoms, reactive aggression, and shared risk

processes. *Clinical Psychology Review, 29,* 658-669. doi:10.1016/j.cpr.2009.08.005

Burnson, C., Poehlmann, J., & Schwichtenberg, A. J. (2013). Effortful control, positive emotional expression, and behavior problems in children born preterm. *Infant Behavior & Development, 36,* 564-574. doi:10.1016/j.infbeh.2013.04.003

Buss, K. A., & Goldsmith, H. H. (1998). Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development, 69*, 359-374

Calkins, S. D. (2011). Caregiving as coregulation: Psychobiological processes and child functioning. In A. Booth, S. M. McHale, N. S. Landale, A. Booth, S. M. McHale, N. S. Landale (Eds.) , *Biosocial foundations of family processes* (pp. 49-59). New York, NY, US: Springer Science + Business Media. doi:10.1007/978-1-4419-7361-0_3

Calkins, S. D., & Dedmon, S. E. (2000). Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. *Journal of Abnormal Child Psychology, 28,* 103-118. doi:10.1023/A:1005112912906

Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology, 14,* 477-498. doi:10.1017/S095457940200305X

Calkins, S. D., & Hill, A. (2007). Caregiver Influences on Emerging Emotion Regulation: Biological and Environmental Transactions in Early Development. In J. J. Gross,

J. J. Gross (Eds.) , *Handbook of emotion regulation* (pp. 229-248). New York, NY, US: Guilford Press.

Calkins, S. D., & Keane, S. P. (2004). Cardiac Vagal Regulation across the Preschool Period: Stability, *Continuity, and Implications for Childhood Adjustment. Developmental Psychobiology, 45,* 101-112. doi:10.1002/dev.20020

Calkins, S. D., Gill, K. A., Johnson, M. C., & Smith, C. (1999). Emotional reactivity and emotion regulation strategies and predictors of social behavior with peers during toddlerhood. *Social Development, 8,* 310-341.

Calkins, S. D., & Leerkes, E. M. (2011). Early attachment processes and the development of emotional self-regulation. In K. D. Vohs, R. F. Baumeister, K. D. Vohs, R. F. Baumeister (Eds.) , *Handbook of self-regulation: Research, theory, and applications* (2nd ed.) (pp. 355-373). New York, NY, US: Guilford Press.

Campbell, S. B., Shaw, D. S., & Gilliom, M. (2000). Early externalizing behavior problems: Toddlers and preschoolers at risk for later maladjustment. *Development and Psychopathology, 12,* 467-488. doi:10.1017/S0954579400003114

Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology, 25,* 394-402. doi:10.1037/0012-1649.25.3.394

Campos, J. J., Mumme, D. L., Kermoian, R., & Campos, R. G. (1994). A functionalist perspective on the nature of emotion. *Monographs of the Society for Research in Child Development, 59,* 284-303. doi:10.2307/1166150

Cicchetti, D. (1993). Developmental psychopathology: Reactions, reflections, projections. *Developmental Review, 13,* 471-502. doi:10.1006/drev.1993.1021

Cicchetti, D., & Rogosch, F. A. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8*, 597-600. doi: 10.1017/S0954579400007318

Cicchetti, D., & Toth, S. L. (1991). A developmental perspective on internalizing and externalizing disorders. *Internalizing and Externalizing Expressions of Dysfunction, 2,* 1-19.

Colder, C. R., Mott, J. A., & Berman, A. S. (2002). The interactive effects of infant activity level and fear on growth trajectories of early childhood behavior problems. *Development and Psychopathology, 14,* 1-23. doi:10.1017/S0954579402001013

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion Regulation as a Scientific Construct: Methodological Challenges and Directions for Child Development Research. *Child Development, 75,* 317-333. doi:10.1111/j.1467-8624.2004.00673.x

Cole, P. M., Michel, M. K., & Teti, L. O. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development, 59*, 73-100. doi:10.2307/1166139

Cox, M. J., Mills-Koonce, R., Propper, C., & Gariépy, J. (2010). Systems theory and cascades in developmental psychopathology. *Development and Psychopathology, 22,* 497-506. doi:10.1017/S0954579410000234

Crockenberg, S., & Leerkes, E. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology, 40,* 1123-1132.

Crockenberg, S. C., & Leerkes, E. M. (2006). Infant and maternal behavior moderate reactivity to novelty to predict anxious behavior at 2.5 years. *Development and Psychopathology, 18,* 17-34. doi:10.1017/S0954579406060020

Crockenberg, S. C., Leerkes, E. M., & Jó, P. S. (2008). Predicting aggressive behavior in the third year from infant reactivity and regulation as moderated by maternal behavior. *Development and Psychopathology, 20,* 37-54. doi:10.1017/S095457940800002

Dawson, G. (1994). Development of emotional expression and emotion regulation in infancy: Contributions of the frontal lobe. In G. Dawson, K. W. Fischer, G. Dawson, K. W. Fischer (Eds.) , *Human behavior and the developing brain* (pp. 346-379). New York, NY, US: Guilford Press.

Deater-Deckard, K., Petrill, S. A., & Thompson, L. A. (2007). Anger/frustration, task persistence, and conduct problems in childhood: a behavioral genetic analysis. *Journal of Child Psychology and Psychiatry, 48,* 80-87. doi:10.1111/j.1469-7610.2006.01653.x

Degnan, K. A., Calkins, S. D., Keane, S. P., & Hill-Soderlund, A. L. (2008). Profiles of disruptive behavior across early childhood: Contributions of frustration reactivity, physiological regulation, and maternal behavior. *Child Development, 79,* 1357-1376. doi:10.1111/j.1467-8624.2008.01193.x

Diener, M. L., & Manglesdorf, S. C. (1999). Behavioral strategies for emotion regulation in toddlers: Associations with maternal involvement and emotional expressions. *Infant Behavior & Development, 22,* 569-583. doi:10.1016/S0163-6383(00)00012-6

Diener, M., Mangelsdorf, S., McHale, J., & Frosch, C. (2002). Infants' behavioral strategies for emotion regulation with fathers and mothers: Associations with emotional expressions and attachment quality. *Infancy. 3,* 153-174.

Edwards, R. C., & Hans, S. L. (2015). Infant risk factors associated with internalizing, externalizing, and co-occurring behavior problems in young children. *Developmental Psychology, 51,* 489-499. doi:10.1037/a0038800

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., & ... Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72,* 1112-1134. doi:10.1111/1467-8624.00337

Evans, G. W., & Fuller-Rowell, T. E. (2013). Childhood poverty, chronic stress, and young adult working memory: The protective role of self-regulatory capacity. *Developmental Science, 16,* 688-696. doi:10.1111/desc.12082

Feinman, S. (1992). *Social referencing and the social construction of reality in infancy.* New York, NY, US: Plenum Press. doi:10.1007/978-1-4899-2462-9

Gartstein, M. A., Bridgett, D. J., Rothbart, M. K., Robertson, C., Iddins, E., Ramsay, K., & Schlect, S. (2010). A latent growth examination of fear development in

infancy: Contributions of maternal depression and the risk for toddler anxiety. *Developmental Psychology, 46*, 651-668. doi:10.1037/a0018898

Garstein M. A., & Rothbart, M . K. (2003). Studying infant temperament via the Revised Infant Behavior Questionnaire. *Infant Behavior and Development, 26*, 64-86. doi: 10.1016/S0163-6383(02)00169-8

Graziano, P., Reavis, R., Keane, S., & Calkins, S. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology*, *45*, 3-19.

Gray, J. A. (1987). *The psychology of fear and stress*. New York: Cambridge University Press.

Groh, A. M., Roisman, G. I., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development, 83*, 591-610.

Grolnick, W. S., Bridges, L. J., & Connell, J. P. (1996). Emotion regulation in two-year-olds: Strategies and emotional expression in four contexts. *Child Development, 67*, 928-941. doi:10.2307/1131871

Guedeney, A., & Puura, K. (2011). Withdrawal behavior and depression in infancy. In H. E. Fitzgerald, K. Puura, M. Tomlinson, C. Paul, H. E. Fitzgerald, K. Puura, ... C. Paul (Eds.) , *International perspectives on children and mental health, Vols 1 and 2: Development and context, Prevention and treatment* (pp. 111-127). Santa Barbara, CA, US: Praeger/ABC-CLIO.

Hastings, P. D., Nuselovici, J. N., Utendale, W. T., Coutya, J., McShane, K. E., & Sullivan, C. (2008). Applying the polyvagal theory to children's emotion regulation: Social context, socialization, and adjustment. *Biological Psychology,79*, 299-306.

Hay, D. F. (2005). The Beginnings of Aggression in Infancy. In R. E. Tremblay, W. W. Hartup, J. Archer, R. E. Tremblay, W. W. Hartup, J. Archer (Eds.) , *Developmental origins of aggression* (pp. 107-132). New York, NY, US: Guilford Press.

Hay, D. F., Mundy, L., Roberts, S., Carta, R., Waters, C. S., Perra, O., & ... van Goozen, S. (2011). Known risk factors for violence predict 12-month-old infants' aggressiveness with peers. *Psychological Science, 22,* 1205-1211. doi:10.1177/0956797611419303

Hill, A. L., Degnan, K. A., Calkins, S. D., & Keane, S. P. (2006). Profiles of externalizing behavior problems for boys and girls across preschool: The roles of emotion regulation and inattention. *Developmental Psychology, 42*, 913-928. doi:10.1037/0012-1649.42.5.913

Hinshaw, S. P. (1987). On the distinction between attentional deficits/hyperactivity and conduct problems/aggression in child psychopathology. *Psychological Bulletin, 101*, 443-463. doi:10.1037/0033-2909.101.3.443

Johnson, M. H., Posner, M. I., & Rothbart, M. K. (1991). Components of visual orienting in early infancy: Contingency learning, anticipatory looking, and disengaging. *Journal of Cognitive Neuroscience, 3,* 335-344. doi:10.1162/jocn.1991.3.4.335

Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology Review, 14,* 251-301. doi:10.1007/s10567-011-0093-4

Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of Child Psychology and Psychiatry, 51*, 706-716. doi:10.1111/j.1469-7610.2009.02202.x

Kopp, C. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*, 199–214.

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology, 25*, 343-354. doi:10.1037/0012-1649.25.3.343

Kristensen, S., Henriksen, T. B., & Bilenberg, N. (2010). The Child Behavior Checklist for ages 1.5–5 (CBCL/1½–5): Assessment and analysis of parent- and caregiver-reported problems in a population-based sample of Danish preschool children. *Nordic Journal of Psychiatry, 64,* 203-209. doi:10.3109/08039480903456595

Leerkes, E. M. (2010). Predictors of maternal sensitivity to infant distress. *Parenting: Science and Practice, 10,* 219-239.

Leerkes, E. M., & Wong, M. S. (2012). Infant distress and regulatory behaviors vary as a function of attachment security regardless of emotion context and maternal involvement. *Infancy, 17,* 455-478. doi:10.1111/j.1532-7078.2011.00099.x

Lewis, M., Ramsay, D. S., & Kawakami, K. (1993). Differences between Japanese infants and Caucasian American infants in behavioral and cortisol responses to inoculation. *Child Development, 64,* 1772 – 1731.

Liu, J. (2004). Childhood Externalizing Behavior: Theory and Implications. *Journal of Child and Adolescent Psychiatric Nursing, 17,* 93-103. doi:10.1111/j.1744-6171.2004.tb00003.x

Maner, J. K., & Schmidt, N. B. (2006). The Role of Risk Avoidance in Anxiety. *Behavior Therapy, 37,* 181-189. doi:10.1016/j.beth.2005.11.003

NICHD ECCRN (2004). Affect dysregulation in the mother-child relationship in the toddler years: Antecedents and consequences. *Development and Psychopathology, 16,* 43-68. doi:10.1017/S0954579404044402

Parade, S. H., & Leerkes, E. M. (2008). The reliability and validity of the Infant Behavior Questionnaire-Revised. *Infant Behavior and Development, 31,* 637-646. doi: 10.1016/j.infbeh.2008.07.009

Putnam, S. P., Helbig, A. L., Gartstein, M. A., Rothbart, M. K., Leerkes, E. (2014). Development and assessment of short and very short forms of the Infant Behavior Questionnaire-Revised. *Journal of Personality Assessment, 1-14.* doi: 10.1080/00223891.2013.841171

Putnam, S. P., & Stifter, C. A. (2005). Behavioral Approach-Inhibition in Toddlers: Prediction From Infancy, Positive and Negative Affective Components, and Relations With Behavior Problems. *Child Development, 76,* 212-226. doi: 10.1111/j.1467-8624.2005.00840.x

Robinson, L. R., Morris, A. S., Heller, S. S., Scheeringa, M. S., Boris, N. W., & Smyke, A. T. (2009). Relations between emotion regulation, parenting, and

psychopathology in young maltreated children in out of home care. *Journal of Child and Family Studies, 18,* 421-434. doi:10.1007/s10826-008-9246-6

Roisman, G. I., Newman, D. A., Fraley, R. C., Haltigan, J. D., Groh, A. M., & Haydon, K. C. (2012). Distinguishing differential susceptibility from diathesis–stress: Recommendations for evaluating interaction effects. *Development and Psychopathology, 24,* 389-409. doi:10.1017/S0954579412000065

Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology, 78,* 122-135. doi:10.1037/0022-3514.78.1.122

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In N. Eisenberg, N. Eisenberg (Eds.) , *Handbook of child psychology, 5th ed.: Vol 3. Social, emotional, and personality development* (pp. 105-176). Hoboken, NJ, US: John Wiley & Sons Inc.

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg, W. Damon, R. M. Lerner (Eds.) , *Handbook of child psychology: Vol. 3, Social, emotional, and personality development (6th ed.)* (pp. 99-166). Hoboken, NJ US: John Wiley & Sons Inc.

Rothbart, M. K., Ziaie, H., & O'Boyle, C. G. (1992). Self-regulation and emotion in infancy. In N. Eisenberg, R. A. Fabes, N. Eisenberg, R. A. Fabes (Eds.) , *Emotion and its regulation in early development* (pp. 7-23). San Francisco, CA, US: Jossey-Bass.

Rubin, K. H., Burgess, K. B., Dwyer, K. M., & Hastings, P. D. (2003). Predicting preschoolers' externalizing behaviors from toddler temperament, conflict, and maternal negativity. *Developmental Psychology, 39,* 164-176. doi:10.1037/0012-1649.39.1.164

Rubin, K. H., & Mills, R. S. (1991). Conceptualizing developmental pathways to internalizing disorders in childhood. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement, 23,* 300-317. doi:10.1037/h0079019

Sandberg, S., Paton, J. Y., Ahola, S., McCann, D. C., McGuinness, D., Hillary, C. R., & Oja, H. (2000). The role of acute and chronic stress in asthma attacks in children. *The Lancet, 356,* 982-987.

