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Temperament-Language Relationships during the First Formal Year of School.

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ABSTRACT

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The purpose of the current study was to investigate temperament-language relationships among school-age children and across a wider variety of SES. Head Start, Pre-K, and Kindergarten classes of 10 elementary schools located in rural Appalachia were sent information about the study and 35 children were consented to participate. Parents completed a short demographic survey and the Child Behavior Questionnaire Very Short Form (CBQ-VSF). Children were administered the Preschool Language Scale-4 (PLS-4). Participants were split into low and high SES groups so associations between the CBQ and PLS-4 scores could be compared at each SES strata. Both reactivity and self-regulation were associated with language outcomes, consistent with prior research. Importantly, socioeconomic status was not found to moderate observed temperament-language relationships, so prior temperament-language research findings do not seem to be an artifact of high SES samples.

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CHAPTER 1

INTRODUCTION

Evidence suggests language delay is one of the most common childhood disabilities (Webster, Majnemer, Platt, & Shevell, 2004) and is frequently associated with behavioral disorders (Carson, Klee, Perry, Muskina, & Donaghy, 1998; Sajaniemi, et al., 2001; Schmitz, Fulker, Emde, & Zahn-Waxler, 2001; Snowling, Adams, Bishop, & Stothard, 2001). More than 50% of children referred to psychiatrists have language difficulties (Cohen, 1996), and children who have receptive language impairments, small productive vocabularies, and limited grammatical skills are noted as having an especially poor prognosis in regards to being at risk for psychiatric disorders and poor social relationships (Beitchman et al., 1996; Clegg, Hollis, Mawhood, & Rutter, 2005). Research indicates that temperament can be a strong predictor for children who may be at an increased risk for language problems (e.g., Dixon & Shore, 1997; Dixon & Smith, 2000). Temperament also has been linked to behavioral disorders (Hirshfeld-Becker et al., 2007), ADHD (Miniscalco, Nygren, Hagaber, Kadesjo, & Gillberg, 2006), mood disorders (Hirshfeld-Becker et al., 2007), and social problems (Rudasill & Rimm-Kaufam, 2009).

Given that both temperament and language delay have been associated with the same kinds of outcomes, researchers have begun to investigate mechanisms common to both domains. To date, however, this research has been fairly limited in scope. For one thing, it has focused primarily on very early childhood, especially infancy and toddlerhood. In addition, extant research has generally restricted its samples to middle to upper class participants. The purpose of this investigation is to address the gap in the literature by addressing these limitations. In

particular, the present study 1) explores the relationship of temperament and language in school-age children and 2) includes low SES to high SES samples.

In the sections that follow, I first review temperament as a theoretical construct and define how I conceptualize it for present purposes. In the course of this review, I address important links between temperament and developmental outcomes in the behavioral, emotional, social, and language domains; paying special attention to how this study addresses gaps in the literature pertaining to temperament-language associations and the potential role of socioeconomic status.

Temperament Overview

Among the most popular contemporary theories of temperament is Rothbart's (1986) neurobiologically based model. In her model, Rothbart characterizes temperament as a "relatively enduring biological makeup of the individual, influenced over time by heredity, maturation, and experience" (p. 356). Rothbart and Bates (2006) suggest that the essence of the various dimensions of temperament can be captured by the umbrella terms of *reactivity* and *self-regulation*. According to Rothbart, reactivity is the responsive predispositions one has to the environment, and self-regulation reflects processes, among other things, involved in activating or inhibiting reactivity.

Reactivity

Reactivity manifests across emotional, cognitive, physical, and/or verbal domains. Indeed, temperament researchers use a variety of descriptors to indicate reactivity, including "easy to startle," "fidgety," or "smiley." But Rothbart and Bates (2006) further split reactivity into two subcategories: negative emotionality and positive emotionality. Although these

categories reference emotionality explicitly, their range of influence is not limited to the domain of emotions (see Figure 1). Negative emotionality, for example, represents anger and frustration, discomfort, falling reactivity and soothability, fear, and sadness. Positive emotionality, in contrast, includes activity level, approach, high intensity pleasure, impulsivity, and smiling and laughter. Operationally, reactivity can be indexed by measures such as latency to respond, duration of response, and intensity of responsiveness and can include looking time, heart rate, and facial displays. Importantly, reactivity is considered more or less an automatic response system present from birth.

Self-Regulation

Self-regulation, in contrast, refers to a child's capacity to volitionally control how she or he reacts to both endogenous and exogenous stimuli and how she or he initiates an intentional action plan. In Rothbart's model, this "effortful control" is represented by dimensions of attentional focusing, inhibitory control, low intensity pleasure, and perceptual sensitivity (see Figure 1). Broad dimensions of temperament reflecting self-regulation in the literature often are identified as executive functioning or executive control, effortful control, or attentional control; however, for present purposes these are synonymous terms that capture the ability to override reactivity and initiate intentional action.

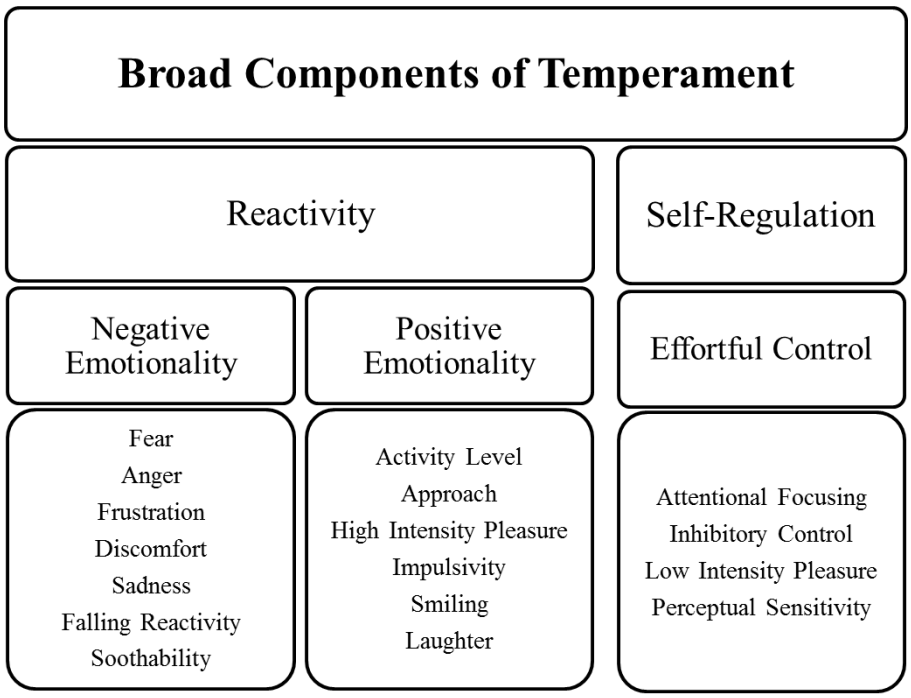

Figure 1. Broad Components of Temperament

Effortful control undergoes considerable development during the first several years of a child's life (Rothbart, Sheese, & Posner, 2007). First emerging during the second half of the first year, the maturation of effortful control is reflected in a child's continuing improvement in asserting voluntary control over his or her behaviors, to inhibit dominant actions such as play with a prohibited toy and to choose a subdominant action such as paying attention to a caregiver's instructions in the presence of the prohibited toy. The development of effortful control is essential for later socialization with peers and compliance with caregiver demands. Children who exhibit lower levels of effortful control tend to have more frequent behavior problems, higher rates of aggression, and associated pathology (Rothbart & Bates, 2006; Rothbart & Posner, 2006). In sum, as effortful control develops, particularly across the latter half of the first year and continuing through the "terrible twos," children become increasingly

capable of inhibiting purely reactive responses such as those engendered by their negative and positive emotionality systems and begin to organize their efforts toward the pursuit of volitional goals established by their self-regulation systems.

Dynamic Interactivity

In Rothbart's conceptualization (Rothbart & Bates, 2006) the relationship between self-regulation and reactivity is a dynamic one. In terms of environmental responsiveness, two children with otherwise equivalently developed self-regulation systems could navigate their environments very differently depending on the relative strengths of their reactivity systems. In principle, it would be harder for a highly reactive child to self-regulate because proportionally more regulatory resources would have to be allocated in the service of regulation than would be the case for the child low in reactivity.

