

ABSTRACT

Title of Thesis: THE ROLE OF EFFORTFUL CONTROL IN
MODERATING THE RELATIONSHIP
BETWEEN TEMPERAMENTAL SHYNESS,
FEARFULNESS, AND INTERNALIZING
BEHAVIORS

Shanyun Zheng, Master of Arts, 2023

Thesis Directed By: Professor Hedwig Teglasi,
Department of Counseling, Higher Education, and
Special Education

Internalizing behaviors, such as anxiety and depression, have frequently been associated with temperament characteristics, specifically Behavioral Inhibition (BI) traits, such as Shyness and Fearfulness. While Effortful Control (EC) has been posited as a potential moderator in the relationship between heightened negative emotionality and Internalizing problems, empirical evidence precisely about BI remains inconclusive. This cross-sectional study investigated the role of Effortful Control and its sub-constructs (Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity) in moderating the relation between Behavioral Inhibition (fear and shyness) and internalizing behaviors in a sample of 130 kindergarteners. The findings indicated that Behavioral Inhibition was significantly correlated with and predicted internalizing behaviors. However, no significant correlations were found between Effortful Control, its sub-constructs, and internalizing behaviors in this sample. Additionally, Effortful Control and its sub-constructs did not moderate the relationship between Behavioral Inhibition and internalizing behaviors.

THE ROLE OF EFFORTFUL CONTROL IN MODERATING THE
RELATIONSHIP BETWEEN TEMPERAMENTAL SHYNESS, FEARFULNESS,
AND INTERNALIZING BEHAVIORS

by

Shanyun Zheng

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Advisory Committee:
Hedwig Teglasi, Ph.D., Chair
Cixin Wang, Ph.D.
Colleen O'Neal, Ph.D.

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Chapter1: Introduction

Temperament refers to the innate and relatively stable emotional and behavioral characteristics of an individual. It is thought to be largely influenced by genetics and biology and is evident in early childhood. Temperament plays an important role in shaping children's behavior, emotions, and interactions with others and therefore, it helps to explain individual differences in behavior and emotional reactivity. For example, some people may be naturally more outgoing and sociable, whereas others may be more introverted and reserved.

Understanding an individual's temperament can help to predict their likely reactions and behaviors in different situations and can also inform the development of interventions and strategies to support their well-being and development. Additionally, temperament plays a crucial role in the development of personality, as it acts as a foundation that shapes the way an individual processes and interprets the world around them. It also plays a role in the development of mental health issues, and in how people cope with stress and adversity.

Overall, understanding temperament can be helpful in many aspects such as parenting, education, mental health and many more fields. By recognizing and understanding the unique characteristics of an individual's temperament, caregivers, educators, and professionals can provide more effective and tailored support to help children thrive and reach their full potential.

In this study, we will focus on exploring the complex interplay between temperamental shyness/fearfulness, effortful control, and internalizing problems in children, with a particular emphasis on the individual components of effortful control. Grounded in the theoretical framework positing that temperament traits, such as shyness and fearfulness, can predispose individuals to internalizing problems, our investigation seeks to understand how individual differences in effortful control may either exacerbate or mitigate these predispositions. By

examining the distinct subconstructs of effortful control, including Attentional Control, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity, this study attempt to gain a more comprehensive understanding of their role in moderating the relationship between behavioral inhibition and internalizing problems, as well as gain a more thorough knowledge of the factors that influence the development of internalizing problems and inform the design of targeted interventions to support children at risk.

Chapter 2: Literature Review

Temperament

Temperament is commonly conceptualized as a collection of biologically determined characteristics that become evident during the early stages of a child's growth and development. These characteristics demonstrate temporal stability and situational consistency, albeit susceptible to modest modifications during a child's developmental process (Rothbart, 2012). Child temperament is postulated to encompass variations in typical behaviors associated with emotions, level of energy, capability to focus, and sensitivity to sensory stimuli. Temperament is related to children's developmental outcomes, including their social functioning, and internalizing as well as externalizing behaviors. For instance, previous research has indicated that children exhibiting elevated levels of behavioral inhibition are more susceptible to developing symptoms of social anxiety and other internalizing problems (Kagan et al., 1988; Schmidt et al., 1997; Schwartz et al., 2012). The manifestation of child temperament becomes apparent throughout the initial years of life and exhibits a notable level of constancy and predictive significance in relation to developmental trajectories (De Pauw & Mervielde, 2012, Rothbart, 2012). Researchers vary in how they conceptualize aspects of temperament, but they all assume a biological basis. For instance, certain studies place emphasis on the emotional aspects of

temperament, while others incorporate regulatory aspects such as attentional qualities and activity level (Fox et al., 2005; Posner & Rothbart, 2007; Thomas & Chess, 1977). Despite the researcher's theoretical perspective, the behaviors that are observed can be attributed to the interplay between an individual's temperament and their surrounding environment.

Consequently, it is crucial to consider the contextual factors when investigating temperament.

Within the realm of child development and temperament research, Mary Rothbart's theory of reactivity and self-regulation is a well-established framework for understanding how children respond to their environment and how this relates to their behavior and development. This model posits that temperament comprises two broad dimensions: reactivity and self-regulation. Rothbart posits that reactivity pertains to the inclination to promptly and intensely react to stimuli present in the surrounding environment, whereas self-regulation pertains to the capacity to govern and manage these responses. Rothbart's theory suggests that reactivity and self-regulation are two interrelated aspects of temperament that work together to influence behavior and development (Gartstein & Rothbart, 2003).

Reactivity

Reactivity pertains to the activation or responsiveness reflexively triggered behavioral and physiological processes in response to environmental stimuli (Rothbart & Derryberry, 1981; Rothbart, Ahadi, & Evans, 2000). The measurement of responsivity can be conducted using several methods, typically relying on factors such as intensity, latency and duration. Reactivity can be categorized into two distinct dimensions: positive reactivity, also known as positive affectivity, and negative reactivity, commonly referred to as negative affectivity. Positive reactivity encompasses inclinations towards vocal reactivity, novel stimuli, high-intensity pleasure responses, and expressions of joy such as smiling and laughing, as well as increased

activity levels. Conversely, negative reactivity pertains to emotional reactions characterized by sadness, distress in the face of limitations or frustration, discomfort and fearfulness (Gartstein & Rothbart, 2003). The aforementioned aspects of reactivity generally manifest during the initial six months of a child's life and exhibit notable consistency over time (Putnam et al., 2008). Reactivity pertains to the manner in which children react to sensory stimuli, encompassing factors such as the time delay in their response and their ability to regulate their response to these stimuli (Fox & Polak, 2004).

Children with high levels of positive reactivity are often described as curious, enthusiastic, and outgoing (Phillips, 2012). They often have a tendency to approach novel situations and individuals with a sense of curiosity and interest, hence displaying a greater inclination towards actively seeking out new experiences and opportunities. Conversely, children with a high degree of negative reactivity exhibit a tendency to approach novel situations with caution, often experiencing fear and subsequently avoiding these circumstances. Children who exhibit low levels of negative reactivity may actively pursue new and risky experiences as a means to achieve a certain emotional state. According to Degnan and Fox (2007), children who possess the ability to regulate their reactivity to novelty are more inclined to cultivate resilience, which in turn facilitates the development of positive social skills while reducing inhibited and nervous behaviors over the course of time.

Self-Regulation

Another important aspect of temperament is regulation, which pertains to the mechanisms that regulate heightened reactivity (Rothbart & Derryberry, 1981). The regulation of reactivity frequently encompasses cognitive processes, such as attentional control, and behavioral processes, such as inhibitory control, which are intentionally and consciously managed. Self-

regulation, which shares similar characteristics, is a cognitive process that involves the ability to regulate one's attention, emotions, and behaviors (Cartwright, 2012). The development of a range of processes, strategies, and skills occurs from infancy and early childhood (Winsler, 2009). The phenomenon of effective self-regulation involves the intricate interaction between cognitive and emotional processes, wherein individuals employ strategies such as distraction in order to mitigate frustration and enhance their ability to engage in goal-directed behavior (Mischel & Ayduk, 2002). Rothbart et al. (2003) assert that the executive anterior attentional network, which is responsible for the formation of effortful regulation, becomes sufficiently operational by the conclusion of the initial year of life. Various factor analytic studies have also indicated that regulation in infancy is composed of multiple nuanced aspects, such as the orientation towards stimuli, the pleasure derived from low-intensity stimuli, the tendency to seek cuddliness, and soothability (Gartstein & Rothbart, 2003; Putnam, Rothbart, & Gartstein, 2008).

The regulatory capacity of children undergoes alterations as they mature, mostly driven by enhancements in attentional regulation and inhibitory control (Bridgett et al., 2011; Gartstein et al., 2013). The development of inhibitory control becomes evident over the period spanning from the first to the second year of life (Rothbart, 1988). As children grow and develop, their capability to regulate their behavior and emotions also changes and improves. This process of increasing regulation is a result of the improvements in attentional regulation and inhibitory control, which are critical skills for healthy development. Research has shown that the development of inhibitory control becomes apparent throughout the period spanning from the first to the second year of life (Rothbart, 1988), and continues to develop throughout childhood and adolescence. This gradual development of inhibitory control allows children to better regulate their behavior and emotions and respond in appropriate ways to different situations.

Additionally, studies have found that increases in attentional regulation and inhibitory control are related to advancements in several domains of development, including social skills and academic achievement (Bridgett et al., 2011; Gartstein et al., 2013). This highlights the importance of these skills for children's overall development and well-being. The developmental process in children involves the acquisition of self-regulatory abilities to manage their reactivity in unfamiliar circumstances, leading to the display of behavioral expressions that can be categorized as either approach or avoidance. According to Willoughby et al. (2011), preschool-age children exhibit substantial developments in self-regulation and depend on external sources of assistance to manage their actions.

Self-regulation is crucial to the mental health and well-being development of children. Research has demonstrated that children with difficulty regulating their emotions and behavior are at increased risk for internalizing problems (Derryberry & Rothbart, 1997; Silk, Steinberg, & Morris, 2003). For example, children who lack the ability to regulate their emotions in response to stress or frustration may become overwhelmed and develop anxiety or depression. Similarly, children who lack inhibitory control and struggle to control their impulses may engage in behaviors that are harmful to themselves or others, which can increase their risk of internalizing problems.

Nevertheless, it is crucial to acknowledge that self-regulation is a multifaceted and intricate concept, and various facets of self-regulation may exert distinct influences on the emergence of internalizing problems. Several research studies have indicated that the association between anxiety and inhibitory control may be more pronounced compared to other facets of self-regulation (Derryberry & Rothbart, 1997). Overall, the relationship between self-regulation and internalizing problems underscores the need of promoting children's self-regulatory skills as

a means of preventing the development of internalizing problems, particularly among children with negative affective reactivity.

Reactivity and Self-regulation in relation to Internalizing Problems

Internalizing disorders are among the most common behavioral and psychological disorders diagnosed in childhood. Examining the association between temperament and internalizing phenomena holds significance due to the potential for early detection and intervention, which can effectively avert or alleviate the emergence of internalizing difficulties. These difficulties, if left unaddressed, may have enduring detrimental consequences for mental health and overall well-being. Research has shown that early internalizing problems in childhood are associated with a heightened probability of experiencing anxiety and depression in adulthood (Bifulco et al., 2002; Kim-Cohen et al., 2005). Gaining insight into the influence of temperament on the development of internalizing problems can provide valuable knowledge for early preventative and intervention strategies, with the goal of mitigating the likelihood of adverse consequences throughout both childhood and adulthood.

Internalizing refers to a category of mental health problems characterized by negative emotions and thoughts that are directed inward, such as anxiety, depression, and withdrawn behavior (Achenbach & Edelbrock, 1983). These problems hold considerable significance due to their potential to affect children's overall well-being and have long-term consequences, such as an increased risk of adult mental health problems (Bridgett et al., 2011; Costello et al., 2003). Understanding the factors that contribute to the development of internalizing problems is crucial for the prevention and treatment of these problems. One important factor that has been shown to be related to internalizing problems is temperament (Rothbart et al., 2000). Studying the link

between temperament and internalizing can help identify children who are at risk for developing these problems and inform early interventions that can promote positive outcomes.