Schieche, M., & Spangler, G. (2005). Individual Differences in Biobehavioral Organization During Problem-Solving in Toddlers: The Influence of Maternal Behavior, Infant-Mother Attachment, and Behavioral Inhibition on the Attachment-Exploration Balance. *Developmental Psychobiology, 46,* 293-306. doi:10.1002/dev.20065

Sethi, A., Mischel, W., Aber, J. L., Shoda, Y., & Rodriguez, M. L. (2000). The role of strategic attention deployment in development of self-regulation: Predicting preschoolers' delay of gratification from mother–toddler interactions. *Developmental Psychology, 36,* 767-777. doi:10.1037/0012-1649.36.6.767

Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years.* New York, NY, US: Cambridge University Press. doi:10.1017/CBO9780511527661

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development, 55,* 17-29. doi:10.2307/1129832

Stifter, C. A., & Braungart, J. M. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology, 31,* 448-455. doi:10.1037/0012-1649.31.3.448

Taylor, C. A., Manganello, J. A., Lee, S. J., & Rice, J. C. (2010). Mothers' spanking of 3-year-old children and subsequent risk of children's aggressive behavior. *Pediatrics, 125,* e1057-e1065. doi:10.1542/peds.2009-2678

Terjesen, M. D., & Kurasaki, R. (2009). Anxiety and depression in early childhood. In B. A. Mowder, F. Rubinson, A. E. Yasik, B. A. Mowder, F. Rubinson, A. E. Yasik (Eds.) , *Evidence-based practice in infant and early childhood psychology* (pp. 443-466). Hoboken, NJ, US: John Wiley & Sons Inc.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59,* 25-52. doi:10.2307/1166137

Thoresen, C. E., & Eagleston, J. R. (1983). Chronic stress in children and adolescents. *Theory Into Practice, 22,* 48-56. doi:10.1080/00405848309543037

Wilson, S. J., & Lipsey, M. W. (2007). School-based interventions for aggressive and disruptive behavior: Update of a meta-analysis. *American Journal of Preventive Medicine, 33*(2,Suppl), S130-S143. doi:10.1016/j.amepre.2007.04.011

APPENDIX A

TABLES AND FIGURES

Table 1. Descriptive Statistics for Emotion Regulation Behaviors, Reductions in Negative Affect, and Variety of Emotion Regulation Behaviors Used by Task

Panel A. 6m Frustration Task (Arm Restraint)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	.00	88.20	23.10	18.33	0	34	10.35	.90
Away	3.52	96.25	56.33	25.14	2	52	12.83	0
Look at Mom	.00	90.03	18.40	16.09	0	35	9.46	.50
Close	.00	71.56	2.19	8.18	0	33	1.04	73.90
Body position								
Normal	82.53	100.02	98.59	3.25	1	11	1.60	0
Approach	.00	6.88	.18	.86	0	3	.09	94.30
Resistance	.00	16.56	1.17	2.99	0	10	.50	81.00
Withdraw	.00	.00	.00	.00	0	0	.00	100.00
Withdraw to mom	.00	6.30	.06	.49	0	3	.05	97.20
Self-Soothing								
With self	.00	100	10.83	17.56	0	13	2.91	15.20
With mom	.00	6.37	.05	.47	0	1	.02	97.60
Stimulation	.00	82.71	8.84	15.86	0	16	2.29	54.00
Variety	1	4	2.28	.48	--			0
Variety_perce	.25	1	.57	.12	--	--	--	--
Reduce	--	--	--	--	0	20	2.58	40.80

Note: perce: percent

Panel B. 6m Fear Task (Fire Truck)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	16.76	100.00	62.11	15.01	1	60	21.16	0
Away	.00	82.90	25.66	13.96	0	59	15.41	1.00
Look at mom	.00	44.31	11.24	8.43	0	30	10.22	1.40
Close	.00	56.69	1.00	4.73	0	17	.64	82.90
Body position								
Normal	34.59	100.02	97.76	7.14	1	9	1.68	0.00
Approach	.00	65.41	1.70	6.85	0	9	.48	80.00
Resistance	.00	.00	.00	.00	0	0	.00	100.00
Withdraw	.00	20.62	.51	2.39	0	8	.22	91.40
Withdraw to mom	.00	3.17	.03	.26			.01	98.60
Self-soothing								
With self	.00	94.20	14.12	18.21	0	17	3.70	10.00
With mom	.00	39.69	1.44	5.74	0	9	.22	88.10
Stimulation	.00	66.71	7.62	11.64	0	22	2.33	39.50
Variety	.00	4.00	2.23	.55	--	--	--	0.50
Variety_perce	.00	1.00	.56	.14	--	--	--	--
Reduce	--	--	--	--	0	19	2.07	46.90

Panel C. 1y Frustration Task (Phone)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	.96	95.96	40.98	20.61	0	29	12.85	.50
Away	2.69	96.23	44.80	21.10	0	25	13.32	.50
Look at mom	.00	68.54	14.21	11.64	0	21	7.70	.90
Body position								
Normal	.00	99.32	53.62	25.58	0	23	7.41	1.40
Approach	.00	100.00	35.72	26.67	0	18	5.52	2.80
Withdraw	.00	30.39	4.44	4.96	0	18	2.93	13.20
Withdraw to mom	.00	59.47	6.22	9.66	0	11	1.85	44.80
Self-soothing								
With self	.00	64.50	2.71	8.40	0	5	.44	74.10
With mom	.00	100.00	17.46	26.03	0	7	1.09	46.20
Stimulation								
With self	.00	100.00	23.79	27.60	0	7	1.71	30.20
With mom	.00	89.43	4.14	11.67	0	4	.46	72.20
Problem solving								
Independent	.00	100.00	30.26	26.00	0	11	3.17	9.90
Experimenter	.00	27.99	1.25	3.54	0	5	.34	80.20
With mom	.00	72.97	3.24	7.72	0	6	.75	68.90
vent	.00	11.17	.21	1.18	0	5	.10	94.80
Variety	1.00	6.00	3.55	1.14	--	--	--	0
Variety_perce	.17	1.00	.59	.19	--	--	--	--
Reduce	--	--	--	--	0	24	3.73	30.90

Panel D.1y Fear Task (Green Monster)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	15.00	97.28	72.71	16.39	1	27	12.19	0
Away	.00	77.35	14.86	12.67	0	25	7.95	2.90
Look at mom	.00	83.83	12.44	13.01	0	19	6.49	1.40
Body position							6.30	
Normal	.00	100.00	83.89	14.35	0	17		.50
Approach	.00	36.23	3.34	6.82	0	17	1.43	58.10
Withdraw	.00	15.07	.78	2.16	0	7	.39	80.50
Withdraw to mom	.00	88.93	11.99	12.88	0	16	4.29	10.00
Self-soothing								
With self	.00	96.04	8.22	18.02	0	6	.66	62.90
With mom	.00	100.00	59.19	38.96	0	7	1.60	12.90
Stimulation								
With self	.00	100.00	10.07	19.25	0	8	.93	61.00
With mom	.00	22.44	1.46	3.71	0	4	.34	78.60
Problem solving								
Independent	.00	2.01	.01	.14	0	1	.00	99.50
With mom	.00	8.81	.04	.61	0	4	.02	99.50
With experimenter	.00	.00	.00	.00	0	0	.00	100.00
vent	.00	2.34	.01	.16	0	1	.00	99.50
Variety	1.00	5.00	2.97	.68	--	--	--	0
Variety_perce	.20	1.00	.59	.14	--	--	--	--
Reduce	--	--	--	--	0	18	3.48	33.30

Panel E. 2y Frustration Task (Lock Box)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	.00	97.99	74.87	18.66	0	30	12.79	.50
Away	.61	100.00	19.94	18.14	1	26	10.47	0
Mom	.00	35.59	5.19	4.90	0	18	5.31	5.00
Body position								
Normal	.00	100.00	13.16	20.10	0	13	2.30	31.70
Approach	.00	100.00	85.16	21.63	0	11	2.82	.50
Withdraw	.00	9.78	1.39	2.03	0	7	.12	43.20
Withdraw to mom	.00	13.86	.29	1.40	0	8	.12	94.00
Self-soothing								
With self	.00	18.89	.60	2.24	0	4	.17	88.40
With mom	.00	70.67	1.52	6.52	0	5	.25	85.90
Stimulation								
With self	.00	100.00	8.56	16.77	0	10	1.37	46.70
With mom	.00	16.56	.66	2.24	0	12	.39	84.90
Problem solving								
Independent	.00	100.00	63.96	25.54	0	12	4.77	1.50
Experimenter	.00	14.07	1.64	2.89	0	6	.68	61.30
With mom	.00	28.99	4.45	5.74	0	11	1.80	34.20
vent	.00	9.21	.38	1.27	0	13	.46	83.40
Variety	1.00	7.00	3.50	1.06	--	--	--	0
Variety_perce	.14	1.00	.50	.15	--	--	---	--
Reduce	--	--	--	--	0	23	3.14	32.70

Panel F. 2y Fear Task (Spider)

	Percent of Task Time				Frequency of Discrete Behaviors			
	Min	Max	Mean	S.D.	Min	Max	Mean	% not used behavior
Gaze								
Inspect	.87	98.54	59.22	18.84	1	41	7.54	0
Away	.53	90.45	30.42	18.39	1	37	6.33	0
Look at mom	.00	70.20	10.36	8.99	0	34	6.83	2.00
Body position								
Normal	27.98	100.00	86.38	14.35	1	26	4.85	0
Approach	.00	72.02	6.05	12.59	0	23	3.47	36.40
Withdraw	.00	18.51	2.19	3.04	0	12	2.24	39.90
Withdraw to mom	.00	37.65	5.39	6.09	0	13	3.17	22.20
Self-soothing								
With self	.00	89.54	7.85	15.74	0	9	1.59	54.50
With mom	.00	100.00	37.59	37.09	0	10	2.09	22.70
Stimulation								
With self	.00	73.63	6.63	12.84	0	15	2.63	54.50
With mom	.00	60.46	4.53	9.79	0	12	2.47	57.10
Problem Solving								
Independent	.00	100.00	2.91	7.77	0	34	2.66	33.30
experimenter	.00	2.22	.05	.28	0	1	0.04	96.50
With mom	.00	25.17	.87	2.79	0	10	.57	79.80
Vent	.00	7.99	.31	1.17	0	6	.22	87.40
Variety	2.00	8.00	5.45	1.33	--	--	--	0
Variety_percen	.25	1.00	.68	.17	--	--	--	--
Reduce	--	--	--	--	0	26	5.89	14.10

Table 2. Descriptive Statistics for IBQ Mother-Reported Temperament, Averaged Observed Affect and Behavior Problems.

	Min	Max	Mean	S.D.
Average Observed Affect				
6m Anger	3.24	5.92	4.09	.43
6m Fear	3.63	5.98	4.10	.36
1y Anger	3.69	6.37	4.18	.37
1y Fear	3.75	6.82	4.21	.45
2y Anger	3.71	5.09	4.09	.20
2y Fear	2.74	5.96	4.31	.52
IBQ				
6m distress to limitation	1.43	7.00	3.70	1.00
6m fear	1.00	6.00	2.63	1.18
1y distress to limitation	1.43	6.86	3.98	1.02
1y fear	1.00	6.83	3.41	1.25
2y frustration	1.67	6.83	3.29	1.09
2y fear	1.00	6.75	2.50	.93
Behavior problems (BITSEA)				
1y externalizing	.00	10.00	2.34	2.12
1y internalizing	.00	17.00	4.30	3.32
2y externalizing	.00	9.00	2.51	1.98
2y internalizing	.00	17.00	4.14	3.03
CBCL				
4.5y externalizing	.00	30.00	10.02	6.82
4.5y internalizing	.00	45.00	7.07	6.33

Table 3. Co-Occurrence of Reduction in Infant Negative Affect with Regulatory Behaviors at Three Time Points.

	6m Arm restraint (anger)	6m Fire truck (fear)	1y Phone (anger)	1y Shrek (fear)	2y Lock box (anger)	2y Spider (fear)	Sum	Overall by Task	
Gaze								Fear	Anger
Inspect	307(249)* 28,44	411(539) 6,57	551(646) 20,66	750(1,079) 7,93	807(928) 13,51	1,301(1,373) 20,54	1/12		
Away	545(613) 20,37	**300(223)*** **42,23***	529(717) 20,58	218(221) 31,64	319(248)* 35,51	715(713) 38,47	3/12	2/6	1/6
At mom	177(201) 18,76	114(96)† 16,69	**511(227)***** **65,44†**	**501(168)***** **84,26****	114(64)* 34,69	311(241)* 51,69	7/12	3/6	4/6
Closed	54(20)** 9,22	41(7)*** 6,19							
Body position									
Approach	0.2(2) 0,8	9(15) 3,18	428(569) 12,73	16(48) 4,43	970(1,055) 5,37	61(139) 15,79	0/12		
Withdraw	0(0) Na,na	9(4)** 4,10	104(72)* 29,78	14(11)* 6,20	35(17)** 21,55	78(50)* 24,66	5/12	3/6	2/6
Wdw to mom	1(0.6)* 1,2	0(0.2) 0,1	**311(100)***** **43,28†**	**558(163)***** **84,22****	8(3)** 3,5	228(125)** 53,54	7/12	3/6	4/6
Resistance	54(13)*** 16,14	0(0) Na,na							
Self-soothing									
With mom	0.9(0.5) 1,2	14(13) 3,11	570(278)** 28,22	1,139(867)** 18,25	36(19)** 9,10	1,083(884)** 22,44	4/12	2/6	2/6
With self	100(116) 22,75	60(125) 20,67	67(37)* 13,30	92(117) 6,39	14(7)* 6,15	200(182)* 10,46	3/12	1/6	2/6
Stimulation									
With self	101(96) 14,29	39(67) 9,43	119(384) 6,73	33(149) 3,28	82(108) 5,53	77(154) 11,61	0/12		

With mom	45(675) 1,36	12(22) 2,23	7(8) 3,17	42(105) 8,54	0/8		
Problem-solving							
Independent	302(482) 16,77	0(0.1) NA	564(791) 9,67	157(68)** 46,60	1/8	1/4	0/4
To mom	71(52)* 9,29	6(0.6)*** 1,NA	108(55)** 33,51	26(21)* 6,24	4/8	2/4	2/4
To experi	6(20) 1,26	0(na) NA,NA	48(20) 12,33	0(1) 0,7	0/7		
Vent							
Vent	23(3)*** 9,1	2(0.1)*** 1,0	32(5)*** 14,15	9(7)* 4,17	4/8	2/4	2/4

Note: Within a cell, the first line includes the observed co-occurrence in seconds, followed by expected co-occurrences in seconds in parentheses, from the pooled analyses.

Effect of odds ratio:*** Strong effect (odds ratio >3); ** moderate effect (odds ratio 2-3), * weak effect (odds ratio 1.25-2).

The second line of the cell includes data from the sign tests (individual-level analyses); the first number indicates the number of infants with a contingency significantly greater than chance, the second indicates the number with a contingency significantly less likely than chance. ** p<.01, * p<.05. †p<.10.

Contingencies that were significant at both the pooled and individual level appear in boldface type.

Abbreviations: indepen: independent problem solving ; experi: bid to experimenter; wdw to mom: withdraw to mom.

Stimulation with mother, vent category, problem solving category were not coded at 6 months. And Body position –resistant was not coded at 1 year and 2 years. Thus, the corresponding columns were left blank.

Sum = summary. This column reflects the number of sequential analyses that have significant results across individual and pooled levels.

Table 4. Emotion Regulation Behaviors that are Included in the "Variety" Variable in Each Task at Each Time Point.

Emotion regulation behavior	6m Anger	6m Fear	1y Anger	1y Fear	2y Anger	2y Fear
Gaze						
Away	Y	Y			Y	Y
Look at mom	Y	Y	Y	Y	Y	Y
Closed	Y	Y				
Body position						
Withdraw		Y	Y	Y	Y	Y
Withdraw to mom	Y		Y	Y	Y	Y
Self-soothing						
With self			Y		Y	Y
With mom			Y	Y	Y	Y
Problem solving						
Independent						Y
With mom			Y	Y	Y	Y
Vent						
Range	**0-4**	**0-4**	**0-6**	**0-5**	**0-7**	**0-8**

*Note: *: p<.05, **: p<.01*

Table 5. Stability of Emotion Regulation Behaviors Across Tasks, Within Time.

Emotion regulation behavior	6 M	1 YR	2YR
Gaze			
Inspect	-.02	.03	.00
Away	.14*	.23**	-.03
Look at mom	.16*	.15*	.09
Closed	.22*		
Body position			
Normal	.00	.08	-.02
Approach	-.01	-.07	-.04
Resistance	--		
Withdraw	--	.11	.18*
Withdraw to mom	-.01	.15*	-.05
Self-soothing			
With self	.16*	.26**	.01
With mom	-.02	.23**	-.04
Stimulation			
With self	.19*	.22*	.05
With mom		.21**	.04
Problem solving			
Independent		.13	.01
With experimenter		--	.06
With mom		-.03	-.02
Vent		.20**	.23**
Variety	.36*	.20**	.06

*Note: *: p< .05, **: p<.01*

Table 6. Stability of Emotion Regulation Behaviors over Time, Within a Task.