Imagine a scenario with three kindergarten children who are equal in self-regulation but who differ in reactivity. "Jon" has heightened negative emotionality, which manifests in being shy, easily frustrated, and difficult to soothe. "Jennie" has heightened positive emotionality, which manifests in being extremely outgoing, easily engaged, and copiously curious. "Sally," in contrast, is considerably "neutral" in regards to reactivity, exhibited by being less shy, less prone to frustration, and easier to soothe compared to Jon while simultaneously being friendly and pleasant but not excessively so as compared to Jennie. Now imagine a teacher requesting these children to read a book aloud in a group. Jon would have to exercise self-regulation to attenuate his shyness and easy frustration. If his negative emotionality is excessive, he may have to spend considerable self-regulatory effort to subdue his reactivity, the result of which would be fewer available attentional resources to devote to the reading material. Even though Jennie's

description may seem more socially desirable than Jon's, she too would have to exercise self-regulation to attenuate her outspokenness. If her positive emotionality is excessive, she may have to spend corresponding amounts of self-regulatory effort to subdue her reactive tendencies, and she too would have relatively few available resources to devote to the reading material. In contrast, because Sally has few of the same regulatory concerns as Jon or Jennie, she could devote proportionally more attentional resources toward book reading under the same environmental conditions.

Links to Temperament

Because of the dynamically interactive role that individual differences in self-regulation and reactivity may play in predicting children's behavioral responsiveness to their social and physical environments, researchers have become interested in the application of temperament theory to developmental outcomes in a number of developmental domains. Accordingly, there are a variety of studies linking reactivity and self-regulation to behavioral, emotional, social, and language outcomes (see Table 1 in Appendix). Because temperament researchers use an extensive vernacular in reference to various temperament constructs, Table 1 represents an attempt at translating the most pertinent studies' temperament constructs into the general categories of reactivity and self-regulation. As can be seen in most of the studies, developmental outcomes across content areas have been associated with aspects of both temperamental reactivity and self-regulation (e.g., Benson, Cherny, Haith, & Fulker, 1993; Blatny, Jelinek, & Osecka, 2007; Dixon & Salley, 2007; Moller, 1983; Salley & Dixon, 2007; Schor, 1985; Slomkowski, Nelson, Dunn, & Plomin, 1992; Wolfe & Bell, 2007a; Wolfe & Bell 2007b).

Behavioral, Emotional, and/or Social Links

Considerable research has linked infant/toddler temperament to the later emergence of a various behavioral, emotional, and social outcomes (e.g., Guerin, Gottfired, Oliver, & Thomas, 2003; Paterson & Sanson, 1999; Prior, Sanson, Smart, & Oberklaaid, 1999; Prior, Smart, Sanson, & Oberklaid, 2000). Research has shown, for example, that temperamental reactivity and self-regulation predict externalizing behaviors (e.g., Paterson & Sanson, 1999; Van Hecke et al., 2007) including disruptive behavior disorders, oppositional defiant disorder, and comorbid mood disorders (e.g., Guerin et al., 2003; Hirshfeld-Becker et al., 2007), and eating disorders (e.g., Dalle Grave et al., 2007). Research has also shown that reactivity and self-regulation predicts internalizing behaviors such as anxiety and depression (e.g., Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988; Paterson & Sanson, 1999; Prior et al., 2000).

Among the more recently published studies, Hirshfeld-Becker et al. (2007) observed temperament longitudinally from 21 months to 6 years of age in a sample of 284 children. They found that infants' approach, impulsivity in unfamiliar situations, and tendency to seek high intensity pleasure, all components of positive emotionality (reactivity), were significantly predictive of self-regulation, which was, in turn, associated with higher rates of disruptive behavior disorders and comorbid mood disorders. Further, they found that higher rates of disruptive behavior disorders served as a precursor of oppositional defiant disorder. Similarly, Vaughan van Hecke et al. (2007) found that children with higher levels of self-regulation at 12 months were rated as higher in social competence at 30 months. Criteria for social competency included desirable behavior skills such as being agreeable, having interest in others, maintaining

positive interactions with others, being goal oriented, and engaging in self-monitoring. In particular, Van Hecke and colleagues found that infants who initiated and maintained joint attention at 12 months of age had lower ratings of externalizing behaviors at 30 months.

Prior et al. (2000) reported that excessive shyness (reactivity) in childhood was linked to the prevalence of adolescent anxiety disorders by age 14. They concluded that children who are high in negative emotionality may be at risk for developing internalizing disorders by adolescence. Similarly, Moehler et al. (2008) concluded that inhibition (reactivity) around age 2 is a predictor of shyness, social anxiety, and depression. Not only were these characteristics predicted in later childhood but in adolescence and adulthood as well. Furthermore, this research suggests that predictors of internalizing symptomology may be evident as early as 4 months of age. Infants who cried to unfamiliar stimuli at 4 months of age was predictive of higher levels of inhibition at 2 years of age which was predictive of internalizing behaviors persisting into adulthood.

In an applied investigation, Dalle Grave et al. (2007) examined the role of reactivity and self-regulation in the treatment efficacy for eating disorders. Their main finding was that self-regulation was significantly predictive of outcomes of patients with eating disorders. However, they also found that chronic eating disorder patients had significantly higher scores of harm avoidance (reactivity) when compared to recovered patients and controls.

In sum, studies suggest that high levels of reactivity predict internalizing symptomology, while low levels of self-regulation predict externalizing symptomology (Paterson & Sanson, 1999). Based on Rothbart's conceptualization of reactivity and self-regulation, we can postulate a variety of mechanisms for why temperament would be linked to these developmental

outcomes. On the one hand, excessive positive emotionality coupled with low self-regulation, or extreme positive emotionality coupled with average self-regulation, could lead to excessive approach and/or impulsivity. These combinations could facilitate undesirable behaviors such as "temper tantrums", anger outbursts, or aggression as well as contribute to the possible development of externalizing disorders. On the other hand, excessive negative emotionality coupled with low-self regulation, or extreme negative emotionality coupled with average self-regulation, could lead to internalizing disorders such as anxiety and depression. In any case, evidence seems abundant, consistent with Rothbart's model, that the dynamic interplay between self-regulation and reactivity may have some bearing on behavioral, emotional, and social outcomes.

Language Links

Among the first theorists to link reactivity to cognitive outcomes was Bloom (1993). In her research on factors that may contribute to children being "late talkers," Bloom suggested that the excessive presence of both positive and negative affect could interfere with children's ability to process information when attending to novel word-referent mappings. Specifically, she argued that emotionally stable or "neutral affect" children, may have more cognitive energy to devote to language acquisition to the extent that they can fully benefit from a conversational exchange without having to compensate for an excessively positive or negative affect. Although Bloom did not identify this connection as a function of temperament directly, her suggestion of a link between emotional expressivity and cognitive resources reflects Rothbart's conception of reactivity and self-regulation and has been referenced by temperament-language researchers (e.g., Dixon & Smith, 2000).

In the first published study formally linking temperament to language in toddlers, Dixon and Shore (1997) demonstrated a predictive relationship between 13-month measures of temperament and 21-month multiword productivity. They found that infants whose mothers' rated them as able to maintain attention for extended lengths of time, easily soothed, (self-regulation), and able to smile and laugh a great deal (reactivity) by 13 months, had relatively large multiword productive constructions 8 months later (Dixon & Shore, 1997). Similarly, Dixon and Smith (2000) reported that greater adaptability, more positive mood, (reactivity) and greater persistence (self-regulation) at 13 months predicted advanced language productivity at 20 months. Dixon and Smith also found that infants at 7 months who were easily soothed (self-regulation), smiled and laughed a lot (reactivity), and maintained long durations of orientation (self-regulation) tended to have advanced vocabulary comprehension at 7 to 10 months of age.

Dixon and colleagues' results are consistent with the possibility that a combination of higher self-regulation coupled with average to high positive emotionality may be especially conducive to language productivity. Children who need to spend less energy regulating their reactivity, may have more attentional resources to devote to the task of vocabulary development. In the same vein, these children are likely gaining more exposure to word-referent mappings, to the extent that their caregivers are not spending their efforts soothing the child, but rather interacting with him or her. A child who is average to high in positive emotionality may elicit more positive interactions from his or her caregiver by being smiley and easily engaged, but this disposition coupled with the ability to engage in self-regulation not only increases the likelihood that the child will be engaged but increases the chances that he or she will be able to devote his or her attentional control to the interaction as well, thus resulting in a dynamic especially conducive to language productivity.