Furthermore, the investigation of the relationship between temperament traits and internalizing problems carries important implications. Initially, it may be advantageous to focus on temperamental features that act as precursor phenotypes for the development of internalizing illnesses. Additionally, this may facilitate the identification of more homogeneous subgroups within the realm of internalizing disorders, each exhibiting distinct developmental paths. Moreover, an examination of the connections between temperament and internalizing behaviors can provide insights into the early processes in the formation of psychopathological conditions. It can also be advantageous in the formulation of treatment strategies and forecasting treatment results. Finally, it may be beneficial to ascertain individuals who are susceptible to the development of internalizing problems. Examining temperament qualities could provide insight into the comorbidity of psychiatric conditions.

Early internalizing behavior places children at risk for long-term mental health problems such as anxiety and depression (Kessler et al., 2005). Early identification and intervention for internalizing problems can be effective in reducing the likelihood of long-term negative outcomes (Ollendick & King, 2014).

Reactivity and self-regulation are two important constructs in the study of internalizing problems in children. Children with elevated levels of negative reactivity are at greater risk for adjustment difficulties, particularly in the form of internalizing behaviors, especially if their self-regulation skills are limited (Bridgett et al., 2011; Derryberry, & Rothbart., 1997; Gartstein & Rothbart, 2003). Research has consistently shown that negative affective reactivity, or the inclination of an individual to undergo negative emotions when faced with stress or obstacles, is

seen as a contributing element in the emergence of internalizing problems, such as anxiety and depression (Gartstein & Rothbart, 2003; Muris et al., 2000). Children with elevated levels of negative reactivity have an increased likelihood of manifesting symptoms associated with anxiety and depression, and this relationship is particularly strong when negative reactivity is combined with other risk factors such as parental depression or stressful life events (Bridgett et al., 2011; Muris et al., 2000). Previous research has also showed a strong link between self-regulation and internalizing problems. Children who possess elevated levels of self-regulation tend to exhibit greater proficiency in managing their emotions and behaviors, hence reducing their likelihood of experiencing internalizing problems (Gartstein et al., 2013; Bridgett et al., 2011). Existing research has demonstrated that children with higher levels of self-regulation exhibit a reduced likelihood of encountering internalizing problems, in contrast to their counterparts displaying lower levels of self-regulation (Eisenberg et al., 2005; Kochanska et al., 2000). Therefore, developing and strengthening self-regulation skills in children may serve as a potential safeguard against the emergence of internalizing difficulties.

However, the joint impact of negative reactivity and self-regulation on internalizing problems is not insignificant. For instance, studies have found that children who exhibit elevated levels of negative reactivity and demonstrate limited self-regulation skills are particularly vulnerable to the emergence of internalizing problems (Bridgett et al., 2011; Gartstein et al., 2013). Hence, it is important to consider both negative reactivity and self-regulation when evaluating the risk of internalizing problems in children.

Self-regulation, which can also be referred to as temperamental effortful control, has been proposed as a protective element in the progression of internalizing disorders. Research findings have suggested that the presence of self-regulation can moderate the association between

reactivity and internalizing problems (Cole et al., 2004). Specifically, high levels of self-regulation may buffer the negative effects of high reactivity on the development of internalizing problems. This suggests that children who hold the ability to regulate their emotional responses effectively may experience greater protection against the adverse consequences of heightened reactivity.

Behavioral Inhibition as a feature of Temperament related to internalizing problems

Behavioral inhibition (BI) is a well-researched aspect of temperament that refers to a child's tendency to withdraw or avoid novel or challenging situations (Kagan & Snidman, 1991). Importantly, Behavioral inhibition has been closely associated with high negative affective reactivity, which involves heightened sensitivity and responsiveness to environmental stressors (Fox et al., 2001; Rothbart & Bates, 2006; Svihra & Katzman, 2004). Children with high BI may display increased physiological and emotional reactivity to novel or stressful situations, predisposing them to internalizing problems (Calkins et al., 1996; Lonigan & Phillips, 2001; Pérez-Edgar & Fox, 2005). This strong link between BI and negative affective reactivity helps to establish a framework for comprehending the interplay of reactivity, self-regulation, and internalizing problems. Evidence suggests that BI has been linked to a heightened susceptibility to internalizing problems, such as anxiety and depression, as well as the development of anxiety disorders in later life (Rosenbaum et al., 1988; Biederman et al., 2001). Additionally, behavioral inhibition has been associated with an increased probability of developing social phobia and panic disorder in adulthood (Hirshfeld-Becker et al., 2002). It is imperative to acknowledge that the manifestation of behavioral inhibition in children does not universally lead to the development of psychopathology. Additional factors, such as familial context and living conditions, also exert influence in this regard. Maturation and environmental factors work jointly

to ameliorate the possibility of developing a clinical disorder (Morales et al., 2016). However, the examination of behavioral inhibition and its relationship with psychopathology holds significance in comprehending the progression of mental health problems and in identifying children who may be at risk.

The groundbreaking research conducted by Kagan and his colleagues laid a foundation for comprehending Behavioral Inhibition (BI) as a component of temperament. In their seminal work, Kagan et al. (1984) delineated two distinct classifications of temperament, namely inhibited and uninhibited, which were based on behavioral inhibition (BI). Children that exhibited inhibited behavior were identified by their tendency to withdraw, display less activity, seek comfort from a caregiver, and limit their vocal expressions when faced with novel stimuli. Uninhibited children were identified as exhibiting persistent engagement and proactive conduct in the face of unexpected stimuli. According to Kagan and Snidman (1999), individuals with an inhibited temperament demonstrate heightened amygdala activation, leading to raised levels of salivary cortisol, increased muscle tension, elevated heart rates, and heightened urinary catecholamine levels. Inhibited individuals are more prone to experiencing anxiety disorders in the future (Kagan et al., 1999). In a similar vein, Hudson and Rapee (2004) subsequently found the temperamental inclination towards behaviorally restricted conduct as a significant individual genetic element that substantially influences the development of internalizing problems.

Behavioral inhibition has been associated with a higher likelihood of internalizing problems, particularly anxiety, in adolescence and a higher social reluctance in children ages 3 to 5 (Dyson, et al., 2011). Behavioral inhibition can be observed during the early stages of infancy and is frequently reported in approximately 15% of children (Dyson, et al., 2011). In a study conducted by Tang et al. (2020), it was discovered that the presence of behavioral inhibition

throughout infancy, namely at 14 months of age, had enduring implications on both personality traits and social outcomes. According to Tang et al. (2020), individuals who exhibited higher levels of behavioral inhibition (BI) during infancy demonstrated certain behavioral and psychological characteristics by the age of 26. These characteristics included a more reserved personality, a reduced number of romantic relationships, impaired social functioning with both friends and family and an elevated likelihood of experiencing internalizing psychopathology in adulthood. Notably, the risk of developing internalizing psychopathology was particularly pronounced when individuals with higher BI also exhibited larger error-related negativity signals at the age of 15 (Tang et al., 2020). Behavioral inhibition is strongly linked to the diagnosis of social anxiety disorder, according to Klein and colleagues (2012). Nevertheless, empirical data indicates that children who initially exhibit avoidance tendencies but possess more advanced effortful control are more likely to achieve improved emotional adaptation in anxiety-inducing circumstances and have a reduced likelihood of developing internalizing symptoms (Bairova et al., 2019; Kozlova et al., 2020; Slobodskaya et al., 2019; White et al., 2011).

Recent studies have endeavored to investigate both behavioral patterns and emotional states in order to accurately ascertain whether a child exhibits inhibited tendencies. For instance, when children exhibit avoidance behavior and experience negative emotions in response, they might be seen as manifesting the inhibitory system. Nevertheless, the absence of negative affect during avoidance behavior may suggest a lack of interest or diminished inclination to engage. Comparably, children may exhibit low levels of inhibition and be extremely motivated to approach stimuli when they approach them with positive affect (Putnam & Stifter, 2015).

Understanding early signs of behavioral inhibition can shed light on the development and maintenance of internalizing problems in childhood and beyond. In the context of toddlers, the

construct of behavioral inhibition encompasses the characteristics of vigilance and withdrawal when confronted with unfamiliar individuals and unexpected circumstances (Degnan & Fox, 2007). In a study conducted by Kagan and Snidman (1991), children at the age of four months were subjected to both visual and auditory stimuli. The results of the study indicated that newborns who exhibited elevated levels of motor activity and negative affect were more prone to displaying high levels of inhibition by the time they reached four years of age (Putnam & Stifter, 2015).

The measurement of behavioral inhibition commonly involves the presentation of a novel object to a kid, followed by the observation of their overt approach or avoidance behavior (Putnam & Stifter, 2015). Other measures include self-report, parent and teacher reports, and researchers have also used observational measures (Carver & White, 1994; Dapprich et al., 2022; Gartstein & Rothbart, 2003). Rothbart's Child Behavior Questionnaire (CBQ) is a comprehensive measure of temperament that includes shyness and fearfulness, characteristics of children with behavioral inhibition.

There is a notable correlation between children exhibiting behavioral inhibition and an increased susceptibility to developing anxiety disorders, in comparison to children who display lower levels of inhibition. According to Fox and Pine (2012), children who exhibit behavioral inhibition from an early age demonstrate increased responsiveness to novel stimuli and heightened sensitivity to changes in their environment. Once toddlers enter the stage of toddlerhood, there is an increased likelihood of their exhibiting withdrawal tendencies in unfamiliar social settings. If continued over time, this pattern of behavior might result in the child experiencing social isolation from their peers. Should this particular pattern of behavior persist throughout the period of adolescence, it is plausible that behavioral inhibition may

culminate in the development of social anxiety, as posited by Fox and Pine (2012). Moreover, empirical studies have demonstrated that the stability of behavioral inhibition exhibits only a moderate level of consistency across time. Fewer children who were identified as behaviorally inhibited as toddlers also showed this inhibition as adults, according to stability estimates that varied from .24 to .64 (Dyson et al., 2011). To be more specific, the inclination of a child to focus on possible threats can significantly influence the outcome of whether a temperament marked by behavioral inhibition would result in subsequent anxiety during adolescence or adulthood. This highlights the complex interplay between individual differences in temperament and environmental factors that can impact mental health outcomes (Pérez-Edgar & Fox, 2005). Therefore, studying behavioral inhibition in young children is important because it has significant implications for their well-being in both the short and long terms.

There is evidence to suggest that high levels of behavioral inhibition can be considered a potential risk factor for the emergence of internalizing problems (Chronis-Tuscano et al., 2009; Schwartz et al., 1999). Conversely, it has been found to function as a protective factor against the development of externalizing problems (Hirschfeld-Becker et al., 2002). Regarding internalizing problems, there exists substantial empirical support indicating that elevated levels of behavioral inhibition (BI) and social reticence are associated with increased levels of subsequent internalizing problems during childhood and adolescence (Fox et al., 2001; Muris et al., 1999; Rubin et al., 2002; Volbrecht & Goldsmith, 2010). The findings of the study conducted by Karevold et al. (2012) indicate that elevated levels of shyness and more rapid rises in shyness during the period from 1.5 to 12.5 years of age are associated with heightened symptoms of depression and anxiety at 12.5 years of age. Likewise, empirical data indicates that heightened levels of fearfulness in infancy are indicative of future anxiety-related issues (Gartstein et al.,

2010). Moreover, prior research has indicated that the maintenance of stable levels of high social reticence, as well as the escalation of social reticence during the developmental period spanning from 2 to 5 years of age, has been found to be a significant predictor of internalizing issues at the age of 5 years (Degnan et al., 2014). Furthermore, there is a positive correlation between heightened levels of early behavioral inhibition (BI) and enhanced stability in BI throughout early childhood and middle childhood, which is associated with an elevated probability of developing Social Anxiety Disorder (Biederman et al., 2001; Chronis-Tuscano et al., 2009).