	6 month and 1 year	6 month and 2 year	1 year and 2 year
Behaviors Anger Task			
Gaze			
Inspect	.05	.06	-.01
Away	.06	-.02	-.02
Look at mom	-.16*	-.04	.10
Body position			
Normal	-.07	.02	.09
Approach	-.02	.01	.08
Withdraw	--	--	.01
Withdraw to mom	.02	-.03	-.03
Self-soothing			
With self	-.08	-.08	-.03
With mom	.06	-.03	.04
Stimulation			
With self	-.05	-.08	.03
With mom	--	--	.07
Problem solving			
Independent	--	--	.04
With experimenter	--	--	-.05
With mom	--	--	.03
Vent	--	--	.06
Behaviors Fear Task			
Gaze			
Inspect	.04	.03	.05
Away	.09	.09	.05
Look at mom	.04	-.00	.07
Body position			
Normal	.19**	-.08	-.03
Approach	-.07	-.03	-.02
Withdraw	.09	.06	.08
Withdraw to mom	-.01	-.01	-.03
Self-soothing			
With self	-.13	-.00	-.12
With mom	-.04	-.02	.18*
Stimulation			
With self	.10	.01	.12
With mom	--	--	.09
Problem solving			
Independent	--	--	-.01
With experimenter	--	--	--
With mom	--	--	-.02
Vent	--	--	--
Variety	.11	.07	.04

*Note: *: p< .05, **: p<.01*

Table 7. Longitudinal Associations Between Different Emotion Regulation Behaviors

Panel A: Gaze Behaviors (frustration task)

	Gaze 6m with other behaviors 1y				Gaze 6m with other behavior 2y				Gaze 1y with other behavior 2y		
	Inspect	Look away	Look at Mom	Closed	Inspect	Look away	Look at Mom	Closed	Inspect	Look away	Look at Mom
Body position											
Normal	.01	.05	-.04	-.07	-.04	-.00	.08	-.06	-.00	-.01	.02
Approach	.05	-.12	.10	.06	.05	-.00	-.08	.05	.01	.00	-.01
Withdrawal	-.06	.07	-.05	.00	-.10	.04	.05	-.02	-.04	.08	-.06
Withdrawal to Mom	-.13	.17*	-.13	.02	-.04	.03	-.03	.03	.04	-.01	-.04
Self-soothing											
With Self	-.13	.09	.00	-.01	.12	.00	-.12	-.05	-.10	.14	-.08
With Mom	-.20**	.23**	-.12	-.02	-.04	.13	-.06	.04	-.10	.02	.12
Stimulation											
Self	.18*	-.09	-.04	-.04	-.04	-.05	.06	.11	-.02	-.03	.09
With Mom	-.00	.11	-.12	-.08	-.04	.13	-.16*	.01	-.05	.09	-.08
Problem solving											
Independent	.02	-.08	.07	.05	.06	-.01	-.02	-.07	.03	-.03	-.01
Bid to mom	.03	-.17*	.19*	.10	-.18*	.14	-.05	.06	-.00	-.05	.10
Bid to exp	.16*	-.14	.06	-.06	.02	-.06	.05	.02	.09	-.05	-.07
Vent	.04	-.02	-.04	.04	-.11	-.01	.11	.04	-.09	.08	.02
Variety	-.13	.16*	-.14	.07	-.09	.09	-.07	.06	-.08	.04	.08

*Note: *: p< .05, **: p<.01*

Panel B: Body position (frustration task)

	Body position 6m with other behavior 1y			Body position 6m with other behavior 2y			Body position 1y with other behavior 2y		
	Approach	Resistance	Withdrawal to Mom	Approach	Resistance	Withdrawal to Mom	Approach	Withdrawal	Withdrawal to Mom
Gaze									
Inspect	-.00	-.01	-.01	-.00	-.02	.04	.05	-.02	-.00
Looking away	-.02	.01	-.03	.02	.03	-.02	-.04	-.01	-.02
Looking at mom	.04	-.00	.08	-.07	-.04	-.07	-.05	.09	.10
Self-soothing									
With Self	-.02	.11	-.04	-.06	.02	-.03	-.07	-.05	-.05
With Mom	.01	-.09	-.00	-.01	-.06	.10	-.06	.04	.10
Stimulation									
Self	.01	.11	-.02	.06	.04	-.03	-.06	-.02	-.01
With Mom	-.07	-.04	-.04	-.05	.01	-.04	-.01	.02	-.05
Problem solving									
Independent	-.05	-.08	-.01	.10	.01	.08	.11	-.01	.01
Bid to mom	-.03	.11	.06	-.08	-.04	-.01	-.01	.02	.09
Bid to exp	-.03	.03	.07	-.07	.04	-.04	.10	.03	-.04
Vent	.17*	-.04	.06	-.06	.13	-.04	-.06	.09	-.02
Variety	.13	-.08	.01	-.16*	.04	.08	-.08	-.02	.12

*Note: *: p< .05, **: p<.01*

Panel C. Self-soothing (frustration task)

	Self-soothing 6m to other behavior 1y		Self-soothing 6m to other behavior 2y		Self-soothing 1y to other behavior 2y	
	Self-soothing	With mom	Self-soothing	With mom	Self-soothing	With mom
Gaze						
Inspect	-.02	-.05	-.06	.08	-.05	.04
Looking away	.04	-.00	.04	-.08	.05	-.05
Looking at mom	-.03	.09	.08	.01	-.01	.05
Body position						
Normal	.07	.01	.02	-.07	.10	.00
Approach	-.07	-.02	-.03	.06	-.09	.00
Withdrawal	.12	-.01	.04	.04	-.05	-.01
Withdrawal to Mom	-.07	.03	.05	-.03	-.02	.01
Stimulation						
Self	-.10	.08	.07	.03	.13	-.05
With Mom	.40**	-.04	.02	-.04	-.02	-.05
Problem solving						
Independent	-.08	-.02	-.08	.04	-.08	.06
Bid to mom	.06	-.05	.20**	-.08	-.04	.14
Bid to exp	-.02	-.03	-.02	-.05	-.07	-.06
Vent	-.03	-.02	.07	-.04	.11	-.10
Variety	-.04	-.01	-.01	-.08	-.05	.13

*Note: *: p< .05, **: p<.01*

Panel D. Stimulation (frustration task)

	Stimulation 6m to other behavior 1y	Stimulation 6m to other behavior 2y	Stimulation 1y to other behavior 2y	
	Self-stimulation	Self-stimulation	Self-stimulation	With Mom
Gaze				
Inspect	-.03	.01	.02	.06
Looking away	.02	-.03	-.01	-.05
Looking at mom	.02	.07	-.03	-.01
Body position				
Normal	.09	-.07	.01	-.02
Approach	-.11	.07	-.01	.01
Withdrawal	.02	-.04	.02	.07
Withdrawal to Mom	.06	-.04	-.02	.02
Self-soothing				
Self	.02	-.01	.06	.07
With Mom	.02	-.06	-.07	.02
Problem solving				
Independent	-.08	-.01	-.04	.02
Bid to mom	-.05	.08	-.06	-.03
Bid to exp	.04	-.05	.01	-.10
Vent	-.07	.04	.00	-.03
Variety	.02	-.05	.03	.07

*Note: *: p< .05, **: p<.01*

Panel E. Problem-solving (frustration task)

	Problem solving 1y with other behavior 2y		
	Independent	Bid to experi	Bid to mom
Gaze			
Inspect	.00	.03	.08
Looking away	.01	-.04	-.07
Looking at mom	-.04	.02	-.07
Body position			
Normal	-.03	-.13	-.08
Approach	.03	.14	.08
Withdrawal	-.06	-.11	-.03
Withdrawal to Mom	.09	-.04	-.05
Self-soothing			
Self-soothing	-.06	-.02	-.01
With Mom	-.06	-.02	-.02
Stimulation			
Self-stimulation	-.01	-.02	.01
With mom	-.01	-.02	.01
Vent	-.03	-.06	-.10
Variety	-.06	-.12	-.01

*Note: *: p< .05, **: p<.01*
experi: experimenter

Panel F. Venting (frustration task)

	Venting 1y with other behavior 2y
Gaze	
Inspect	.03
Looking away	-.02
Looking at mom	-.06
Body position	
Normal	.08
Approach	-.10
Withdrawal	.22**
Withdrawal to Mom	-.03
Self-soothing	
Self	-.01
With Mom	.16*
Stimulation	
Self	.02
With mom	.08
Problem solving	
Independent	-.07
Bid to mom	.01
Bid to exp	-.05
Variety	.11

*Note: *: p< .05, **: p<.01*

Panel G. Variety (frustration task)

	Variety 6m and other behavior at 1y	Variety 6m and other behavior at 2y	Variety 1y and other behavior 2y
Gaze			
Inspect	.07	-.05	-.03
Looking away	-.08	.06	.01
Looking at mom	.01	-.06	.07
Body position			
Normal	-.09	.07	.04
Approach	.05	-.07	-.03
Withdrawal	.20**	.03	-.03
Withdrawal to Mom	.00	.01	-.01
Self-soothing			
Self	-.06	-.08	-.05
With Mom	-.03	.13	.11
Stimulation			
Self-stimulation	-.02	.14	.01
With mom	-.11	-.06	.01
Problem solving			
Independent	.04	-.06	-.04
Bid to mom	.11	-.02	.03
Bid to exp	-.05	.05	-.10
Vent	.14	.03	.01

*Note: *: p< .05, **: p<.01*

Panel H. Gaze behavior (fear task)

	Gaze 6m to other behavior 1y				Gaze 6m to other behavior 2y				Gaze 1y to other behavior 2y		
	Inspect	Look away	Look at mom	closed	Inspect	Look away	Look at mom	closed	Inspect	Look away	Look at mom
Body position											
Normal	-.08	.09	-.01	-.01	.03	-.07	.00	-.07	.19**	-.11	-.13
Approach	.04	-.05	-.01	.06	.03	-.01	.01	-.07	-.11	.09	.03
Withdrawal	.05	-.13	.09	.12	-.08	.10	-.00	-.02	-.15*	.10	.08
Withdrawal to Mom	.05	-.05	.00	-.04	-.08	.13	-.02	-.06	-.16*	.03	.22**
Self-soothing											
With Self	.02	-.01	-.02	-.00	-.16*	.04	.06	.27**	-.09	.08	.00
With Mom	-.03	.04	.00	-.07	-.04	-.06	.15*	.03	.00	-.02	.02
Stimulation											
Self	-.11	.08	.00	.17*	.04	.02	-.07	-.04	.02	-.02	.00
With Mom	.02	-.01	-.00	-.03	-.04	.13	-.12	-.05	.07	-.08	.03
Problem solving											
Independent	-.16*	.16*	.04	-.02	-.00	.01	.00	-.02	-.06	-.01	.12
Bid to mom	-.10	-.04	.15*	.29**	-.04	.02	.02	.03	.04	-.08	.07
Experimenter					.06	-.01	-.09	-.03	-.17*	.18*	-.02
Vent	.03	.02	-.08	-.02	.15*	-.13	-.05	-.03	.06	-.06	-.00
Variety	.01	-.08	.09	.06	-.10	.15*	-.07	.03	-.04	.03	.02

*Note: *: p< .05, **: p<.01*

Panel I Body position (fear)

	Body position 6m and other behavior 1y			Body position 6m and other behaviors 2y			Body position 1y and other behavior 2y		
	Approach	withdrawal	Withdrawal to mom	Approach	withdrawal	Withdrawal to mom	Approach	withdrawal	Withdrawal to mom
Gaze									
Inspect	-.18*	-.04	.08	-.16*	.15	.05	-.08	-.06	-.03
Looking away	-.04	.07	-.09	.14	-.13	-.03	.03	.05	.03
Looking at mom	.26**	-.02	-.01	.04	-.05	-.04	.10	.04	.00
Self-soothing									
With Self	.01	.02	-.03	-.08	-.01	.06	.02	.00	.03
With Mom	.03	-.12	.04	-.00	.13	.03	-.11	.05	-.04
Stimulation									
Self	-.03	.15*	-.05	.17*	-.02	-.01	.02	-.02	.07
With Mom	-.01	-.04	-.04	-.07	-.05	-.04	-.02	.07	-.03
Problem solving									
Independent	-.02	-.02	-.01	.03	.03	.03	-.02	-.01	-.03
Bid to mom	-.02	-.02	-.01	.00	.04	-.04	.06	.00	.27**
Bid to exp				-.05	-.00	-.02	-.04	-.04	.01
Vent	-.02	-.02	-.01	.06	-.06	-.03	.10	.08	.06
Variety	.05	-.13	.00	-.15	.12	-.02	.02	-.04	.03

*Note: *: p< .05, **: p<.01*

Panel J. self-soothing (fear)

	Self-soothing 6m with other behavior 1y		Self-soothing 6m with other behavior 2y		Self-soothing 1y with other behavior 2y	
	Self-soothing	With mom	Self-soothing	With mom	Self-soothing	With mom
Gaze						
Inspect	.07	.03	.01	-.09	-.07	.06
Looking away	-.06	.05	-.03	.05	.03	-.01
Looking at mom	-.03	-.09	.06	.11	.09	-.10
Body position						
Normal	.00	.08	-.05	.05	.04	.00
Approach	-.02	-.06	-.02	-.06	-.08	-.03
Withdrawal	-.08	-.00	.04	-.03	-.01	-.07
Withdrawal to Mom	.02	-.05	.15*	.03	.07	.09
Stimulation						
Self	-.13	.00	-.00	-.01	-.01	-.06
With Mom	.07	-.02	.02	-.02	.18*	-.04
Problem solving						
Independent	-.02	-.02	-.10	-.04	-.03	.02
Bid to mom	-.05	-.02	-.00	-.05	-.09	.13
Bid to exp			-.07	-.04	-.05	-.05
Vent	-.01	.40**	.04	-.04	.01	-.02
Variety	.04	-.07	.10	-.02	-.06	.17*

*Note: *: p< .05, **: p<.01*

Panel K. Stimulation (fear)

	Stimulation 6m to other behavior 1y	Stimulation 6m to other behavior 2y	Stimulation 1y to other behavior 2y	
	stimulation	stimulation	stimulation	With mother
Gaze				
Inspect	.03	-.06	-.15*	-.11
Looking away	.02	.08	.12	.08
Looking at mom	-.06	-.04	.08	.06
Body position				
Normal	.13	-.06	.01	-.02
Approach	-.10	.01	.05	.03
Withdrawal	-.07	.01	.03	-.05
Withdrawal to Mom	-.08	.11	-.14	.01
Self-soothing				
Self	-.09	-.05	.15*	.06
With Mom	.15*	.00	-.13	.01
Problem solving				
Independent	.08	-.03	-.00	.11
Bid to mom	-.05	.05	-.07	-.06
Bid to exp		.09	.09	.06
Vent	.04	.03	.07	-.04
Variety	.04	.02	-.06	.00

*Note: *: p< .05, **: p<.01*

Panel L. Problem-solving (fear)

	Problem solving 1y to other behavior 2y	
	Independent	With mom
Gaze		
Inspect	.03	.07
Looking away	-.05	-.04
Looking at mom	.04	-.07
Body position		
Normal	.06	-.03
Approach	-.03	-.00
Withdrawal	-.05	.21**
Withdrawal to Mom	-.06	-.04
Self-soothing		
Self-soothing	-.04	-.04
With Mom	-.06	.10
Stimulation		
Self-stimulation	-.04	-.04
With mom	-.03	.01
Vent	-.02	-.02
Variety	-.03	.03

*Note: *: p< .05, **: p<.01*

Panel M. Variety (Fear)

	Variety 6m and other behavior 1y	Variety 6m and other behavior 2y	Variety 1y and other behavior 2y
Gaze			
Inspect	-.07	.13	.02
Look away	.10	-.11	.05
Look at mom	-.01	-.06	-.15*
Body position			
Normal	-.09	-.09	-.16*
Approach	.19**	.06	.13
Withdrawal	.13	.11	.16*
Withdrawal to Mom	-.03	.04	.05
Self-soothing			
Self	-.01	-.03	-.00
With Mom	-.08	.09	.07
Stimulation			
Self	.21**	.05	.05
With mom	-.07	.02	-.06
Problem solving			
Independent	-.03	.07	.01
Bid to mom	.10	.12	.10
Bid to exp		.14	.01
Vent	-.03	-.01	-.03

*Note: *: p< .05, **: p<.01*

Table 8. Correlations Between Observed Averaged Affect (Mean) and Emotion Regulation Behaviors in the Same Task, and Correlations Between Observed Averaged Affect and Reductions in Negative Affect/Variety of Emotion Regulation Behaviors.