These studies may be interpreted as incongruent with Bloom's speculations about the harmful effects of positive affectivity on language acquisition. Recall that Bloom theorized that children with excessive positive or negative affect would have fewer attentional resources to allocate to language acquisition, whereas Dixon and colleagues reported a positive correlation between positive emotionality and vocabulary size. It is plausible they are both correct, and that the distinction between the two views is dependent upon positive affect or emotionality being on a continuum and hinging on the degree to which self-regulation is available. In other words, if a child is high in self-regulation and high in positive emotionality, she or he can present as easily soothed, interactive, smiley, attentive, and enjoyable to communicate with thus facilitating language productivity per Dixon and colleagues. However, if a child is excessive in positive affect per Bloom, perhaps she or he is low in self-regulation and/or falls high on the continuum of reactivity thus exhibiting hyperactivity and excessive curiosity that would then require relatively mature self-regulation to override those tendencies, potentially sacrificing resources that could be used for language acquisition.

This idea of self-regulation moderating reactivity has been formally studied. In perhaps the first vocabulary acquisition study designed to tap into the potential role of self-regulation as a moderator of reactivity, Dixon, Salley, and Clements (2006) explored whether environmental distracters could disrupt novel word learning by virtue of their impact on children's abilities to maintain attention to word learning events. In general, Dixon et al. found environmental distractions to negatively impact both nonword- and word-based learning. As well, children performed relatively poorly when interrupted by a sudden-onset distraction regardless of whether they were engaged in word or nonword learning tasks. However, importantly for present purposes, the effects of the distractions depended on children's level of attentional focus.

Children high in attentional focus did not experience the same word-learning decrement in the presence of distractions as children low in attentional focus. Because attentional focus is a property of self-regulation, we may conclude that children higher in self-regulation experienced less of an attentional decrement in response to potentially distracting exogenous stimuli, than those lower in self-regulation, which further supports Rothbart's contention that self-regulation may moderate reactivity.

Addressing a Literature Gap

Despite the growing literature linking temperament to social, emotional, behavioral, and language development, there are several gaps in the literature base. Of particular interest, however, is the relationship between temperament and language as they are both found to be linked to behavioral, emotional, social, and language outcomes. As previously noted, the primary limitations of the literature linking temperament to language development includes a relatively limited focus on the infancy to toddlerhood age range and an almost exclusive reliance on middle to upper class samples (See Table 1 in Appendix).

Language and Formal Education

The fact that research links temperamental characteristics to language development in infants and toddlers has helped shed light on factors common to both domains. Namely, language outcomes may be a product of the extent that children's self-regulatory capacities are capable of moderating their reactivity. But whether these relationships persist throughout later childhood has not been investigated.

As such, one may be especially interested in whether relationships between temperament and language continue as children enter the school setting. As children become more participatory members of the social community other factors linking temperament to language may also become involved. For example, teacher-child relationships may moderate the temperament-language relationships. In this regard, research shows that the relationship between the teacher and child is an important one, and that the quality of such a relationship can actually predict social and academic performance within the educational setting (e.g., Hamre & Pianta, 2001; Rudasill & Rimm-Kaufman, 2009). For example, positive teacher-child relationships seem to predict the highest overall success socially and academically. The mechanisms through with this relationship develops however has only recently been investigated.

According to Rudasill and Rimm-Kaufman (2009) the child's temperament plays a critical role in how many interactions she or he has with the teacher, whether they are positive or negative, self-initiated or teacher-initiated, and whether they result in closeness or conflict with the teacher. More specifically, they found that children with lower levels of effortful control (self-regulation) were more likely to have conflict with teachers while children with higher levels of effortful control enjoyed teacher-child closeness. Children with less shyness (more positive emotionality) initiated contact with their teachers, while children low in effortful control (self-regulation) received more teacher-initiated interactions. It is likely the children with less shyness were able to initiate contact with their teachers that could facilitate a positive social interaction that could improve the child's skills in regards to social and/or academic material. However, the children with lower effortful control likely had more teacher-initiated interactions that consisted of being reprimanded for their behavior and consequently did not yield the same positive social interaction that could have improved social or academic skills.

It is plausible that children experience similar relationship dynamics with their caregivers and peers as what was demonstrated in Rudasill and Rimm-Kaufman's (2009) study. If a child's temperamental characteristics somewhat predetermine how they interact with others, it seems highly likely that their social skills and academic mastery, particularly in the area of vocabulary development and grammar usage, will be impacted. By collecting temperamental data on school age children and assessing their language skills receptively and expressively, we can begin to build a research base that addresses these assumptions.

Socioeconomic Status

One aspect of the temperament-language link that has been systematically neglected throughout the literature has to do with the role of Socioeconomic Status (SES). As can be seen in Table 1, most research linking temperament to language development has focused on samples of middle to high SES research participants. However, there is plenty of reason to believe that learning happens differently for children of different SES strata. Indeed, research linking SES to academic performance is well-documented (e.g., Arnold & Doctoroff, 2003; Lee & Burkam, 2002; Yeung, Linver, & Brooks-Gunn, 2002). For example, research indicates that economically disadvantaged children experience higher rates of delayed letter recognition and phonological sensitivity, acquire language skills more slowly, and are at risk for reading difficulties (Whitehurst & Lonigan, 1998). Furthermore, research suggests that educators often have preconceived attitudes about children based on their SES, and rate low SES students as having less promising futures or academic successes than their higher SES counterparts (Auwarter & Arguete, 2008).

Given that aspects of temperament and SES have both been associated with similar kinds of outcomes, there is reason to believe that temperament and SES may themselves be interrelated. Unfortunately, the extant research linking SES to temperament has been sparse. Sanson, Smart, Prior, Oberklaid, and Pedlow (1994) found that mothers in low SES groups rated their children more often as having "difficult" temperaments. Such "difficult" temperaments were described as being low in self-regulation and being excessively high in negative reactivity. Additional research suggests that low-income mothers have interactions with their children that are more brief and/or rudimentary (e.g., Luster & Vandenbelt, 1999; Vernon-Feagans et al., 2008) thus potentially resulting in perpetuating limited vocabularies and less developed language skills.

Taken together, these studies seem to imply that low SES mothers alter their brief and/or rudimentary interactions with their infants or toddlers based on the child's temperament. For example, if the infant is pleasant to interact with and high in effortful control, even low-income mothers may elaborate more during conversations or story time than those with children who are more challenging to engage (Luster & Vandenbelt, 1999; Vernon-Feagans, et al., 2008).

Accordingly, temperament-language associations may differ as a function of children's SES status. However, a review of the research suggests that it remains an empirical question as to the direction of the moderating effect. Thus, the purpose of the current study is to investigate the moderating effect and determine a more conclusive direction.

Stronger Associations among Low SES Families

On the one hand, it has been argued that families from higher SES strata are in a position to maintain enriched environments that offer protection to their offspring from difficulties

relating to behavioral, emotional, social, or language development (Bradley, Corwyn, McAdoo, & Garcia, 2001). Additionally, research indicates that children of lower SES strata have more "difficult" temperaments than their counterparts (e.g. Prior, Sanson, Carroll, & Oberklaid, 1989). Based on these two pieces of literature, it is possible that SES moderates temperament-language relationships in that the association is greater in magnitude for lower SES children. In other words, because lower SES children collectively have more "difficult" temperaments and do not have the same environmental protective factors as the higher SES group, it is likely that temperament is more strongly associated to language outcomes among the low SES group, as the high SES group's environmental buffers may mediate their temperament-language associations.

Stronger Associations among High SES Families

On the other hand, research also shows that low SES groups have limited access to environmental protectors such as income, education, and social status (e.g. Conger & Donnellan, 2007). This can result in caretakers having to focus on essential needs for their children (food, shelter, etc.) rather than focusing on experiences seen in higher SES groups (extracurricular activities, peer interaction, and the like). So then it is possible that SES might moderate the temperament-language relationship in that the associations among lower SES strata are weaker in magnitude because the hardships regarding income, education, and social status overpower the effect of temperamental dispositions. The current study should offer more insight regarding such issues.