Behavioral Inhibition, Shyness and Fear

In this study, behavioral inhibition is defined in terms of fear and shyness. and is characterized by a child's tendency to exhibit a cautious or withdrawn response to new or unfamiliar situations or stimuli, which may be accompanied by feelings of anxiety or discomfort. Children with high levels of behavioral inhibition may avoid social situations, display a reluctance to explore new environments, and may have difficulty adapting to new people or unfamiliar circumstances. Fear and shyness are considered key components of the behavioral inhibition temperament.

Both shyness and fear tendencies are evident early in development and are linked to a range of internalizing problems. Research has consistently shown that shyness and fearfulness are early indicators of behavioral inhibition and are linked to internalizing problems (Degnan & Fox, 2007; Hirshfeld-Becker et al., 2002; Pérez-Edgar & Fox, 2005). Additionally, both shyness and fearfulness can be considered indicators of inhibited behavior, as children who are highly reactive to novel or unfamiliar situations may be more likely to avoid such situations, which can impact their ability to explore and learn from their environment. Research has shown that both shyness and fearfulness are related to avoidance and withdrawal in novel situations (Buss &

Plomin, 1984; Kagan et al., 1987). For example, Kagan and colleagues (1987) found that children who were classified as inhibited on the basis of their reactions to novel stimuli were more likely to exhibit withdrawal behaviors in social situations later in life. Therefore, support has been found for the use of a combination of shyness and fear to capture behavioral inhibition. Both tendencies have been shown to be early indicators of risk for internalizing problems and are related to inhibited behavior in novel or unfamiliar situations.

Behavioral inhibition is a temperamental attribute denoting a predisposition to exhibit inhibitory responses towards both social and nonsocial novelty. In contrast, shyness pertains specifically to experiencing discomfort in social contexts while not extending to nonsocial situations (Van Ameringen et al., 1998). Though shyness refers specifically to being socially reticent, it largely correlates with fear. For example, a study by McLeod and colleagues (2007) revealed a significant positive correlation between shyness and fearfulness in both adults and children. Similarly, a meta-analysis by Coplan and colleagues (2017) found a moderate to strong association between shyness and fear across multiple studies. These findings provide a strong rationale for combining shyness and fear when assessing behavioral inhibition. Additionally, the high correlation between shyness and fear suggests that the two constructs may share similar underlying mechanisms, further supporting the utility of combining them for assessing behavioral inhibition.

Shyness, fear and behavioral inhibition are associated with anxiety disorders in children and adults. It is important to comprehend the various components that contribute to inclinations towards behavioral inhibition, encompassing fear and shyness, as these traits are correlated with anxiety disorders in individuals across different age groups, including children and adults. In addition, identifying factors that moderate the relation between behavioral inhibition and adverse

outcomes is crucial for understanding the complex interplay between temperament and mental health. As both fear and shyness contribute to responses that resemble behavioral inhibition, additional research is needed to elucidate the nature and relative contribution of these factors in shaping risk for internalizing problems. By identifying these underlying mechanisms, we can develop more effective strategies to prevent or treat internalizing problems in at-risk children, ultimately improving their long-term mental health outcomes.

Internalizing problems including but not limited to depression, anxiety, loneliness, low self-esteem, and somatic complaints have been associated with shyness in children (Asendorpf & Van Aken, 1994; Findlay et al., 2009; Graham & Coplan, 2012; Henriksen & Murberg, 2009; Karevold et al., 2012; Kingsbury et al., 2012; Kingsbury et al., 2013; Murberg, 2009). The majority of the research consisted of cross-sectional studies that specifically examined the relationship between shyness and adjustment during the early to middle childhood period. There exists a body of evidence suggesting that shyness may serve as a predictor of internalizing disorders in the long run. For instance, the research conducted by Karevold and colleagues (2009; 2012) demonstrated that shyness exhibited throughout early infancy can serve as a predictor for the development of internalizing problems from middle childhood up to early adolescence. Moreover, scholarly investigations have revealed a significant correlation between shyness and the experience of depression and loneliness in the period of adolescence. An and Eggum-Wilkens (2021) and Murberg (2009), for instance, used short-term longitudinal designs and self-reports to report concurrent relationships between shyness and depressive symptoms among adolescents. Additionally, these studies investigated the association between the initial level of shyness and the subsequent increase in depressive symptoms after one year. In a similar vein, scholars have noted through the utilization of self- and peer reports that there exists a

positive correlation between shyness in adolescents and concurrent feelings of loneliness (Vanhalst et al., 2014; Zhao et al., 2018). Liu et al. (2017) made an intriguing discovery that peer-nominated shyness sensitivity exhibited a positive correlation with depression and loneliness in Chinese adolescents. However, this relationship was not observed among younger Chinese children in the early to middle childhood stage. These findings suggest that shyness could play a particularly problematic role during the period of adolescence.

In addition to shyness, research has also shown that fear is related to internalizing problems, such as depression and anxiety. A study by Bar-Haim and colleagues (2007) found that higher levels of fear at age 4 predicted greater social anxiety symptoms at age 9. Similarly, a study by Bittner and colleagues (2007) found that fear was a strong predictor of later anxiety disorders in a sample of young children. These findings suggest that fear, like shyness, is an important factor to consider when assessing risk for internalizing problems. A longitudinal study by Chronis-Tuscano and colleagues (2009) found that fearfulness in preschool-aged children predicted later anxiety symptoms in middle childhood. Degnan and colleagues (2010) conducted a study that revealed a positive association between elevated levels of fear during infancy and the manifestation of anxiety symptoms during early childhood. Additional research has corroborated the idea that there exists a positive correlation between fearfulness and depressive symptoms in individuals of various age groups, as evidenced by studies conducted by Cicchetti and Toth (2009) and Gregory et al. (2007). By assessing both fearfulness and shyness, and considering their potential interactions and contributions to internalizing problems, we can gain a more comprehensive understanding of the influence of temperament on the emergence of mental health problems. This knowledge can inform the development of prevention and intervention

methods that are designed to reduce the risk for internalizing problems in children who exhibit fearfulness and shyness.

Effortful Control

Effortful control, defined by Rothbart (1998) as "the ability to inhibit a dominant response to perform a subdominant response" (p. 137) or the "efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors." (Rothbart and Bates, 2006, p.129) is an essential dimension of temperament. Effortful control encompasses the capacity to consciously regulate attention and selectively suppress or initiate behaviors in accordance with situational demands. Therefore, effortful control, containing the concept of attentional regulation, inhibitory control, and activational control, enables children to adapt accordingly, particularly in cases when the child does not want to do so (Eisenberg, 2005). Effortful control has been associated with lower internalizing problems (Eisenberg et al., 2000, 2004; Rothbart et al., 1994).

The measure of effortful control used in this study subsumes four constructs emphasized in the Rothbart model: Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity.

Attentional Focusing

Attentional focusing is the capacity to transfer and focus attention from one stimulus to another when desired (Derryberry & Rothbart, 1988). Attentional focusing plays a crucial role in the process of self-regulation by aiding in the facilitation, inhibition, or filtering of information. Specifically, attentional focusing was thought to facilitate the selective processing of pertinent information while simultaneously inhibiting the processing of irrelevant or detrimental information (Derryberry & Reed, 2002). Many research studies have documented the

significance of attentional focusing on the context of regulation, particularly in children exhibiting heightened levels of anxiety or fear. Children who possess a diminished capacity to redirect their attention from a particular task may encounter challenges in effectively managing their emotions, perhaps leading to heightened levels of anxiety and fear. The cognitive processing of inputs and the creation of reactions to stimuli can also be influenced by attentional focusing (Derryberry & Reed, 2002). In a study conducted by Kim et al. (2013), it was discovered that attentional focusing may also serve as a predictor for future academic achievement.

Eisenberg and colleagues (1993) conducted a study with children aged 4 to 6 years, wherein they discovered a negative correlation between teachers' ratings of attentional focusing and their ratings of children's negative emotionality. Hence, it can be observed that attentional processes exhibit a correlation with reduced levels of negative emotionality during the initial stages of childhood. This association may play a role in the endeavors of toddlers and children to manage negative emotions, including fearfulness and shyness. However, recent research has suggested that the correlations between attentional focusing and shyness typically have not been significant, and the directions of the significant correlations have been mixed (Eggum-Wilken et al., 2015).

Inhibitory control

The construct of inhibitory control, also referred to as impulse control in scholarly works, is operationally described as the ability to engage in strategic planning and restrain inappropriate approach behaviors in response to explicit instructions or when confronted with unfamiliar or ambiguous circumstances (Rothbart et al., 2001). The process of inhibitory control often begins with the establishment of reciprocal communication and engagement between an

infant and their caregiver. Additionally, the child becomes aware of activities that are considered proper or prohibited based on the guidance provided by their caregivers (Kopp, 1982). The utilization of inhibitory control has the potential to assist children in regulating the manifestation of an unsuitable or maladaptive emotional reaction, hence facilitating the development of adaptive social and emotional skills (Kieras et al., 2005). The development of internalizing and externalizing problems has been linked to inhibitory control. The study conducted by Vuontela and colleagues in 2013 has found a positive association between reduced inhibitory control and increased levels of internalizing and emotional symptoms in non-clinical children.

Low-intensity Pleasure and Perceptual Sensitivity

Another aspect of Effortful Control is Low-intensity Pleasure. The concept of Low-intensity Pleasure pertains to the level of pleasure or delight that children derive from settings characterized by low levels of stimulus intensity, complexity, rate, novelty, and incongruity (Rothbart et al., 2001). For instance, children who exhibit elevated levels of low-intensity pleasure may derive satisfaction from engaging in activities such as soaking themselves in a warm bath or engaging in gentle swinging on a playground. Perceptual sensitivity is another construct that is associated with effortful control. The concept of perceptual sensitivity pertains to the ability to detect and discern various sensory stimuli, including visual appearances, auditory sounds, tactile textures, olfactory odors, and gustatory tastes (Rothbart et al., 2001).

Using the Early Childhood Behavior Questionnaire (ECBQ) and the Childhood Behavior Questionnaire (CBQ), Putnam, Rothbart, and Gartstein (2008) investigated the stability of temperamental traits from infancy to about age five. The researchers discovered significant temporal associations between many dimensions of newborn temperament and the experience of low-intensity pleasure during the early childhood period, specifically between the ages of 18 and

36 months. In a study conducted by Clifford et al. (2012), the researchers examined the early temperament of 54 infants who were at family high-risk of Autism Spectrum Disorders (ASD). The findings indicated that infants who later had ASD exhibited reduced involvement in low-intensity pleasure at approximately 24 months of age.

Based on the review, researchers tend to refer to Attentional Focusing and Inhibitory Control as two key components of Effortful Control, whereas Low-intensity pleasure and Perceptual Sensitivity are often not adequately addressed. The widely used approach of using only specific subscales or integrating limited subscales into a composite has hampered research into the relationship between temperamental constructs and internalizing problems. Low-intensity pleasure can reflect awareness of subtle stimuli, which might enable the individual to detect the occasions that call for effortful control. However, the Low-Intensity Pleasure subscale garnered considerable controversy among content researchers in the field. According to Clark et al. (2016), the Low-Intensity Pleasure scale could pose issues as a measurement tool due to its lack of scalar invariance at the factor level when considering the gender of the parent (mother vs. father) and the child. However, this could be because different types of low-intensity pleasures are associated with effortful control differently during development. Ahadi (2017) posits that the role of effortful control may transform during children's developmental trajectory, particularly in relation to certain tasks. For example, the acquisition of word interpretation skills to enhance reading comprehension necessitates a substantial degree of effortful control, namely attention. However, as children progress in their reading abilities, this cognitive process gradually transitions towards automatization, resulting in a reduced reliance on effortful control.