	6 month		1 year		2 year	
	frustration	fear	frustration	fear	frustration	fear
Gaze						
At stimulus	-.09	-.12	.03	-.31**	-.26**	-.10
Look away	-.07	-.16*	-.29**	-.16*	.19**	.04
At mom	-.09	.17*	.47**	.58**	.27**	.14
Closed	.59**	.58**				
Body position						
Approach	-.07	-.01	-.17*	-.10	-.19**	-.24**
Withdraw	--	.51**	-.06	.06	.21**	-.11
Withdraw to mom	-.14*	-.04	.43**	.55**	.34**	.22**
Resistance	.13	--	--	--	--	--
Self-soothing						
With mom	.13	.06	.38**	.24**	.14	.33**
Self-soothing	-.06	-.19**	.35**	.02	.00	.13
Stimulation						
With self	-.05	-.16*	-.30**	-.21*	.02	-.15*
With mother			-.03	-.06	-.08	-.14
Problem-solving						
Independent			-.21**	-.05	-.33**	-.03
Bid to mother			-.02	-.01	.29**	.31**
Bid to experim			-.05	--	.08	.07
Vent						
Vent			.06	-.03	.59**	.01
Variety of adaptive (%)						
6m Anger	.28**	--	.00	-.17*	.02	-.01
6m fear	--	.30**	.01	-.06	.08	.11
1y Anger	.05	-.02	.33*	.08	.00	-.03
1y fear	-.05	.00	.08	.12	.11	.06
2y Anger	.14	.03	.02	-.02	.20**	-.01
2y fear	-.01	.05	--	.03	.00	.28**
Reduce						
6m anger	.46**	.27**	-.01	-.05	-.08	-.09
6m fear	.38**	.62**	.05	-.02	.02	.01
1y anger	.11	-.09	.57**	.08	.09	-.00
1y fear	-.03	-.07	.17**	.50**	.06	.07
2y anger	-.05	-.06	-.08	.13	.55**	.20**
2y fear	-.10	.06	.10	-.01	.23**	.49**

*Note: *: p< .05, **: p<.01*

Table 9. Correlations Between IBQ (frustration and fear at 6m), Internalizing Symptoms (1y,2y,4.5y), Externalizing Symptom (1y, 2y, 4.5y), Race, Gender and Observed Averaged Affect (6m,1y,2y).

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Race	.03	.30**	.30**	.17*	.07	.01	.07	-.03	.14	.29**	.28**	.24*	.30**	.09	.09
2. Gender	1	.01	.13	-.03	-.02	.01	.11	-.03	.13	-.02	.09	-.17*	.07	-.01	.05
3. I 6m anger		1	.31**	.02	.05	.23**	.09	.05	.02	.29**	.33**	.12	.22**	-.00	.03
4. I 6m fear			1	.17*	.11	.08	.06	.14	.07	.12	.30**	-.02	.22**	-.04	.08
5. O 6m anger				1	.34**	-.05	-.06	-.05	-.12	-.07	-.04	-.02	.06	-.07	-.05
6. O 6m fear					1	-.08	-.09	.02	.06	-.08	-.11	-.17*	-.10	-.14	-.10
7. O 1y anger						1	.10	.04	-.01	.08	.07	.04	.04	-.01	-.02
8. O 1y fear							1	-.00	.15*	.07	.06	.01	.01	-.10	-.01
9. O 2y anger								1	.23**	.02	.09	.03	.10	.08	-.07
10. O 2y fear									1	.08	.15*	.01	.15*	-.01	.04
11. Exter1y										1	.54**	.53**	.39**	.38**	.26**
12. Inter1y											1	.29**	.48**	.21**	.38**
13. Exter2y												1	.50**	.54**	.37**
14. Inter2y													1	.34**	.37**
15. Exter4.5														1	.69**
16. Inter4.5															1

Note: abbreviation: I: IBQ report O: observed averaged affect *: $p < .05$, **: $p < .01$

Table 10. Correlations Between Emotion Regulation Behavior/Reductions in Negative Affect/Variety of Effective Emotion Regulation Behaviors Used and Children's Behavior Problems

Panel A. 6m Frustration Task (Arm Restraint)

	BITSEA 1 YR		BITSEA 2y		CBCL 4.5y	
	external	internal	external	internal	external	internal
Gaze						
Inspect	.12	.09	.04	.09	.05	.11
Away	-.15*	-.05	.04	-.03	-.07	-.09
Look at mom	.09	.00	-.10	-.04	.06	.02
Closed	.02	-.08	-.00	-.01	-.02	-.01
Body position						
Normal	-.04	.01	-.07	-.11		
Approach	-.11	-.16*	-.06	-.04	-.20**	-.08
Resistance	.07	.04	.10	.14*	.02	-.02
Withdraw	--	--	--	--	.20**	.08
Withdraw to mom	.03	-.00	-.01	-.06	--	--
Self-soothing					.07	.06
With self	-.03	-.06	.03	.13		
With mom	-.04	.01	.00	.14*	.03	-.03
Stimulation	.09	.15*	.04	.24**	.11	.04
Reduce	-.05	.05	-.02	.11	.05	.05
Variety	.03	-.09	.04	-.05	.00	-.02

*Note: *: p< .05, **: p<.01*

Panel B. 6m Fear (Fire Truck)

	BITSEA 1 YR		BITSEA 2y		CBCL 4.5y	
	external	internal	external	internal	external	internal
Gaze						
inspect	.10	.05	.05	-.03	.01	-.03
Away	-.12	.02	.01	.08	-.00	.03
Look at mom	.01	-.08	-.05	-.03	.02	.03
Closed	-.00	-.08	-.10	-.08	-.04	-.06
Body position						
Normal	.01	-.08	.07	-.02	.04	.05
Approach	-.01	.10	-.03	.03	-.09	-.07
Resistance	--	--	--	--	--	--
Withdraw	-.01	-.08	-.07	-.02	.10	-.00
Withdraw to mom	.01	.12	-.08	-.03	.14	.25**
Self-soothing						
Ss_self	-.02	-.06	-.01	.06	.02	-.05
Ss_mom	-.04	-.05	-.07	.07	-.09	-.05
Stimulation	.03	.08	.01	.19**	-.06	-.03
Reduce	-.07	-.09	-.18*	-.02	-.10	-.08
Variety	.03	-.07	-.05	.05	.10	-.04

*Note: *: p< .05, **: p<.01*

Panel C. 1y Frustration (Phone)

	BITSEA 1 YR		BITSEA 2y		CBCL 4.5y	
	external	internal	external	internal	external	internal
Gaze						
Inspect	.11	.19**	.21**	.14*	.09	.14
Away	-.09	-.23**	-.13	-.15*	-.02	-.08
Look at mom	-.02	.08	-.13	.01	-.13	-.10
Body position						
Normal	-.08	-.16*	-.12	-.10	-.06	-.13
Approach	.11	.15*	.15*	.10	.06	.16*
Withdraw	.06	-.11	.17*	-.03	.17*	-.02
Withdraw to mom	-.12	.05	-.16*	.00	-.09	-.08
Self-soothing						
With self	-.00	.05	.07	.04	.07	.11
With mom	-.10	.03	-.12	-.06	-.13	-.17*
Stimulation						
With self	-.01	-.09	-.08	-.07	-.01	-.07
With mom	-.07	-.06	-.04	.01	-.07	-.03
Problem solving						
Independent	.09	.11	.20**	.13	.08	.19*
With experimenter	.01	.05	-.07	.05	.01	.08
With mom	.05	.07	-.09	-.04	-.05	-.01
Vent	-.03	-.09	.02	-.10	.00	-.03
Reduce	-.08	.03	-.11	-.01	-.08	-.05
Variety	-.15*	-.09	-.16*	-.10	-.05	-.09

*Note: *: p< .05, **: p<.01*

Panel D. 1y Fear (Green Monster)

	BITSEA 1 year		BITSEA 2 years		CBCL 4.5 year	
	external	internal	external	internal	external	internal
Gaze						
inspect	.00	-.11	.02	-.03	.03	-.07
Away	-.02	.05	-.04	.12	-.06	.06
Look at mom	.02	.09	.02	-.08	.02	.03
Body position						
Normal	-.03	-.06	-.03	.09	-.03	-.05
Approach	.11	.06	.04	-.01	.07	.12
Withdraw	.01	-.17*	.00	-.11	.05	-.02
Withdraw to mom	-.02	.07	.01	.07	-.02	-.02
Self-soothing						
With self	-.06	.01	.04	-.05	-.10	.04
With mom	.06	.08	-.05	.01	-.05	-.16*
Stimulation						
With self	-.02	.11	.09	.15*	.02	.09
With mom	-.15*	-.13*	-.08	-.20**	-.14	-.15*
Problem solving						
Independent	-.01	.10	.02	.02	.02	.06
With experimenter	--	--	--	--	--	--
With mom	-.08	-.05	.13	-.10	--	--
Reduce	.01	.04	-.04	.02	-.04	.07
Variety	-.08	-.19**	-.07	-.18*	.01	-.05
Vent	-..01	-.09	--	--	-.01	-.00

*Note: *: p< .05, **: p<.01*

Panel E. 2y Frustration (Locked Box)

	BITSEA 1year		BITSEA 2y		CBCL 4.5y	
	external	internal	external	internal	external	internal
Gaze						
Inspect	.02	-.01	-.02	.04	.04	.09
Away	-.02	-.02	-.01	-.11	-.06	-.09
Look at mom	-.01	.11	.08	.24**	.07	.02
Body position						
Normal	-.04	-.07	.01	-.13	-.01	-.03
Approach	.03	.07	-.02	.13	.00	.03
Withdraw	.04	-.04	.07	-.05	.08	-.01
Withdraw to mom	.01	.02	-.03	-.08	-.06	-.08
Self-soothing						
With self	-.04	-.02	-.04	-.06	.03	.09
With mom	.02	.04	.04	.01	-.03	.09
Stimulation						
With self	-.05	-.09	-.03	-.13	-.07	-.07
With mom	-.10	-.07	-.00	-.09	-.19*	.09
Problem solving						
Independent	.02	-.04	-.04	.06	.01	.02
With experimenter	.19**	.12	.19*	.18*	.24**	.17*
With mom	-.02	.09	.08	.14	-.00	.00
Vent	-.01	.01	.04	-.01	.10	.02
Reduce	.10	.10	.07	-.01	.10	-.03
Variety	-.04	.08	.09	.02	.08	.05

*Note: *: p< .05, **: p<.01*

Panel F. 2y Fear (Spider)

	BITSEA 1y		BITSEA 2y		CBCL 4.5y	
	external	internal	external	internal	external	internal
Gaze						
Inspect	.00	-.10	-.01	-.14	.16*	.12
Look Away	-.14	-.00	-.02	.10	-.19*	-.13
Look at mom	.30**	.21**	.05	.09	.04	.02
Body position						
Normal	-.04	.03	-.03	.05	-.13	-.03
Approach	.04	-.03	.02	-.05	.10	.03
Withdraw	.05	-.03	.15*	.04	.26**	.13
Withdraw to mom	-.01	.01	-.05	-.02	-.05	-.03
Self-soothing						
With self	-.07	-.04	-.04	-.09	.04	.01
With mom	-.10	-.12	-.11	-.10	-.14	-.06
Stimulation						
With self	-.00	.11	.02	.19**	.01	-.01
With mom	-.13	-.15*	-.01	-.01	-.10	-.10
Problem Solving						
Independent	.03	.18*	.01	.08	.04	.08
Bid to experimenter	-.01	.01	-.06	-.01	-.05	.02
Bid to mom	.15*	.14	-.02	-.04	-.05	-.07
Vent	.08	.14	.09	.03	.04	.02
Reduce	.09	.09	-.08	.04	.03	.06
Variety	.07	.03	.01	-.09	.08	.01

*Note: *: p< .05, **: p<.01*

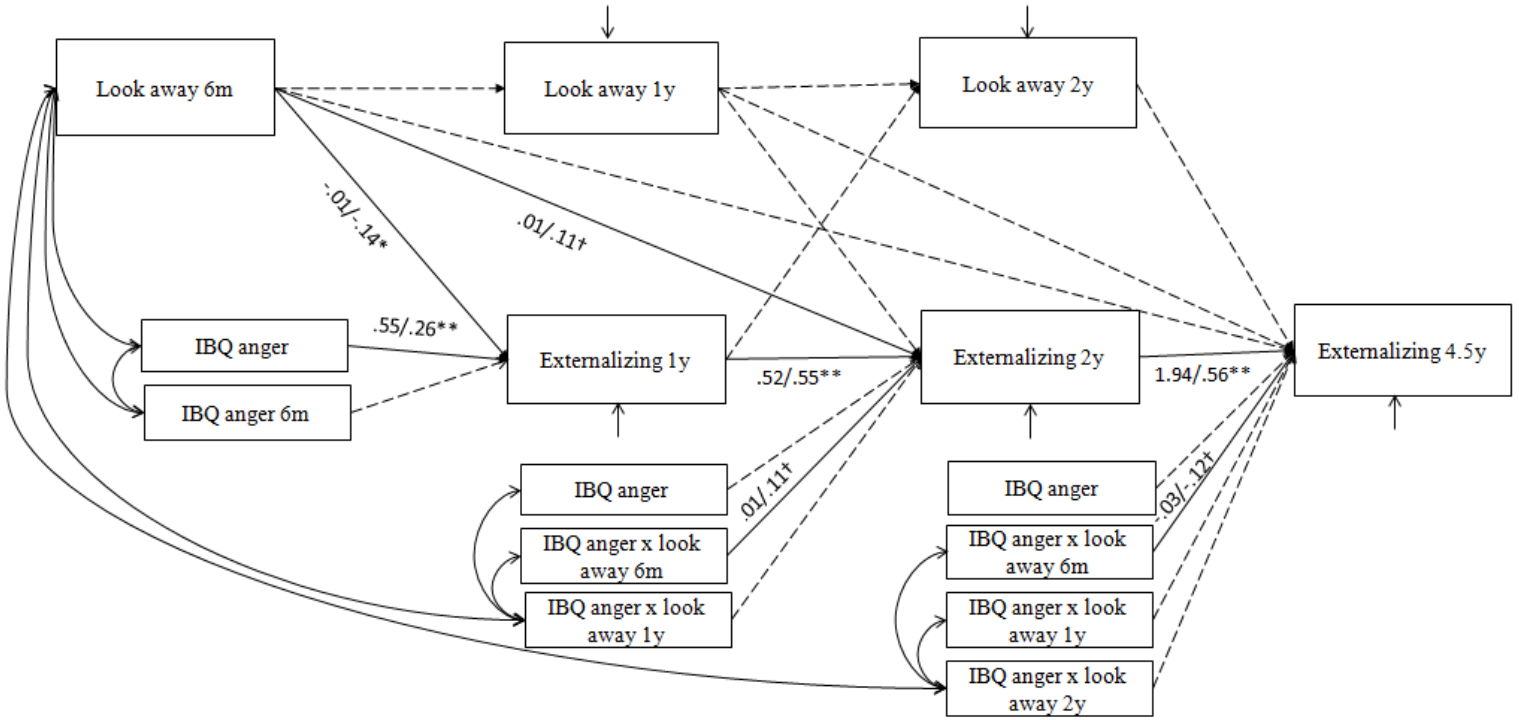
Table 11. Summary of Results from Path Analyses.

	Frustration/Externalizing				Fear/Internalizing			
	Main effect tested	Sig.	Moderation effect tested	Sig.	Main effect tested	Sig.	Moderation effect tested	Sig.
Look away	6	1 (+)	7	0	6	1 (+)	7	2 (-)
Look at mom	6	2 (+)	7	1 (+)	6	1 (+)	7	0
Self-soothing	6	1 (+)	7	0	6	0	7	0
Self-soothing with mom	6	0	7	0	6	1 (+)	7	0
Bodily withdrawing	3	0	5	0	3	0	5	0
Bodily withdrawing to mom	3	0	5	0	3	0	5	1
Bidding to mom	3	0	5	0	1	0	1	0
Venting	3	0	5	0	1	0	1	1 (-)
Variety	6	1 (-)	7	0	6	0	7	0

Note: + refers to the result is consistent with the hypothesis. – refers to that the result is not consistent with the hypothesis. The number under the "main effect tested" refers to the total number of analyses tested in the model. The number under the sig. category refers to the number of analyses that were significant from the results.