Project Goals and Hypotheses

In sum, the purpose of the current investigation is to: 1) explore the relationship of temperament and language in school-age children, and 2) compare the temperament-language

relationship of low SES to high SES samples. The hypothesis for the first goal is that the relationship of temperament-language will reflect previous studies in that both reactivity and self-regulation will be associated with language outcomes. The subhypotheses for the first goal are 1a) positive emotionality will be associated with positive language outcomes; 1b) negative emotionality will be associated with negative language outcomes; 1c) self-regulation will be associated to language outcomes so that high self-regulation is related positive language outcomes and low self-regulation is related to negative language outcomes. The hypothesis for the latter goal is that SES will moderate temperament-language associations, although the direction of the moderating event remains unclear.

CHAPTER 2

METHODS

Participants

Forty-eight participants were enrolled in the study; however, all 48 participants did not complete every assessment measure given, resulting in varying rates of missing data. Packets sent out to parents assessed the child's age, gender, current year of education, and whether the child had previous exposure to educational experiences outside of the home (N=35 unless noted otherwise). Age ranged from 4 years and 6 months to 7 years and 3 months, yielding a mean age of 5 years and 5 months old. Twenty-two girls (62.9%) and 13 boys (37.1%) were enrolled. Eleven children (22.9%) were currently enrolled in Head Start, 31 children (64.6%) were currently enrolled in Kindergarten, and the current grade for 6 children (12.5%) was not specified. Although children were also recruited from Pre-K, no children from this grade participated in the study. Nineteen children (39.6%) had no prior educational experiences outside of the home; 5 children (10.4%) had previously attended an early learning center or daycare; 21 children (43.8%) had formal educational experiences previously (i.e., child is currently in Kindergarten but attended Head Start or Pre-K in a formal school system the year prior); previous education was not specified for 3 participants (6.3%, N=48).

Demographic data specific to the child's caretaker consisted of even higher rates of missing data (approximately 50% completion rate). Data obtained indicate that the mean age for the mother was 33 years (range of 24 years to 54 years, N=27), and the mean age for the father was 36 years (range of 24 years to 62 years, N=24). Race of the primary care taker was White, Non-Hispanic in 26 cases (54.2%), American Indian or Alaskan Native in 1 case (2.1%), and unidentified in 21 cases (43.8%).

Measures

Socioeconomic Status

SES was assessed via The Pregnancy and Birth Inventory (Salley, Clements, Dixon, & Stanley, 2005). This measure captured demographic information about primary caregivers and siblings in the home. Information collected included age, occupation, annual income, gender, ethnicity, and highest level of education attained. This measure has been used in previous studies assessing temperament-language associations.

SES was calculated by using the algorithm proposed by Ganzeboom, De Graaf, and Treiman (1992) in developing the International Socio-Economic Index of occupational status (ISEI). Age, income, and education were used to derive an estimated socioeconomic index of occupational status, or for our purposes, composite SES. For households with more than one identified caretaker, age, income, and education were averaged before ISEI calculation to get a composite SES score.

Temperament

Temperament was assessed using the Children's Behavior Questionnaire Very Short Form (CBQ-VSF) (Putnam & Rothbart, 2006). The CBQ-VSF comprises 36 items reflecting 11 dimensions of children's temperament and was completed by participating parents. It is applicable for use assessing temperament in children 3 to 8 years of age. The CBQ-VSF is an extracted version of the standard CBQ original version which contains 195 items and has been validated in numerous investigations (e.g. Ahadi, Rothbart, & Ye, 1993; Goldsmith, Buss, & Lemery, 1997; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999). The CBQ-VSF exhibits

acceptable internal consistency and has been deemed efficient for research use when addressing broad dimensions of temperament (Putnam & Rothbart, 2006).

Parents were asked to complete the form based on how they believed their child would respond to a variety of situations and were asked to base their answers on reactions they had observed from their child over the prior 6 months. The questionnaire is in the form of a Likert-scale ranging from 1 to 7, with 1 representing "extremely untrue of your child" and 7 representing "extremely true of your child". Response number 4 is a neutral response that allows the parents to select the situational item as neither true or untrue about the child, whereas the other numbers represent gradients of progression such that 2 is "quite untrue", 3 is "slightly untrue", and so on. Parents may have alternatively circled 'N/A' for any criteria in which they felt they could not appropriately assess their child's reaction.

Reactivity. Children's reactivity was defined as parents' responses to 24 items on the CBQ-VSF (see Table 2). In addition, two aspects of reactivity were identified. First, Negative Emotionality was defined as parents' responses to 12 items, reflecting in particular their responses to items deriving from the temperament dimensions of anger and frustration, discomfort, falling reactivity and soothability, fear, and sadness. Sample Negative Emotionality items included (employing the stem "my child…") "gets angry when she or he can't find something she or he wants to play with," "is afraid of burglars or the boogie man," "is very difficult to soothe when she or he has become upset." Second, Positive Emotionality was defined as parents' responses to 12 items, reflecting their responses to items deriving from the temperament dimensions of activity level, approach, high intensity pleasure, impulsivity, and smiling and laughter. Sample items from this section included "is full of energy, even in the

evening" "likes going down high slides or other adventurous activities," "seems to be at ease with almost any person."

Self-Regulation. Children's self-regulation was defined as parents' responses to 12 items on the CBQ-VSF (see Table 2) that are linked to the temperament subdimensions of attentional focusing, inhibitory control, low intensity pleasure, and perceptual sensitivity. Sample items from this section included "is good at following instructions," "is quickly aware of some new item in the living room," "shows strong concentration when drawing or coloring in a book."

Language Outcomes

Language outcomes were derived from children's scores on the Preschool Language Scale-Fourth Edition (PLS-4) (Zimmerman, Steiner, & Pond, 2002). The PLS-4 is a psychometrically sound instrument (Zimmerman & Castilleja, 2005) that assesses both receptive and expressive language. The PLS-4 targets interaction, attention, vocal and gestural behaviors, literacy, and phonological awareness skills. The instrument is administered in an interactive, game-like fashion and includes manipulatives such as a ball, blocks, cars, and a teddy bear for example.

The PLS-4 is divided into two categories: auditory and expressive. The auditory section assesses the level at which a child processes incoming linguistic information and is based on how the child uses motor activity to respond to questions by pointing or nodding. An item that assesses auditory language may ask the child to point at the cookie on the page or to select which line is longer than another. The expressive section reflects questions within the auditory section but requires the child to verbally communicate his or her response. An item that assesses

expressive language may ask the child to tell a story about his or her pets at home or to describe a picture presented to him/her.

Specific areas addressed by the PLS-4 include language precursors, semantics, structure, integrative language skills, and phonological awareness. Within these areas a variety of indices are addressed: attention; vocabulary; concepts such as quality, quantity, spatial-awareness, and time-sequence; analogies; and rhyming to name a few. The items have been adapted so that the measure can be used on ages from birth to 6 years and 11 months and across both auditory and expressive categories. Because most of the current sample were 4 to 5 years of age, the sections used for assessment targeted more advanced language skills within the domain of morphology, syntax, and phonological awareness for example. Three language competence scores were derived: Auditory Comprehension (AC), Expressive Communication (EC), and a Total Language (TL) score.

Procedure

Children in their first year of formal education in Head Start, preschool, and kindergarten programs from 10 elementary schools located in a rural Northeast Tennessee were targeted for the study. Parents or guardians were provided an informed consent document as well as a cover letter via child-as-courier methodology. The cover letter outlined eligibility requirements for the child (i.e., that the child needs to be in his or her first formal year of school) and allowed the parent to specify how they preferred to be contacted to complete future questionnaires: via mail or phone. Based on their preference, parents were contacted either by mail or phone to complete the questionnaires regarding SES and their child's temperament. Together, these questionnaires took about 30-45 minutes to complete. Once the informed consent document had been received,

a research assistant visited the child's school and administered the PLS-4, which took approximately 30-45 minutes.

Statistical Analysis

A series of planned regression equations were calculated to regress language scores on temperament and composite SES. Each child had three scores of language: Auditory Comprehension (AC), Expressive Communication (EC), and Total Language (TL). The composite SES was dummy coded so that 0 = low SES and 1 = high SES via median split. Temperament was scored to represent three dimensions: positive reactivity, negative reactivity, and self-regulation.

The first regression equation was $y=a+b_1x_1+b_2x_2+b_3(x_1x_2)$, wherein this equation y represented the language outcome measure, x_1 represented positive emotionality and x_2 represented composite SES. The interaction term (x_1x_2) was used to test for whether SES moderated the relationship between positive emotionality and auditory comprehension scores.

