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The Moderating Effects of Maternal Behaviors on Infant Fine-grained Temperament in the Development of Toddler Behavior Problems

영아기질과 걸음마기 문제행동 간 종단적 관련성: 엄마 행동의 조절효과를 중심으로

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Abstract

The Moderating Effects of Maternal Behaviors on Infant Fine-grained Temperament in the Development of Toddler Behavior Problems

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Most studies have focused on the direct association between infant temperament and their behavior problems in toddlerhood. Even though abundant work on the relation between temperament and the development of behavior problems exists, many of them do not consider fine-grained approach. Furthermore, there is limited existing literature on moderating effects of maternal behaviors on these fine-grained infant temperament traits in predicting toddler behavior problems; thus, the information on specific paths of behavior problems in the development has been overlooked, and

implications for these issues also have been limited. Therefore, the present study examined role of each fine-grained temperamental dimension in the development of toddler behavior problems. Additionally, this study also subdivided behavior problems into externalizing and internalizing behavior problems. This approach provides a deeper understanding of specific developmental paths in behavior problems. Notably, the current study demonstrated the mechanism how a given infant temperament can be moderated by a certain maternal behavior during the mother-infant interaction to affect the development of toddler externalizing and internalizing behavior problems; thus, the moderating effects of maternal behaviors on the association between fine-grained infant temperament and toddler behavior problems were examined in a sample of 83 Korean infants (35 males, 39 females). Infant Temperament was measured by the Infant Behavior Questionnaire-Revised (IBQ-R) at 12 months. Maternal behaviors were observed during the mother-infant free play interaction and were coded with Caregiver-Child Affect, Responsiveness, and Engagement Scale (C-CARES) when infants were 12 months old. Lastly, toddlers' behavior problems were assessed by maternal reports of the Toddler Behavior Checklist (TBC) at 18 months. Results indicated the main effects of infant temperament on toddler externalizing behavior problems. Temperamentally more sad infants at 12 months exhibited more externalizing behavior problems. Infants who were more active and approachable also showed more externalizing problems later.

Infant soothability and cuddliness also negatively associated with toddler externalizing problems. The findings also evidenced direct relations between infant temperament and internalizing behavior problems at 18 months. Temperamentally more fearful infants had more internalizing problems when they became toddlers, while infants who scored high in smiling/ laughter, duration of orienting, soothability and cuddliness demonstrated less internalizing problems in toddlerhood. There were also significant moderating effects of maternal behaviors on the relation between infant temperament and toddler behavior problems. For externalizing problems, the effects of infant activity level and soothability was varied by maternal responsive behaviors. As a function of maternal negative behaviors, infant negative emotionality, fear and low intensity pleasure differentially predicted the development of toddler externalizing problem behaviors. Maternal intrusive behaviors also moderated the effects of infant distress to limitation and activity levels in relation to the externalizing problems. For toddler internalizing behavior problems, maternal responsive behavior functioned as moderators in the association between infant fear and internalizing problems as well as in the relation between infant low intensity pleasure and internalizing behaviors. Maternal negativity also moderated infant fear and toddler internalizing behavior problems. Additionally, the effects of infant soothability also differentially predicted the development of toddler internalizing behavior problems as a function of maternal intrusive behaviors.

The current study showed various fine-grained temperamental dimensions differently predicted toddler externalizing and internalizing behavior problems longitudinally. These findings demonstrated different functions of sub-dimensions of infant temperament on toddler behavior and emphasize the necessity of fine-grained approach on temperament. Furthermore, the present study evidenced the moderating effects of various maternal behaviors. The results suggested that a certain maternal behavior or a certain temperament is not always related to the best or the worst developmental results. Instead, various infant temperament can vary by different maternal behaviors in predicting the development of toddler behavior problems. Taken together, the current study explored more specific developmental paths of toddler behavior problems in relation to various infant temperament and maternal behaviors during infancy. These findings may allow researchers and parents to identify infants at risk by assessing their fine-grained temperament and to intervene between infant temperament and toddler behavior problem via appropriate maternal behaviors depending on infants' specific temperament. Further explanations for the results and limitations are discussed later in the paper.

Keywords: infant temperament, mother-infant interactions, maternal behaviors, toddler behavior problems, externalizing behavior problems, internalizing behavior problems

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

Introduction

The interactions between mothers and their children start from early life and have long lasting effects on every aspect of a child's life. Although characteristics of children have a great impact on their own development, a mother's influence on their development may be more crucial especially during infancy. Not only mothers but also researchers are interested in ways to interact with children and to behave properly for the better development. A concept of temperament can help mothers understand their children and adjust parenting behaviors to the children's temperament. Depending on temperament, some infants may have difficult time in interaction with their mother while other infants interact with their mother more easily. Infants who had a difficult temperament are likely to have unpleasant interactions with their mothers and also to have negative effects on their development (Basten et al., 2016; Kjeldsen, Janson, Torgersen, & Mathiesen, 2014). Fortunately, an influence of children's temperament on development can be moderated if proper maternal behaviors exist (Chang & Shaw, 2016; Karreman, Haas, van Tuijl, van Aken, & Dekovic, 2010; Stright, Gallagher, & Kelly, 2008). Here, what it means by proper maternal behaviors is that mothers respond to children's signals appropriately, express more positive affect, and limit children's misbehaviors according to each child's temperament (Funamoto & Rinaldi, 2015). That is, mother adjust their behaviors during mother-infant interactions to the needs of a certain infant. On the other hand, negative

maternal behaviors may worsen harmful effects of such difficult temperament and result in unwanted outcomes such as behavior problems (Edwards & Hans, 2015; Karreman et al., 2010). The development of behavior problems is one of researchers' concerns that children exhibit maladjusted and dysfunctional behaviors. Since these behaviors have devastating influences on children persistently, the etiology of behavior problems has been interested. Previous findings have shown that infant temperament predicts later behavior problems in toddlers. However, most of these works have focused on influences of broader temperamental constructs on behavior problems (Bohlin & Hagekull, 2009; Crawford, Schrock, & Woodruff-Borden, 2011; Gartstein, Putnam, Rothbart, 2012) instead of fine-grained temperamental dimensions in contributing to the development of behavior problems. Above all, the mechanism of these fine-grained infant temperamental traits influencing behavior problems as a function of maternal behavior has not been extensively studied. Especially, no studies with infants in Eastern culture has been conducted on these issues.

To address these issues, the current study examined the longitudinal associations between various infants' temperamental dimensions at 12 months and toddler behavior problems including externalizing and internalizing behavior problems at 18 months. Furthermore, the present study investigated the moderating effects of various maternal behaviors on the relationships between infant temperament and toddler behavior problems.

Behavior Problems in Toddlerhood

Behavior problems is generally defined as maladjusted and dysfunctional ways of acting, including externalizing behaviors such as physical aggression, defiance and noncompliance, and internalizing behaviors like anxiety, depressed and shyness. These behaviors have a detrimental impact on human development. Children who exhibit any form of behaviors not only have difficult time to adjust social situation and to achieve academic works, but also they are more likely to commit juvenile delinquency and adult criminality later in life (Broidy et al., 2003). Furthermore, these problem behaviors can precede psychological disorders such as like conduct disorder and attention deficit hyperactive disorder (Harvey, Breaux, & Lugo-Candelas, 2016; Sitnick, Shaw, & Hyde, 2014; Stifter & Dollar, 2016). Therefore, researchers have vigorously worked on these issues to understand the development of the behavior problem.

Recent research on the behavior problem mainly focuses on two questions: 1) whether the behavior problems in toddlerhood persist later in life and 2) what precursors of behavior problems are. During the toddlerhood, parents face many challenges since their children are freer to mobile and seek a sense of autonomy (Colson & Dworkin, 1997). Thus, unlike infants who used to be totally dependent on parents, toddlers start asserting their opinions

with a lack of self-control. Many children in this period exhibit temper tantrums including hitting and biting. Although it seems like some mild form of behavior problems are normative in toddlerhood, children who show more and serious problems usually continue their misconducts (Stifter & Dollar, 2016). Previous studies have found that behavior problems in toddlerhood persist through childhood and adolescence, and even into adulthood (Basten et al., 2016; Kjeldsen, et al., 2014). Basten et al. (2016) asked parents to report their children's behavioral problems when children were 1.5, 3, and 6 years old. The finding indicates that children who did not have any problem at 1.5 and 3 years old did not develop behavior problems at 6. However, children who showed both externalizing and internalizing behavior problem when they were young kept exhibiting the behavior problems at 6 years old. Kjeldsen et al. (2014) also found the stability of behavior problems from 18 months to 14.5 years old. This study suggests that toddlers who exhibited more behavior problems appeared to have behavior problems in adolescence. Therefore, identifying behavior problems in toddlerhood allows researchers and clinicians not only to prevent and intervene with these problems, but also to target children at risk.

Researchers are also interested in exploring the precursors of behavioral problems in toddlerhood. Identifying children who have behavior problem issues as early as possible provides more opportunities for children at risk to prevent these problems before the onset of behavior problems. Even though

research on predictors of behavior problems were abundant (Hessler & Katz, 2010; Loeber, Burke, & Pardini, 2009), few studies have focused on infancy. These limited studies with infants explored predictors of behavior problems longitudinally and found that a child's own characteristics such as sex and temperament, and external factors like family income and parental education level were associated with behavior problems in toddlerhood (Basten et al., 2016; Kjeldsen et al., 2014). Especially infant temperament was the strongest precursor for general behavior problem that persists throughout the childhood.

Infant Temperament

Temperament is defined as an individual difference in emotional, attentional reactivity, self-regulation and motor (Rothbart & Bates, 2006). It is based on biological differences among children and therefore considered as stable traits throughout the life (Putnam, Gartstein, & Rothabart, 2006; Rothabart, Ahadi, Hershey, & Fisher, 2001). Recent works on temperament investigated several major research questions: temperamental characteristics and its dimensions, and its influence on developmental outcomes.

First, many researchers explored the temperamental construct and its dimensions. Three higher-order temperamental constructs were generally suggested by researchers: negative emotionality, surgency and effortful control or regulation capability in infancy (Buss & Plomin, 1975; Gartstein & Rothbart, 2003; Stifter & Dollar, 2016). Negative emotionality is characterized by children who frequently cry and easily react negatively and

get frustrated across situations; children who are surgent show positive emotionality, high level of activity and impulsivity (Rothbart & Bates, 2006). Regulation capability or effortful control is related to regulatory ability in emotional and behavioral reactivity. Researchers have developed to measure these three-higher temperamental constructs in infancy. Regarding to Stifter and Dollar (2016), one of the most well-known, reliable and valid temperament measure for infants is Rothbart's measurement (Gartstein & Rothbart, 2003). She suggested fourteen fine-grained dimensions to measure infants' temperament. These fourteen dimensions include activity level, smiling and laughter, high intensity pleasure, perceptual sensitivity, approach, vocal reactivity, distress to limitation, fear, falling reactivity, sadness, duration of orienting, low intensity pleasure, soothability, and cuddliness (see Table 1 for definitions of each temperamental dimensions). When these dimensions are factor-analyzed (Gartstein & Rothbart, 2003), the result shows that distress to limitation, fear and sadness and negatively loaded falling reactivity together compose the higher temperamental construct negative emotionality. In case of surgency, activity level, smiling and laughter, high intensity pleasure, approach, vocal reactivity and perceptual sensitivity of lower-order temperamental dimensions are included. Regulation capability consists of low intensity pleasure, cuddliness, duration of orienting and soothability temperamental traits. Analyzing broader construct instead of sub-dimensions of temperament is useful in comparing across studies that adopt different

methodological and theoretical approaches since there is no one integrated model for the temperament yet (Sifter & Dollar, 2016). However, even though sub-dimensions are all considered as similar traits under the broader construct of temperament, each dimension may have different functions (Barrett & Campos, 1987). For instance, anger and sadness are positively related, but anger and fear do not even though these dimensions are all belong to negative emotionality (Dyson, Olino, Durbin, Goldsmith, & Klein, 2012). Furthermore, fine-grained temperamental dimensions affect the development of behavior problems differently (Eisenberg et al., 2001; Kim & Kwak, 2007). As we noted above, temperament is one of the strongest contributing factors for problem behavior (Basten et al., 2016; Kjeldsen et al., 2014). Researchers have been demonstrated that children who exhibit negative emotionality had more behavioral problems (Carrasco, Holgado-Tello, Delgado & Gonzalez-Pena, 2016; Crawford et al., 2011; Gartstein et al., 2012). Crawford and his colleague (2011) found that concurrent direct association between child negative emotionality and internalizing behavioral problems. Consistent with this assertion, Gartstein and his colleagues (2012) also suggested that externalizing behavior problems during preschool were predicted longitudinally by high levels of negative emotionality during infancy and toddlerhood. However, these studies only measured broader temperament construct temperament to find its relation to the behavior problem. Additionally, there are some inconsistent results found that negative

emotionality fail to predict externalizing problems (Belsky, Hsieh, & Crnic, 1998). Although there are advantages of using broad temperamental factors in research, as we have seen, each dimension has different characteristics and function. A certain temperamental dimension would have a different impact on the development of behavior problems. Kim and Kwak (2007) found that fear and sadness at 6 months predicted children's maladjustment at 18 months, but distress to limitation and reversal of falling reactivity did not. Eisenberg et al. (2001) also evidenced that while anger predicted externalizing behavior problems, but not the internalizing behavior problems. Additionally, fear showed mixed findings on the development of behavior problems. Leve, Kim and Pears (2005) found that fear was a significant predictor of internalizing behavior problems, but other study showed that low levels of fear predicted internalizing problems (Colder, Mott, & Berman, 2002). These results suggested that each temperamental dimension differently influenced the path of the development in behavior problems. Thus, fine-grained approach is required. A fine-grained approach may extend research on temperament, and reveal more precise relations between temperament and behavior problems. However, studies on these lower temperamental dimensions are limited only to negative emotionality such as fear. Further investigation with other temperamental traits such as surgency and regulatory capability is needed to understand the role of temperament in the etiology of problem behaviors.

Table 1. *Definition of Temperamental Dimensions of the IBQ-R Scales*

Broader Construct	Label	Definition
Negative emotionality	Fear	Negative affect that anticipates pain, distress and/or threat, including startle and reactions to novelty and social stimulation
	Distress to limitation	Negative affect when one is experiencing confinement, interruption of goal achieving.
	Sadness	Negative affect that is related to lowered mood of physical state, disappointment, loss.
	Falling reactivity	Rate of recovery from peak arousal, excitement or distress, or ease of falling asleep.
Surgency	Activity level	Gross motor activity related to rate and extent of movement
	High-intensity pleasure	Enjoyment to high intensity stimulus (internal) related to rate, complexity, novelty and incongruity.
	Vocal reactivity	Vocalization
	Perceptual sensitivity	Detection of slight and low-intensity stimulation from the external environment
	Approach	Positive excitement and rapid approach toward pleasurable activities.
	Smiling and laughing	Smiling or laughter during general caretaking and play

(Continued Table 1.)