Anger Context

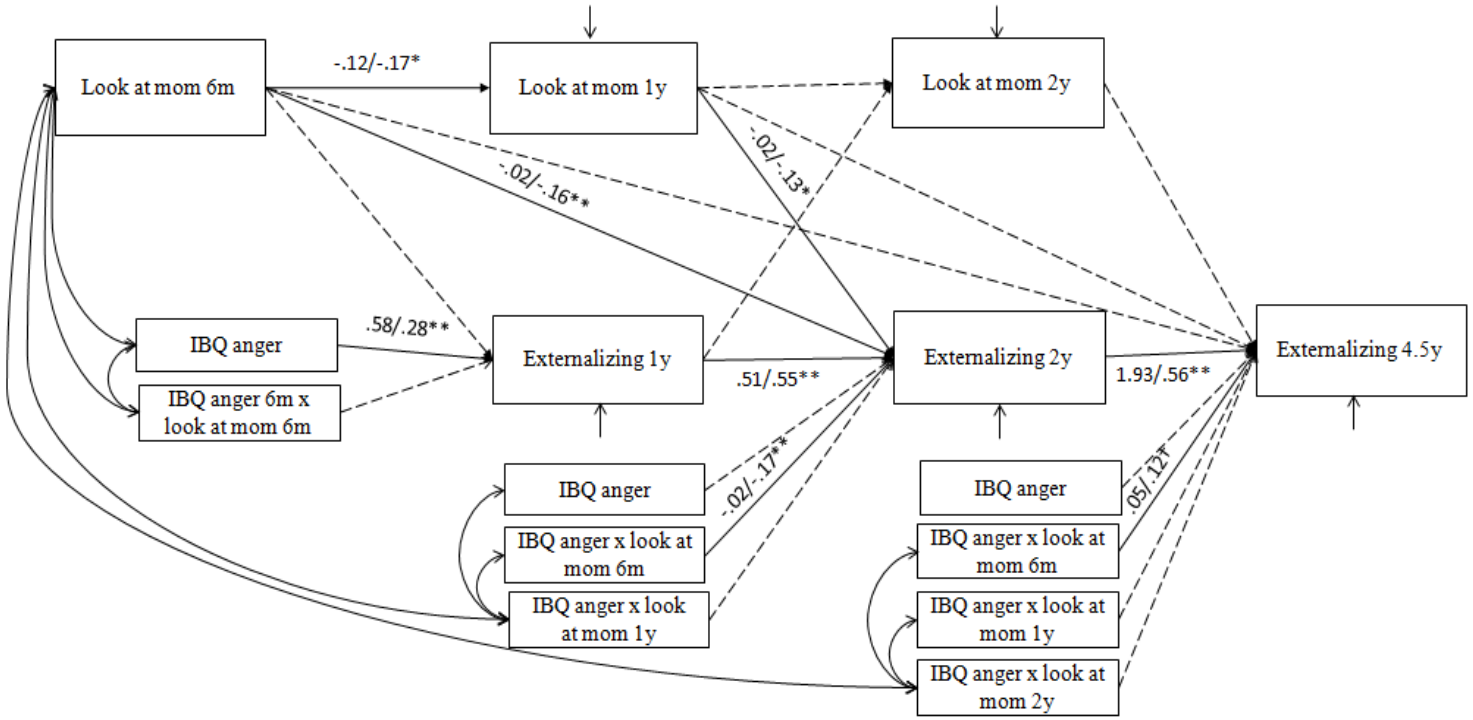
Figure 1. The Path Model of Looking Away Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

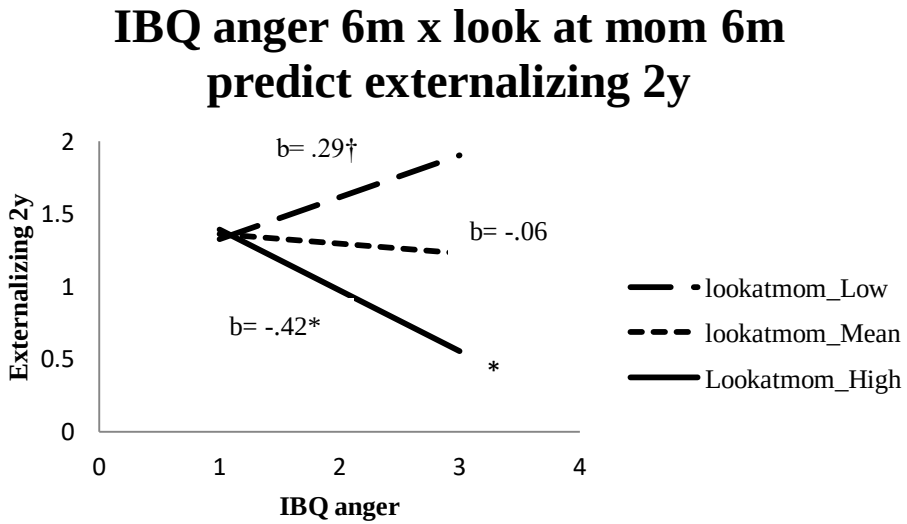
Figure 2(a). The Path Model of Looking at Mom Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

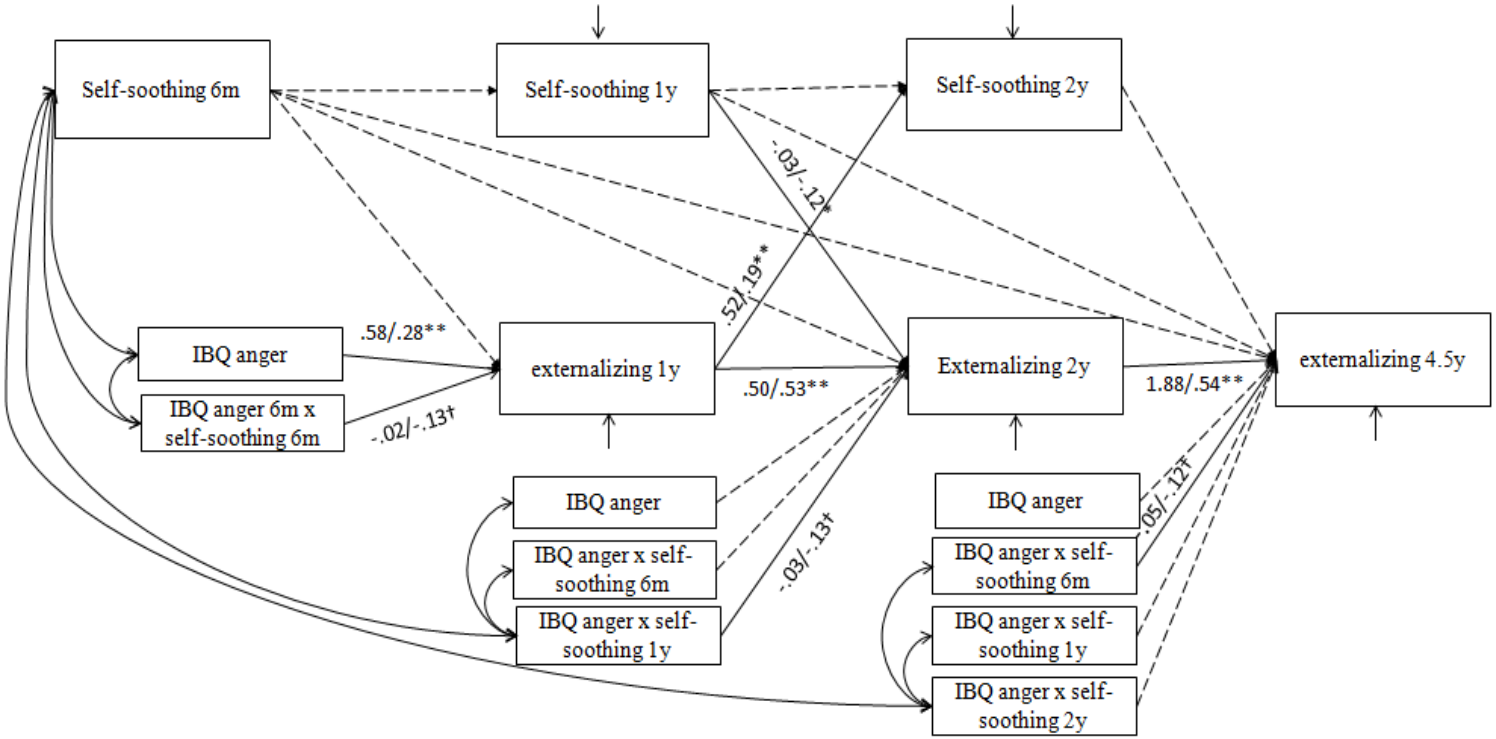
Figure 2 (b). The Moderating Effect of Looking at Mom (6m) on the Association between IBQ Anger (6m) and Externalizing Symptoms (2y).



Note:

a. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. †indicates that the path coefficient is significant at a trend level.

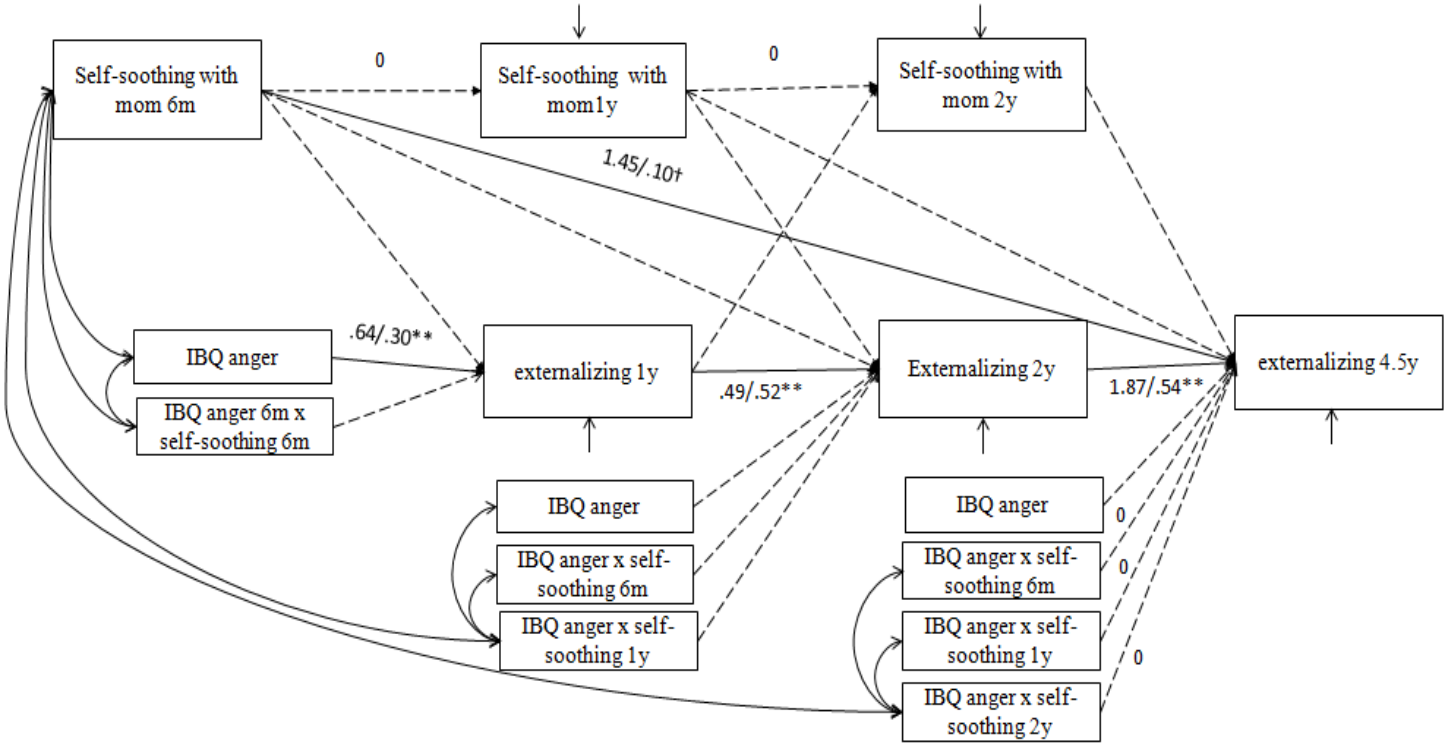
Figure 3. The Path Model of Self-Soothing Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

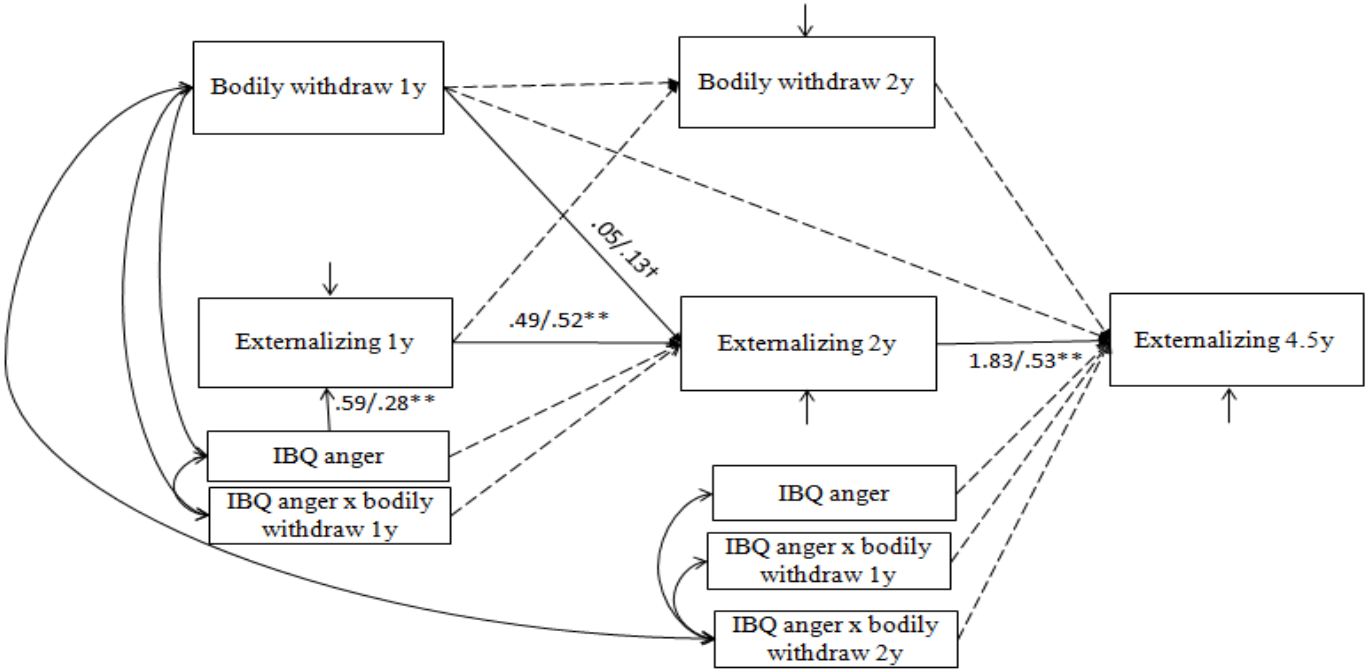
Figure 4. The Path Model of Self-Soothing with Mom Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