Researchers should make a clear distinction between low-intensity pleasures that need cognitive engagement, such as completing a puzzle, and those that are characterized as passive or

inactive, such as indulging in a warm bath. Similarly, younger children such as toddlers who notice subtle differences in their surroundings could react and behave differently than 4- to 6-year-olds, thus the relation between perceptual sensitivity and effortful control would also be different. Young children's perceptual sensitivity involves both visual sensitivity and sensory sensitivity, indicating their ability to notice changes in the surroundings including differences in the caregiver's physical appearance, the presence of novel items within the household, and the capacity to perceive nuanced aspects of non-visual stimuli, such as unfamiliar sounds, flavors, aromas, and tactile sensations. Visser et al. (2006) found that there is a positive association between a child's sensitivity to their environment and the presence of internalizing problems. There is a prevailing argument that children who exhibit anxious and shy tendencies often display a proclivity for withdrawal and demonstrate hesitancy in seeking support from their immediate environment. Therefore, perceptual sensitivity might intensify the risk of internalizing problems.

Effortful Control as a Moderator between Behavioral Inhibition and Internalizing

Considerable scholarly investigation has been dedicated to examining the direct correlations between negative emotionality and effortful control in relation to problem behavior in children. However, there is a dearth of study exploring the potential interacting impacts of temperament on these outcomes. It is worth noting that, as suggested by Rothbart and Bates (2006), there is a lack of research investigating the relationships between temperamental traits despite the expected interplay between reactive and control systems. In the context of children who are at risk for maladjustment due to heightened emotionality, it has been suggested that self-regulatory abilities, such as Effortful Control, may play a significant role in changing the trajectory of this relationship (Moran et al., 2013; Raines et al., 2020). There is a theoretical

proposition that suggests that increased EC in children may provide them with the ability to regulate and control elevated emotional states. On the other hand, it is possible that children who have lower levels of control may exhibit reduced adaptability and competence in managing stressors that elicit negative emotions. This might potentially lead to the adoption of less effective coping strategies, such as depression or avoidance (Muris & Ollendick, 2005). An illustrative instance may be found in the study conducted by Dinovo and Vasey (2011), which demonstrated the significant role of EC in internalizing symptoms, both as a main effect and as a moderating influence. The researchers disclosed that children who have elevated levels of negative reactivity, together with low positive reactivity and effortful control (EC), demonstrate a greater vulnerability to experiencing symptoms of depression (Dinovo & Vasey, 2011). Furthermore, the research conducted by Tortella-Feliu et al. (2012) revealed a noteworthy correlation between elevated levels of negative affect, diminished levels of EC, and heightened symptoms of anxiety. EC was found to moderate the prospective relationship between negative affectivity and depressive behaviors.

However, one area for improvement in the existing literature is the treatment of EC as a whole construct. Many studies aggregate EC measures, often grouping *Attentional Focusing* and *Inhibitory Control* as unified facets of EC. Notably, the subscales *Low-intensity Pleasure* and *Perceptual Sensitivity*, integral components of the EC framework, are frequently overlooked in research.

Nevertheless, it is pertinent to recognize the landscape of contradictory findings. A study by Delgado et al. (2018) unearthed an interesting interaction between negative affect and EC concerning internalizing disorders. Contrary to the buffering role traditionally attributed to EC, their findings unveiled that children exhibiting elevated levels of both negative affect and EC

were more susceptible to internalizing disorders. This suggests that, in certain contexts, elevated EC might indicate behavioral inhibition or over-control tendencies. In this review, the majority of research examining the interplay between reactivity and regulation in relation to internalizing seems to focus on Negative Affectivity (NA) rather than Behavioral Inhibition (BI).

The Current Study

The present study aims to investigate the relationship between temperamental Shyness/Fearfulness, Effortful Control, and Internalizing problems in children. The study is based on the theoretical framework that posits that temperamental traits such as shyness and fearfulness can predispose individuals to internalizing problems, which can be exacerbated or mitigated by individual differences in effortful control (Eisenberg et al., 2010). Effortful control refers to the capacity to effectively manage and regulate one's emotions, attention, and conduct when confronted with various challenges, stressors, or distractions. (Rothbart & Bates, 2006). While prior research has examined the role of effortful control in the relation between behavioral inhibition and internalizing problems, most studies have primarily focused on overall levels of effortful control and treated effortful control as a unitary construct. The present study seeks to extend the finding that effortful control moderates the relationship between behavioral inhibition and internalizing problems in young children by examining the role of each specific component of effortful control in moderating the impact of behavioral inhibition on internalizing problems. Specifically, the study examines the influence of Attentional Focusing, Inhibitory Control, and Low-intensity Pleasure, and Perceptual Sensitivity, on the relationship between behavioral inhibition and internalizing problems. By investigating these individual components of effortful control, we aim to gain a more nuanced understanding of the ways in which effortful control may

influence the development of internalizing problems in children who exhibit fearfulness and shyness.

Effortful control is a central construct in Rothbart's theory of temperament, which emphasizes the role of self-regulation in child development (Rothbart & Bates, 2006). The measure of effortful control used in this study includes four subconstructs, namely Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity. Although Attentional Focusing and Inhibitory Control have received more attention in research and are often grouped together, Low-intensity Pleasure and Perceptual Sensitivity have been less studied. Rothbart (2007) suggests that Low-intensity Pleasure and Perceptual Sensitivity contribute to effortful control because they require the individual to regulate attention and affect, even in low-stress situations. Low-intensity Pleasure reflects the capacity to retain a positive affective state when exposed to low-intensity stimuli, which requires the individual to sustain attention and regulate affect. Perceptual Sensitivity involves the ability to detect and process subtle stimuli, which also requires attentional regulation. However, some researchers have questioned the utility of including Low-intensity Pleasure and Perceptual Sensitivity as subconstructs of effortful control. For example, Ahadi and colleagues (1994) discovered that the four subconstructs of effortful control did not consistently load onto a single factor, and that Perceptual Sensitivity was more strongly associated with a temperament dimension of Sensory Sensitivity than with Effortful Control. Additionally, some researchers have suggested that Low-intensity Pleasure and Perceptual Sensitivity may be less relevant to self-regulation in high-stress situations (Eisenberg et al., 2004).

Whereas some researchers have questioned the inclusion of Low-intensity Pleasure and Perceptual Sensitivity in the measure of effortful control, Rothbart (2007) argues that they are

important components of the construct because they reflect the ability to regulate attention and affect in low-stress situations. Further research is needed to determine the extent to which Low-intensity Pleasure and Perceptual Sensitivity contribute to effortful control and whether they are related to different aspects of self-regulation. The present study is designed to investigate how the four subconstructs, taken separately, influence the relations between behavioral inhibition and internalizing problems in young children.

Research Questions

RQ 1-- *Replication of prior research*

1. RQ 1A: Evaluating the congruence of current data with previous research - Does the present study corroborate earlier findings, indicating that children with higher levels of Behavioral Inhibition (BI) are more likely to experience higher internalizing problems compared to those with lower levels of BI?

Hypothesis: The present study hypothesizes that children with higher levels of Behavioral Inhibition (BI) will be more likely to experience higher levels of internalizing problems compared to those with lower levels of BI.

2. RQ 1B: Evaluating the congruence of current data with previous research – Does Effortful Control (EC), as an aggregate measure comprising Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity, serve as a moderator in the relationship between Behavioral Inhibition (BI) and internalizing problems in children? If so, in what manner does EC exert its influence on this association?

Hypothesis: Effortful Control (EC), as an aggregate measure comprising (AF, IC, LIP and PS), serves as a moderator in the relationship between Behavioral

Inhibition (BI) and internalizing problems in children. Specifically, it is hypothesized that the influence of BI on internalizing problems will vary depending on the levels of EC; with higher levels of EC expected to buffer or reduce the impact of BI on internalizing problems.

In order to ensure a clear and interpretable interaction term, it is desirable for the moderator variable to have no correlation with both the predictor variable and the dependent variable (Baron & Kenny, 1986). Unfortunately, the current study will not be able to fulfill this requirement. Nevertheless, the moderators (EC) and predictors (BI) in the current study are on the same level regarding their function as causal variables exogenous or antecedent to specific criterion effects, which met the benchmark for testing moderator effects according to Baron and Kenny (1986).

Behavioral Inhibition is theorized to influence thoughts and behaviors, placing children at risk for anxiety, withdrawal, and inhibition, which can be attributed to their inherent temperament (Rothbart & Bates, 2006). However, as Effortful Control develops, specific factors are believed to moderate the well-established link between BI and internalizing. Certain aspects of Effortful Control may not be as “effortful” as others, suggesting that some components can be learned or trained.

Effortful Control is considered a moderator in the context of the overarching theory of the development of Behavioral Inhibition (Dinovo & Vasey, 2011; Moran et al., 2013; Muris & Ollendick, 2005; Raines et al., 2020; Tortella-Feliu et al., 2012). Whereas Effortful Control might be trainable or learned, Behavioral Inhibition is primarily viewed as a trait-based characteristic that places children at risk for internalizing behaviors. The role of Effortful

Control's role in this context is to potentially alter the relationship between BI and internalizing, rather than directly predicting the outcome.

Previous research has shown that children with elevated levels of temperamental shyness and fearfulness are more susceptible to the development of internalizing problems such as anxiety, depression, and social withdrawal (Buss & Goldsmith, 1998; Coplan, Arbeau, & Armer, 2008). However, not all shy or fearful children develop internalizing problems, which suggests that other factors may influence the relationship between temperament and psychopathology. One such factor is effortful control, which has been found to buffer the negative effects of temperament on socio-emotional adjustment (Eisenberg et al., 2010). For example, children with high levels of effortful control are less likely to exhibit anxious or depressive symptoms even if they are temperamentally shy or fearful (Rothbart & Bates, 2006; Raines et al., 2020).

The first set of research questions aims to replicate findings from prior research, providing a solid foundation for understanding the role of Behavioral Inhibition (BI) and Effortful Control (EC) in relation to internalizing problems. By replicating previous findings, this research can contribute to the existing body of knowledge and enhance the credibility of the study.

Research Questions 1A and 1B aim to corroborate whether children with high levels of temperamental shyness and fearfulness, in conjunction with low levels of effortful control, are more likely to exhibit internalizing problems compared to those with high levels of effortful control. This inquiry aligns with the possibility that effortful control might serve as a protective factor, buffering the negative impact of temperament on mental health outcomes (Eisenberg et al., 2010). Furthermore, it examines the notion that both temperament and effortful control are important predictors of socioemotional adjustment, and that their interaction may contribute to

explaining the variability in internalizing problems observed among children (Rothbart & Bates, 2006; Lengua, 2006).

RQ 2-- *Extension of prior research – Exploratory*

1. RQ 2A: Do the individual subconstructs of effortful control - Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity - as well as fearfulness and shyness, each correlate with internalizing problems in children?
2. RQ 2B: Do specific components of EC (Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity) moderate the relation of BI with internalizing when controlling for other components?
 - a. If Low-intensity Pleasure and Perceptual Sensitivity do have an interaction/moderating effect with Behavioral Inhibition (BI) when predicting internalizing behaviors- Would their influence differ from the more commonly studied Effortful Control components, Attentional Focusing and Inhibitory Control? Specifically, will they weaken the effect whereas AF and IC strengthen the effect? I wanted to know why LIP and PS were mostly omitted in research studies.

The second set of exploratory questions (Research Questions 2A, 2B) extends the existing research by examining the individual subconstructs of effortful control, especially the understudied Low-intensity Pleasure and Perceptual Sensitivity, in relation to internalizing problems. By investigating the unique contributions of these four subconstructs, coupled with the evaluation of Fearfulness and Shyness using correlation analyses, this research can provide a more nuanced and comprehensive understanding of the factors influencing the development of internalizing problems in children.