Broader Construct	Label	Definition
Regulatory capacity/ orienting	Duration of orienting	Capacity to sustain attention on an object or task.
	Low-intensity pleasure	Enjoyment to low stimulus (internal) related to rate, intensity, complexity, novelty, and incongruity.
	Cuddliness	Desire for warmth and closeness with caregivers.
	soothability	Proneness to ease from fussing, crying, or distress when received soothing techniques by caregivers.

Unlike negative emotionality, not much research has been conducted on surgency; or it is only studied as a counterpart of negative emotionality (Stifter & Dollar, 2016; Zentner & Shiner, 2015). According to Lengua and Wachs (2015), traits related to surgency would enhance resilience and buffer the detrimental effects of aversive environments. However, more recently surgency-like temperament traits become issued by their disruptive influences instead of adaptive and protective impacts on the child developmental outcomes (Putnam & Stifter, 2005; Schwartz, Snidman, & Kagan, 1996; Stifter, Putnam, & Jahromi, 2008). For example, researchers found that surgent toddlers (Putnam & Stifter, 2005), elementary school students and adolescents (Oldehinkel, Hartman, deWinter, Veenstra, & Ormel, 2004; Rothbart, Derryberry, & Posner, 1994) displayed more aggressive and

externalizing behavior problems. These inconsistent results may be explained by different functions of fine-grained temperament traits. One study has shown that activity level and approach which are lower temperamental dimensions under surgency at 6 months were positively related to behavior problems at 18 months (Kim & Kwak, 2007). However, positive affect predicted lower behavior problems (Lahey et al., 2008). That is, different sub temperamental dimensions may affect the development of behavior problems differently. Therefore, by investigating the role of each fine-grained infant temperament on the development of behavior problems, the issue on these inconsistent findings may be addressed. Additionally, a knowledge of the relation between the temperament and behavior problems would be extended.

Although researchers proved the association between effortful control which is characterized by voluntarily inhibiting dominant responses to perform subdominant responses and behavior problems (Gallitto, 2015; Muhtadie, Zhou, Eisenberg, & Wang, 2013), not many works on regulation capability have been conducted. Since effortful control develops around 18 months, research on regulation related temperamental dimensions is limited to the period after infancy. However, recently Gartstein and Rothbart (2003) identified temperamental dimensions called regulation capability which is infant version of effortful control; thus, it is now possible to explore the relation between regulation capability in infancy and behavior problem in toddlerhood. Few of studies has proven that regulatory capability has a

negative correlation with behavior problems (Gartstein, Slobodskaya, Putnam, & Kinsht, 2009; Olson, Bates, Sandy, & Schilling, 2002). However, it is suggested that regulatory capability is also consist of several different sub temperamental dimensions such as soothability and cuddliness, and they have different functions (Olson et al., 2002; Putnam et al., 2006); therefore, further study is required. Above all, only a handful of research on these issues has been conducted with infant samples. Therefore, the current study focuses on infant temperamental characteristics as a predictor of the development of behavior problems in toddlerhood.

Many studies on temperament and behavior problems have examined direct relationship between them. However, temperament do not influence the development of behavior problem alone. It also interacts with environmental factors in affecting child developmental outcomes (Stifter & Dollar, 2016). It appeared that environmental factors such as social economic status and maternal behaviors can change phenotypes of temperament (Bates, Schermerhorn, & Petersen, 2015); therefore, the effects of temperament on behavioral problems can be differentiated by these environmental factors. Thus, researchers have paid attention to the indirect association between temperament and behavioral problems with regarding environmental factors. Especially the present study emphasizes the moderating role of maternal behaviors during the mother-infant interaction context on the relation between temperament and behavior problems.

Maternal Behaviors during the Mother-Infant Interaction as a Moderator

Mother-infant interaction is a transactional process in which maternal behaviors are influenced by children's characteristics and behaviors. In turn, maternal behaviors also affect the development of children. During infancy, infants' mobility is limited. They do not have a language ability to communicate with their mother verbally. Instead, they express what they need via various non-verbal signals such as cooing, facial expressions. They heavily depend on their mothers in every aspect of life. Therefore, a maternal role in mother-infant interactions is crucial during infancy. One of the strongest environmental factors in infancy that affect children's developmental outcome may be maternal behaviors during interaction with their child. As noted above, through interaction with the mother, the phenotypes or expressions of child temperament can change over time. For example, infants are more likely to misbehave for getting attention from parents when they are rejected by parents. In contrast, infants who receive immediate attention from their mother would learn a more proper way to self-soothing when they are distressed. Furthermore, infants may gradually internalize their parents' modeling of behaviors.

As mentioned, since it is not complementary to examine the effect of temperament alone to investigate the development of behavior problems, many researchers have been interested in indirect relation between

temperament and behavior problems, and evidenced the maternal behavior during the mother-infant interaction is one of the strongest environmental factors interacting with infant temperament that influences the path of the development in problem behaviors (Chang & Shaw, 2016; Karreman, et al., 2010; Stright et al., 2008). Promising findings from these previous studies indicate that maternal behaviors may moderate the function of temperament in the development of behavior problems; thus, researchers have worked to understand how certain parental behaviors are interacting with the certain children's temperament in buffering or exacerbating the behavior problems. Several theoretical hypothesis and empirical evidences have proven the moderating role of maternal behaviors on the association between child temperament and behavior problems.

Some works showed that negative emotionality affects the development of behavior problems differently depending on maternal behaviors. Regarding to Stright et al. (2008) infants with negative emotionality showed more behavior problems when they experienced poorer parental behaviors; however, when they were exposed to higher quality of parenting behaviors, they had better adjustment. These results suggest that negative environments like poor maternal behaviors can exacerbate the negative influences of temperamentally negative emotionality on the development of behavioral problems; in contrast, the effects of negative emotionality can be mitigated by positive maternal behaviors. Another study also measured infants'

negative emotionality and maternal behaviors and later measured behavior problems; the result indicated that maternal negative behaviors exacerbated the effects of negative emotionality (Belsky et al., 1998).

Unlike the abundant works of infants' negative emotionality with maternal behaviors, very few studies have been conducted with surgency and regulatory capability dimensions among infants. However, some studies suggested that the function of surgency and regulatory capability may change depending on maternal behaviors. One study found that maternal positive behavior buffered externalizing behavior problems among children who are surgent (Karreman et al., 2010). However, among children who experienced maternal negative behaviors, their surgency trait did not predict their behavior problems (Lahey et al., 2008). The effects of low regulatory capability related to temperament on behavior problems were also mitigated among children who were exposed to positive maternal behaviors (Karreman, van Tuijl, van Aken, & Dekovic, 2009). These results indicate surgency and regulatory capability temperamental constructs also interact with maternal behaviors to affect the development of problem behaviors. Therefore, the current study focus on these temperamental constructs and their interactional effects with maternal behaviors.

It is important to note that since diverse temperamental sub-dimensions under three broad temperament constructs have different function, each lower temperamental trait also may differently interact with maternal behaviors and

yield different developmental outcomes. For instance, children who became easily angry were more likely to develop externalizing behavior problems and aggression when they were experienced maternal negative behaviors (Edwards & Hans, 2015). However, children who were temperamentally fearful did not develop the externalizing behavior when they were exposed to maternal negative behaviors; rather, they showed exacerbated internalizing behavior problems (Karreman et al., 2010). These results suggest that each fine-grained temperament dimension functions differently depending on maternal behaviors. Furthermore, these results also indicate that externalizing and internalizing behaviors have different developmental paths; thus, it is necessary to study externalizing problems and internalizing problems separately instead of merging two different kinds of behavior problems. However, limited research on these fine-grained temperament traits as well as behavior problems with maternal behavior exists; or only broad constructs of temperament or sub-dimensions under negative emotionality were studied. However, based on prior studies (Edwards & Hans, 2015; Karreman et al., 2010), we can assume that sub-dimensions under surgency and regulation capability also predict the development of behavior problems differently depending on maternal behaviors. Therefore, the present study will consider all aspects of infant temperament, including fourteen lower-order temperamental traits and three broader constructs\.

In addition to fine-grained approach to temperament, maternal behaviors

also need to be specified. Even though maternal behaviors that emerge during mother-infant interaction are various, these behaviors do not have well-established constructs like children's temperament (Bates et al., 2015). Additionally, previous studies did not differentiate parental negative and intrusive behaviors; rather, they merged these two dimensions as a negative parenting. However, a few of studies suggested that negative and intrusive behaviors are different (McFadden & Tamis-LeMonda, 2013; Verhoeven, Junger, van Aken, Dekovic, & van Aken, 2010). Verhoeven and colleagues (2010) investigated the associations between specific parenting dimensions and children's externalizing behaviors. The result indicated that higher parents' intrusive behaviors significantly predicted more externalizing behaviors among children. However, parental negative behaviors was not significant. These results requires to specify maternal behaviors. Thus, the present study adopts the measurement that assesses various aspects of maternal behavior during the mother-infant interactions. The Caregiver-Child Affect, Responsiveness, and Engagement Scale (C-CARES) developed by Tamis-LeMonda, Ahuja, Hannibal, Shannon and Spellmann (2001) examines various aspects of mother-infant interaction. This coding scheme contains various maternal behaviors which appear in the middle of a mother-infant interaction; it includes the maternal affect, sensitivity, communication and others (Funamoto & Rinaldi, 2015).

Maternal behaviors play an important role in children's development

especially during infancy. Unlike infants' temperament or internal characteristics, maternal behaviors are easier to modify and can change the phenotype of infants' temperament in influencing the development of behavior problems among children. Therefore, the current study aims to find out the underlying mechanism of which maternal behaviors moderates in the link between various temperamental traits and externalizing and internalizing behavior problem.

The Current Study

The present study examined the direct relation between temperamental traits during infancy and behavior problems in toddlerhood. Furthermore, the current study aimed to demonstrate the mechanism of infant temperament influencing toddler behavior problems as a function of maternal behaviors by exploring moderating effects of maternal behaviors on the infant temperament in contributing to the development of toddlers' behavior problems.

Studies persistently indicated that both high levels of externalizing and internalizing behavior problems during toddlerhood are a great risk of continuing problem behaviors throughout the course of their life (Basten et al., 2016; Kjeldsen et al., 2014) and preceding several clinical disorders such as conduct disorders, anxiety and depression (Harvey et al., 2016; Sitnick et al., 2014; Stifter & Dollar, 2016). These results emphasized the necessity of studying of behavior problems during early life. Therefore, the current study explored the etiology of behavior problems in toddlerhood around 18 months, and try to find out contributing factors derived from infancy. Since most temperamental dimensions during infancy become stabilized around 12 months (Carranza Carnicero, Perez-Lopez, Del Carmen, & Martinez-Fuentes, 2000; Gartstein & Rothbart, 2003), it was appropriate to study longitudinally to investigate the relation between infant temperament and behavior problems

in toddlerhood.

Because previous studies heavily focused on undifferentiated broader constructs of the temperament or on a limited number of specific temperamental traits such as fear, the present study aimed to relate more fine-grained measures of temperament in infancy to the development of externalizing and internalizing behavior problems in toddlerhood. Moreover, work on temperament and its relation to the behavioral problems revealed inconsistent and complex findings (Lengua & Wachs, 2015; Putnam & Stifter, 2005). Some results evidenced protective influences of surgency, but others demonstrated the harmful effect of it (Berdan, Keane, & Calkins, 2008; Gartstein et al., 2012; Zentner & Shiner, 2015). Therefore, replication and in-depth investigation about various sub-dimensions of temperament are required.

Finally, moderating effects of various maternal behaviors on infant temperament were evidenced in this study. There were limited knowledge of moderating effect of maternal behaviors on the relation between temperament and behavior problems found especially with infant samples in Eastern cultures (Stifter & Dollar, 2016; Zentner & Shiner, 2015). These further investigations would also extend knowledge of the nature of combined effects between infants' internal characteristics such as temperament and environmental factors like maternal behaviors. Above all, there is a gap in literature on the etiology of behavior problems related to temperament and

parental behaviors. Unlike previous studies which relied mostly on older children samples, the present study focused on young age samples. This approach would provide a deeper understanding of how some types of parental behaviors during infancy have different implications for infants who have different temperamental traits in influencing the development of behavior problems.

Research Questions and Hypotheses

First, of various temperamental traits, which temperament dimensions during infancy are related to externalizing and internalizing behavior problems in toddlerhood? Regarding to previous evidences, we hypothesize that among broader constructs of temperament, infant negative emotionality and surgency will be positively related to externalizing behaviors during toddlerhood. On the other hand, infant regulatory capability will be negatively associated with externalizing behavior problems. For internalizing problems, negative emotionality will have a positive correlation with internalizing problems while surgency and regulatory capability will be negatively correlated to the internalizing behaviors. Some of fine-grained infant temperamental dimensions are expected to be differentially associated with externalizing and internalizing behavior problems in toddlerhood. Because our investigation on the role of specific infant temperamental dimensions in predicting toddler behavior is largely exploratory, no specific hypotheses are

formulated.

Second, is there any moderating effects of maternal behavior on infants' temperament in predicting toddler externalizing and internalizing behavior problems? Especially, do certain maternal behaviors differentiate the association between infant temperament and toddler behavior problems? If so, which maternal behaviors interact with which temperamental dimensions? All three maternal behaviors are expected to moderate some of relations between infant temperament and behavior problems in toddlerhood. We anticipate that maternal responsive behaviors would buffer negative effects of some infants' temperamental traits while maternal negative behaviors exacerbate negative effects of some temperament dimensions. Maternal intrusive behaviors is expected to have complex findings. Due to the absence of clear guidance from the previous research on moderating effect of maternal behaviors on fine-grained temperamental dimensions, no specific hypotheses are formed.

Method

Participants

Eighty-three infant-mother dyads participated in the current study. They were recruited for a longitudinal study by Korean Infants Development Study. Participants who resided in Seoul and Gyeonggi province of the Republic of Korea had various social economic statuses and educational backgrounds. All of the families were martially intact. All infants were full-term and healthy at birth.

When we first assessed infants' temperament and their mother's behaviors, they were around 12 months (*M* = 12.80; range = 12 – 15 months; *SD* = .69). Mothers completed the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003) to assess infant temperament. The maternal behaviors during mother-infant interaction was observed and recorded via video tapes. To assess children's problem behaviors at 18 months (*M* = 18.57; range = 18 – 20 months; *SD* = .53), mothers were asked to fill out the Toddler Behavior Checklist (TBC; Larzelere, Lartin, & Amberson, 1989).

Of the 83, 74 infants (35males, 39 females) and their mothers were included for the final analysis due to damaged videos and incomplete questionnaires. No bias was found for sex and missing data on infant

temperamental scores.