The second regression equation was $y=a+b_1x_1+b_2x_2+b_3(x_1x_2)$, wherein this equation y represented the language outcome measure, x_1 represented negative emotionality and x_2 represented composite SES. The interaction term (x_1x_2) tested for whether SES moderated the relationship between negative emotionality and auditory comprehension scores.

The third regression equation was $y=a+b_1x_1+b_2x_2+b_3(x_1x_2)$, wherein this equation y represented the language outcome measure, x_1 represented self-regulation, and x_2 represented composite SES. The interaction term (x_1x_2) tested for whether SES moderated the relationship between self-regulation and auditory comprehension scores.

More than one language outcome measure was calculated (e.g., AC, EC, and TL). Therefore, these three sets of analyses were recalculated to regress each measure of language on temperament and composite SES. This procedure yielded nine regression equations.

CHAPTER 3

RESULTS

Descriptive Statistics

Descriptive statistics were generated for each of the scales used in the study and are arranged by cross-sectional category (i.e., Head Start, Kindergarten, and Total). First, descriptives for the three language outcome variables (auditory comprehension, expressive communication, and total language score) of the PLS-4 are shown in Table 3. These scores reflect the standardized statistics for the PLS-4 (mean score of 100, SD=15). Means and standard deviations for the temperament variables of the CBQ-VSF can be found in Table 4. Data were also collected using the PBSI to elicit information about caregiver education, status, and income. These variables were combined to represent an overall measure of socioeconomic status (composite SES). Means and standard deviations for the individual and composite SES measures can be found in Table 5.

Table 3

Descriptive Statistics for Language Scores across Groups (N=35)

Variable	Head Start		Kindergarten		Total	
	M	SD	M	SD	M	SD
Auditory Comprehension	97.40	17.96	98.70	13.63	97.60	14.02
Expressive Communication	94.30	17.84	101.85	15.05	98.80	15.36
Total Language Score	95.70	17.61	100.30	14.64	98.94	15.88

Table 4

Descriptive Statistics for Temperament across Groups (N=27)

Variable	Head Start		Kindergarten		Total	
	M	SD	M	SD	M	SD
Positive Reactivity	**4.31**	**1.24**	**4.94**	**0.85**	**4.72**	**1.00**
Activity Level	5.15	0.71	4.76	1.22	4.94	1.07
High Intensity Pleasure	4.89	1.64	5.86	1.03	5.53	1.31
Impulsivity	3.81	1.31	4.02	1.29	3.90	1.27
Shyness	3.37	1.77	5.10	1.43	4.48	1.70
Negative Reactivity	**4.98**	**0.94**	**4.17**	**0.44**	**4.45**	**0.73**
Fear	4.44	1.67	3.26	1.65	3.70	1.69
Anger	5.17	1.30	5.09	1.12	5.13	1.14
Discomfort	5.30	1.62	3.67	1.44	4.11	1.69
Sadness	5.19	0.78	4.75	1.04	4.85	0.98
Soothability	4.56	1.70	4.21	1.48	4.41	1.56
Self-Regulation	**4.89**	**0.78**	**5.61**	**0.87**	**5.38**	**0.88**
Attentional Focus	4.19	1.74	5.55	1.27	5.11	1.54
Inhibitory Control	4.22	1.19	5.59	1.19	5.12	1.32
Perceptual Sensitivity	5.59	1.10	5.67	1.18	5.64	1.11
Low Intensity Pleasure	5.56	1.26	5.65	0.85	5.63	0.97

Table 5

Descriptive Statistics for Socioeconomic Status across Groups (N=27)

Variable	Head Start		Kindergarten		Total	
	M	SD	M	SD	M	SD
Composite SES	**4.22**	**0.83**	**4.76**	**1.20**	**4.56**	**1.09**
Education	2.44	0.53	3.15	1.25	2.87	1.09
Status	3.50	2.91	3.65	2.58	3.59	2.59
Income	$9,321	$5,052	$16,605	$14,235	$13,894	$12,063

Inferential Statistics: Correlations

Temperament-Language Zero Order Correlations

Consistent with expectations, Pearson correlational analyses revealed that two of the three temperament superdimensions were associated with language outcomes (see Table 6 in Appendix). Negative reactivity was negatively correlated with auditory comprehension and total language. Self-regulation was positively associated with all three language outcome variables. However, positive reactivity was not significantly associated with any of the language outcomes. The first two associations are consistent with past research regarding temperament and language outcomes (e.g., Dixon & Shore, 1997; Dixon & Smith, 2000).

Temperament-language correlations were also analyzed by temperament subscales (N = 21). One subscale of positive reactivity, shyness, was positively associated with auditory comprehension (r =.47, p <.05). No subscales of negative reactivity were significantly associated with language outcomes. Two subscales of self-regulation were positively associated with language outcomes. Attentional focus was associated with auditory comprehension (r = .49, p < .05) and total language score (r = .49, p < .05). Inhibitory control was associated with

all three language outcomes: auditory comprehension ($r = .49$, $p < .05$), expressive communication ($r = .53$, $p < .05$), and total language ($r = .53$, $p < .05$).

Temperament-SES Correlations

Exploratory correlations between the individual and composite SES variables and the temperament and language measures indicated that composite SES was positively associated with self-regulation (see Table 6 in Appendix). However, this association was primarily driven by total household income because neither educational attainment nor employment status was significantly associated with temperament. Income was positively associated with self-regulation.

The individual and composite SES variables were also analyzed by temperament subscale. Two subscales of self-regulation were positively correlated with SES variables. Inhibitory control was associated with all SES variables: composite SES ($r = .55$, $p < .01$), educational attainment ($r = .39$, $p < .05$), job status ($r = .42$, $p < .05$), and household income ($r = .44$, $p < .05$). Perceptual sensitivity was associated with only household income ($r = .50$, $p < .01$). No other SES-temperament associations achieved statistical significance.

SES-Language Correlations

Associations between the SES variables and language outcomes were also evaluated by correlational analysis (see Table 6 in Appendix). Job status was the only SES measure associated with language outcome. Specifically, job status was positively correlated with expressive communication and total language.

Inferential Statistics: Multiple Regressions

Nine moderated regressions were analyzed. Each dependent variable (auditory comprehension, expressive communication, and total language) was regressed on each of the predictor variables (positive reactivity, negative reactivity, and self-regulation), the moderator variable (composite SES), and the interaction term (predictor of interest x moderator). Significant main effects can be found in Tables 7-9 in the Appendix. As can be seen, none of the interactions terms achieved statistical significance, which indicates that no moderating effects were found.

Auditory Comprehension

As can be seen in Column 1 of Tables 7-9, positive reactivity was weakly associated with auditory comprehension in the positive direction. Negative reactivity was significantly associated with auditory comprehension but in the negative direction. Self-regulation was also predictive of auditory comprehension language outcomes in the positive direction.

Expressive Communication

Main effects for expressive communication can be seen in Column 2 of Tables 7-9. Neither positive nor negative reactivity were associated with expressive communication outcomes. Self-regulation was predictive of expressive communication, however.

Total Language

Finally, Column 3 of Tables 7-9 indicates the regression output for total language. Positive reactivity was not predictive of total language scores. Negative reactivity was weakly

associated with total language. Self-regulation was total language scores' strongest predictor with an $\alpha = .01$ level.

CHAPTER 4

DISCUSSION

Temperament-Language in Preschool-Age Children

The two aims of the present investigation were: 1) to explore the relationship between temperament and language in a sample of children entering their first year of formal schooling, and 2) to see if SES moderated these observed temperament-language relationships. The hypothesis for the first aim was that the temperament-language relationships observed in this sample would reflect that observed in previous research, in that both emotional reactivity and self-regulation would be associated with language outcomes (e.g., Dixon et al., 2006; Dixon & Shore, 1997; Dixon & Smith, 2000). More specifically, it was hypothesized that positive emotionality and self-regulation would positively associate with language outcomes, and that negative emotionality would negatively associate with language outcomes. These results were generally obtained.

Positive Reactivity

Although the positive reactivity superdimension was not significantly correlated with the language outcome measures, the shyness subdimension of positive reactivity was significantly correlated with auditory comprehension. Thus, children rated by their parents as low on the shyness dimension also tended to have high auditory comprehension scores. This finding corroborates prior research that found children who were low on dimensions reflecting smiling and laughter tended to have delayed language comprehension skills (e.g., Dixon & Shore, 1997).