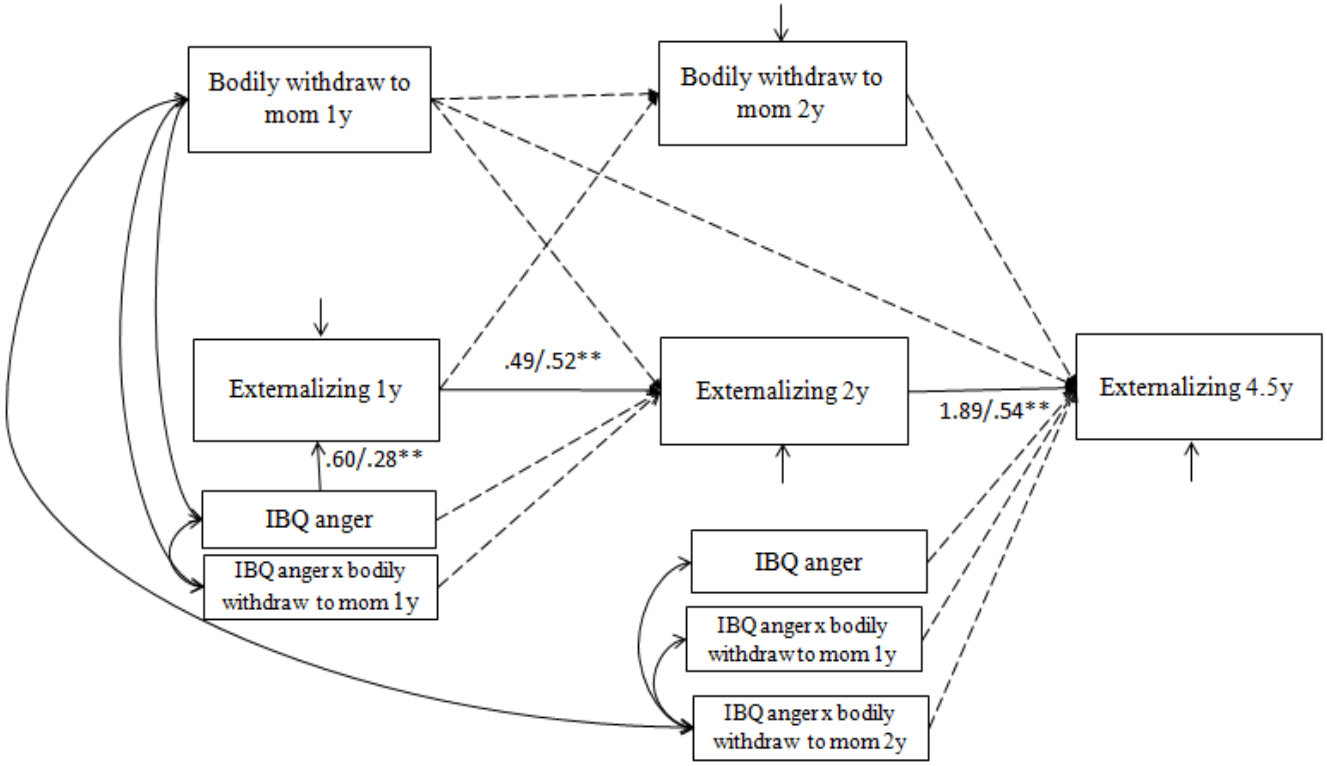
Figure 5. The Path Model of Bodily Withdrawing Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

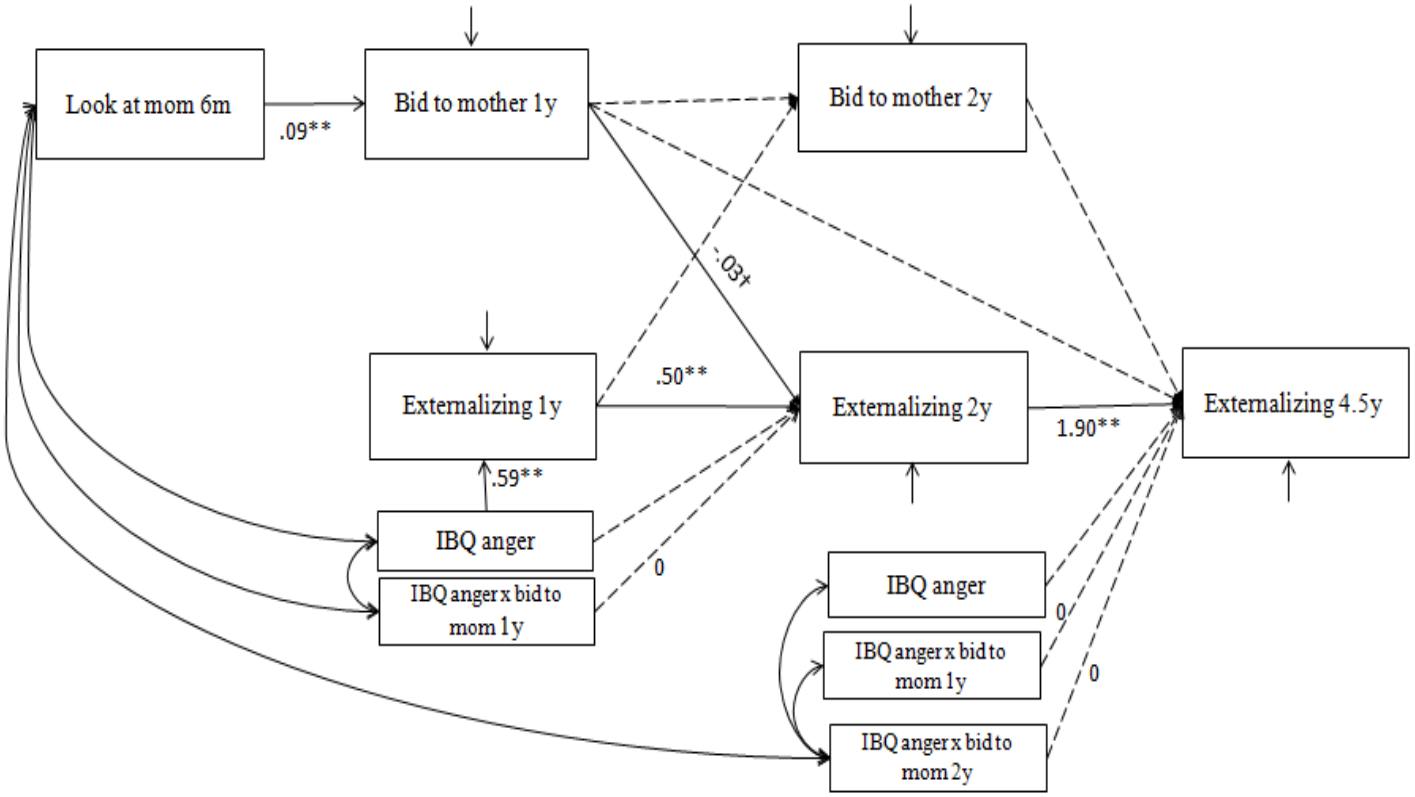
Figure 6. The Path Model of Bodily Withdrawing to Mom Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

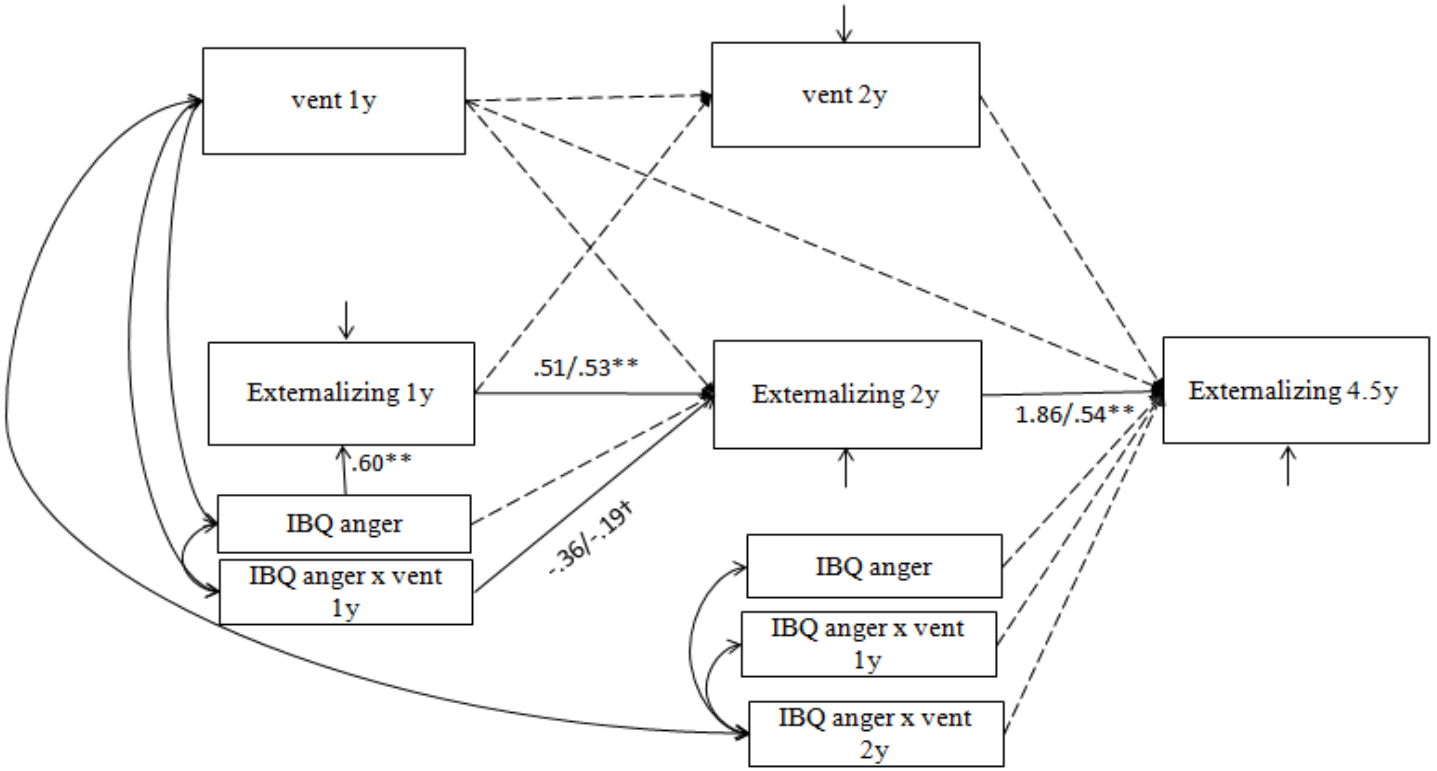
Figure 7. The Path Model of Bidding to Mom (Problem-Solving with Mom) Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

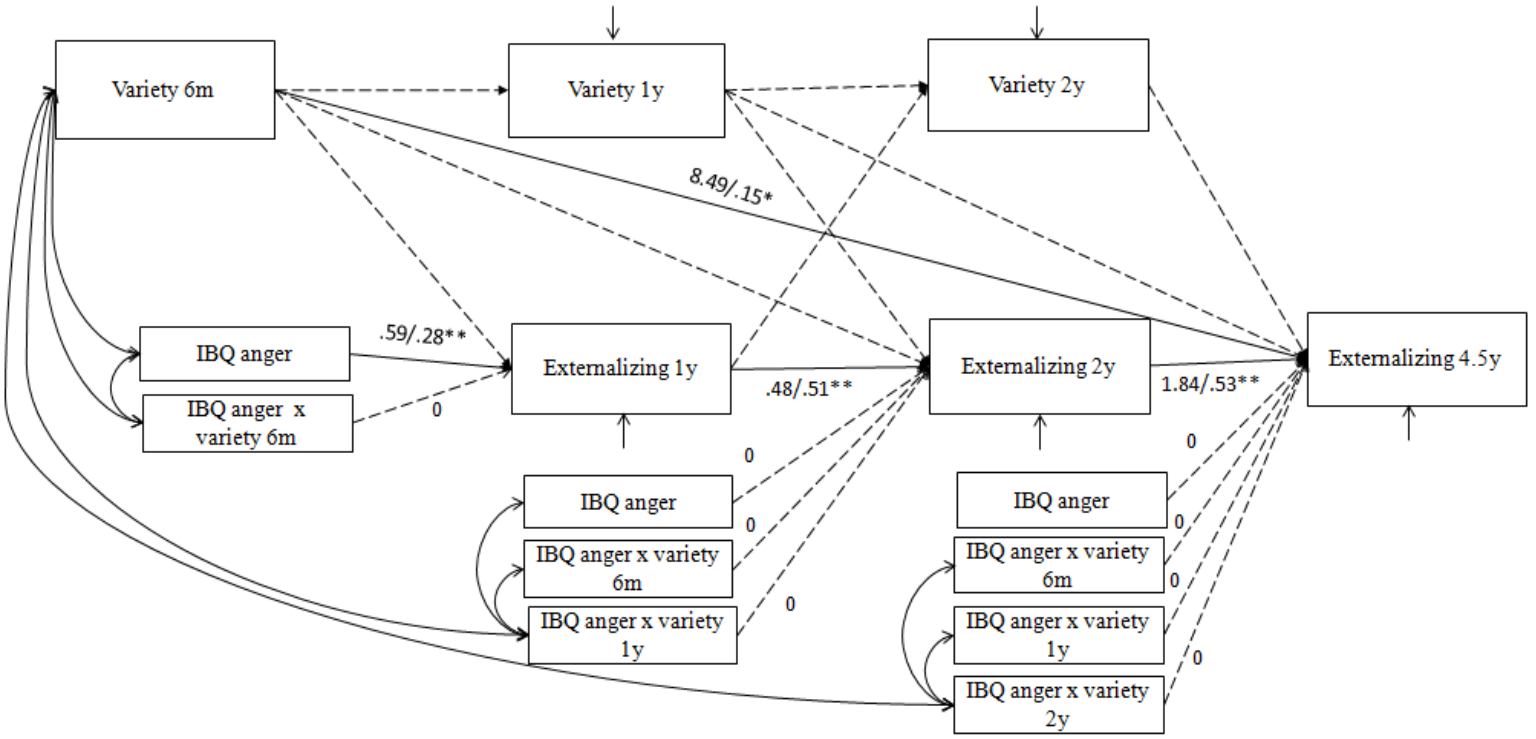
Figure 8. The Path Model of Venting Behavior Predicting Externalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Figure 9. The Path Model of the Variety of Emotion Regulation Behaviors Used Predicting Externalizing Behaviors.