Procedures and Measures

Mothers were contacted and were briefly informed of the study. The mothers who were willing to participate in the study were scheduled for an appointment. When infants were at 12 months of age, they visited the developmental psychology laboratory at the Seoul National University. Before the procedure began, the trained experimenters explained the purpose and procedures of the current study, and required mothers to read and sign a consent form. Mothers joined the free-play task. Mothers were asked to play with their infant as usual daily life. This interaction between the mother and infant was videotaped. In addition to the free-play task, mothers were required to complete the IBQ-R to assess infant temperament. For the purpose of this study, the infants and mothers were reassessed when infants became 18 months old to complete TBC scale. When the completed forms were returned to the researcher for analysis, parents received feedback of the study.

Infant Temperament. Since samples of the current study are infants who are unable to speak and move freely, it is more appropriate to use a questionnaire for the study. Furthermore, a maternal report of temperament allows researchers to assess infant temperament across contexts rather than measuring temperament in a laboratory. Therefore, the present study used

IBQ-R. Mothers were asked to rate their infants' temperament on a 7-point Likert scale ranging from 1 (*never*) to 7 (*always*) via the IBQ-R. This measurement consists of 191 items that compose 14 scales: activity level, smiling and laughter, high intensity pleasure, perceptual sensitivity, approach, vocal reactivity, distress to limitation, fear, sadness, falling reactivity, duration of orienting, cuddliness, soothability and low intensity pleasure. Regarding to Gartstein and Rothbart (2003), three higher-order factors can be derived from 14 temperamental dimensions: surgency, negative emotionality and regulatory capability. Surgency includes approach, vocal reactivity, high pleasure, smiling and laughter, activity level and perceptual sensitivity. Negative emotionality consists of sadness, distress to limitations, fear and reversal of falling reactivity. Regulatory capability is composed of low intensity pleasure, cuddliness, duration of orienting and soothability (see Table 1). We computed all 14 sub-dimensions of temperament and three broad constructs. Cronbach's alpha for this study was .54 for activity level, .59 for smiling and laughter, .80 for high intensity pleasure, .56 for perceptual sensitivity, .71 for approach, .58 for vocal reactivity, .49 for distress to limitation, .84 for fear, .67 for sadness, .67 for falling reactivity, .68 for duration of orienting, .41 for cuddliness, .45 for soothability and .83 for low intensity pleasure. In case of broader constructs of temperament, alpha level for surgency was .64; negative emotionality was .49, and .43 for regulatory capability. Although some of temperamental dimensions had a weaker alpha

level, the current study focused on the function of each sub-dimensions; thus, we included all fourteen dimensions in this study based on conceptual theory and prior empirical studies. This measure was translated into Korean by Kim and Kwak (2007).

Maternal Behaviors during Mother-Infant Interactions. To assess maternal behaviors during mother-infant interactions, the experimenters recorded mother and infant dyad's free play situation for 10 minutes. During the free-play, mother and infant were invited to sit in the middle of the room. There was a basket with full of toys including two toy telephones, a ball, a baby doll, a picture book, and a playing house set. The mother was asked to play with their infants as they usually did. Toys were for assessing whether mother tried symbolic play with their infants as well as promoting interactions between mothers and infants. In order to set the natural interactions between the mother and infant, the video camera was set up outside the room where the mother-infant interactions happened.

Maternal behaviors were assessed via the Caregiver-Child Affect, Responsiveness, and Engagement Scale (C-CARES; Tamis-LeMonda et al., 2001). This coding scheme examined various aspects of a dyad's interaction between mothers and their infants. Especially it assessed mutuality that describes how harmonious, reciprocal, cooperative, and responsive the interaction can be (Funamoto & Rinaldi, 2015). This coding scheme consists of 18 items for mothers, including elements like affect, sensitivity and

didactic. Following Tamis-LeMonda and her colleagues (McFadden & Tamis-LeMonda, 2013; Shannon, Tamis-LeMonda, & Cabrera, 2006; Shannon, Tamis-LeMonda, London, & Cabrera, 2002), three dimensions of parental behaviors were analyzed in the current study: responsive/didactic parental behaviors, negative parenting behaviors, and intrusive parenting behaviors (see Table 2 for definition of maternal behaviors and items composing three maternal behavior dimensions).

Based on C-CARES, coders rated a general impression of the mother and child behaviors, and their mutuality on scores ranging from 1 (*rarely observed*) to 5 (*constantly observed*). The reliability of the C-CARES has been shown in several studies (Funamoto & Rinaldi, 2015). To achieve inter-coder reliability, 20% of recorded tapes (N = 15) were randomly selected and coded by several coders. Inter-coder reliability for mother-infant interaction was .93 in Kappa. As long as inter-coder reliability was established, trained coders were free to complete the remaining videos. Coders watched each video sample at least three times and then coded. They first observed a general impression on the interaction between the mother and infant. Then, coders focused on maternal behaviors according to the items listed on the coding sheet. Lastly, they coded the infant's behaviors in response to maternal behaviors. If there was disagreement among coders, they watched and coded the video again until those behaviors were matched. Following McFadden and Tamis-LeMonda (2013), the experimenters computed three maternal

behavioral dimensions including responsive behaviors (mean of positive affect, responsiveness to infant's nonverbal/verbal cues, emotional attunement, achievement orientation, amount of language, quality of language and amount of symbolic play), negative behaviors (mean of negative affect, negative touch, and negative verbal statements), and intrusive behaviors (mean of inflexibility, intrusiveness and teasing). Cronbach alpha for maternal responsive behaviors is .88. Alpha level for negative behaviors is .74 and .46 for intrusive behaviors. Unlike the high level of the alpha for maternal responsive and negative behaviors, maternal intrusive behaviors' alpha level was weak. It was because that the intrusiveness dimension consisted of few items, and these items had relatively low variance. However, maternal intrusive behaviors were distinguished from positive and negative behaviors based on conceptual reasons (McFadden & Tamis-LeMonda, 2013) and for the purpose of the current study. Additionally, to generalize maternal behaviors across contexts, the experimenters compared maternal behaviors assessed in three different time points—these data were from parts of the longitudinal study, and there were no differences found for maternal behaviors.

Table 2. *Definition and items Composing Three Maternal Behavioral Dimensions in C-CARES*

Maternal behavioral dimension	Components of behaviors	Definition and description
Responsive/ didactic	Positive affect	Exhibiting positive emotions such as approval, enjoyment and affection. These behaviors can be shown by facial expression and vocal tone.
	Responsiveness to child cue	Appropriately responding to infants' cues that ask their needs throughout facial expression, body posture or verbal statements.
	Emotional attunement	Mirroring infants' emotions, showing emotional expression or helping infants to display their emotions. For example, when infants are excited by toys, making sounds, caregivers also became hyperactive.
	Achievement orientation	Encouraging infants' cognitive achievement and intellectual activities. For instance, mothers ask infants a question like "what is it?"
	Amount of language	Regardless of contents or styles, consistently speaking to infants.
	Quality of language	Regarding contents or style of communication. Whether caregivers using explanatory style rather than directive statements.
	Symbolic play	Playing pretended play with infants

(Continued Table 2.)

Maternal behavioral dimension	Maternal behavioral dimension	Maternal behavioral dimension
Negative	Negative affect	Showing negative emotions and attitudes such as anger, hostility, frustration, impatience and disapproval. These behaviors can be shown by facial expression, vocal tone and body posture.
	Negative touch	Touching a child coercively or unexpectedly. For instance, a mother moves infant's position oppressively.
	Negative statements	When infants do not comply with caregivers, criticizing and making negative statements such as name-calling.
Intrusive	Inflexibility	Not allowing infants' autonomy. Although infants are not interested in what caregivers provide, caregivers keep showing it.
	Intrusiveness	Adult centered behaviors. Limiting and controlling infants' behaviors.
	Teasing	Unexpectedly making fun of infants so that infants become insecure. For example, caregivers hide or throw away toys from infants.

Toddler Problem Behaviors. TBC (Larzelere et al., 1989) is the useful tool for measuring problem behaviors during toddlerhood. It is similar to the Child Behavior checklist (CBCL; Achenbach, 1992), but designed for a wider range of age from 9 to 48 months old to examine toddlers' social emotional development. For the current study, mothers completed TBC in the 4-point Likert scales ranging from 0 (*never*) to 3 (*frequently*) when infants became 18 months old. TBC contains 76 items and composes five domains of behaviors: opposition, immaturity, emotional instability, physical aggression and shyness. In the present study, we calculated externalizing and internalizing problem scores following Moore, Cohn and Campbell (2001). We summed opposition and physical aggression scores to compute externalizing behavior problem score, and internalizing behavior problems was also computed by summing immaturity, emotional instability and shyness scores. The Cronbach alpha for externalizing behavior problems is .85, and for internalizing behavior problems is .72.

Results

In the current study, the relationship between infant temperament and behavior problems during toddlerhood was examined. Associations between maternal behaviors during mother-infant interactions and toddler behavior problems were also investigated. Additionally, the moderating effect of maternal behaviors on infant's temperament in relation to the behavior problems in toddlerhood was evidenced.

For the analysis of the current data, we used SPSS Statistics 18 for windows. First, we provided means and standard deviations for variables including fourteen infant temperamental dimensions, three broader constructs of temperament at 12 months, and toddler behavior problems at 18 months as well as three maternal behaviors when infants were 12 months old. Then, we did correlation and regression analysis to explore the association between infant temperament, maternal behaviors and toddler behavior problems. Since one of the goals in the present study is to investigate the moderating effects of maternal behaviors, we used a hierarchical regression analysis instead of SEM; furthermore, due to the limited sample size and considerable disagreement regarding the most appropriate technique to test moderating effect in SEM (Frazier, Tix, & Barron, 2004), the hierarchical regression analysis was more appropriate for the current study.

Means and Standard Deviations: Infant Temperament, Maternal Behaviors and Toddler Behavior Problems

Table 3 presents the descriptive statistics for infant temperament measured by the IBQ-R at 12 months, maternal behaviors coded by C-CARES when infant were 12 months old, and toddler behavior problems rated via TBC by mothers when their children were 18 months. In preliminary analyses, sex differences were examined with the major variables. There were no significant sex differences in means scores on any of the variables. There was adequate range and variability for all variables assessed. Overall infants' mean for various temperament traits fell above the midpoint of the 7-point Likert scale. Infants scored on distress to limitation (*M* = 3.90, *SD* = .51), fear (*M* = 3.97, *SD* = .94), sad (*M* = 4.87, *SD* = .72), activity level (*M* = 4. 10, *SD* = .61), smiling and laughter (*M* = 4.56, *SD* = .68), high intensity pleasure (*M* = 4. 80, *SD* = .89), perceptual sensitivity (*M* = 4. 09, *SD* = .66), approach (*M* = 4.99, *SD* = .65), vocalization (*M* = 4.98, *SD* = .62), duration of orienting (*M* = 4.27, *SD* = .74), low intensity pleasure (*M* = 4. 85, *SD* = .90), soothability (*M* = 4.83, *SD* = .52), and cuddliness (*M* = 3.96, *SD*=.42). Compared to surgency (*M* = 4.59, *SD* = .42) and regulatory capability (*M* = 4. 48, *SD* = .41) and their sub-dimensions, negative emotionality (*M* = 3.78, *SD* = .46) and its lower temperamental traits showed lower scores. Maternal responsive/ didactic behaviors (*M* = 4.31, *SD* = .55) scored high compared to the midpoint of the 5-point Likert scale; on the other hand, the sample mean for maternal

negative (M = 1.04, SD = .15) and intrusive behaviors (M = 1.38, SD = .45) fell below the midpoint of the 5-point scale. The mean score for toddler externalizing behavior problems was 2.07 with standard deviation of .35. The mean score for internalizing behavior problem was 1.95 and its standard deviation was .25.

Table 3. *Descriptive Statistics of Infant Temperament, Maternal Behaviors and Toddler Behavior Problems*

Measure	Mean	S.D.	Range
Infant temperament at 12 months			
Negative emotionality	3.78	.46	2.71 - 4.98
Distress to limitation	3.90	.51	2.81 - 4.81
Fear	3.97	.94	2.13 - 6.44
Falling reactivity(r)	2.36	.66	1.15 - 3.62
Sad	4.87	.72	3.64 - 6.50
Surgency	4.59	.42	3.41 - 5.46
Activity level	4.10	.61	2.80 - 5.60
Smiling and laughter	4.56	.68	2.90 - 6.00
High intensity pleasure	4.80	.89	.91 - 6.73
Perceptual sensitivity	4.09	.66	2.42 - 5.58
Approach	4.99	.65	2.75 - 6.17
Vocalization	4.98	.62	3.67 - 6.33
Regulation Capability	4.48	.41	3.20 - 5.34
Duration of orienting	4.27	.74	2.50 - 6.08
Low intensity pleasure	4.85	.90	.92 - 6.31
Soothability	4.83	.52	3.44 - 6.17
Cuddliness	3.96	.42	2.94 - 4.88
Maternal Behaviors at 12 months			
Responsive/ didactic behaviors	4.31	.55	2.63 - 5.00
Negative behaviors	1.04	.15	1.00 - 2.00
Intrusive behaviors	1.38	.45	1.00 - 3.00
Behavior Problems at 18 months			
Externalizing problems	2.07	.35	1.39 - 2.83
Internalizing problems	1.95	.25	1.33 - 2.45

The Relationship among Infant Temperament, Maternal Behaviors and Toddler Behavior Problems

As shown in Table 4, bivariate correlations among variables revealed significant associations between externalizing behavior problems at 18 months and some of infant temperamental dimensions. Infant negative emotionality, which was one of broader temperamental constructs is positively correlated with toddler externalizing problems (r = .27, p < .05). However, among temperamental dimensions under negative emotionality, only distress to limitation (r = .28, p < .05) and fear (r = .23, p < .05) showed positive correlation with toddler externalizing behavior problems. Unlike negative emotionality, surgency was not significantly correlated with externalizing behaviors. Instead, some of its sub-dimensions showed significant association with toddler externalizing problems, but these different temperamental dimensions showed different direction of correlation with toddler externalizing problems. Infant activity level had a positive correlation with externalizing behaviors (r = .26, p < .05) while smiling/ laughter had a negative correlation with toddler externalizing problems (r = -.23, p < .05). In case of regulatory capability, it was negatively correlated with externalizing problems (r = -.26, p < .05). In addition to regulatory capability, its sub temperamental dimensions including infant soothability (r = -.25, P < .05) and cuddliness (r = -.28, P < .05) also had a significant negative correlation with externalizing behavior problems.

Internalizing behavior problems in toddlerhood also have relations with some of infant temperamental traits and maternal behaviors. First, negative emotionality had a negative association with toddler internalizing problems (r = .28, p < .05). Unlike externalizing problems, only fear reached significance in correlation with internalizing behavior problems (r = .29, p < .05). Second, surgency did not showed significant correlation with internalizing behaviors, but smiling/ laughter which was one of sub temperamental dimensions under surgency had a negative correlation with internalizing problems (r = -.23, p <.05). Similar to surgency, regulatory capability was not significantly correlated with internalizing problems; however duration of orienting which was one of lower dimensions under regulatory capability reached significance in a negative correlation with toddler internalizing behavior problems (r = -.29, p < .05).