Negative Reactivity

The negative reactivity superdimension was negatively correlated with both auditory comprehension and total language scores, indicating that children high in negative reactivity (characterized by fear, anger, discomfort, sadness, and unsoothability) tended to have less desirable language outcomes. This finding is also consistent with past research (Dixon & Smith, 2000) and is further consistent with the possibility that children with a negatively reactive temperament are at risk for delays or deficits in language skills, particularly in regards to receptive language. Interestingly, and unexpectedly, although the negative reactivity superdimension predicted language outcomes, none of the individual subdimensions were likewise associated. Perhaps being high on any one of the subdimensions is not as predictive of language outcomes as achieving high scores on a critical mass of subdimensions of negative reactivity overall.

Self-Regulation

The self-regulation superdimension and two of its subdimensions were associated with language outcomes. Whereas self-regulation overall and inhibitory control were associated with auditory comprehension, expressive communication, and total language scores; attentional focusing was associated with auditory comprehension and total language. Again, these findings are generally consistent with previous research (e.g., Dixon et al., 2006). It is interesting that of the three temperament superdimensions, self-regulation appeared most robustly associated with language, to the extent that it was the only superdimension that was correlated with all three language outcomes.

Language Outcomes and Summary

Data from the current study suggest that of the three language outcome measures assessed, auditory comprehension, a measure of receptive language, is consistently associated with temperament. Auditory comprehension was statistically impacted by all three temperament predictor variables (positively with positive reactivity and self-regulation; negatively with negative reactivity). In contrast, expressive communication was associated only with self-regulation.

Recall that in the PLS-4 auditory comprehension reflects the degree to which children process linguistic information and also reflects how the children use motor activity to respond to questions by pointing or nodding. An auditory comprehension test item may have children point at a cookie on the page or select which object appears larger in a given picture. It was performance on these kinds of items that was most robustly associated with all three superdimensions of temperament. On the other hand, the PLS-4 expressive communication measure, which was primarily associated with self-regulation, prompted participants to verbally communicate their responses to test items. An item that assessed expressive language may have instructed children to tell a story about their pet or to repeat phrases after hearing them read by the test administrator.

The relationships reported among temperament superdimensions and auditory comprehension were consistent with previous research and the hypothesis for this study. Yet, that the same relationships were not also consistent for expressive communication was unanticipated. Mechanisms explaining the different associations among temperament superdimensions and specific types of language skills (i.e., auditory versus expressive) were not

formally investigated in this study; however, some postulations come to mind. One, the recurring associations between auditory comprehension and temperament dimensions may suggest that temperament's effect is most directly linked to children's ability to process incoming linguistic information. Two, because the expressive communication measure was administered to participants after the auditory comprehension measure, it is plausible that as assessment time increased so did participants' levels of disinterest, distractibility, or inattention. Because one's self-regulation would have to attempt to override these challenges, it would make sense why self-regulation resulted as the most predictive temperament measure for expressive communication. Future studies could alter the order of assessment administration to determine to what degree this postulation might be accurate.

Temperament-Language Links and SES

The hypothesis of the second aim was that SES may moderate links between temperament and language outcomes. This hypothesis derived from research that found children from different socioeconomic backgrounds tend to experience different academic outcomes (e.g., Arnold & Doctoroff, 2003; Lee & Burkam, 2002; Yeung et al., 2002); that economically disadvantaged children tend to experience higher rates of delayed letter recognition and phonological sensitivity, acquire language skills more slowly, and are at risk for reading difficulties (Whitehurst & Lonigan, 1998); and that educators often have preconceived attitudes about children based on their SES and rate low SES students as having less promising futures or academic successes than their higher SES counterparts (Auwarter & Arguete, 2008).

Thus, given the research linking SES to language and academic outcomes, the hypothesis for the second aim was that SES would moderate temperament-language associations, although

the direction of the moderating effect was unclear. On the one hand, as noted previously, families from higher SES strata are in a position to maintain enriched environments that offer protection to children from difficulties relating to behavioral, emotional, social, or language development (Bradley et al., 2001) resulting in environmental buffers that may attenuate temperament-language associations. On the other hand, low SES groups have limited access to environmental protectors such as income, education, and social status (e.g. Conger & Donnellan, 2007) resulting in environmental stressors that may overpower any potential effect of temperamental dispositions on language outcomes. However, the hypothesis that SES would moderate temperament-language links was not confirmed. The associations observed between temperament and language did not vary as a function of SES. Thus, for example, positive reactivity and self-regulation were just as strongly predictive of language outcomes among children in the high SES group as they were among children in the low SES group.

Given the small sample size of this study, it is possible that the high and low SES groups may not be statistically different from one another, thus not truly representing a dichotomous group and inhibiting the ability to accurately test for moderation effects. As such, descriptives and independent t-tests were generated post hoc to compare the differences between high and low SES groups categorized in this study (see Table 10). Results indicate that all SES variables (education, status, income, and the composite SES measure) are statistically different between high and low SES groupings. Therefore, the failure to identify a moderating effect of SES does not seem to be an artifact of homogeneity between high and low SES groupings.

The failure to identify a moderating effect of SES is interesting given past research linking SES to academic outcomes; however, knowing that SES does not moderate temperament-language links is an important addition to the literature. This finding helps

externally validate prior temperament-language research which has primarily consisted of higher SES samples. The inclusion of a more diverse SES sample did not significantly change the relationship historically observed among temperament and language, indicating that it is unlikely prior research findings have been an artifact of high SES samples.

Implications of Findings and Future Directions

In sum, it appears that the kinds of associations between temperament and language previously reported in middle- to upper-SES infants and toddlers are also observed among preschool-aged children and among children from a wider range of socioeconomic statuses. Findings from the present study of preschool-aged children extend the infant and toddler literature linking temperament to language. However, efforts toward expanding this line of inquiry need now proceed in at least two main directions. First, the question remains as to how much farther beyond preschool temperament may be linked to language. Targeting older age groups of children may allow different types of language skill sets to be investigated. For example, links between temperament and receptive and productive grammar could be investigated as children matriculate through formal systems of education. Further, targeting older age groups of children may produce a better understanding of how teacher-child relationships may moderate temperament-language relationships.

Second, the question also remains as to possible mechanisms underlying temperament-language links. To be sure, a burgeoning literature has linked temperament to a number of behavioral, cognitive, emotional, and social outcomes (e.g., Dixon et al., 2006; Dixon & Smith, 2000; Dixon & Shore, 1997; Guerin et al., 2003; Paterson & Sanson, 1999; Prior et al., 1999; Prior et al., 2000). Yet, simply demonstrating links between these constructs does not explain

their origin. Rather, to identify mechanisms underlying temperament-language associations, researchers may need to turn to experimental investigations.

For example, recall Dixon et al. (2006). These authors found that environmental distractions negatively impacted both nonword- and word-based learning. Further, children performed relatively poorly when interrupted by a sudden-onset distraction regardless of whether they were engaged in word or nonword learning tasks. Yet, the effects of the distractions depended on children's temperament, specifically, their level of attentional focus. Children high in attentional focus did not experience the same word-learning decrement in the presence of distractions as children low in attentional focus. Thus, it may be that attentional focus is a mechanism underlying temperament-language links. If so, future efforts to manipulate attentional focus, via attention training perhaps, would allow exploration of the effects of attention manipulation on word-learning.

It may very well be that self-regulation (as reflected in attentional focus) is a key component underlying temperament-language links. Recall from Rothbart's model that reactivity is considered more or less an automatic response system present from birth that is often characterized by descriptors like "easy to startle," "difficult to soothe," "smiley," and "fidgety." Self-regulation reflects processes that are, among other things, involved in activating or inhibiting reactivity. Also recall that the relationship between self-regulation and reactivity is a dynamic one (Rothbart & Bates, 2006), meaning that two children with otherwise equivalently developed self-regulation systems could navigate their environments very differently depending on the relative strengths of their reactivity systems. In principle, it would be harder for a highly reactive child to self-regulate because proportionally more regulatory resources would have to be

allocated in the service of regulation, than would be the case for the child low in reactivity—such as in the earlier example of "Jon", "Jenny", and "Sally".