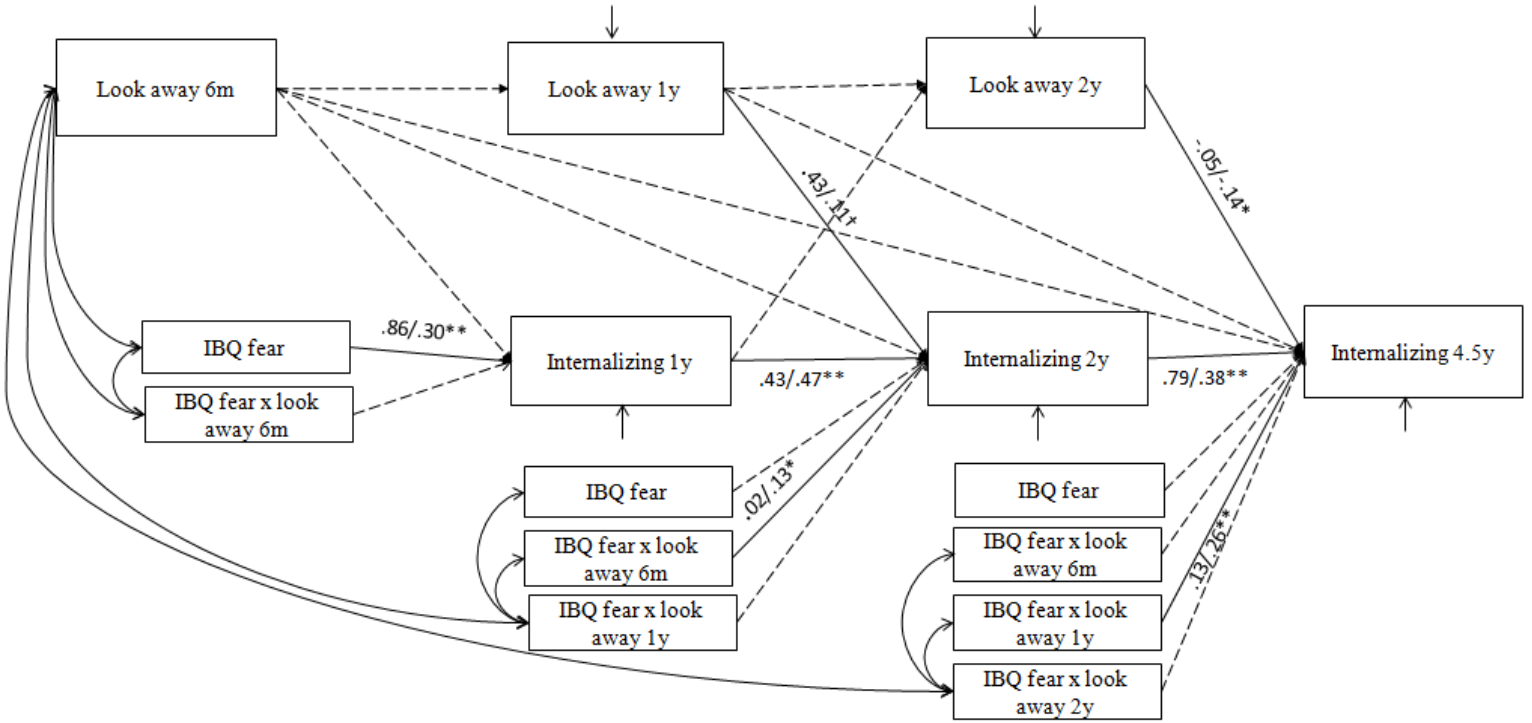


Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Fear Context

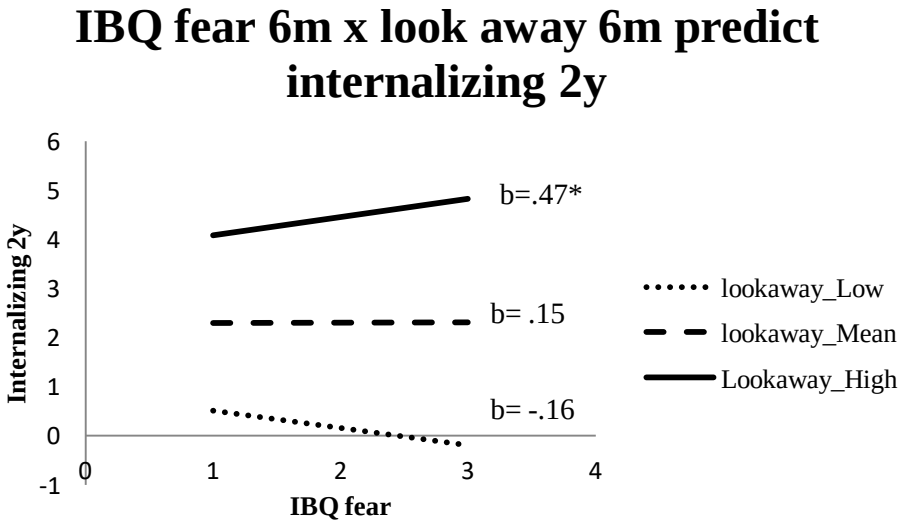
Figure 10(a): The Path Model of Looking Away Behavior Predicting Internalizing Behaviors.



Note:

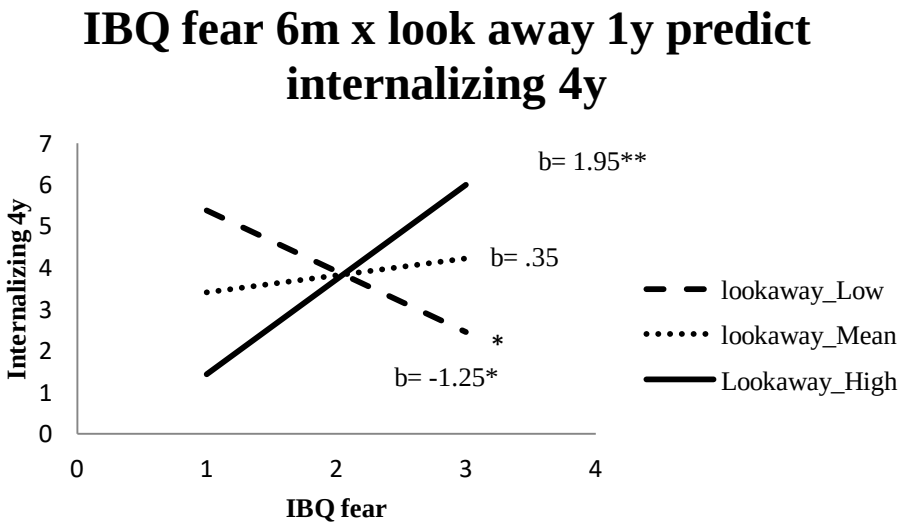
a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Figure 10(b). The Moderating Effect of Looking Away (6m) on the Association Between IBQ Fear (6m) and Internalizing Symptoms (2y).



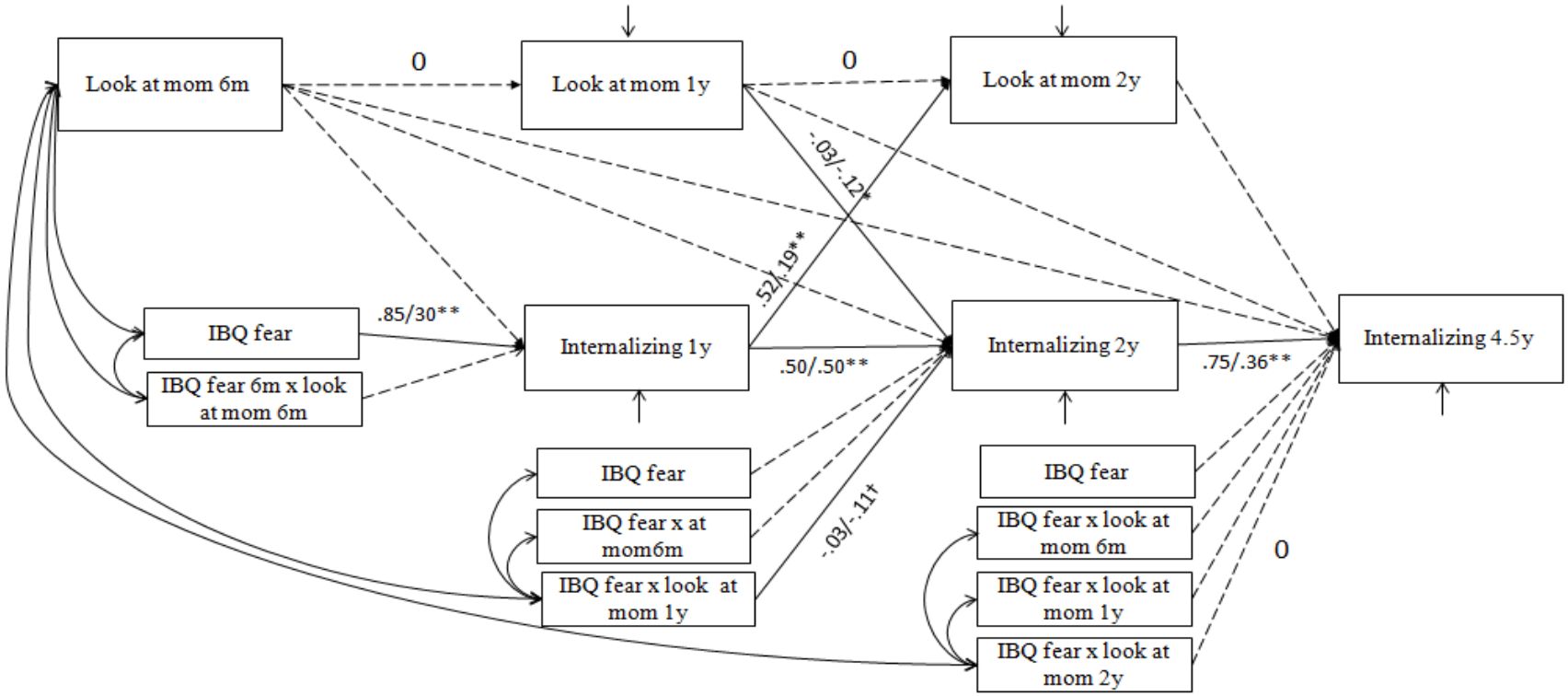
Note: * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Figure 10(c). The Moderating Effect of Looking Away (1y) on the Association Between IBQ Fear (6m) and Internalizing Symptoms (4y).



Note: * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

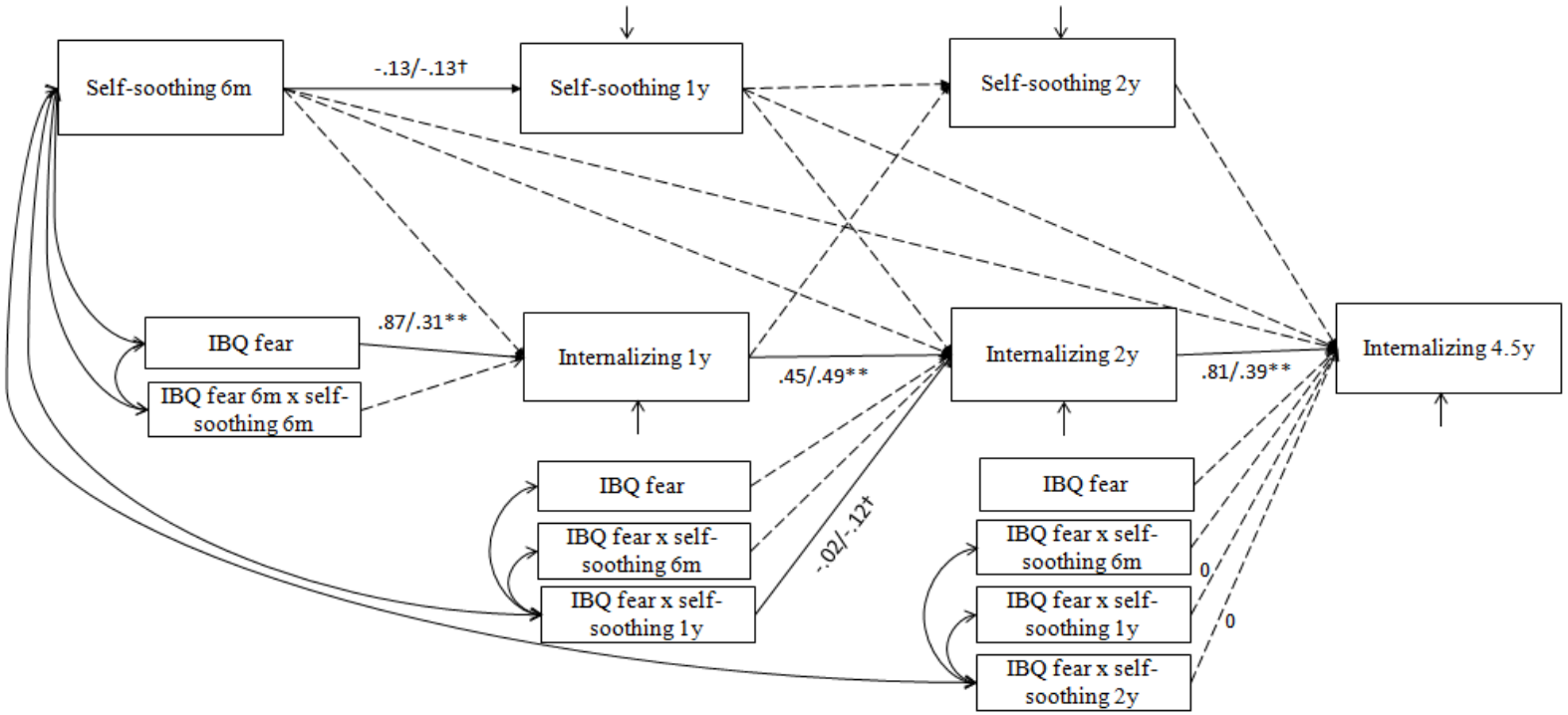
Figure 11. The Path Model of Looking at Mom Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

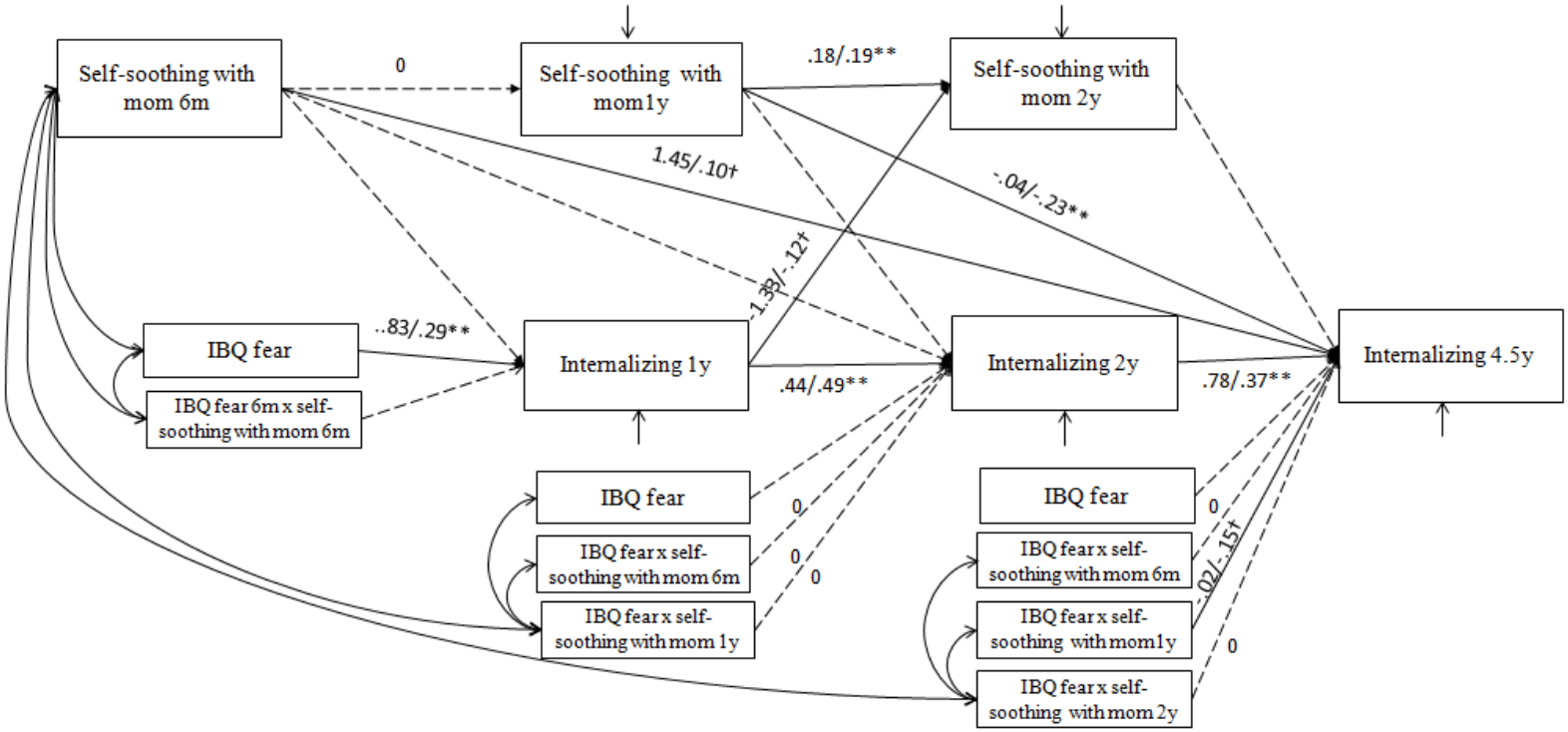
Figure 12. The Path Model of Self-Soothing Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