Toddler externalizing and internalizing behavior problems evidenced association with some of maternal behaviors when infants were 12 months old. Significant correlations were found between externalizing behaviors and all three dimensions of maternal behaviors including maternal responsiveness (r = -.37, p < .01), maternal negativity (r = .31, p < .01) and maternal intrusiveness (r = .35, p < .01). However, only maternal negative behaviors was significantly correlated with internalizing behavior problems in toddlerhood (r = .29, p < .05). Additionally, toddler externalizing behaviors and internalizing problems were highly correlated (r = .61, p < .01).

Correlations between infant temperament and maternal behaviors were not found except few cases. For instance, distress to limitation showed a negative correlation with maternal negative (r = -.25, p < .05) and intrusive behaviors (r = -.24, p < .05). Smiling/ laughter was also positively correlated with maternal responsiveness (r = .34, p < .01).

Some temperamental traits were interrelated. First, negative emotionality was positively correlated with its sub-dimensions including distress to limitation (r = .53, p < .01), fear (r = .75, p < .01), reversal of falling reactivity (r = .49, p < .01) and sad (r = .70, p < .01). Interestingly, negative emotionality also showed positive associations with some of lower temperamental dimensions under surgency including high intensity pleasure (r = .26, p < .05), perceptual sensitivity (r = .43, p < .01) and approach (r = .32, p < .01). Furthermore, negative emotionality was also positively correlated with low intensity pleasure (r = .31, p < .01). On the other hand, sub temperamental dimensions under negative emotionality had different relations with other temperamental traits. Distress to limitation showed significant correlation with sadness(r = 32, p < .01), perceptual sensitivity (r = .34, p < .01) and approach (r = .27, p < .05) while fear had significant associations with sadness (r = .31, p < .01), surgnecy (r = .28, p < .05), high intensity pleasure (r = .28, p < .01) and low intensity pleasure (r = 31, p < .01). Sadness also evidenced significant relations with surgency (r = .48, p < .01), high intensity pleasure(r = 31, p < .01), perceptual sensitivity (r = .59, p < .01),

approach (r = 40, p < .01), vocalizing (r = 26, p < .05), and low intensity pleasures (r = .35, p < .01). Second, surgency showed positive correlation with activity level, smiling/laughter, high intensity pleasure, perceptual sensitivity, approach, vocalization, regulatory capability, duration of orienting, low intensity pleasure; on the other hand, surgency was negatively correlated with cuddliness (r = -.28, p < .05). Sub-dimensions under surgency also demonstrated different correlation with other temperamental traits. Smiling/ laughter was positively correlated with perceptual sensitivity (r = .30, p < .01) and vocalization (r = .55, p < .01). High intensity pleasure showed a positive associations with perceptual sensitivity, approach, vocalization, regulatory capability, duration of orienting, and low intensity pleasure. Infant perceptual sensitivity also correlated with approach, vocalization, regulatory capability and low intensity pleasure. Approach was positively correlated with vocalization, regulatory capability, duration of orienting, low intensity pleasure and sootahbility, but was negatively correlate with cuddliness. Additionally, vocalization also had a negative correlation with cuddliness while showed positive association with regulatory capability, duration of orienting, low intensity pleasure and soothability. Third, regulatory capability also had a positive correlations with its sub-dimensions except cuddliness; significant correlations between regulatory capability and duration of orienting (r = .75, p < .01), low intensity pleasure (r = .73, p < .01) and soothability (r = .64, p < .01) were found. Duration of orienting also

demonstrated significant relations with low intensity pleasure ($r = .45$, $p < .01$) and soothability ($r = .34$, $p < .01$).

Table 4. *Correlations among Infant Temperament, Maternal Behaviors and Toddler Behavior Problems*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.	NE	-	.53**	.73**	.49**	.70**	.36**	.21	-.07	.26*	.49**	.32**	.15	.16	.03	.31**	.07	-.10	.02	.09	-.07	.27*	.28*
2.	Dis		-	.16	.09	.32**	.20	.13	-.17	.19	.34**	.27*	-.10	.12	.02	.17	.10	-.08	.08	-.25*	-.24*	.28*	.19
3.	Fear			-	.12	.31**	.28*	.20	-.09	.28*	.20	.22	.18	.23	.06	.31**	.12	-.03	.00	.16	.04	.23*	.29*
4.	Fall(r)				-	.16	-.08	.07	-.05	-.18	.01	-.10	.00	-.21	-.07	-.16	-.11	-.09	.03	.02	-.08	.00	.04
5.	Sad					-	.48**	.12	.08	.31**	.59**	.40**	.26*	.18	.05	.35**	.04	-.12	-.06	.20	-.04	.22	.18
6.	SUR						-	.27*	.49**	.66**	.73**	.77**	.69**	.46**	.34**	.66**	.15	-.28*	.17	.08	-.05	.10	.05
7.	Act							-	-.13	-.16	.09	.03	.08	-.09	-.04	-.10	-.08	.05	.16	.08	-.10	.26*	.22
8.	Sm								-	.10	.30**	.17	.55**	.09	.12	.17	.04	-.16	.34**	-.22	-.13	-.23*	-.29*
9.	High									-	.42**	.66**	.26*	.56**	.37**	.82**	.10	-.18	-.07	.18	-.05	.03	-.04
10.	Per										-	.55**	.38**	.25*	.13	.50**	.01	-.23	.09	-.02	-.04	.06	.11
11.	App											-	.36**	.49**	.33**	.67**	.24*	-.28*	.04	.16	.04	.14	.04
12.	Voc												-	.29*	.30**	.27*	.24*	-.27*	.17	.04	.03	-.02	.00
13.	RC													-	.75**	.73**	.64**	.18	.15	-.05	-.10	-.26*	-.20
14.	Dur														-	.45**	.34**	-.01	.11	-.07	-.05	-.18	-.29*
15.	Low															-	.23	-.16	.07	.09	-.03	-.06	-.08
16.	Soo																-	-.10	.16	-.14	-.06	-.25*	-.14
17.	Cudd																	-	.04	-.03	-.10	-.28*	-.10

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
18. Mres																		-	-.47**	-.64**	-.37**	-.16
19. Mneg																			-	.48**	.31**	.29*
20. Mint																				-	.35**	.18
21. Ext																					-	.61**
22. Int																						-

Note. NE=negative emotionality; dis=distress to limitation; fall(r)=reversal of falling reactivity; SUR=surgency; act=activity level; sm=smiling and laughter; high=high intensity pleasure; per=perceptual sensitivity; app=approach; voc=vocalization; RC=regulatory capability; dur=duration of orienting; low=low intensity pleasure; soo=soothability; cudd=cuddliness; mres=maternal responsive/ didactic behaviors; mneg=maternal negative behaviors; mint=maternal intrusiveness; ext=externalizing behavior problems; int=internalizing behavior problems

*$p < .05$, two-tailed, **$p < .01$, two-tailed.

The Main Effect of Infant Temperament on Toddler Behavior Problems

In order to investigate whether the infant temperamental traits further contributed to the development of behavior problems in 18 months, we performed a multiple regression analysis. The significant results of the regression analysis for externalizing behavior problems are presented in Table 5. Infants' temperament was significantly related to toddler externalizing behavior problems. Furthermore, some of temperamental dimensions significantly predicted the toddler behavior problems. The overall model significantly explained 56% of the variance of the infant's temperament, R^2 = .59, F (1, 73) = 5.11, p < .00 (see Table 5).

The Infants who showed sadness were more likely to exhibit externalizing behavior problems during toddlerhood (β = .32, t = 2.69, p < .01). Infant fear temperamental trait reached marginal significance in predicting toddler externalizing problems. Infant activity level (β = .78, t = 2.71, p < .01) and approach (β = .71, t = 2.54, p < .01) also significantly predicted toddler externalizing problems at 18 months. Infants who had higher soothability (β = -.92, t = -2.48, p < .05) and cuddliness (β = .76, t = -2.63, p < .05) were less likely to exhibit externalizing behaviors at 18 months. Duration of orienting was marginally significant. None of broader temperamental construct such as negative emotionality, surgency and regulatory capability predicted

externalizing problems in toddlerhood.

Table 5. *A Multiple Regression Analysis of Infant Temperament Predicting Toddler Externalizing Behavior Problems*

Variable	*B*	*SE*	*β*	*t*	*p*
constant	120.04	22.65		5.30	.00
Fear	.15	.08	.19	1.84	.07
Sad	.39	.14	.32	2.69	.01
Act	1.03	.38	.78	2.71	.01
App	1.10	.43	.71	2.54	.01
dur	-.80	.43	-.62	-1.88	.07
Soo	-1.20	.48	-.92	-2.48	.02
cudd	-1.28	.48	-.76	-2.63	.01
$R^2 = .59$, $F = 5.11$ ($p < .00$)					

The results of the regression analysis for internalizing behavior problems are presented in Table 6. The infants' temperament at 12 months significantly explained 40% of internalizing behavior problems at 18 months (F (1, 73) = 2.34, $p < .05$). Although any of higher order temperamental dimensions did not predict the internalizing problems, some of sub-dimensions were found to be significant in predicting internalizing behavior problems in toddlerhood. Infants who scored high in fear tended to exhibit more internalizing behavior problems later (β = .25, t = 2.04, $p < .05$). Infants who got higher scores on smiling/ laughter showed less internalizing behaviors (β = -.71, t = -2.57, $p < .01$). Infant high intensity pleasure trait appeared to be marginally significant. Infants who displayed longer duration of orienting (β = -.97, t = -2.16, $p < .05$), more soothability (β = -.97, t = -2.16, $p < .05$) and cuddliness (β = -.75, t = -2.16, $p < .05$) exhibited lesser internalizing problems at 18 months. We will discuss about these results later in the paper.

Table 6. *A Multiple Regression Analysis of Infant Temperament Predicting Toddler Internalizing Behavior Problems*

Variable	*B*	*SE*	*β*	*t*	*p*
Constant	91.32	22.73		4.02	.00
Fear	.17	.08	.25	2.04	.04
Sm	-1.00	.39	-.71	-2.57	.01
High	-.71	.40	-.69	-1.75	.08
Dur	-1.05	.49	-.97	-2.16	.04
low	-.92	.48	-1.07	-1.92	.06
Soo	-1.05	.49	-.97	-2.16	.04
cudd	-1.05	.49	-.75	-2.16	.04
$R^2 = .40$, $F = 2.34$ ($p < .05$)					

Maternal Behaviors as Moderators in the Relation between Infant Temperament and Toddler Behavior Problems

To examine the impact of maternal behaviors during mother-infant interactions on behavior problems during toddlerhood, a regression analysis was conducted. The results showed that any maternal behaviors did not predict neither externalizing behavior problems nor internal problems. Only maternal negative behaviors were marginally significant to predict internalizing behavior problems.

In the current study, we hypothesized that temperamental traits do not solely influence the development of behavior problems; rather, they may interact with maternal behaviors during infancy. Therefore, we conducted a hierarchical multiple regression analysis to figure out moderating effects of maternal behaviors on the relation between infant temperament and the toddler behavior problems. To minimize any possible multicollinearity, each of the variables and interactions was mean centered. Furthermore, following Baron and Kenny (1986)'s moderator analysis, we performed a series of regression analysis. In the first step, infant temperamental trait, a predictor of a dependent variable was entered. At the second step, we put each maternal behavior, which was a moderator. At the final step, interactional terms between infant temperamental dimension and maternal behavior were computed. There were a number of significant moderating effects of maternal

behaviors on certain infant temperamental dimensions. Maternal behaviors appeared to moderate the relation between infant temperament and toddler externalizing and internalizing behavior problems. The significant results are reported in Table 7-9.

Maternal Responsive Behaviors. First, maternal responsiveness when infants were 12 months old was examined as a moderator of the association between infant temperament and externalizing behavior problems in toddlerhood. As shown in Table 7, there was a significant moderating effect of maternal responsive behaviors in the relation between infant activity level and toddler externalizing behaviors. When interactional term between maternal responsiveness and infant activity level was entered, two variables' interaction significantly influenced toddler externalizing behaviors ($B = .10$, $p < .05$) explaining 31% of the overall model. The significant moderating role of maternal behaviors was further examined by plotting the relation between infant activity level and toddler externalizing behavior problems as a function of mothers' responsiveness (see Figure 1a). Interaction between maternal behaviors and infant temperament was plotted based on the regression coefficients and covariance matrixes estimated in the interaction model. The positive association between infant activity level and toddler externalizing behavior problems became stronger at higher levels of maternal responsiveness (at 1 *SD* above the mean). That is, infants who had higher activity level and experienced higher maternal responsive behaviors, they

tended to exhibit more externalizing problems. On the other hand, infants who had more responsive mothers and showed lower activity level, they were less likely to exhibit externalizing problems compared to infants who experienced lower maternal responsiveness. The result also demonstrated that a significant moderating role of maternal responsive behaviors on infant soothability (B = -.08, $p < .05$) explaining 23% of externalizing behavior problems (see Table 7). To evidence the moderating effect of maternal responsiveness on the infant soothability, we plotted the statistical prediction of toddler externalizing problems influenced by infants' soothability at one standard deviation above and below the mean of maternal responsive behaviors (see Figure 1b). The two-way interaction graph suggested that maternal responsive behaviors enhanced the negative relation between infant soothability and externalizing behaviors during toddlerhood. Therefore, as infants who experienced more maternal responsiveness showed more soothability traits during infancy, they were less likely to exhibit externalizing behavior problems in toddlerhood compared to infants who experienced less maternal responsiveness when they were 12 months old.

For toddler internalizing behavior problems, there were significant moderating effects of maternal responsive behaviors. To investigate further analysis, we plotted the relation between internalizing problems and infant temperament as a function of maternal responsiveness. As shown in Figure 2a, the predisposing effects of fear on the internalizing problems became

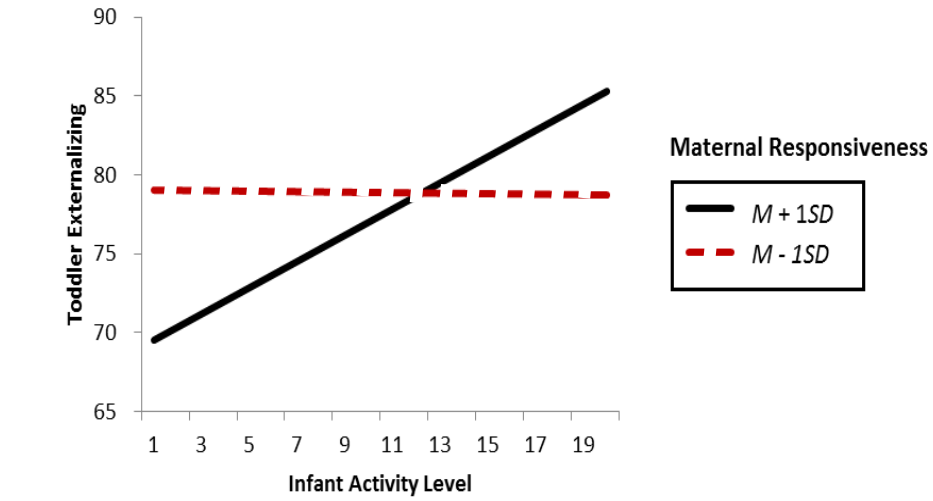
mitigated by maternal responsive behaviors (B = -.05, p < .05). When maternal responsiveness was high, the relation between infant fear and toddler internalizing was weak compared to lower maternal responsiveness. However, when maternal responsiveness was low, infants who were more likely to fear scored high on internalizing problems when they were 18 months old. In addition to fear, maternal responsive behaviors also significantly moderated the association between infant low pleasure seeking trait and toddler internalizing problems (B = -.06, p < .01; see Figure 2b). Infants who had more responsive mothers scored lower on internalizing problems than infants who had less responsive mothers when these infants had more low pleasure temperamental traits. On the other hand, when mother showed less responsive behaviors, more low pleasure seeking infants exhibited more internalizing behaviors in toddlerhood.