This study seeks to delve into the intricate relationships between temperamental Shyness/Fearfulness, effortful control, and internalizing problems in children. By breaking down the Effortful Control variable, the study aims to assess both the distinct impacts of individual factors and the potential moderating influences of effortful control subconstructs on the connection between behavioral inhibition (BI) and internalizing problems. Firstly, the study will assess the potential correlational relationships between the subconstructs of Effortful Control, as well as Fearfulness and Shyness, on Internalizing problems in children. Subsequently, the study will examine whether the relation of BI with Internalizing problems is moderated by Effortful Control and each of its four components. The analysis will focus on the relationship between BI and Internalizing problems, taking into account each Effortful Control component and the interaction between BI and each component. By examining the roles of Attentional Focusing and Inhibitory Control, which have been consistently linked to positive outcomes, alongside the less frequently studied but potentially influential Low-intensity Pleasure and Perceptual Sensitivity, this study seeks to provide a comprehensive understanding of how these specific components of effortful control may influence and interact with BI to shape the development of internalizing problems in children.

Children with high levels of temperamental shyness/fearfulness may be more prone to internalizing problems due to difficulties in regulating their emotional responses and behavior (Novick et al., 2020). Levels of low-intensity pleasure and perceptual sensitivity are relevant to regulation in the face of BI. This is because low levels of these subconstructs may limit children's ability to experience pleasure and satisfaction from subtle or low-key stimuli or to detect and respond to nuanced changes in the environment, which can impair their ability to regulate their emotions and behavior adaptively. Additionally, children with BI with high levels

of attentional focusing and inhibitory control appear better equipped to regulate their emotions and behavior in response to stressors and social challenges. For these reasons, it is important to consider the multidimensional nature of effortful control when examining the relationships between temperament and internalizing problems in children.

The focus on Low-intensity Pleasure and Perceptual Sensitivity, which are less frequently studied, can potentially uncover novel insights into how these subconstructs of effortful control may contribute to the development of internalizing problems. Identifying the unique effects and patterns of these subconstructs could help to expand the current understanding of the role of temperament in the development of internalizing problems and inform future research directions.

The findings from this research could have important implications for the development of targeted interventions that aim to enhance specific subconstructs of effortful control in children at risk of internalizing problems.

Chapter 3: Methods

Design

The present study utilized an archival dataset that was obtained as a component of a broader investigation led by Dr. Hedwig Teglasi and a group of graduate student researchers. This study will use a subset of the data that includes parent ratings of social skills (Social Skills Improvement System; SSiS; Gresham & Elliott, 2008), as well as rating scales measuring temperament (Children's Behavior Questionnaire Short Form; CBQ-SF; Rothbart et al., 2006). Behavioral inhibition (BI) was assessed using the fear and shyness subscales of the parent completed CBQ. Effortful control was assessed using the Effortful Control domain (EC) of the

parent-completed CBQ, which is a composite of the attentional focusing, inhibitory control, low-intensity pleasure, and perceptual sensitivity subscales. Internalizing problems were assessed using the internalizing subscale of the parent completed SSiS.

Participants

The participants in this study were preschool students (N=130; 57% males, 43% females) and their parents (or guardians). Participants were recruited from eight schools in the DC metro region, one in Chicago, and one in New York City (10 schools in total). One was an experimental school at a public research university, two was a public school, and seven of these schools were private schools.

The average age of the preschool children was 69 months, with a range of 60 to 79 months. 63% of the preschoolers were White, 9% were African American, 9% were Hispanic, 11% were Asian, 7% were of mixed race or other, and 1% had missing ethnicity data.

According to their self-reported level of education, the majority of the parents of the preschoolers were from the middle class. 52% of parents with jobs requiring a bachelor's degree; 33 % of parents with jobs requiring a professional or graduate degree. (13% of parents who declined to provide this information.) Age and ethnicity data for the parents of the participating children were unavailable.

Procedure

The University of Maryland Institutional Review Board (IRB) approved the study, and data collection occurred between 2012 and 2019. The compilation of data did not occur during the COVID-19 pandemic. In accordance with the protocol approved by the IRB, informed consent forms and cover letters describing the study were distributed to the parents of all preschool-aged children. Forms containing parental or guardian signatures represent informed

consent on the child's behalf. Multiple consent forms were sent out, and families were given multiple opportunities to participate in the study over the course of data collection.

Temperament rating scales Child Behavior Questionnaire (CBQ) and internalizing problems rating scale Social Skills Improvement System (SSiS) were provided to each child's parent/caregiver to complete with prior parental consent. Questionnaires were sent to parents using the parent's email or school mailbox.

All identifying information, such as consent forms and demographic information, was isolated from the data after collection. Graduate researchers had entered all data twice into a Microsoft Excel spreadsheet and performed congruence checks. The finalized, de-identified data were then transferred to SPSS for analysis from Microsoft Excel.

Measures

Children's Behavior Questionnaire Short Form (CBQ-SF)

In order to assess temperament, parents completed the Children's Behavior Questionnaire Short Form (CBQ-SF; Putnam & Rothbart, 2006). The CBQ-SF was developed to assess individual differences in temperament's reactive and self-regulatory components. The CBQ-SF consists of 94 items scored on a Likert scale ranging from 1 (*extremely untrue of this child*) to 7 (*extremely true of this child*). Each rater also had the option to designate whether certain items were irrelevant (N/A). The entire questionnaire includes items that cluster in 3 broad factors and 15 subscales: Negative Affectivity (Anger/Frustration, Discomfort, *Fear*, Sadness, Soothability); Surgency (Activity Level, Approach/Positive Anticipation, High-Intensity Pleasure, Impulsivity, *Shyness*, Smiling/Laughter); and Effortful Control (Attentional Focusing, Inhibitory Control, Low-Intensity Pleasure, Perceptual Sensitivity). In the present study, the subscales *Fear* (6 items)

and Shyness (6 items) were utilized. The Effortful Control Composite (24 items) was then calculated by aggregating the scores of the four subscales' items. If three or more items within a subscale were omitted or rated as "N/A," the subscale composite score was not calculated for that child. Missing items were addressed by substituting the mean of the respective scale for each participant, provided that no more than two items were omitted or rated as not applicable (N/A). Otherwise, The CBQ-Short Form shyness and fear subscales have demonstrated adequate reliability. Cronbach's alpha for the shyness ($\alpha = .85$) and fear ($\alpha = .68$) subscales were both adequate (Putnam and Rothbart, 2006).

Cronbach's Alpha was utilized to calculate the internal consistency of the Effortful Control scales. Putnam and Rothbart (2006) reported that Cronbach's alpha coefficients for the EC scales were found to be adequate: Inhibitory Control subscale ($\alpha = .72$), the Attentional Focusing subscale ($\alpha = .75$), the Low-Intensity Pleasure subscale ($\alpha = .69$), and the Perceptual Sensitivity subscale ($\alpha = .73$).

Internal consistencies for the current sample were acceptable for all scales, including Effortful Control ($\alpha = .71$), Attentional Focusing ($\alpha = .72$), Inhibitory Control ($\alpha = .68$), Low Intensity Pleasure ($\alpha = .63$), Perceptual Sensitivity ($\alpha = .74$), Shyness ($\alpha = .90$) and Fearfulness ($\alpha = .73$).

Social Skills Improvement System (SSiS)

In order to assess children's problem behaviors, parents/caregivers completed the Social Skills Improvement System (SSiS; Gresham & Elliott, 2008). The SSIS Rating Scales were designed as a measurement for assessing children and adolescents' behavior in three interconnected areas: social skills, problem behavior, and academic competence (Gresham & Elliott, 2008). The SSIS items are scored on a 4-point scale for frequency (*Never, Seldom, Often,*

Almost Always). The SSIS includes two major scales and 94 items in total: Social skills, Problem Behaviors; and 12 subscale scores: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, Self-control, Externalizing, Bullying, Hyperactivity/Inattention, Internalizing, and Autism. The current study focuses on the Internalizing domain only. According to Gresham et al. (2011), the Social Skills Improvement System (SSiS) demonstrates satisfactory levels of internal consistency and test-retest reliability when parent-reported scales and subscales are utilized. The alpha coefficients for all subscales exhibit a range of reliability, specifically falling within the mid- to high-.80s, as reported by the parents. Furthermore, the study conducted by Gresham et al. (2011) revealed that the Cronbach's alpha coefficients for each of the seven subscales measuring social skills were found to be equal to or greater than .70. The internal consistency of the internalizing scale was deemed acceptable, with a Cronbach's alpha coefficient of .77.

Data Analytic Procedure

Missing data

The CBQ had an option to indicate Not Applicable (NA) and this response was considered missing data. If there were two or fewer items that were skipped or rated as N/A, the participant's mean score on that subscale was substituted. Missing data in the SSiS (internalizing measures) were handled in accord with the protocol in the Test Manual. When one or more items were missing from the internalizing subscale or four or fewer items were missing from the overall social skills frequency score, lab members provided "adjustment values" as part of the SSiS's original scoring methods. The subscale scores were adjusted in accordance with the recommendations outlined in the manual for the Social Skills Improvement System (SSiS). This

adjustment involved the addition of values to the subscale scores, aiming to enhance the accuracy of the estimation of scale or subscale scores (Gresham & Elliot, 2008). Approximately 11% of the participants had missing data.

Preliminary Analyses

Preliminary Descriptive Analyses. After removing significant outliers, the preliminary analyses conducted for the present study yielded descriptive statistics for each measured variable as well as demographic information of the sample (refer to Table 1).

Correlations within Constructs. Preliminary bivariate (Pearson's) correlations were performed to ascertain the relationships among all variables examined in this study.

Power Analysis

An a priori power analysis was performed for hypotheses in the present study with G*Power. Statistical power refers to the probability of correctly rejecting a null hypothesis when it is indeed untrue. According to the G*Power analysis, a minimum sample size of **114** individuals is recommended to achieve a power of **.80**, a significance level of .05, and a median effect size ($f^2 = .15$) when including up to **9** predictor variables. The current study's sample was determined to be sufficient for incorporating a total of 9 predictors.

Hypothesis Testing

Correlations Analyses. In response to RQ 1A, 2A, correlation analyses were conducted to determine whether Fearfulness, Shyness, BI, EC and individual subconstructs of Effortful Control—specifically, Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity were associated with internalizing problems in children.

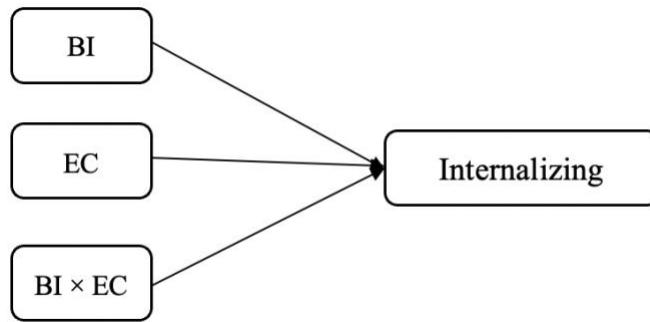
Multiple Linear Regression Analyses. Multiple regression analyses were employed to test research questions and hypotheses. Prior to conducting the analyses, all requisite assumptions were verified, and the study maintained adequate statistical power to detect meaningful effects.

The present study has taken into account the assumptions of multiple regression analyses in order to assure the appropriate implementation of these analyses. The process of assumption testing encompassed the evaluation of various conditions, namely: (1) linearity, (2) homoscedasticity, (3) independence of errors, (4) normality, and (5) independence of independent variables. In addition, cohort differences were tested using ANOVA.