Because self-regulation is believed to attenuate reactivity, its theoretical relationship with language outcomes may be more strongly indicative of temperament-language associations than reactivity per se. Findings from the present study raise the possibility that attentional focusing and/or inhibitory control may play especially central roles in linking temperament to language development and are consistent with other research in which temperament has been linked to language development via attentional mechanisms (e.g., Dixon & Salley, 2007; Todd & Dixon, 2010).

Intervention

If temperament contributes causally to language development, then aspects of temperament that are amenable to external intervention such as self-regulation may provide a means to prevent language delay. Past research supports the notion that certain subdimensions of self-regulation are malleable to external interventions (e.g., Dowsett & Livesey, 2000; Kerns, Eso, & Thompson, 1999; Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005). Studies have shown, for example, that attention training is effective at increasing attentional skills in both typically developing children and those with language difficulties, (e.g., Rueda et al., 2005; Stevens, Fanning, Coch, Sanders, & Neville, 2008). It stands to reason then that interventions tailored to strengthen attentional focus may result in improved language outcomes. This type of reasoning is consistent with The Specific Disabilities Model of child language disorders that posits auditory perceptual deficits such as problems with attention as primary mechanisms through which language development occurs (Paul, 2007).

Although no known studies have examined whether attention training improves language outcomes specifically, Stevens et al. (2008) reported that interventions designed to improve language skills simultaneously improved attention. In their study 20 children (about half with typically developing language, and half with specific language impairment (SLI)) received computerized training designed to improve language skills. Compared to a control group, children who received the training showed significant increases of auditory comprehension scores in addition to increases in the effects of attention. Thus, results from Stevens et al. suggest that attention can be enhanced through 6 weeks of high-intensity training, with commensurate improvements on standardized measures of language. In sum, there is reason to believe future research using such training programs may highlight the potential for intervention strategies with self-regulation as well as offer support to the proposal of attention as a primary mechanism underlying temperament and language. However, it should be noted that attention modulation is only one means to serve as a language intervention from a child language disorders perspective.

Prevention

Because low self-regulation and poor language skills have both been associated with a host of negative clinical outcomes (e.g., Carson et al., 1998; Hirshfeld-Becker et al., 2007; Miniscalco et al., 2006; Rudasill & Rimm-Kaufam, 2009; Sajaniemi, et al., 2001; Schmitz et al., 2001; Snowling et al., 2001), improving children's self-regulatory skills could address a range of problems beyond the domain of language. Further, because temperament can be identified in infancy, assessment of temperament can offer early detection for children who may be at-risk for later language delay and behavioral disorders. Early identification coupled with more

knowledge about interventions to improve self-regulation could be advantageous for primary care providers.

Carey (1989) proposed three levels in which the clinical use of temperament could be applied in pediatric care. Level 1 is comprised of brief and general educational discussions between the clinician and the parent. These discussions could help parents develop a greater awareness about typical pediatric behaviors (i.e., feeding, sleeping, crying, toileting, and communicating) and provide parents with a greater understanding of the kinds of behaviors that may or may not change with time. Level 2 involves identifying a child's individual temperament profile. This information provides both the clinician and the parent with an overview of the child's behavioral style and whether such a style might place the child at risk for maladaptive outcomes such as language delay or socio-emotional behavior disorders. Level 3 is an attempt to influence the temperament-environment interaction as needed. This level is aimed at training parents on alternate ways to manage their child's problem behaviors (i.e., "difficult temperament"). It is at this level that appropriate attention-improving interventions could be introduced.

For example, a pediatrician might work within Level 1 during the first year of a child's life; offering advice and guidance to the parents as needed about common pediatric concerns such as sleeping and feeding. At about the 12-month well-child check, the parents could be mailed a temperament profile survey to be completed and returned to the clinic. The temperament profile could then be scored accordingly in order to begin Level 2 interactions upon the child's next pediatric visit. Level 2 visits would include giving the parents information about their child's temperamental disposition in order to help them anticipate, prevent, and/or treat problems that may be associated with the presented profile (e.g., language delay, externalizing or

internalizing behavior problems). Level 3 could then be initiated as needed to train families how to manage difficult temperamental profiles (i.e., excessively high reactivity coupled with low self-regulation). Such training might encompass the attention-improving interventions previously mentioned, behavior modification protocols, and/or parent training techniques as needed.

Carey and McDevitt (1995) have provided an extensive overview of how temperament has been associated with conditions particularly relevant to pediatric populations. For example, temperamental difficulty has been associated with increased rates of accidents (particularly lacerations needing sutures); increased rates of feeding and growth problems such as nonorganic failure to thrive and obesity; colic, sleep disturbances, recurrent abdominal pain, recurrent headaches; low adaptability and high distress in response to illness and to procedures; overuse of medical care; and problems in management of chronic illness and developmental disabilities. Therefore, future research efforts should build on this literature and investigate the feasibility and effect of incorporating temperamental profiling into pediatric visits as a means for prevention and tailoring treatment protocols.

Limitations

Although the present study expands the temperament-language literature, results should be interpreted with caution due to study limitations. For example, participant recruitment and retention posed a considerable challenge. Although 900 families from 10 different schools were sent letters explaining the study and soliciting involvement, only 48 families responded with signed consent forms. Of the consented families, only 35 actually completed any measures pertaining to the study. This attrition rate may have resulted for a variety of reasons. One such

reason is that letters were sent home towards the end of the school year. A combination of end-of-the-year testing, scheduled classroom parties, and anticipation of summer could have played a role in deterring families from participating in a research study late in the school year as it would require their child to miss a portion of class time and the parent to fill out several documents. Another reason for the small sample might have been because most of the schools used were located in rural areas and have not been targeted regularly for data collection, so unfamiliarity with research participation might have been an additional deterrent.

Another possible limitation is that temperament ratings were collected from only one source: parents. It may prove useful in the future to collect temperament ratings by more than one method. This could be completed by collecting temperament ratings from school teachers as well as from parents and by allowing parents who live separately to complete separate temperament measures as well.

Conclusion

Consistent with expectations, both reactivity and self-regulation were associated with language outcomes. Self-regulation seems to have the strongest relationship across all language outcomes. Importantly, socioeconomic status was not found to moderate observed temperament-language relationships, so prior temperament-language research findings do not seem to be an artifact of high SES samples.

Several future research aims have been recommended. Understanding to what degree temperament may be linked to language beyond preschool age may allow different types of language skills to be explored. Increasing empirical focus on mechanisms underlying temperament and language, particularly attentional focus, is needed. Investigating in what ways

self-regulation may be malleable to external interventions may provide useful intervention and prevention implications. Further, translating research on temperament to inform clinical practice is also recommended—specifically in regards to pediatric primary care. Future directions should also include replications of this study with its limitations addressed.

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APPENDIX: Supplemental Tables

Table 1

Reactivity and Self-Regulation: Translating Previous Research Vernacular

Authors	**Outcome Measure**	**Predictor Measure**	**Temperament Domain**	**SES of Study Participants**
Benson, et al., 1993	IQ	Affect-extraversion Task orientation	Reactivity Self-regulation	Mean education level of parents 14+ years; middle to high SES
Blatny, et al., 2007	Adult personality	Disinhibition	Reactivity	Predominately families with college, graduate, or professional degrees
Dixon & Salley, 2007	Language	Attention	Self-regulation	Lower-middle class status; white, rural, working class families
Dixon & Shore, 1997	Language	Smiling and laugher Soothability Attention	Reactivity “ Self-regulation	unavailable
Dixon & Smith, 2000	Language	Positive affect Adaptability and soothability Mood and smiling Persistence and duration of Orientation Attentional control	Reactivity “ “ Self-regulation “ “	unavailable

Dixon, et al., 2006	Language	Attentional focus	Self-regulation	All but one from two-parent homes; located within university community; median family income of $66,000
Dalle Grave, et al., 2007	Eating disorders	Novelty seeking Reward dependence Cooperativeness Harm avoidance Persistence Self directedness Self transcendence	Reactivity “ “ “ Self-regulation “ “	unavailable
Hirshfeld-Becker et al., 2007	Disruptive behavior disorders; oppositional defiant disorder; comorbid mood disorder	Behavioral disinhibition	Reactivity	unavailable
Moller, 1983	Cognitive-verbal and motor development	Activity Rhythmicity Approach Adaptability Mood Persistence	Reactivity “ “ “ “ Self-regulation	Urban area; otherwise SES unidentified
Salley & Dixon, 2007	Language	Negative affect Joint attention Executive control	Reactivity Self-regulation “	Upper SES; median income $66,000
Schor, 1985	Behavior in the classroom	Adaptability Distractibility	Reactivity “	unavailable

		Rhythmicity Intensity Negative mood Thresholds of response	“ “ “ “	
Slomkowski, et al., 1992	Language	Affect-extroversion	Reactivity	Denver metropolitan area
Van Hecke, et al., 2007	Social Competence Externalizing behaviors	Joint attention	Self-regulation	92% of mothers had college, graduate, or professional degree
Wolfe & Bell, 2007a	Language	Working memory Surgency Inhibitory control Effortful control	Reactivity “ Self-regulation “	Mean education level for parents 16+ years
Wolfe & Bell, 2007b	Working memory	Distress to limitations Approach and anticipation Soothability Duration of orienting	Reactivity “ Self-regulation “	Predominately parents had college degrees

Table 2.