Table 7. *A Hierarchical Multiple Regression Analyzing Moderating Effects of Maternal Responsive Behaviors on the Association between Infant Temperament and Toddler Behavior Problems*

Step	Variables	R^2	ΔR^2	B	SE	F
	EXT					
1	Act	.07	.07*	.36*	.15	5.42*
2	Act	.24	.17**	.45**	.14	11.35**
	Mres			-1.21**	.30	
3	Act			.34*	.14	
	Mres	.31	.07*	-1.19**	.29	10.54**
	Act x mres			**.10***	.04	
1	Soo	.06	.06*	-.33*	.15	4.62*
2	Soo	.17	.11**	-.26†	.15	7.28**
	Mres			-1.00**	.32	
3	Soo			-.02	.15	
	Mres	.23	.06*	-1.10**	.31	7.00**
	Soo x mres			**-.08***	.03	
	INT					
1	Fear	.10	.10**	.22**	.08	7.49**
2	Fear	.12	.03	.25**	.08	4.75*
	Mres			-.40	.29	
	Fear			.30**	.08	
3	Mres	.19	.07*	-.52†	.28	5.25**
	Fear x mres			**-.05***	.02	

(Continued Table 7.)

Step	Variables	R^2	ΔR^2	B	SE	F
1	Low	.01	.01	-.07	.10	.52
2	Low	.03	.02	-.07	.10	1.10
	Mres			-.35	.27	
3	Low	.09	.06*	.06	.11	2.30†
	Mres			-.35	.27	
	Low x mres			**-.06***	.03	



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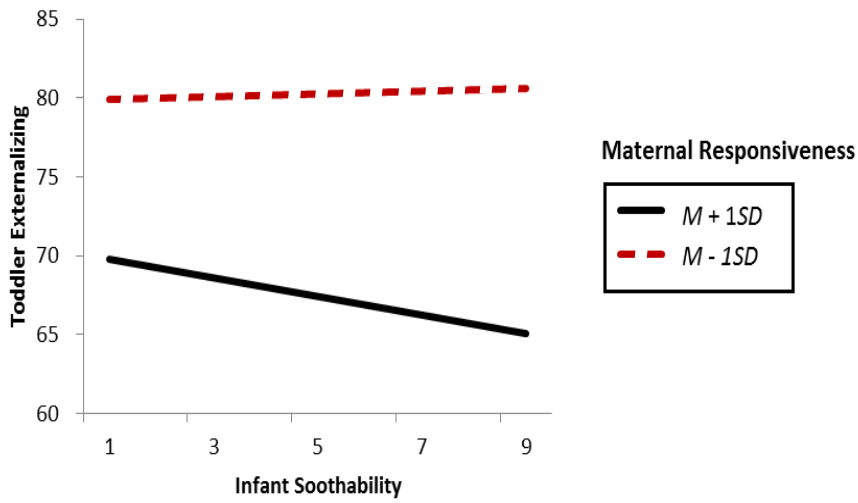

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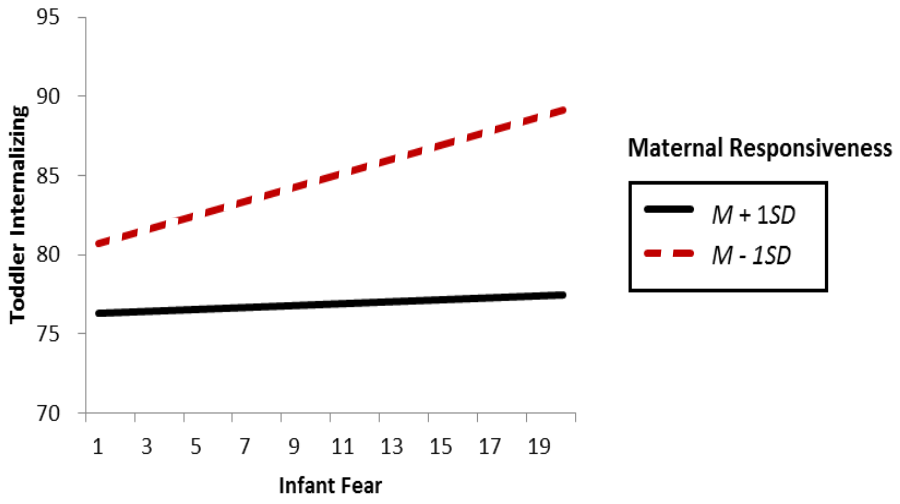
Figure 1. *A Moderating Effect of Maternal Responsive Behaviors on the Association between Infant Temperament and Toddler Externalizing Behavior Problems (Figure 1a. Infant Activity Level, 1b. Infant Soothability)*



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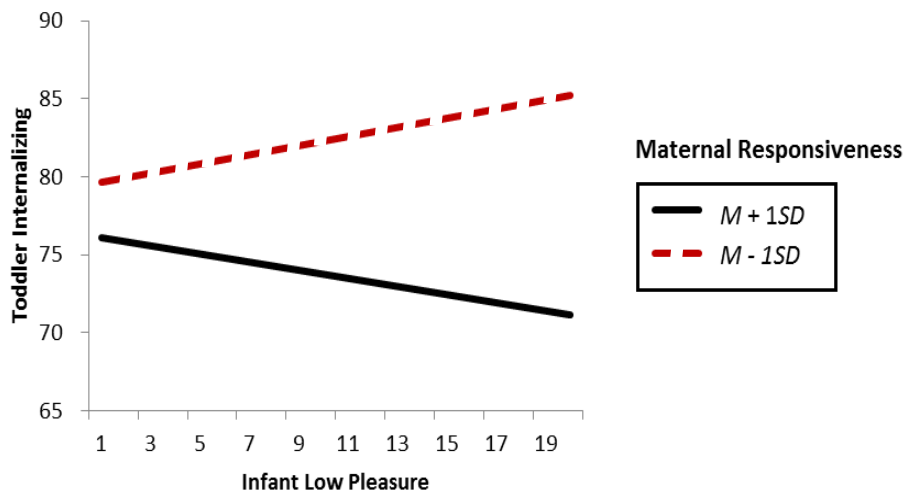

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Figure 2. *A Moderating Effect of Maternal Responsive Behaviors on the Association between Infant Temperament and Toddler Internalizing Behavior Problems (Figure 2a. Infant Fear, Figure 2b. Infant Low Pleasure Intensity)*

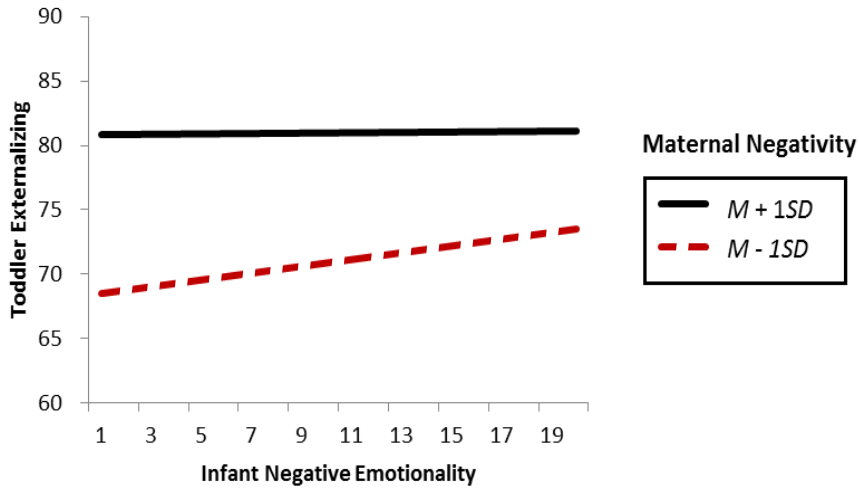
Maternal Negative Behaviors. Next, a moderating role of maternal negative behaviors in the association between infant temperament and toddler externalizing problem is investigated. The result indicated that maternal negative behaviors showed significant moderating effects on both infant negative emotionality (B = -.25, p < .05) and fear (B = -.28, p < .05) in a similar way. These significant interactions were evidenced by plotting the relation between infant temperament and toddler externalizing problems at one standard deviation above and below the mean of maternal negativity (see Figure 3a and 3b). Overall, infants who experienced more maternal negativity showed higher externalizing behaviors than infants who experienced less maternal negative behaviors. However, as infant negative emotionality increases, the effects of negative emotionality on toddler externalizing behaviors became mitigated among infants who experienced more maternal negative behaviors. This pattern appeared to be similar to the moderating effects of maternal negativity on infants' fear, too. The result also suggested that maternal negative behaviors moderated the relation between infant low intensity pleasure and toddler externalizing behaviors (B = -1.01, p < .05).). The maternal negative behavior strengthened the negative relation between infant low intensity pleasure and toddler externalizing problems (see Figure 3c). When infants experienced more maternal negative behaviors and showed less low intensity pleasure, they tended to exhibit more externalizing problems compared to infants who experienced less maternal negativity.

However, if infants had higher temperamental trait of low intensity pleasure and experienced more maternal negative behaviors, they were less likely to show externalizing behaviors than infants who experienced less maternal negativity. These unexpected results are discussed later in the paper.

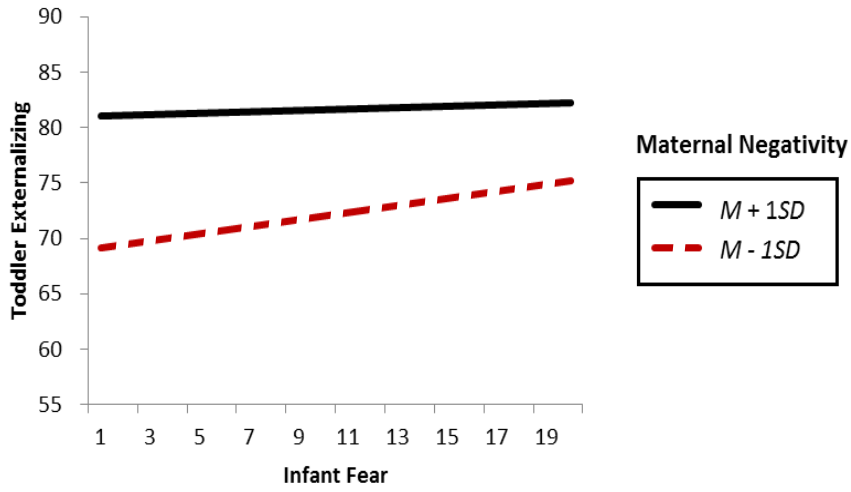
There was a significant role of maternal negative behaviors on the relation between infant fear and toddler internalizing problems (B = -.24, p < .05; see Table 8). For the further examination, we plot the prediction of toddler internalizing problems affected by infants' fear at one standard deviation above and below the mean of maternal negativity (see Figure 4a). Overall infants who experienced maternal negative behaviors at 12 months showed more internalizing problems, but as infants showed more fearful temperamental traits, its effects on internalizing problems seemed to be lessened by maternal negativity. This unexpected result also will be discussed later.

Table 8. *A Hierarchical Multiple Regression Analyzing Moderating Effects of Maternal Negative Behaviors on the Association between Infant Temperament and Toddler Behavior Problems*

Step	Variables	R^2	ΔR^2	B	SE	F
	EXT					
1	NE	.07	.07*	.12*	.05	5.44*
2	NE	.15	.08*	.11*	.05	6.45**
	mneg			8.00*	3.01	
	NE			.10†	.05	
3	Mneg	.21	.05*	13.71**	3.80	6.07**
	NE x neg			**-.28***	.12	
1	Fear	.05	.05*	.19*	.10	4.05*
2	Fear	.13	.08*	.15	.09	5.35**
	mneg			7.75*	3.08	
	Fear			.15	.09	
3	Mneg	.18	.05*	13.28**	4.02	5.17**
	Fear x mneg			**-.28***	.14	
1	Low	.00	.00	-.07	.13	.27
2	Low	.11	.10**	-.10	.12	4.19*
	Mneg			8.79**	3.09	
	Low			-.33*	.16	
3	Mneg	.16	.06*	14.37**	3.94	4.54**
	Low x mneg			**-1.01***	.46	
	INT					
1	Fear	.08	.08*	.19*	.08	6.53*
2	Fear	.14	.06*	.17*	.07	5.86**
	mneg			5.42*	2.46	
	Fear			.16*	.07	
3	Mneg	.19	.06*	10.18**	3.20	5.81**
	Fear x mneg			**-.24***	.11	


90
85
80
75
70
65
60
Toddler Externalizing
1
3
5
7
9
11
13
15
17
19
Infant Negative Emotionality
Maternal Negativity
M + 1SD
M - 1SD

a


90
85
80
75
70
65
60
55
Toddler Externalizing
1
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5
7
9
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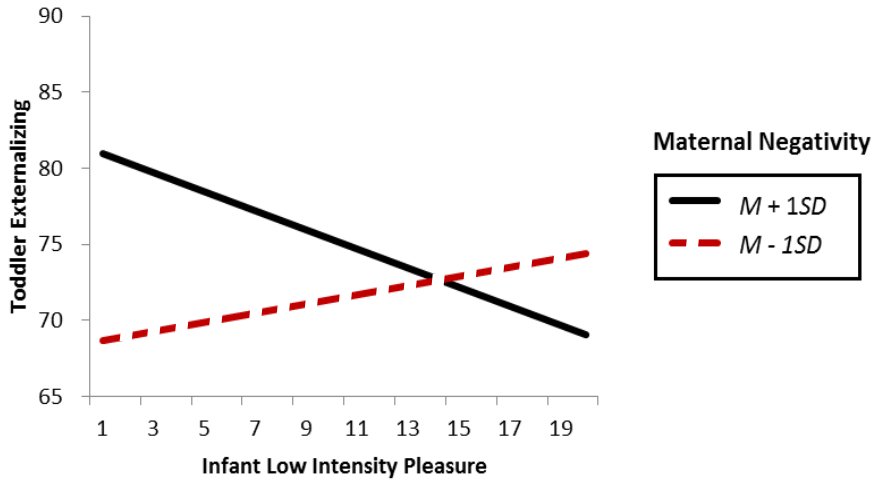
13
15
17
19
Infant Fear
Maternal Negativity
M + 1SD
M - 1SD

b



c

Figure 3. *A Moderating Effect of Maternal Negative Behaviors on the Association between Infant Temperament and Toddler Externalizing Behavior Problems (Figure 3a. Infant Negative Emotionality, Figure 3b. Infant Fear, Figure 3c. Infant Low Intensity Pleasure)*