To address Research Questions 1B, a multiple linear regression analysis was conducted to evaluate the moderation effect of aggregated Effortful Control (EC) in the relationship between Behavioral Inhibition (BI) and internalizing problems. BI was formulated from a composite of Shyness and Fearfulness, and both BI and aggregated EC, which was derived by averaging subscale scores of Attentional Focusing, Inhibitory Control, Low-Intensity Pleasure, and Perceptual Sensitivity, were input as independent variables. Internalizing problems were entered as the dependent variable. An interaction term was subsequently formed by multiplying BI with aggregated EC. The model comprised the main effects of BI and aggregated EC, along with the interaction term (See Figure 1)

Figure 1

Regression Model 1 (Research Questions 1B)

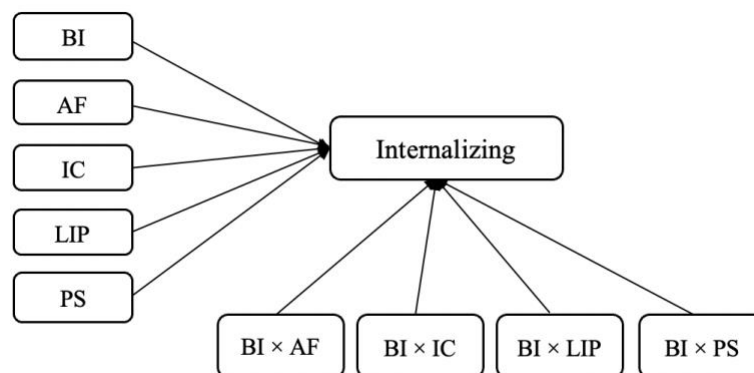


Note. EC = Effortful Control and BI = Behavioral Inhibition

To investigate Research Question 2B, which examined both the main and moderation effects of BI and individual components of EC—Attentional Focusing (AF), Inhibitory Control (IC), Low-intensity Pleasure (LIP), and Perceptual Sensitivity (PS)—on the relationship between BI and Internalizing problems, a second multiple linear regression analysis was conducted. BI, AF, IC, LIP, and PS were introduced as independent variables. Internalizing problems served as the dependent variable. Interaction terms, including $BI \times AF$, $BI \times IC$, $BI \times PS$, and $BI \times LIP$, were entered into the model to determine possible moderation effects (Figure 2).

Figure 2

Regression Model 2 (Research Questions 2B)



Note. BI = Behavioral Inhibition, AF = Attentional Focusing, IC= Inhibitory Control, LIP=Low-intensity Pleasure, and PS= Perceptual Sensitivity

Chapter 4: Results

Preliminary Analyses

Preliminary analyses were conducted to examine the bivariate correlations of each variable with internalizing; assess the assumptions of multiple linear regression; test cohort differences on dependent variable; and provide descriptive information for each measure after removing one influential outlier.

Descriptive Analyses

Tables 1 through 5 include the properties of the measures used, including internal consistencies, standard deviations, means, as well as correlations.

The parent-report Children's Behavior Questionnaire Short Form (CBQ-SF) scores were calculated for shyness and fearfulness, and the four scales of the Effortful Control domain in the present sample. As shown in Table 1, Shyness scores ($M = 3.66$, $SD = 1.51$, range = 1 to 7) and Fearfulness scores ($M = 3.90$, $SD = 1.21$, range = 1 to 6.8) were normally distributed (Shyness: skewness = .12, kurtosis = -.79; Fearfulness: skewness = -.15, kurtosis = -.46). Additionally, Attentional Focusing scores ($M = 5.11$, $SD = .96$, range = 2.3 to 6.8, skewness = -.65, kurtosis = .55), Inhibitory Control scores ($M = 4.92$, $SD = .96$, range = 2.5 to 6.8, skewness = -.30, kurtosis = -.47), and Low-intensity Pleasure ($M = 5.81$, $SD = .60$, range = 4.2 to 7, skewness = -.20, kurtosis = -.50) were all normally distributed as well. Perceptual Sensitivity scores ($M = 5.36$, $SD = 0.92$, range = 1.83 to 6.83) were slightly negatively skewed (skewness = -1.16) with a somewhat more peaked distribution than normal (kurtosis = 1.81). As for Internalizing, the scores ranged from 0 to 13, with a mean score of 4.32 ($SD = 3.12$). The data displayed a slightly positive skewness of .639 and a distribution slightly flatter than a perfect normal distribution

(kurtosis = -.180). As previously reported, all seven scales demonstrated acceptable internal consistency, ranging from $\alpha = .63$ for Low-intensity Pleasure to $\alpha = .90$ for Shyness.

Table 1

Summary of Descriptive Statistics: Means and Standard Deviations for Shyness, Fearfulness, Effortful Control subscales, and Internalizing Scales.

Variable	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Shyness	1.00	7.00	3.66	1.51	.12	-.81
Fearfulness	1.00	6.83	3.90	1.21	-.15	-.48
Attentional Focusing	2.33	6.83	5.11	.96	-.64	.52
Inhibitory Control	2.50	6.83	4.92	.96	-.31	-.46
Perceptual Sensitivity	1.83	6.83	5.36	.92	-1.16	1.78
Low- Intensity Pleasure	4.25	7.00	5.81	.60	-.22	-.50
Internalizing	0	13	4.32	3.12	.639	-.18

Bivariate Correlations

Within Behavioral Inhibition

The Pearson correlation coefficient was computed to assess the linear relationship between Behavioral Inhibition variables. A modest but statistically significant correlation (Table 2) was found between Shyness and Fearfulness, $r(128) = .277, p < .001$, signifying that an increase in shyness is moderately linked to an increase in fearfulness and vice versa.

Nevertheless, it is important to interpret this relationship within the broader context of behavioral inhibition. Prior empirical research and theoretical models have suggested that shyness and

fearfulness are not isolated constructs, but rather integral components of a larger Behavioral Inhibition (BI) construct. Thus, despite their modest correlation, these two variables were integrated to formulate the overarching Behavioral Inhibition variable.

Table 2

Bivariate Correlations of Shyness and Fearfulness

		Shyness
Fearfulness	Pearson Correlation	.277**
	Sig. (2-tailed)	.001
	N	130

** . Correlation is significant at the 0.01 level (2-tailed).

Within Effortful Control

Pearson correlation coefficients were computed to assess the linear relationships among Effortful Control subscales. Within the domain of Effortful Control (Table 3), all associations were in the positive direction (ranging from .279 to .485) as follows: Attentional Focusing and Inhibitory Control, $r(128) = .485, p < .001$, Attentional Focusing and Low-intensity Pleasure, $r(128) = .291, p < .001$, Inhibitory Control and Perceptual Sensitivity, $r(128) = .287, p < .001$, Inhibitory Control and Low-intensity Pleasure, $r(128) = .372, p < .001$, and Perceptual Sensitivity and Low-intensity Pleasure $r(128) = .279, p < .001$. The correlation between Perceptual Sensitivity and Attentional Focusing approached but did not reach significance ($r(128) = .166, p > .001$). These results underscore the interconnectedness of the components within the EC construct while also demonstrating the varying degrees of association among these subscales.

Table 3*Bivariate Correlations of Effortful Control (EC) scales*

		Inhibition Control (IC)	Perceptual Sensitivity (PS)	Low-intensity Pleasure (LIP)
Attentional Focusing (AF)	Pearson Correlation	.485**	.166	.291**
	Sig. (2-tailed)	.000	.058	.001
	N	130	130	130
Inhibition Control (IC)	Pearson Correlation	1	.287**	.372**
	Sig. (2-tailed)		.001	.000
	N	130	130	130
Perceptual Sensitivity (PS)	Pearson Correlation	.287**	1	.279**
	Sig. (2-tailed)	.001		.001
	N	130	130	130

** . Correlation is significant at the 0.01 level (2-tailed).

Behavioral Inhibition, Effortful Control and Internalizing

As illustrated in Table 4, a statistically significant correlation was found between Behavioral Inhibition (BI) and Internalizing behaviors, with a Pearson's correlation coefficient of $r(128) = .386, p < .001$. This relationship is moderate, suggesting that higher levels of BI are associated with a greater propensity for Internalizing behaviors in young children. The two components of BI, Shyness, and Fearfulness were also significantly correlated with Internalizing behaviors. Shyness displayed a moderate correlation, $r(128) = .364, p < .001$, whereas Fearfulness had a weaker but nonetheless statistically significant correlation, $r(128) = .242, p < .001$. These findings align with existing theoretical expectations and suggest that both Shyness and Fearfulness, as components of BI, are associated with Internalizing behaviors, but to varying degrees.

Hotelling's t-test and Steiger's Z-test were used, treating each test as two-tailed with an alpha level of .05. to test if the relationships between internalizing behaviors and Fearfulness, as

well as internalizing behaviors and Shyness were significantly different. The results from both tests were consistent. Hotelling's t-test produced a t-value of 1.23 ($df = 127$), $p = .221$, and Steiger's Z-test yielded a Z-value of 1.223, $p = .221$. In both cases, the differences between the correlations did not reach significance. This indicates that the relationships of internalizing behaviors with both Shyness and Fearfulness are not statistically different within the current sample.

As for correlations between Effortful Control, its subscales with Internalizing behaviors, none reached significance based on the data from this sample.

Table 4

Bivariate Correlations of Behavioral Inhibition (Shyness, Fearfulness), Effortful Control (including four subscales), and Problem Behaviors (Internalizing)

		Internalizing
Behavioral Inhibition (BI)	Pearson Correlation	.386**
	Sig. (2-tailed)	.000
	N	130
Fearfulness	Pearson Correlation	.242**
	Sig. (2-tailed)	.006
	N	130
Shyness	Pearson Correlation	.364**
	Sig. (2-tailed)	.000
	N	130
Effortful Control (EC)	Pearson Correlation	-.124
	Sig. (2-tailed)	.160
	N	130
Attentional Focusing (AF)	Pearson Correlation	-.081
	Sig. (2-tailed)	.359
	N	130
Inhibition Control (IC)	Pearson Correlation	-.137
	Sig. (2-tailed)	.119
	N	130
Perceptual Sensitivity (PS)	Pearson Correlation	-.103
	Sig. (2-tailed)	.242

	N	130
Low-intensity Pleasure (LIP)	Pearson Correlation	-.030
	Sig. (2-tailed)	.737
	N	130

**. Correlation is significant at the 0.01 level (2-tailed).

Multiple Regression Analyses

Two multiple linear regression analyses were conducted to scrutinize the interplay and potential moderating influence of Behavioral Inhibition and Effortful Control on the manifestation of Internalizing problems.

The first analysis was conducted to ascertain whether aggregated EC, as a comprehensive construct encompassing Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity, moderated the relationship between BI and Internalizing problems. In this regression model, BI, and the EC composite scores were entered simultaneously along with one interaction term $EC \times BI$ as the predictors, and Internalizing problems served as the outcome variable. The second analysis examined the main effects and moderation effects of BI, the individual components of EC—Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity—on the relationship between BI and Internalizing problems, controlling for the influence of the remaining components. BI and each EC component were entered simultaneously as predictors (independent variables), Internalizing problems was entered as the outcome (dependent) variable and interaction terms of $BI \times AF$, $BI \times IC$, $BI \times PS$, $BI \times LIP$ were entered to assess potential moderation effects.

Assumption Testing

Five primary assumptions that are requisite for the valid execution of multiple regression analysis were evaluated, including Linearity, Normality, Independence of Observations, Homoscedasticity, and the Absence of Multicollinearity.

Linearity. In assessing the Linearity assumption, the linear relationship between the dependent variable (internalizing problems) and each independent variable (Behavioral Inhibition, Effortful Control, and the interaction term between Behavioral Inhibition and Effortful Control) was examined. This process involved plotting the residuals against the predicted values of the dependent variable (Figure 3, 4 of the *Appendix*). Fairly equal dispersion throughout the plot suggested that the relationship between each of the independent variables and the dependent variable is indeed linear. Shyness, fearfulness, and the four subscales of Effortful Control (Attentional Focusing, Inhibitory Control, Low-intensity Pleasure, and Perceptual Sensitivity) were included to provide consistency.

Normality. In both regression analyses, a Quantile-Quantile (Q-Q) plot (Figure 5, 6 of the *Appendix*) was constructed using the residuals of each model to verify the assumption of Normality. For both regression models, the points in the Q-Q plots fell approximately along a straight line with no significant deviation from its linear pattern, affirming the normality of the residuals.