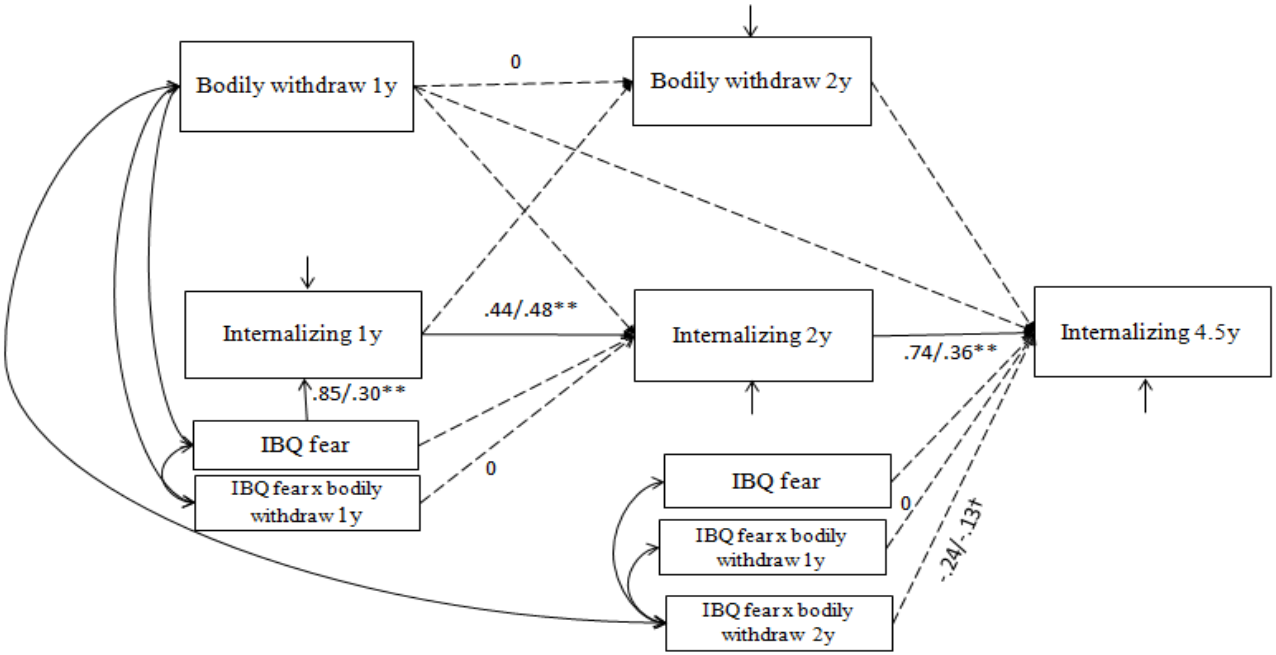
Figure 13. The Path Model of Self-Soothing with Mom Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

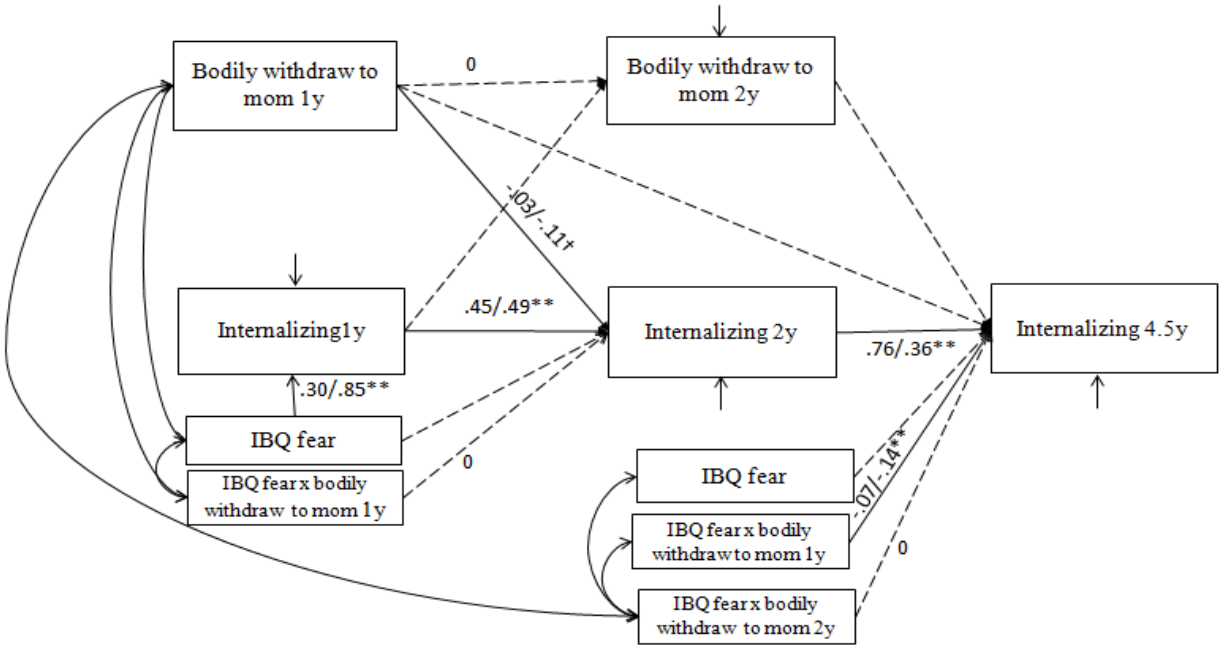
Figure 14. The Path Model of Bodily Withdrawing Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

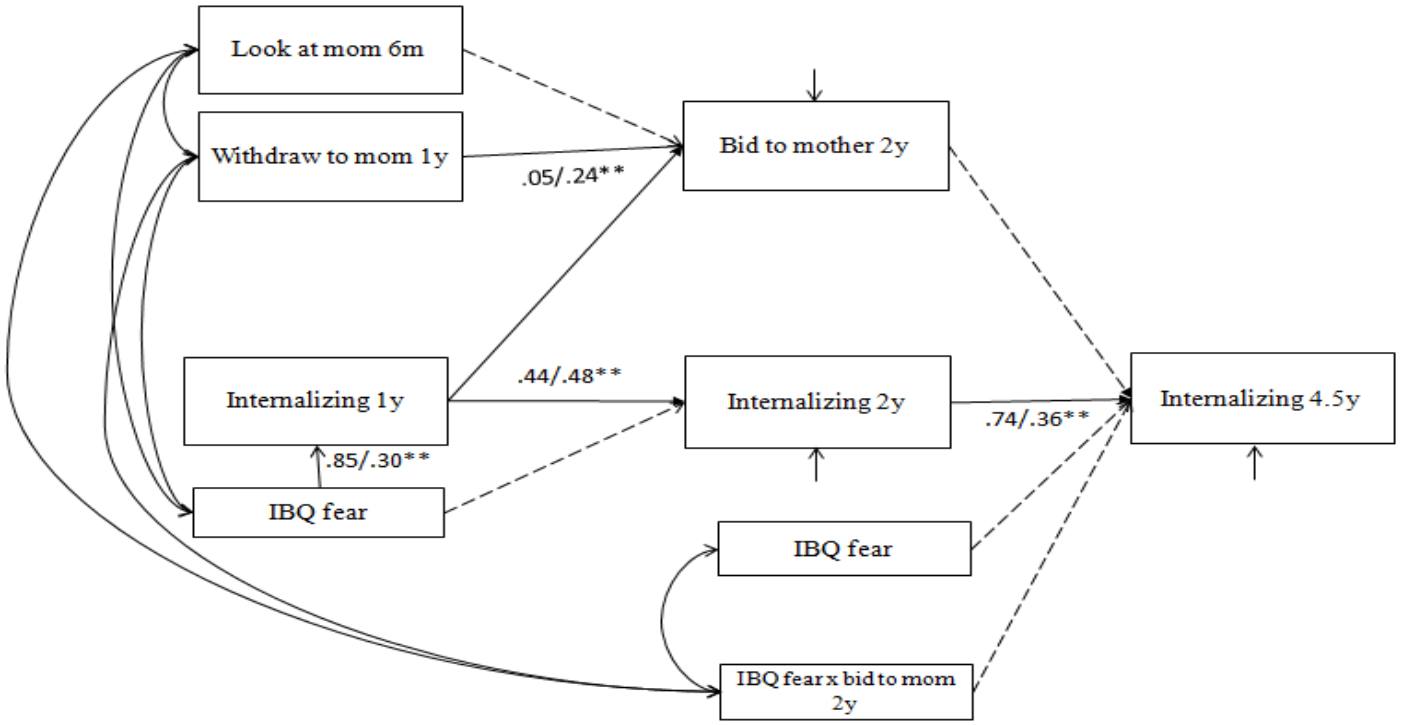
Figure 15. The Path Model of Bodily Withdrawing to Mom Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.
d. The interactions (IBQ fear x bodily withdraw to mom 1y) across three levels were not sig.

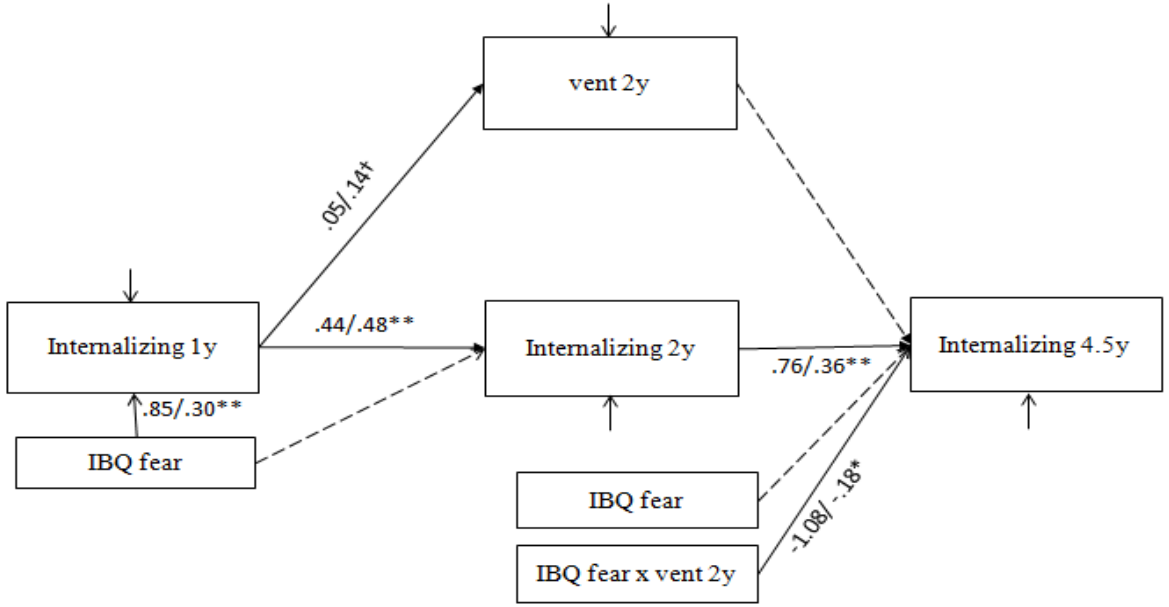
Figure 16. The Path Model of Bidding to Mom Behavior Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

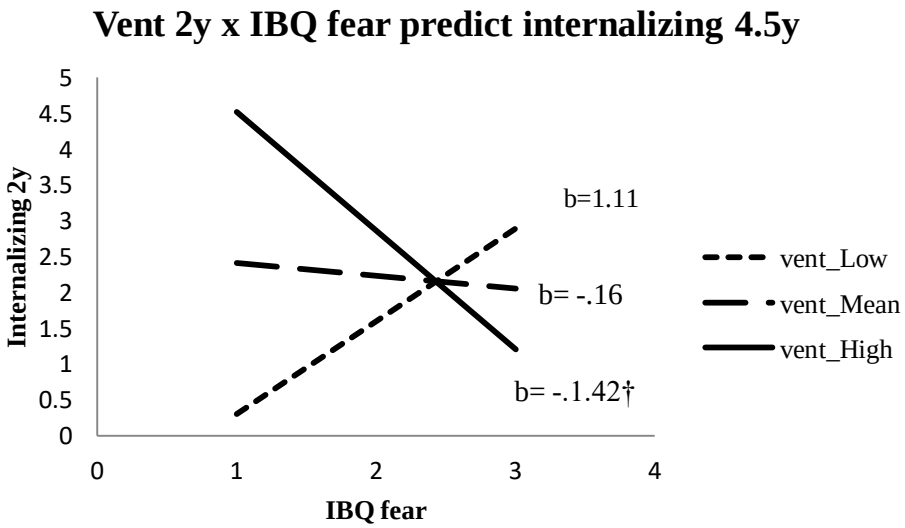
Figure 17(a). The Path Model of Venting Behavior Predicting Internalizing Behaviors.



Note:

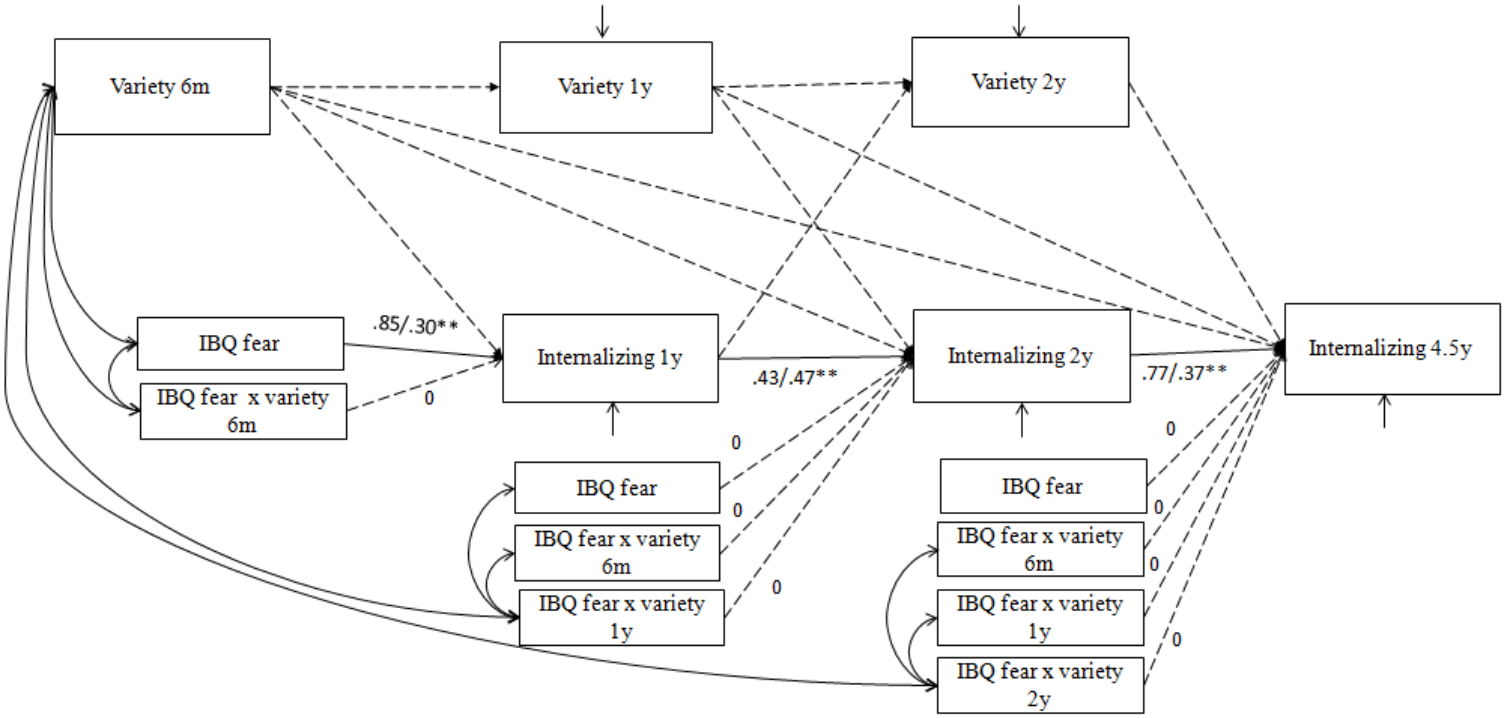
a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Figure 17(b). The Moderating Effect of Venting Behavior (2y) on the Association Between IBQ Fear (6m) and Internalizing Symptoms (2y).



Note: * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.

Figure 18. The Path Model of the Variety of Emotion Regulation Behaviors Used Predicting Internalizing Behaviors.



Note:

a. The 1st coefficient is the unstandardized coefficient, the 2nd is the standardized coefficient from the path model analysis.
b. Dashed line indicates that the coefficients are not significant. Solid line indicates that the path coeffient is sig.
c. * indicates that the path coefficient is significant at .05 level. ** indicates that the path coefficient is significant at .01 level. † indicates that the path coefficient is significant at a trend level.