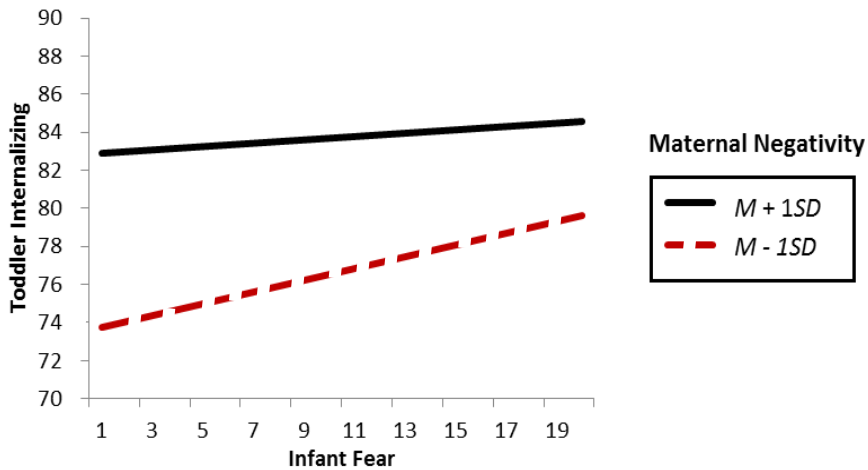


Figure 4. *A Moderating Effect of Maternal Negative Behaviors on the Association between Infant Fear and Toddler Internalizing Behavior Problems*

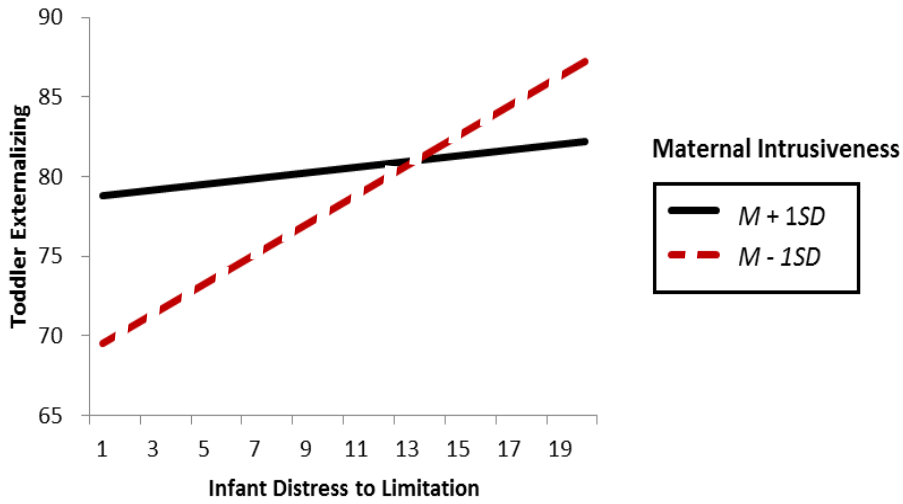
Maternal Intrusive Behaviors. Maternal intrusive behaviors were also examined as a moderator of the relation between infant temperament and externalizing behavior problems in toddlerhood. The significant results were reported in Table 9. The result of the hierarchical regression analysis yielded significant moderating effects of maternal intrusive behaviors on infant distress to limitation (B = -26, p < .01) and activity level (B = -.24, p < .05) in predicting toddler externalizing problems. These significant moderating effects were further demonstrated by plotting the association between toddler externalizing behaviors and infant temperament traits at one standard deviation above and below the mean of maternal intrusive behaviors (see Figure 5a and 5b). Maternal intrusive behaviors interacted with infant distress to limitation and activity level in a similar pattern to influence the development of externalizing behavior at 18 months. Compared to infants who experienced more maternal intrusiveness, infants who scored low on distress to limitation tended to have less toddler externalizing problems when their mother showed more intrusive behaviors. However, when infants who had intrusive mothers scored high on distress to limitation, they tended to show more externalizing behaviors. An effect of infants' activity level on toddler externalizing was also similarly moderated by maternal intrusive behaviors. When infants experienced less maternal intrusiveness, they showed far less toddler externalizing problems with lower activity level. However, when infants became more active, those infants who

had less intrusive mothers were more likely to exhibit externalizing problems in toddlerhood. These results are also discussed in the later part of the present study.

There was a significant a moderating effect of maternal intrusive behaviors on infant soothability in predicting toddler internalizing behavior problems ($B = .20$, $p < .05$). Further explanation was provided by plotting the relation between infant soothability and toddler internalizing problems at one standard deviation above and below the mean of maternal intrusive behaviors (see Figure 6). Infants who had more intrusive mothers generally exhibited more toddler internalizing problems, and infants got worse if they scored high on soothability. On the other hand, infants who had less intrusive mothers showed less internalizing problems. Additionally, as infants scored more on soothability, these infants showed far less internalizing problems in toddlerhood.

Table 9. *A Hierarchical Multiple Regression Analyzing Moderating Effects of Maternal Intrusive Behaviors on the Association between Infant Temperament and Toddler Externalizing Problems*

Step	Variables	R^2	ΔR^2	B	SE	F
	EXT					
1	Dis	.08	.08*	.41*	.17	5.96*
2	Dis	.26	.19**	.57**	.16	12.61**
	Mint			3.82**	.09	
	Dis			.50**	.15	
3	Mint	.33	.07**	3.46**	.88	11.53**
	Dis x mint			**-.26****	.10	
1	Act	.07	.07*	.36*	.15	5.42*
2	Act	.22	.15**	.41**	.14	9.72**
	Mint			3.30**	.91	
	act			.30*	.15	
3	mint	.27	.06*	3.52**	.89	8.61**
	Act x mint			**-.24***	.10	
	INT					
1	Soo	.02	.02	-.16	.13	1.51
2	Soo	.05	.03	-.14	.13	1.86
	Mint			1.19	.80	
	Soo			-.13	.12	
3	Mint	.10	.05*	1.85*	.85	2.70†
	Soo x mint			**.20***	.10	



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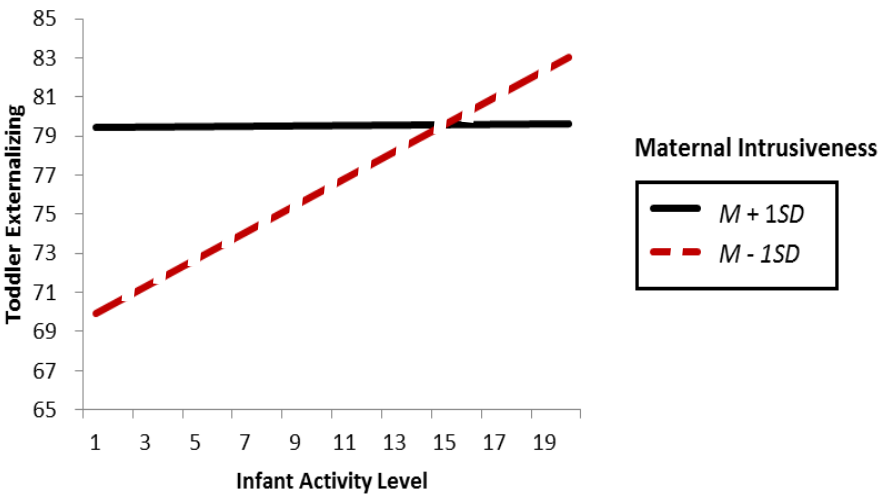

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Figure 5. *A Moderating Effect of Maternal Intrusive Behaviors on the Association between Infant Temperament Toddler Externalizing Behavior Problems (Figure 5a. Infant Distress to Limitation, Figure 5b. Infant Activity Level)*

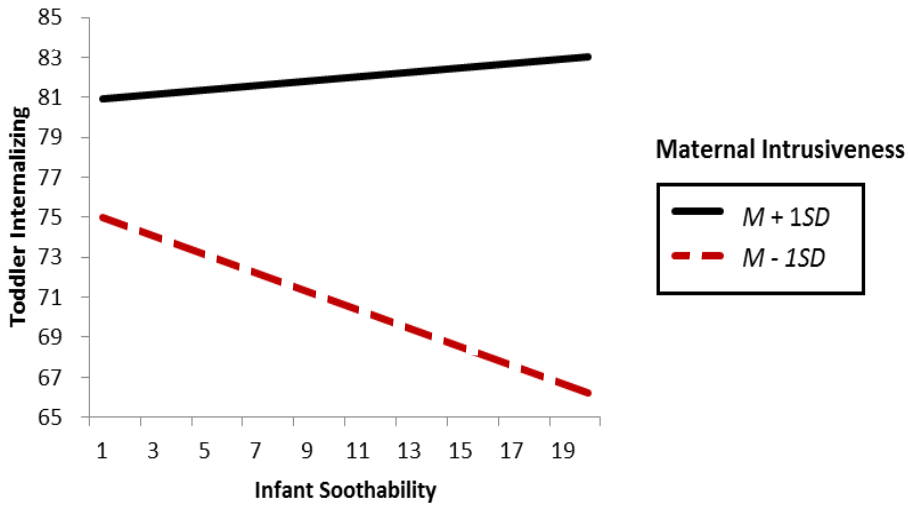

Figure 6. *A Moderating Effect of Maternal Intrusive Behaviors on the Association between Infant Soothability and Toddler Internalizing Behavior Problems*

Discussion

The goal of the current study was to explore the additive effects of various types of infant temperament including broad construct and its fine-grained dimensions on toddler externalizing and internalizing behavior problems. Additionally, this study also aimed to examine the moderating effect of mothers' behaviors on the association between infant temperament and toddler externalizing and internalizing behavior problems. The infant temperament and maternal behaviors were was measured when infants were 12 months old. When these infants became 18 months old, mothers were contacted again and rated their toddlers' externalizing and internalizing problems.

The findings supported direct relationships between some of infant temperament traits and their externalizing behavior problems when they were 18 months old. The results also evidence direct associations between some of infant temperament traits and toddler internalizing behavior problems. Some of maternal behaviors appeared as significant moderators between infant temperament and toddler externalizing behavior problems as well as between infant temperament and internalizing problems.

Infant Temperament and Behavior Problems in Toddlerhood

Unlike most of the earlier research relied on measuring and analyzing broader construct of temperament such as negative emotionality, surgency and regulation capability (Crawford et al., 2011; Gartstein et al., 2012), the current study subdivided these higher order factors into fourteen temperament traits and analyzed each fine-grained dimension. More notably, focusing on fine-grained temperament dimensions as predictors of toddler behavior problems extends previous study on temperament. Regarding to Tackett, Martel and Kushner (2015), analyzing broader constructs of temperament may provide a general notion of risk factors such as genetics and psychobiological effects; on the other hand, examining fine-grained analysis allows researchers to find out more specific developmental paths and behavioral outcomes. In addition to the infant temperament, we also subdivided toddler behavior problems into externalizing and internalizing. This approach may allow us to find more specific paths to the various outcomes in the association between infant temperament and behavior problems.

In the current study, among three of broader temperamental constructs, none of them significantly predicted externalizing behavior problems in toddlerhood. These results were not consistent with previous findings that negative emotionality or surgency influence the development of externalizing

behaviors (Carrasco et al., 2016; Crawford et al., 2011; Gartstein et al., 2012). These findings required further studies on fine-grained approach; it may indicate that sub-dimensions of temperament have different effects on the externalizing behavior development by interacting with maternal behaviors. In the analysis of the fine-grained temperamental dimensions, the functional significance of sadness under negative emotionality, activity level and approach under surgency were found. These results were consistent with previous studies that infants' sadness (Gartstein et al., 2012; Kim & Kwak, 2007), activity levels and approach (Kim & Kwak, 2007; Windle, 1992) had positive associations with the development of externalizing behavior problems. In addition to these traits, some of temperamental sub-dimensions under regulatory capability were newly found to have a negative relationship with toddler externalizing behaviors. Infants who scored high in soothability and cuddliness had fewer problems in toddlerhood. Taken together, these findings suggest that broader temperamental construct may not always represent the whole story of the contribution of temperament to the behavior problems.

Contrary to the hypotheses, negative emotionality did not demonstrate significant contributions to the toddler externalizing behaviors. This result may reflect the varying degrees to which temperamental dimensions under negative emotionality influence the development of behavior problems, and therefore, emphasizes the fine-grained approach. Alternately, early negative

emotionality does not contribute to the development of behavior problems alone; this perspective is consistent with Belsky et al. (1998); they also found no association between negative emotionality and externalizing problems and suggested third variables may interact with temperament in predicting behavior problems. Unlike our expectation, our results did not show a significant role of distress to limitation in predicting externalizing behavior problems. Instead, the current study found that a significant association between infant sadness and externalizing problems. It can be explained by cultural differences. Previous findings with Western samples found that temperamental aspects of distress to limitation and sadness were related to the behavior problems (Eisenberg et al., 2001; Gartstein et al., 2012). These results explains that children who had distress to limitation and sadness tend to experience more rejections by peers and other people, and therefore feel more loneliness and stress; in turn, they develop more behavior problems. Unlike western cultures, eastern cultures may be more permissive to sadness compared to distress to limitation (Muhtadie et al., 2013).

Infant activity level and approach were only significant dimensions under surgency in affecting externalizing behaviors in toddlerhood. These findings explain inconsistent previous findings (Lahey et al., 2008; Putnam & Stifter, 2005). Surgency has both pros and cons. According to Putnam (2015), parts of surgency traits like smiling/ laughter can be beneficial in social relationship by forming bonds with others and attracting social partners,

and also play a protective role in the development of depression. However, these positive affectivity is less likely to be longitudinally stable than other temperament traits (Wachs & Bates, 2010); therefore, in the current study, these temperamental dimensions were not found as significant. On the other hand, some of the traits high intensity pleasure seeking, high activity level and approach in surgency can challenge self-regulatory capability by focusing too much on the goals and stimulation (Zentner & Shiner, 2015); therefore, infants who have these traits are more likely develop behavior problems Additionally, the results found that infant soothability and cuddliness predict later externalizing problems; this result is consistent with previous studies with results (Eisenberg et al., 2001; Eisenberg et al., 2005) and extends previous works by including infant samples.