Independence of Observations. An inspection was undertaken using residuals versus fitted values plot to examine whether the assumption had been met or not. The residuals from the regression model (the difference between observed and predicted values) were plotted (Figure 3, 4 of the *Appendix*) against the fitted values of the dependent variable (internalizing problems). The plot showed no clear pattern, and the points were approximately symmetrically distributed around a horizontal line, representing zero residual value. To further examine the presence of this crucial independence, the Durbin-Watson statistic was employed. Both Durbin-Watson values were found to fall between 1-3, indicating the assumption of independence is met.

Homoscedasticity. A plot of residuals versus fitted values was generated for each model to assess the Homoscedasticity assumption (Figure 3, 4 of the *Appendix*). Both plots displayed a cloud of points that is evenly dispersed around the horizontal axis across all fitted values, implying a constant variance of residuals. No funnel-like pattern or systematic curve appears in the plots. Upon visual inspection of these plots for both regression analyses, the residuals were found to be distributed uniformly across the range of fitted values, suggesting the presence of homoscedasticity. Additionally, the Cook-Weisberg test for heteroscedasticity was conducted to provide a statistical measure of homoscedasticity. The results were non-significant, further confirming the Homoscedasticity assumption.

The Absence of Multicollinearity. To verify the Absence of Multicollinearity assumption, the Variance Inflation Factor (VIF) and Tolerance statistics were computed for each independent variable in the model. In the present analyses, all VIF values were found to be well below 5 and all Tolerance statistics were significantly above 0.2, suggesting that multicollinearity was not a concern. Furthermore, the correlation matrix of the independent variables was examined, with none of the correlations exceeding the generally accepted threshold of 0.7. All measures reliably indicated the absence of multicollinearity in both regression analyses.

Regression

Two multiple linear regression analyses were conducted to examine the predictive relationships of Behavioral Inhibition (BI), Effortful Control (EC), and their interactions with internalizing problems in children. The first analysis considered EC in its aggregate form, while the second analysis separately incorporated each EC subscale. Both analyses included BI and the

interactions of BI with EC or its subscales as predictors. Cohort differences were assessed prior to these analyses.

Cohort differences. The influence of cohort differences on the results was examined using a one-way Analysis of Variance (ANOVA). Participants were categorized into four cohorts corresponding to the year in which their data were collected and were dummy coded in the dataset as dc1, dc2, dc3, and dc4. The ANOVA revealed a non-significant effect of the cohort on the dependent variable of internalizing problems, $F(3, 126) = 1.322, p = .270$. Moreover, the multiple regression model yielded a small, non-significant R-squared value ($R^2 = .031$), indicating that only approximately 3.1% of the variation in internalizing problems could be accounted for by cohort differences. The adjusted R-squared value was .007, further confirming the marginal impact of cohort differences on internalizing problems. The standard error of the estimate was 3.104. Collectively, these statistics suggest that the measured level of internalizing problems did not significantly vary across the four cohorts. Therefore, the cohort differences do not appear to significantly impact the manifestation of internalizing problems among the participants in this study. These findings reinforce the generalizability of our results across different years of data collection, minimizing potential concerns regarding temporal variation in the sampled population.

In the first multiple linear regression analysis, Behavioral Inhibition (BI), the Effortful Control (EC) composite and the BI by EC interaction were entered as the independent variables predicting Internalizing problems (dependent variable). The analysis revealed that the overall regression model significantly predicted internalizing problems, $R^2 = .168, F(3, 127) = 8.549, p < .001$. Consistent with prior empirical evidence, the main effect of BI on internalizing problems emerged as statistically significant, $B = 1.085, \beta = .381, SE = .232, t(129) = 4.676, p < .001$,

95% CI [.626, 1.545] (Table 5). This signifies that higher levels of BI were associated with greater manifestations of internalizing problems, aligning our results with established research that underscores a positive relationship between these variables. The effect of EC on internalizing problems was not significant ($B = -0.587$, $\beta = -.115$, $SE = .420$, $t(129) = -1.397$, $p = .165$, 95% CI [-1.417, .244]), which suggests that changes in EC do not significantly predict changes in internalizing problems when holding all other variables constant in this sample.

The interaction term (BI×EC) was not statistically significant, $B = 0.289$, $\beta = .066$, $SE = .354$, $t(129) = 0.818$, $p = .415$, 95% CI [-.411, .989] (Table 5). This finding indicates that Effortful Control did not significantly moderate the relationship between Behavioral Inhibition and internalizing problems in the current sample, which seems to deviate from most previous research that showed EC as having a moderating, lessening effect on internalizing problems.

Table 5

Results of multiple linear regression analysis of internalizing on Behavioral Inhibition, Effortful Control, and Behavioral Inhibition × Effortful Control

Variable	Beta	SE	95%CI		β	t	p
			LL	UL			
Behavioral Inhibition (BI)	1.09	.232	.626	1.545	.381	4.676	.000
Effortful Control (EC)	-.587	.420	-1.417	.244	-.114	-1.397	.165
BI*EC Interaction	.289	.354	-.411	.989	.067	.818	.415

The second regression analysis was conducted to more deeply explore the distinct main effects and moderation effects of each of the individual components of Effortful Control (EC)—Attentional Focusing (AF), Inhibitory Control (IC), Low-intensity Pleasure (LIP), and Perceptual Sensitivity (PS)—on the relationship between Behavioral Inhibition (BI) and Internalizing

problems. Central to this analysis, within the purview of RQ 2B, was a focused inquiry into the roles of LIP and PS. These components, though integral, remain relatively understudied in the literature. Given the scarcity of research specifically examining the potential main effects and moderation effects of these lesser-studied sub-constructs of EC, we aimed to illuminate any unique patterns in predicting internalizing problems. This exploration was intended to provide insights into the multifaceted nature of EC and its role in moderating the relationship between BI and internalizing problems.

BI and the four individual EC components were entered simultaneously as the predictor variables (independent variables), then four interaction terms were entered $BI \times AF$, $BI \times IC$, $BI \times PS$, $BI \times LIP$. The internalizing score was entered as the outcome variable (dependent variable). The overall regression model was statistically significant, $F(9, 120) = 2.976$, $p = .003$, explaining approximately 18.2% of the variance in internalizing behaviors ($R^2 = .182$). The adjusted R^2 value, which takes into account the number of predictors in the model, was .121, suggesting that when controlling for the number of predictors, about 12.1% of the variance in internalizing behaviors can be explained by the model.

However, the results showed (Table 6) that none of the interaction effects between BI and the individual EC components were statistically significant: $BI \times AF$ ($B = -.215$, $\beta = -.076$, $SE = .306$, $p = .483$, 95% CI $[-.822, .391]$), $BI \times IC$ ($B = .403$, $\beta = .153$, $SE = .300$, $p = .181$, 95% CI $[-.190, .997]$), $BI \times LIP$ ($B = -.161$, $\beta = -.035$, $SE = .461$, $p = .728$, 95% CI $[-1.073, .752]$), and $BI \times PS$ ($B = .094$, $\beta = -.031$, $SE = .288$, $p = .745$, 95% CI $[-.477, .665]$). These findings suggest that in the current study's sample, the individual components of EC do not demonstrate a significant moderating role in the relationship between BI and internalizing difficulties when the

effects of other EC components are statistically accounted for. This result was contrary to our initial hypotheses and provided an interesting departure from the expected outcomes.

Table 6

Results of multiple linear regression analysis of Internalizing on Behavioral Inhibition, four Subconstructs of Effortful Control, and Behavioral Inhibition $\times$ Effortful Control Subconstructs

Variable	Beta	SE	95%CI		β	<i>t</i>	<i>p</i>
			<i>LL</i>	<i>UL</i>			
Behavioral Inhibition (BI)	1.125	.247	.636	1.63	.394	4.56	.000
Attentional Focusing (AF)	.046	.319	-.586	.677	.014	.144	.886
Inhibitory Control (IC)	-.230	.334	-.892	.431	-.071	-.689	.492
Low-intensity Pleasure (LIP)	-.090	.485	-1.049	.870	-.017	-.185	.854
Perceptual Sensitivity (PS)	-.248	.329	-.900	.404	-.073	-.753	.453
BI $\times$ AF Interaction	-.215	.306	-.822	.391	-.076	-.703	.483
BI $\times$ IC Interaction	.403	.300	-.190	.997	.153	1.346	.181
BI $\times$ LIP Interaction	-.161	.461	-1.073	.752	-.035	-.348	.728
BI $\times$ PS Interaction	.094	.288	-.477	.665	.031	.325	.745

In addition, regression models featuring only one EC sub-component at a time were also conducted. This approach was used to separate out each EC sub-component's unique contribution and rule out any potential suppressor effects that would appear if all EC sub-components were incorporated into a single model. These single-moderator models were consistent with the findings from the multiple regression analyses, which indicated that

individual EC sub-constructs did not significantly moderate the relationship between BI and internalizing problems in the current sample. The consistency across different models adds further credibility to the current results.

Chapter 5: Discussion

This study aimed to investigate the complex relations among Behavioral Inhibition (BI), Effortful Control (EC), and Internalizing problems in children. The constructs of Behavioral Inhibition, inclusive of Shyness and Fearfulness, and the Effortful Control domain, which includes Attentional Focusing, Inhibitory Control, Perceptual Sensitivity, and Low-intensity Pleasure, were the primary focus of the study. Behavioral Inhibition and Effortful Control were examined in relation to children's internalizing issues both at a bivariate level and through regression analyses. The latter approach was employed to explore unique main effects and the potential moderating effects of EC, as well as their sub-constructs, on the relationship between BI and internalizing problems. The findings revealed that Behavioral Inhibition was significantly correlated with, and predictive of, internalizing behaviors in children. However, Effortful Control and its sub-constructs did not show any significant correlations with internalizing behaviors, nor did they moderate the impact of Behavioral Inhibition on these problems. These results set the stage for our subsequent discussion on the implications, limitations, and future directions of this research.

Bivariate Relations

The bivariate correlational analysis conducted in the present study confirmed a statistically significant, albeit modest, relationship between Shyness and Fearfulness, which are key variables encapsulating the Behavioral Inhibition construct. This finding is congruent with

prior empirical evidence that consistently posits a connection between these two facets of Behavioral Inhibition (Kagan et al., 1987; Rubin et al., 2009; Degnan & Fox, 2007). In particular, research on inhibited temperaments in children has routinely associated heightened levels of Shyness with increased Fearfulness, thereby reinforcing the conceptualization of these dimensions as essential elements within the Behavioral Inhibition construct (Fox et al., 2005; Biederman et al., 2001). The findings of this current study reinforce the existing literature, consistently demonstrating a connection between the key variables of Shyness and Fearfulness within the Behavioral Inhibition construct.

As proposed in Research Question 1A, Behavioral Inhibition (BI) as a composite of Shyness and Fear correlated with internalizing behavior. Also as hypothesized both Shyness and Fear correlated significantly with internalizing behavior. Previous studies have consistently shown a positive link between these characteristics, and this correlation supports those findings (Biederman et al., 2001; Hirshfeld-Baker et al., 2007). The findings also echo the recent literature. Specifically, they align with the work of Degnan et al. (2010) and Liu & Bell (2020), which identify fearful temperament as a predictor of anxiety-related issues. Furthermore, these findings are consistent with the study by Hansen & Karevold (2023), which explores the central aspects of Shyness from early to middle childhood. According to their research, Shyness in early childhood often manifests through fearfulness and inhibition, with the influence of the social context becoming more pronounced in later childhood. The consistent relationship between Shyness, Fearfulness, and Internalizing behaviors, validated in both younger and middle childhood, stresses the developmental continuity and the potential for these characteristics to persist or even accentuate over time.