CBQ-VSF Items

Positive Emotionality

1 Seems always in a big hurry to get from one place to another.
4 Likes going down high slides or other adventurous activities.
7 Often rushes into new situations.
10 Seems to be at ease with almost any person.
13R Prefers quiet activities to active games.
16 Likes to go high and fast when pushed on a swing.
19R Takes a long time in approaching new situations.
22R Is sometimes shy even around people s/he has known a long time.
25 Is full of energy, even in the evening.
28 Likes rough and rowdy games.
31R Is slow and unhurried in deciding what to do next.
34R Sometimes turns away shyly from new acquaintances.

Negative Emotionality

2 Gets quite frustrated when prevented from doing something s/he wants to do.
5 Is quite upset by a little cut or bruise.
8 Tends to become sad if the family's plans don't work out.
11 Is afraid of burglars or the "boogie man."
14 When angry about something, s/he tends to stay upset for ten minutes or longer.
17 Seems to feel depressed when unable to accomplish some task.
20R Hardly ever complains when ill with a cold.
23 Is very difficult to soothe when s/he has become upset.
26R Is not afraid of the dark.
29R Is not very upset at minor cuts or bruises.
32 Gets angry when s/he can't find something s/he wants to play with.
35 Becomes upset when loved relatives or friends are getting ready to leave following a visit.

Self-Regulation

3 When drawing or coloring in a book, shows strong concentration.
6 Prepares for trips and outings by planning things s/he will need.
9 Likes being sung to.
12 Notices it when parents are wearing new clothing.
15 When building or putting something together, becomes very involved in what s/he is doing, and works for long periods.
18 Is good at following instructions.
21 Likes the sound of words, as in nursery rhymes.
24 Is quickly aware of some new item in the living room.
27 Sometimes becomes absorbed in a picture book and looks at it for a long time.
30 Approaches places s/he has been told are dangerous slowly and cautiously.
33 Enjoys gentle rhythmic activities, such as rocking or swaying.
36 Comments when a parent has changed his/her appearance.

Table 6

Bivariate Correlations of Study Variables (N=21)

	Auditory	Expressive	Total Communication	Positive	Negative	Self-Regulation	Education	Status	Income	Total SES
Auditory	-									
Expressive	.632**	-								
Total Comm.	.846**	.869**	-							
Positive	.346	.271	.299	-						
Negative	-.503*	-.365	-.458*	-.504**	-					
Self-Reg.	.574**	.536*	.599**	.462*	-.575**	-				
Education	.351	.376	.296	-.098	-.025	.326	-			
Status	.289	.633**	.461*	-.053	-.268	.325	.294	-		
Income	.269	.388	.287	-.025	-.167	.488**	.576**	.611**	-	
Total SES	.241	.212	.185	-.047	-.268	.425*	.600**	.657**	.739**	-

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

Table 7

Positive Reactivity, Socioeconomic Status, and Language Outcomes (N = 20)

	Auditory Comprehension				Expressive Communication				Total Language			
	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2
Block One				0.058				0.045				0.034
Constant	83.46***	14.62	-		86.52***	15.00	-		88.09***	16.19	-	
SES Total	3.37	3.11	0.24		3.02	3.19	0.21		2.82	3.44	0.19	
Block Two				0.190				0.127				0.131
Constant	56.89**	20.88	-		65.15***	22.08	-		63.10**	23.64	-	
SES Total	3.70	2.97	0.27		3.29	3.14	0.23		3.14	3.36	0.21	
Positive Reactivity	5.39*	3.16	0.36		4.34	3.34	0.29		5.07	3.58	0.31	
Block Three				0.190				0.154				0.141
Constant	57.51	58.72	-		107.08*	61.13	-		90.38	66.09	-	
SES Total	3.55	13.43	0.25		-6.74	13.98	-0.47		-3.39	15.11	-0.22	
Positive Reactivity	5.26	12.13	0.35		-4.63	12.62	-0.31		-0.76	13.65	-0.05	
SES Total X Positive Reactivity	0.03	2.81	0.01		2.15	2.92	0.91		1.40	3.16	0.55	

Note: *p< .10, **p <.05, ***p <.01

Table 8

Negative Reactivity, Socioeconomic Status, and Language Outcomes (N =20)

	Auditory Comprehension				Expressive Communication				Total Language			
	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2
Block One				0.058				0.045				0.034
Constant	83.46***	14.62	-		86.52***	15.00	-		88.09***	16.19	-	
SES Total	3.37	3.11	0.24		3.02	3.19	0.21		2.82	3.44	0.19	
Block Two				0.261				0.144				0.212
Constant	136.15***	27.19	-		124.01***	29.81	-		142.03***	30.70	-	
SES Total	1.295	2.981	0.09		1.55	3.27	0.11		0.70	3.37	0.05	
Negative Reactivity	-9.502**	4.276	-4.74		-6.76	4.69	-0.33		-9.73*	4.83	-0.44	
Block Three				0.311				0.243				0.283
Constant	60.37	73.18	-		15.53	78.14	-		43.39	81.63	-	
SES Total	19.47	16.58	1.39		27.57	17.71	1.94		24.36	18.50	1.60	
Negative Reactivity	7.89	16.17	0.39		18.13	17.27	0.89		12.91	18.04	0.59	
SES Total X Negative Reactivity	-4.21	3.78	-1.34		-6.03	4.03	-1.88		-5.48	4.21	-1.59	

Note: *p< .10, **p <.05, ***p <.01

Table 9

Self-Regulation, Socioeconomic Status, and Language Outcomes (N = 20)

	Auditory Comprehension				Expressive Communication				Total Language			
	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2	Unstandardized B	(SE)	β	R^2
Block One				0.058				0.045				0.034
Constant	83.46***	14.62	-		86.52***	15.00	-		88.09***	16.19	-	
SES Total	3.369	3.11	0.24		3.02	3.19	0.21		2.82	3.44	0.19	
Block Two				0.334				0.293				0.380
Constant	49.28	17.78	-		53.52***	18.66	-		46.28**	18.76	-	
SES Total	-1.06	3.14	-0.08		-1.26	3.30	-0.09		-2.60	3.31	-0.17	
Self-Regulation	10.30**	3.77	0.61		9.94**	3.96	0.58		12.60***	3.98	0.69	
Block Three				0.354				0.387				0.380
Constant	-20.70	98.44	-		208.50**	97.71	-		61.53	105.41	-	
SES Total	14.57	21.85	1.04		-35.88	21.69	-2.52		-6.01	23.40	-0.39	
Self-Regulation	22.93	17.88	1.37		-18.02	17.74	-1.05		9.85	19.14	0.54	
SES Total X Self-Regulation	-2.77	3.82	-1.65		6.12	3.79	3.58		0.60	4.09	0.33	

Note: *p< .10, **p <.05, ***p <.01

Table 10

Statistics for Socioeconomic Status by High and Low Grouping (N=27)

Variable	Low SES			High SES			t-value
	M	SD	Range	M	SD	Range	
Composite SES	3.64	0.50	3-4	5.54	.52	5-6	-9.693**
Education	2.07	0.43	1-2.5	3.60	.76	3-5	-6.074**
Status	1.91	1.00	1-3.5	6.05	2.20	4-10	-5.846**
Income	$9,487.71	$6,192.44	$0-$19,000	$44,666.15	$22,367.44	$20,000-$95,000	-5.479**

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

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