For internalizing problems, none of three broader temperamental constructs significantly predicted toddler internalizing behavior problems. However, some of fine-grained temperamental dimensions significantly predicted toddler internalizing problems in different ways. Consistent with previous study (Leve et al., 2005), infant who were more fearful tended to have more internalizing problems than infants who were less fearful. It is because fearful infants are not likely to express their emotions and difficulties, and thus, more easily develop internalizing problems. Moreover, fear related traits shares common genes with depression and anxiety (Leve et al., 2005). Infant smiling/ laughter negatively related to toddler internalizing problems;

that is, infants who smile and laugh more exhibited less internalizing problems later compared to infants who smile less. It is consistent with previous findings (Gartstein et al., 2012; Lahey et al., 2008). Unlike externalizing problems, duration of orienting significantly predicted internalizing problems. This result suggest that attentional control, which is one of components under regulation capability, is more related to internalizing problems compared to externalizing problems (Eisenberg et al., 2001). Additionally, infant soothability and cuddliness also affect the development of internalizing problems in toddlerhood. These results indicate that infants who voluntarily control their orienting and inhibit their negative emotions or distress by asking caregivers to soothe or hug are less likely to develop internalizing problems as well as externalizing behavior problems (Eisenberg et al., 2001, 2005). Overall, the results evidenced the role of fine-grained temperament in predicting toddler behavior problems in various ways. Therefore, it is worthwhile to consider the fine-grained temperamental traits instead of merely measuring and analyzing broader construct of temperament.

The Role of Maternal Behaviors: The Moderating Effects of Maternal Behaviors on the Relation between Infant Temperament and Toddler Behavior Problems

The current study found that a moderating effect of maternal behaviors on the association infant temperament and toddler behavior problems. First, there was a significant moderating effects of maternal responsive behaviors on infant temperament in predicting toddler behavior problems. Infants who experienced more maternal responsive behaviors at 12 months exhibited less externalizing problems among less active infants. However, for active infants, as mother showed more responsive behaviors, these infants had more externalizing problems. This finding can be explained by Putnam's (2015) review where he addressed that high levels of activity expressed in highly intense or stimulating context is related to the development of behavior problems, while in the absence of high stimulating situations, this temperamental trait functions as protective factors for maladjustment and as catalysts for better social relationships with others. That is, when infants who showed a higher activity level in the presence of high levels of maternal responsive behaviors, which can be interpreted as high stimulating environments, they would exhibit more behavior problems. On the other hand, infants who are active with mothers of less responsive, which means low levels of stimulating context, would show less behavior problems. This suggestions is further demonstrated by Augustine et al. (2017) that showed active infants exhibited more behavior problems with maternal responsive

behavior in the high stimulating play context while displayed less problems under low stimulating situations. Alternately, beyond certain level of activity may be related to behavior disorders; thus, responsive mothers may recognize these problems more than less responsive mothers. Due to this reason, it is recommended for the future study to assess toddler behavior problems by experimenters rather than mothers. The effects of infant soothability on externalizing behavior problems was also moderated by maternal responsive behaviors. As infants who had a more responsive mother were more soothable, they had less externalizing problems. It is because more responsive mothers provide comforts and needs of infants more easily and appropriately, and more soothable infants can benefit of these maternal behaviors easier than those who are less soothable (Karreman et al., 2009). In addition to externalizing behavior problems in toddlerhood, significant moderating effects of maternal responsive behaviors on the relations between infant temperament and internalizing problems were found. Among fearful infants who experienced more maternal responsiveness at 12 months, their scores on internalizing problems was low. However, when infants had a less responsive mother, they showed more internalizing problems as they were more fearful. It may be because that a more responsive mother provides comforts when infants feel fear or helps them to explore such a fearful situation and overcome it. This explanation can be further supported by Braungart-Rieker, Hill-Soderlund and Karrass' (2010) findings that maternal responsiveness

decrease the rate of infants' fear development. The effect of infant low pleasure seeking traits on internalizing problems was also varied by maternal responsiveness. When mothers are responsive, infants who had low intensity pleasure seeking temperament tends to exhibit less internalizing problems; on the other hand, infants who experienced less maternal responsive behaviors showed more internalizing problems if they had more low intensity pleasure temperamental trait. This result can be construed as meaning that maternal responsiveness buffer the negative effects of low levels of infant low intensity pleasure seeking traits on toddler behavior problems. Infant low intensity pleasure is one of sub-dimensions under regulation capability, and children who are low at regulation have a difficulty in managing the distress and negative emotions (Muhtadie et al., 2013). However, if a mother provides proper strategies and model to deal with such difficulties, infant who are sensitive to low pleasure may be more likely to internalize and learn maternal positive and adaptive behaviors in difficult situations.

Second, maternal negative behaviors function as moderator on the relation between infant temperament and behavior problems. In general, infants who experienced more maternal negative behaviors and scored high in negative emotionality at 12 months exhibited worst results in toddlerhood. These results are consistent with previous studies (Belsky et al., 1998; Stright et al., 2008) and support diathesis-stress hypothesis that as the most negative infants seemed to produce the worst developmental outcomes when they

experienced maternal negative behaviors (Zuckerman, 1999; Barnett & Scaramella, 2015). The relation between infant fear and toddler behavior problem including externalizing and internalizing behaviors was also moderated by maternal negative behaviors. Fearful infants need an appropriate response and support rather than commands or any negative force especially when they are exposed to unfamiliar situations (Karreman et al., 2010). However, if a mother act negatively toward these fearful infants, these fearful infants may feel distressed and be more likely to develop behavior problems. Additionally, these infants may internalize maternal negative behavior when they experienced stress or any difficulties (Karreman et al., 2010); thus, they are more likely develop behavior problems. Infants who were less low intensity pleasure seekers tended to exhibit more behavior problems if they experienced more maternal negativity. However, surprisingly, among infants who scored high in low intensity pleasure, this relation was reversed; when mother behave more negatively, infants showed less toddler behavior problems. This result may be explained by that infants who are able to enjoy low intensity pleasure may be more sensitive to maternal negative behaviors (Gartstein & Rothbart, 2003). Thus, infants who showed low intensity pleasure may show less behavior problems with maternal negativity.

Finally, maternal intrusive behaviors differentiate the association between infant temperament and toddler behavior problems. The effect of infant distress to limitation on toddler externalizing problems was moderated

by maternal intrusiveness. While infants who had a less intrusive mother showed less externalizing problems than infant who had a more intrusive mother, infants who experienced less maternal intrusiveness tend to exhibit more externalizing problems compared to infant who experience more maternal intrusive behaviors. Similar to the association between infant distress to limitation and toddler externalizing behaviors, the relation between infant activity level and externalizing problems at 18 months was also moderated by maternal intrusive. When a mother behaved less intrusively at more active infants, these infants showed more externalizing problems. Infants who showed distress to limitation and activity level were characterized by more goal-oriented and motivated (Kochanska, Aksan, Penney, & Doobay, 2007; Zentner & Shiner, 2015); thus, they tended to exhibit behavior problems when their goals were blocked or they cannot get what they want. Therefore, these infants sometimes may require limits, and parents may intervene them before these infants get to explode; it will teach and guide infants to learn their limits (Augustine, Moding, & Stifter, 2016). For internalizing problems in toddlerhood, maternal intrusive behaviors also moderated the relation between infant soothability and their internalizing behaviors at 18 months. As infants scored high in soothability and had a less intrusive mother, their internalizing problems decreased a lot compared to infants who had a more intrusive mother. This result is consistent with Bates and colleagues' (2015) works which probed children's self-regulatory

capacity may be related to low levels of maternal intrusive behaviors. Bates explains that low maternal intrusiveness may provide infants an optimal environment for the development of internalized self-control (Bates, Pettit, Dodge, & Ridge, 1998). However, higher levels of maternal intrusive behaviors may hinder the infants to initiate exploration and engagement with the situation; this may further prevent infants forming a sense of competence and making them more vulnerable (Bates et al., 2015). That is, maternal intrusive behavior may interrupt development of infants' autonomy, and therefore, infants may develop more internalizing problems.

Overall, these results further extend the mechanism of infant temperament influencing toddler behavior problems as a function of maternal behaviors. When infants get aroused, mothers or caregivers can deal with infants' physiological responses by either providing a proper response or an intrusive behavior. At that same time, infants are able to internalize their maternal behaviors (Bates et al., 2015). Therefore, despite the children's active role in the development, maternal behaviors could affect infants' expressions of temperament, and in turn, it can change the path of the development of behavior problems.

Limitations, Implications and Future Research

Although the current study provides several worthwhile contributions to the literature investigating the etiology of behavior problems in toddlerhood in relation to infant temperament and maternal behaviors, there are several limitations that we should acknowledge and consider in terms of future directions. First, analysis of fine grained traits instead of broader temperamental constructs may reduce the stability of the results (Mervielde & De Pauw, 2015). Second, this study assessed infant temperament and toddler behavior problems by the mothers' report of a questionnaire. Although it is efficient and may be more proper to use questionnaires for the preverbal samples, it has a possibility of response bias. Thus, in future study, it is highly recommended to use observational methods or assess temperament and behavior problems from many informants such as fathers, teachers or other caregivers. Finally, the study sample was relatively small and limited to a certain area in South Korea. Some temperamental dimensions that appeared as significant in association with behavior problems in previous studies did not reach the significance or showed different results from previous studies. It may be a result of the lack of statistical power due to the size of the sample. Also, the bias of sample location may affect these results. Therefore, future research should be replicated with more various samples such as infant living in rural areas in Korea. It would allow researchers to examine more complex relationships between temperament and behavior problems along with

maternal behaviors.

Many gaps exist in the literature regarding how a given kind of parental behaviors may have different implications for temperamentally different children in a different developmental period in predicting behavior problems. The current study fills up parts of these gaps by exploring various maternal behaviors and infants' temperament with very early age samples. The current study provides strong evidence of infants' temperamental role in the development of externalizing and internalizing behavior problems. By acknowledging these findings, infant temperaments as risk factors of later behavior problems can be assessed as early as the end of the first year of life; it allows parents, teachers or clinicians to target infants at risk during earlier period time. Furthermore, the present study showed parental behaviors are able to shape the social behaviors that constitute the phenotype of infant temperament. Examining maternal behaviors during mother-infant interaction according to infants' temperament can help parents learn effective parenting knowledge. Additionally, this knowledge also provides more specific paths of behavior problems in the development, and therefore allows researchers and parents to deal with toddler behavior problems in more specific and efficient ways. For instance, one of findings in the present study showed that maternal responsive behaviors are not the best choice with active and approachable infants; rather, these maternal behaviors cause more problems among infants. This result suggests that not all maternal responsive

behaviors works in a desired directions; thus, researchers and parents should identify infants' specific temperament and provide more proper behaviors that match with infants' temperament even though those behavior might be intrusive. Ultimately, these findings assists teachers, researchers and policy makers in developing prevention, intervention programs for the children's behavior problems. Additionally, recently there were few studies conducted on these issues with various ethnicities in a different culture (Clincy & Mills-Koonce, 2013; Muthadie et al, 2013), but there are almost no studies with Korean samples. The current study evidences possible cultural variation that may exist in Eastern cultures.

References

Achenbach, T. M. (1992). *Manual for child behavior checklist/2-3 and 1992 profile*. Burlington, VT: University of Vermont.

Augustine, M. E., Moding, K. J., & Stifter, C. A. (2016). Predicting toddler temperamental approach-withdrawal: Contributions of early approach tendencies, parenting behavior, and contextual novelty. *Journal of Research in Personality, 67*, 97-105.

Barnett, M. A., & Scaramella, L. V. (2015). Child fear reactivity and sex as moderators of links between parenting and preschool behavior problems. *Development and Psychopathology, 27*, 1179-1190.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173.

Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development II: A functionalist approach to emotions. In Osofsky, J. D. (Ed.), *Handbook of Infant Development (2nd ed.)* (pp. 555-578). Oxford, England: John Wiley & Sons.

Basten, M., Tiemeier, H., Althoff, R. R., van de Schoot, R., Jaddoe, V. W., Hofman, A., ... & van der Ende, J. (2016). The stability of problem behavior across the preschool years: an empirical approach in the

general population. *Journal of Abnormal Child Psychology, 44*(2), 393-404.

Bates, J. E., Pettit, G. S., Dodge, K. A., & Ridge, B. (1998). Interaction of temperamental resistance to control and restrictive parenting in the development of externalizing behavior. *Developmental Psychology, 34*(5), 982.

Bates, J. E., Schermerhorn, A. C., & Petersen, I. T. (2015). Temperament and parenting in developmental perspective. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.425-437). New York: The Guilford Press.

Belsky, J., Hsieh, K. H., & Crnic, K. (1998). Mothering, fathering, and infant negativity as antecedents of boys' externalizing problems and inhibition at age 3 years: Differential susceptibility to rearing experience? *Development and Psychopathology, 10*(02), 301-319.

Berdan, L. E., Keane, S. P., & Calkins, S. D. (2008). Temperament and externalizing behavior: social preference and perceived acceptance as protective factors. *Developmental psychology*, *44*(4), 957.

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*(4), 791.

Broidy, L. M., Nagin, D. S., Tremblay, R. E., Bates, J. E., Brame, B., Dodge,

K. A., ... & Lynam, D. R. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: a six-site, cross-national study. *Developmental Psychology, 39*(2), 222.

Buss, A. H., & Plomin, R. (1975). *A temperament theory of personality development*. Oxford, England: Wiley-Interscience.

Buss, A. H., & Plomin, R. (1984). Theory and measurement of EAS. *Temperament: Early Developing Personality Traits*, 98-130.

Carranza Carnicero, J. A., Pérez-López, J., Del Carmen, G. S., & Martínez-Fuentes, M. T. (2000). A longitudinal study of temperament in infancy: Stability and convergence of measures. *European Journal of Personality*, *14*(1), 21-37.

Carrasco, M. Á., Holgado-Tello, F. P., Delgado, B., & González-Peña, P. (2016). Reactive temperament traits and behavioural problems in children: the mediating role of effortful control across sex and age. *European Journal of Developmental Psychology, 13*(2), 197-212.

Chang, H., & Shaw, D. S. (2016). The emergence of parent–child coercive processes in toddlerhood. *Child Psychiatry & Human Development, 47*(2), 226-235.

Clincy, A. R., & Mills-Koonce, W. R. (2013). Trajectories of intrusive parenting during infancy and toddlerhood as predictors of rural, low-income African American boys' school-related outcomes. *American*

Journal of Orthopsychiatry, 83, 194-206.

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.

Colson, E. R., & Dworkin, P. H. (1997). Toddler development. *Pediatrics in Review*, *18*, 255-259.

Crawford, N. A., Schrock, M., & Woodruff-Borden, J. (2011). Child internalizing symptoms: contributions of child temperament, maternal negative affect, and family functioning. *Child Psychiatry & Human Development, 42*(1), 53-64.

Dyson, M. W., Olino, T. M., Durbin, C. E., Goldsmith, H. H., & Klein, D. N. (2012). The structure of temperament in preschoolers: a two-stage factor analytic approach. *Emotion, 12*(1), 44.

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*(4), 489.

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*(4), 1112-1134.

Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H.,

Valiente, C., ... & Shepard, S. A. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: concurrent relations and prediction of change. *Developmental Psychology, 41*(1), 193.

Eisenhower, A. S., Blacher, J., & Bush, H. H. (2015). Longitudinal associations between externalizing problems and student–teacher relationship quality for young children with ASD. *Research in Autism Spectrum Disorders, 9*, 163-173.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology, 51*(1), 115.

Funamoto, A., & Rinaldi, C. M. (2015). Measuring parent–child mutuality: A review of current observational coding systems. *Infant Mental Health Journal*, *36*(1), 3-11.

Gallitto, E. (2015). Temperament as a moderator of the effects of parenting on children's behavior. *Development and Psychopathology, 27*, 757-773.

Gartstein, M. A., & Rothbart, M. K. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior and Development, 26*(1), 64-86

Gartstein, M. A., Putnam, S. P., & Rothbart, M. K. (2012). Etiology of preschool behavior problems: Contributions of temperament

attributes in early childhood. *Infant Mental Health Journal, 33*(2), 197-211.

Gartstein, M. A., Slobodskaya, H. R., Putnam, S. P., & Kinsht, I. A. (2009). A cross-cultural study of infant temperament: Predicting preschool effortful control in the United States of America and Russia. *European Journal of Developmental Psychology, 6*(3), 337-364.

Harvey, E. A., Breaux, R. P., & Lugo-Candelas, C. I. (2016). Early development of comorbidity between symptoms of attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD*). Journal of Abnormal Psychology, 125*(2), 154.

Hessler, D. M., & Katz, L. F. (2010). Brief report: Associations between emotional competence and adolescent risky behavior. *Journal of Adolescence, 33*(1), 241-246.

Karreman, A., de Haas, S., van Tuijl, C., van Aken, M. A., & Deković, M. (2010). Relations among temperament, parenting and problem behavior in young children. *Infant Behavior and Development, 33*(1), 39-49.

Karreman, A., Van Tuijl, C., Van Aken, M. A., & Dekovic, M. (2009). Predicting young children's externalizing problems: Interactions among effortful control, parenting, and child gender. *Merrill-Palmer Quarterly, 55*(2), 111-134.

Kim, S. & Kwak, K. J. (2007). The relationship of developmental change of temperament and problem behaviors during infancy: early characteristic of temperament and developmental patterns. *Korean Children Journal, 28*(6), 183-199.

Kjeldsen, A., Janson, H., Stoolmiller, M., Torgersen, L., & Mathiesen, K. S. (2014). Externalising behaviour from infancy to mid-adolescence: Latent profiles and early predictors. *Journal of Applied Developmental Psychology, 35*(1), 25-34.

Kochanska, G., Aksan, N., Penney, S. J., & Doobay, A. F. (2007). Early positive emotionality as a heterogenous trait: Implications for children's self-regulation. *Journal of Personality and Social Psychology*, *93*(6), 1054.

Lahey, B. B., Van Hulle, C. A., Keenan, K., Rathouz, P. J., D'Onofrio, B. M., Rodgers, J. L., & Waldman, I. D. (2008). Temperament and parenting during the first year of life predict future child conduct problems. *Journal of Abnormal Child Psychology, 36*(8), 1139.

Larzelere, R. E., Martin, J. A., & Amberson, T. G. (1989). The Toddler Behavior Checklist: A parent-completed assessment of social-emotional characteristics of young preschoolers. *Family Relations*, 418-425.

Lengua, L. J. & Wachs, T. D. (2015). Temperament and risk. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.519-534). New

York: The Guilford Press.

Leve, L. D., Kim, H. K., & Pears, K. C. (2005). Childhood temperament and family environment as predictors of internalizing and externalizing trajectories from ages 5 to 17. *Journal of Abnormal Child Psychology, 33*(5), 505-520.

Loeber, R., Burke, J. D., & Pardini, D. A. (2009). Development and etiology of disruptive and delinquent behavior. *Annual Review of Clinical Psychology, 5*, 291-310.

McFadden, K. E., & Tamis-Lemonda, C. S. (2013). Maternal responsiveness, intrusiveness, and negativity during play with infants: Contextual associations and infant cognitive status in a low-income sample. *Infant Mental Health Journal, 34*(1), 80-92.

Mervielde, I. & De Pauw, S. S. W. (2015). Models of child temperament. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.21). New York: The Guilford Press.

Moore, G. A., Cohn, J. F., & Campbell, S. B. (2001). Infant affective responses to mother's still face at 6 months differentially predict externalizing and internalizing behaviors at 18 months. *Developmental Psychology, 37*(5), 706.

Muhtadie, L., Zhou, Q., Eisenberg, N., & Wang, Y. (2013). Predicting internalizing problems in Chinese children: The unique and interactive effects of parenting and child temperament. *Development*

and Psychopathology, 25(03), 653-667.

Oldehinkel, A. J., Hartman, C. A., De Winter, A. F., Veenstra, R., & Ormel, J. (2004). Temperament profiles associated with internalizing and externalizing problems in preadolescence. *Development and Psychopathology, 16*(2), 421-440.

Olson, S. L., Bates, J. E., Sandy, J. M., & Schilling, E. M. (2002). Early developmental precursors of impulsive and inattentive behavior: From infancy to middle childhood. Journal of Child Psychology and Psychiatry, 43(4), 435-447.

Putnam, S. P. (2015). Positive emotionality. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.114-118). New York: The Guilford Press.

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*(1), 212-226.

Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The Early Childhood Behavior Questionnaire. *Infant Behavior and Development, 29*(3), 386-401.

Rothbart, M. K., & Bates, J. E. (2006). Temperament. In W. Damon, R. Lerner, & N. Eisenberg (Eds.), *Handbook of Child Psychology: Vol. 3. Social,*

Emotional, and Personality Development (6th ed.). New York: Wiley.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development, 72*(5), 1394-1408.

Rothbart, M. K., Derryberry, D., & Posner, M. I. (1994). A psychobiological approach to the development of temperament. In J. E. Bates & T. D. Wachs (Eds.), *Temperament: Individual differences at the interface of biology and behavior* (pp. 83-116). Washington, DC: American Psychological Association.

Schwartz, C. E., Snidman, N., & Kagan, J. (1996). Early childhood temperament as a determinant of externalizing behavior in adolescence. *Development and Psychopathology, 8*, 527-537.

Shannon, J. D., Tamis-LeMonda, C. S., & Cabrera, N. J. (2006). Fathering in infancy: Mutuality and stability between 8 and 16 months. *Parenting, 6*, 167-188.

Shannon, J. D., Tamis-LeMonda, C. S., London, K., & Cabrera, N. (2002). Beyond rough and tumble: Low-income fathers' interactions and children's cognitive development at 24 months. *Parenting: Science and Practice, 2*(2), 77-104.

Sitnick, S., Shaw, D. S., & Hyde, L. (2014). Precursors of adolescent substance use from early childhood and early adolescence: Testing a developmental cascade model. *Development and*

psychopathology, *26*(1), 125.

Stifter, C., & Dollar, J. (2016). Temperament and developmental psychopathology. *Developmental Psychopathology* (pp. 546-593). Oxford, England: John Wiley & Sons.

Stifter, C. A., Putnam, S., & Jahromi, L. (2008). Exuberant and inhibited toddlers: Stability of temperament and risk for problem behavior. *Development and psychopathology*, *20*(02), 401-421.

Strelau, J. & Zawadzki, B. (2015). Activity as a temperament trait. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.84-96). New York: The Guilford Press.

Stright, A. D., Gallagher, K. C., & Kelley, K. (2008). Infant temperament moderates relations between maternal parenting in early childhood and children's adjustment in first grade. *Child Development*, *79*(1), 186-200.

Tackett, J. L., Martel, M. M., & Kushner, S. C. (2015). Temperament, externalizing disorders, and attention-deficit/hyperactivity disorder. In M. Zentner & R. L. Shiner (Eds.), *Handbook of Temperament* (p.564). New York: The Guilford Press.

Tamis-LeMonda, C. S., Ahuja, P., Hannibal, B., Shannon, J., & Spellmann, M. (2001). *Caregiver-Child affect, responsiveness, and engagement scale (C-CARES).* Unpublished manuscript.

Thomas, A., & Chess, S., & Birch, H. G. (1968). *Temperament and behavior*

disorders in children. New York: New York University Press.

Verhoeven, M., Junger, M., Van Aken, C., Deković, M., & Van Aken, M. A. (2010). Mothering, fathering, and externalizing behavior in toddler boys. *Journal of Marriage and Family, 72*(2), 307-317.

Wachs, T. D. & Bates, J. E. (2010). Temperament. In J. G. Bremner & T. D. Wachs (Eds.), *The Wiley-Blackwell Handbook of Infant Development. Volume 1: Basic Research (2*nd ed.) (pp. 592-622). Malden, MA: Wiley Blackwell.

Windle, M. (1992). Temperament and social support in adolescence: Interrelations with depressive symptoms and delinquent behaviors. *Journal of Youth and Adolescence, 21*(1), 1-21.

Zentner, M., & Shiner, R. L. (2015). *Handbook of temperament*. New York: Guilford Publications.

Zuckerman, M. (1999). *Vulnerability to psychopathology: A biosocial model*. Washington, DC, US: American Psychological Association.

국문초록

영아 기질과 걸음마기 문제행동 간 관련성에 대해서는 많은 연구가 진행되어 왔지만, 다양한 기질의 차원을 세분화하여 살펴본 연구는 매우 드물다. 그리고 무엇보다 이러한 세분화된 영아 기질과 문제행동 간 관계에 대한 엄마 행동의 조절효과를 본 선행연구는 매우 제한적이기 때문에, 영아기 모아 상호작용에서의 엄마의 역할이 아동 특징인 기질과 함께 이후 아동 문제행동발달에 어떠한 영향을 미치는지에 대한 실용적인 정보가 부족하다. 이러한 제한점을 해결하기 위하여 본 연구는 영아기 기질의 하위 차원을 세분화하여 각 기질 특성이 걸음마기 문제행동에 미치는 영향을 알아보았다. 또한, 문제행동을 외현화와 내재적 문제행동으로 분류하여 문제행동 발달의 다양한 경로를 알아보고자 하였다. 그리고 이러한 영아기 질과 걸음마기 문제행동 간의 종단적 관계에서 엄마 행동의 조절효과를 검증하고자 하였다. 이를 위해 서울 경기 지역에 거주하는 12개월 영아-엄마 83쌍을 대상으로 12개월 때의 영아기질을 Infant Behavior Questionnaire-Revised (IBQ-R)을 사용하여 측정하였다. 그리고 영아가 12개월일 때 모아 상호작용 또한 관찰하여, Caregiver-Child Affect, Responsiveness, and Engagement Scale (C-CARES)를 통해 관찰된 엄마 행동(반응적 행동, 부정적

행동, 간섭적 행동)을 코딩하였다. 마지막으로 아동의 문제행동은 영아가 18개월이 되었을 때 Toddler Behavior Checklist (TBC)를 엄마보고를 통해 측정하였다. 연구 결과, 걸음마기 외현화 문제행동 발달에 대한 영아기 기질의 직접적 영향이 종단적으로 확인되었다. 12개월에 기질적으로 슬픔 기질 수준이 높은 영아는 이후 더 많은 외현화 문제를 나타내었고, 좀 더 활동적이고 접근하는 경향의 기질을 보였던 아동도 이후 이러한 문제를 더 많이 보였다. 반면, 12개월에 잘 달래지고 양육자에게 잘 안기는 기질의 영아들은 걸음마기에 적은 외현화 문제행동을 가졌다. 외현화 문제행동뿐만 아니라, 영아기 기질은 걸음마기 내재적 문제행동과도 직접적인 관련이 있었다. 12개월 때 기질적으로 두려움이 많은 영아는 이후 더 높은 내재적 문제행동 점수를 받았다. 반면, 더 많은 미소를 보였던 영아들은 그렇지 않은 아동에 비해 18개월에 내재적 문제행동 점수가 낮았다. 또한, 주의 집중 시간이 길고, 양육자에게 잘 안기는 영아의 기질 또한 유의미하게 낮은 걸음마기 내재적 문제행동을 예측했다. 모아 상호작용에서의 엄마의 행동은 영아기 기질과 걸음마기 문제행동 간 관계를 유의미하게 조절하는 것으로 확인되었다. 더 자세하게, 엄마의 반응적인 행동은 12개월 영아의 활동 수준과 쉽게 달래어 지는 기질의 효과를 조절하여 이후 걸음마기 외현화 문제행동을 유의미하게 예측하였다. 엄마의 부정적인

행동 또한 영아의 부정 정서, 두려움 그리고 낮은 자극 추구 기질과 걸음마기 외현화 문제행동 간 관계를 조절하는 것으로 나타났다. 엄마의 간섭적 행동은 영아의 제한에 대한 고통과 활동 수준이 외현화 문제행동 간 관계를 조절하였다. 영아 기질과 내재적 문제행동 간 관계 역시 엄마의 다양한 행동에 의해 서로 다르게 조절되었다. 먼저 엄마의 반응적 행동은 영아 두려움과 내재적 문제행동 간 관계를 조절하였다. 또한 영아의 낮은 자극 추구와 내재적 관계도 조절하였다. 게다가 엄마의 부정적 행동은 영아 두려움과 내재적 문제행동 간 관계를 조절하였고, 마지막으로 엄마의 간섭적 행동은 영아의 잘 달래지는 기질의 효과를 조절하여 이후 걸음마기 내재적 문제행동을 예측하는 것으로 나타났다. 본 연구 결과는 세분화 된 영아 기질 차원들이 서로 다르게 걸음마기 외현화 및 내재적 문제행동 발달을 예측한다는 것을 보여줌으로써, 세분화 된 기질 연구의 필요성을 다시 한 번 강조한다. 이와 함께, 본 연구는 영아의 세분화된 기질과 다양한 엄마 행동이 함께 걸음마기의 문제행동에 미치는 영향을 실증적으로 확인하였다. 무엇보다 본 연구는 영아의 세분화된 기질 특성과 서로 다른 엄마 행동이 다양한 발달 경로를 가지고 걸음마기 외현화 및 내재적 문제행동으로 이어지는 것을 보여주었다. 이는 특정 기질 특성이 반드시 부정적인 아동 발달로 이어지기보다는 영아 기질에 따라 효과적인

부모 행동은 다양할 수 있으며, 그에 따라 발달적 결과도 상이할 수 있음을 시사하는 것으로 해석될 수 있다. 따라서 영아기 기질을 확인하고 이에 따른 엄마 행동을 조정하는 것은 걸음마기의 외현화 및 내재적 문제행동 발달을 예방하는 데 도움이 될 수 있을 것이다. 결과에 대한 더 자세한 해석과 설명은 논의에서 다루도록 한다.

주요어: 영아 기질, 모아 상호작용, 엄마 행동, 문제행동, 외현화 문제행동, 내재적 문제행동

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