Within the Effortful Control domain, the correlations amongst the four subscales in the current study mainly exhibited significant positive relationships ranging from $r = .279$ to $r = .485$, with the exception of the correlation between Attentional Focusing and Perceptual Sensitivity. Although both constructs are facets of Effortful Control, they represent distinct aspects of this broad construct (Rothbart & Rueda, 2005). Attentional focusing is commonly understood as the cognitive capacity to sustain attention on inputs that are relevant to a given activity when there are potential distractions present (Eisenberg et al., 2004), whereas Perceptual Sensitivity refers to the detection and responsiveness to subtle or low-intensity stimuli in the environment (Ahadi et al., 1993). Consequently, these constructs may not necessarily correlate significantly with one another due to their distinct operational definitions and functionalities (Frohn, 2017). Hence, it is plausible for an individual to have high Perceptual Sensitivity (i.e., being sensitive to small changes in the environment), yet have difficulty with Attentional Focusing (i.e., maintaining attention on a single task in the face of distractors). For example, an individual might display high Perceptual Sensitivity, demonstrating an acute awareness of minor environmental changes, while struggling with Attentional Focusing, finding it challenging to maintain attention on a single task when faced with distractors. This lack of correlation may underscore the diverse ways in which EC can manifest within an individual, reflecting the nuanced interactions between cognitive and sensory elements of self-regulation.

While our understanding of the distinctive aspects within the Effortful Control domain, such as Attentional Focusing and Perceptual Sensitivity, continues to evolve, the findings also prompt us to reconsider the traditionally held beliefs regarding the relationship between Effortful Control and Internalizing behaviors. The non-significant correlations between Effortful Control (or its subscales) and Internalizing behaviors in this study challenge the conventional theoretical

model. Notably, many previous literature advocates for an inverse relationship between these constructs, with higher levels of Effortful Control generally linked to lower levels of internalizing behaviors (Eisenberg et al., 2004; Valiente et al., 2003). Other recent studies also substantiate this relationship. For instance, in a longitudinal study involving 1,226 children and their mothers, spanning from infancy (6 months) to early childhood (72 months), findings suggest that for girls, modulating temperamental reactivity through effortful control can serve as a protective factor, potentially mitigating the progression from early behavioral inhibition to childhood anxiety (Niditch & Varela, 2018). Similarly, Gulley et al. (2016) found that in conditions of low stress, high levels of Effortful Control serve as a protective factor against developing depressive and anxious symptoms among children who possess elevated levels of negative affectivity.. This premise posits that children with a heightened capacity for Effortful Control can more effectively regulate their emotional responses, thereby minimizing their propensity towards internalizing behaviors.

However, our findings resonate with a recent subset of empirical studies that report mixed or non-significant relationships between Effortful Control and internalizing behaviors. For instance, Oldehinkel et al. (2007) found in a Dutch sample of pre-and early adolescents from highly educated two-parent households that effortful control had a complex, quadratic relationship with internalizing problems, with variations across racial-ethnic groups. There might be implications that the relationship between effortful control and internalizing problems is not linear; instead, there could be an optimal point of effortful control beyond which its protective effect diminishes or even reverses. This could suggest that while moderate levels of effortful control might serve as a protective factor against internalizing problems, excessively high or low levels may exacerbate them. Moreover, Moran et al. (2013) revealed that Effortful Control did

not significantly forecast the presence of depressive symptoms in children at an elevated risk for conduct problems.

In line with these findings, a study conducted by Knyazev et al. (2021) in Russia, which utilized a community sample of 365 children aged 2–8 years, found a significant negative correlation between overall Effortful Control (EC) and internalizing problems, indicating that higher EC levels are linked to fewer internalizing problems; this relationship was specifically observed for the EC subcomponents of Perceptual Sensitivity and Inhibitory Control but not for Attentional Control and Low-Intensity Pleasure (Knyazev, 2021), using parent-reported Effortful Control scale from the Very Short Form of the Children's Behavior Questionnaire (CBQ-VSF, Putnam & Rothbart, 2006), adds to the growing body of evidence suggesting a more nuanced relationship between Effortful Control and Internalizing behaviors.

Furthermore, a comprehensive review by Santens et al. (2020) examined the role of Effortful Control (EC) across various age groups and clinical disorders, including internalizing disorders. Their review underscored the pivotal role of EC as a determinant of diverse outcomes - both adaptive and adverse - across developmental stages. It is worth mentioning that the majority of the studies included in this review were carried out using non-pathological student populations. The aforementioned studies highlight the significance of EC in the development and onset of a variety of mental illnesses, emphasizing the cross-cutting character of this concept. This particular role has the potential to exert a direct influence, so contributing causally, or it may function as a mediator element that impacts the consequences linked with a specific disorder. However, most studies reviewed have focused on the aggregate score of Effortful Control, as the overall construct tends to be the focal point of interest, and the reliability of the subscales often falls short of the total score's reliability (Santens et al., 2020).

Hence, in alignment with previous research, the current findings suggest that the connection between Effortful Control and internalizing behaviors may be more complicated than typically proposed, possibly influenced by other variables or being non-linear, thereby emphasizing the need for additional studies to elucidate this complex relationship.

Multivariate Relations

This study conducted two regression analyses to examine the intricate dynamics among Behavioral Inhibition (BI), Effortful Control (EC), EC's four sub-constructs, and their association on internalizing problems. The hypothesis posited a moderating role of Effortful Control (EC) and its sub-constructs in the relationship between Behavioral Inhibition (BI) and internalizing problems, proposing that EC might buffer the effects of BI on internalizing problems. However, the results did not confirm this hypothesis. While the overall model was statistically significant, denoting the combined influence of BI and EC on internalizing problems, and the main effect of BI on internalizing problems was significant - corroborating the widely recognized association in the existing literature - the current study found no evidence of interaction between BI and EC or its sub-constructs. These findings suggest that the putative buffering role of EC in the BI-internalizing problems relationship might be more complex than previously assumed, underlining the need for further research to explore other potential moderating or mediating factors.

In the current study, the observed absence of a moderation effect might be explained by considering the range and distribution of the internalizing scores within the current sample. Notably, while the utilized measure, SSiS, allows for a scoring range from 0 to 15, the data captured in our study peaked at a score of 13, with a mean of 4.32. This distribution indicates that the majority of our participants reported relatively low levels of internalizing problems. This

interpretation is further backed by a skewness value of 0.639, showing that a larger proportion of participants clustered towards the lower end of the scale. The limited representation of extreme or clinically significant levels of internalizing issues might have constrained our capacity to discern potential moderation effects. The restricted variability in our sample, leaning predominantly towards non-clinical levels, may have obscured any nuanced relationships where effortful control acts as a moderator. For a more holistic understanding of the potential moderation effects, future investigations should incorporate samples that span the entire range of internalizing scores, particularly those at the higher, more clinically significant end.

Another plausible explanation for the absence of the expected moderation effect may be attributed to measurement challenges. The study of Effortful Control (EC) has been conducted extensively across diverse age groups, ranging from infants as young as 38 months (Kim, 2013) to adults up to 58 years old (Zeytinoglu, 2017). Such widespread research underscores the significance and interest in understanding EC throughout various developmental stages including infancy, early childhood, adolescence, and adulthood. However, adopting a developmental lens on temperament reveals that, even though these traits exhibit relative stability (Rothbart & Bates, 2006), how they are measured and interrelate may change over time. This transition can pose challenges, especially for parents attempting to grasp this intricate concept. For example, the dimension of Perceptual Sensitivity, which falls under *Effortful Control* in the Children's Behavior Questionnaire (CBQ) for ages 3-7, is categorized differently in other instruments. It is associated with *Surgency* in infancy as gauged by the Infant Behavior Questionnaire-Revised (IBQ-R) (Gartstein & Rothbart, 2003) and with *Negative Affectivity* in early childhood as assessed by the Early Childhood Behavior Questionnaire (ECBQ) (Putnam et al., 2006). Such

discrepancies underscore the complex nature of EC and hint at potential measurement challenges when relying solely on parent questionnaires.

To further encapsulate the multifaceted and multidimensional character of the EC construct, a combination of measures might be more revealing. Various task-based evaluations, such as the Delay-of-Gratification Tasks (Kim, 2013; Duckworth, 2013), self-regulation tasks such as Simon Says tasks and Disappointing Gift tasks (Carlson, 2005), behavioral tasks such as Tower of Patience tasks (Lipsey, 2017) and Bead Sorting tasks (Studer-Luethi, 2016) could offer observational data and objective insights. Future investigations of Effortful control should integrate diverse methodologies—blending subjective self-reports, parent and teacher reports/evaluations, with more objective task-based approaches to create a more comprehensive measurement of EC.

Limitations and Future Research

Interpretation of the findings of this study is constrained by the nature of the sample and by sole reliance on parent informants. Parent-report measures might lead to response bias, such as social desirability, thereby potentially skewing the results. Importantly, as shown by generally low agreement found in the literature between parent and teacher informants, each informant has a unique perspective. Hence, the integration of multi-informant reports or behavioral observations would serve to triangulate data and offer a richer, more nuanced understanding of children's behaviors in future research. For example, teacher reports could reveal behavioral patterns in a social setting like the classroom, which might differ from behaviors exhibited at home. Another limitation is that the sample did not capture the full range of internalizing behaviors, particularly falling short at the higher, more clinically severe end. This relatively narrow scope constrains the applicability of the findings, especially in the context of individuals

experiencing more severe forms of internalizing problems. Future research could address this limitation by including a more diverse sample that encompasses the full range of internalizing behaviors, ranging from mild to clinically severe, to provide a more comprehensive understanding of the relationships among BI, EC, and internalizing behaviors. Future studies employing a longitudinal approach might offer additional insight into the temporal and potentially causal relationships among BI, EC, and internalizing behaviors. Finally, the sample's homogeneity poses a constraint on the generalizability of our findings. Although this study included children from different demographic backgrounds, they were similar in socioeconomic status. It is important to recognize that cultural context, socioeconomic diversity, and other demographic variables could significantly shape BI, EC, and the manifestation of internalizing problems.

Conclusions and Implications

This investigation into the complex relationships among Behavioral Inhibition (BI), Effortful Control (EC), and internalizing problems in children has provided both supporting and unexplored insights. The observed positive relationship between BI and Internalizing - aligns with prevailing research, reinforcing existing literature and emphasizing that early markers of inhibited temperaments can be predictive of internalizing behaviors (Fox et al., 2005; Smith et al., 2022). The persistence of these traits throughout childhood implies that timely interventions during early stages could be beneficial in mitigating adverse outcomes.

The absence of a significant correlation between Attentional Focusing and Perceptual Sensitivity challenges the conventional understanding of EC construct (Rothbart & Bates, 2006) and highlights the multifaceted nature of EC. Revised Perceptual Sensitivity Scale might be valuable for future research.

Surprisingly, while existing models posit an inverse relationship between Effortful Control and internalizing behaviors (Eisenberg et al., 2004; Martinez & Rogers, 2021), the findings of current study did not strictly replicate this relationship. Instead, the observed interactions highlight the multifaceted nature of Effortful Control. This suggests that a blanket approach, viewing Effortful Control as a consistent protective factor against internalizing problems, might be overly simplistic. An especially pertinent observation is the potential non-linear relationship between EC and internalizing behaviors, suggesting there may be an optimal point of EC beyond which its protective effects might diminish or even reverse. This complex interplay needs to be taken into account in both academic research and clinical contexts.

The absence of a discernable moderation effect of Effortful Control on the relationship between Behavioral Inhibition and internalizing problems was unexpected. However, given the sample's distribution and potential measurement challenges, this non-finding prompts a deeper exploration into the operationalization of Effortful Control and the tools utilized to measure it. Greater integration of diverse methodologies, such as task-based measures combined with subjective reports, may offer a more holistic perspective in future research.

Perhaps this study has paved the way for a more comprehensive understanding of the interplay between Behavioral Inhibition, Effortful Control, and internalizing problems. The findings also catalyze a call to action for researchers, driving them toward a more integrated and comprehensive approach to understanding and addressing the intricate dynamics of temperament and internalizing behaviors in early childhood children.

Appendix

Figure 3

Checking Linearity, Independence of Observations, and Homoscedasticity: Residuals vs. Predicted Values Plot for Model 1- Assessing the Moderation Effect of Aggregate EC on the Relationship between BI and Internalizing Problems.

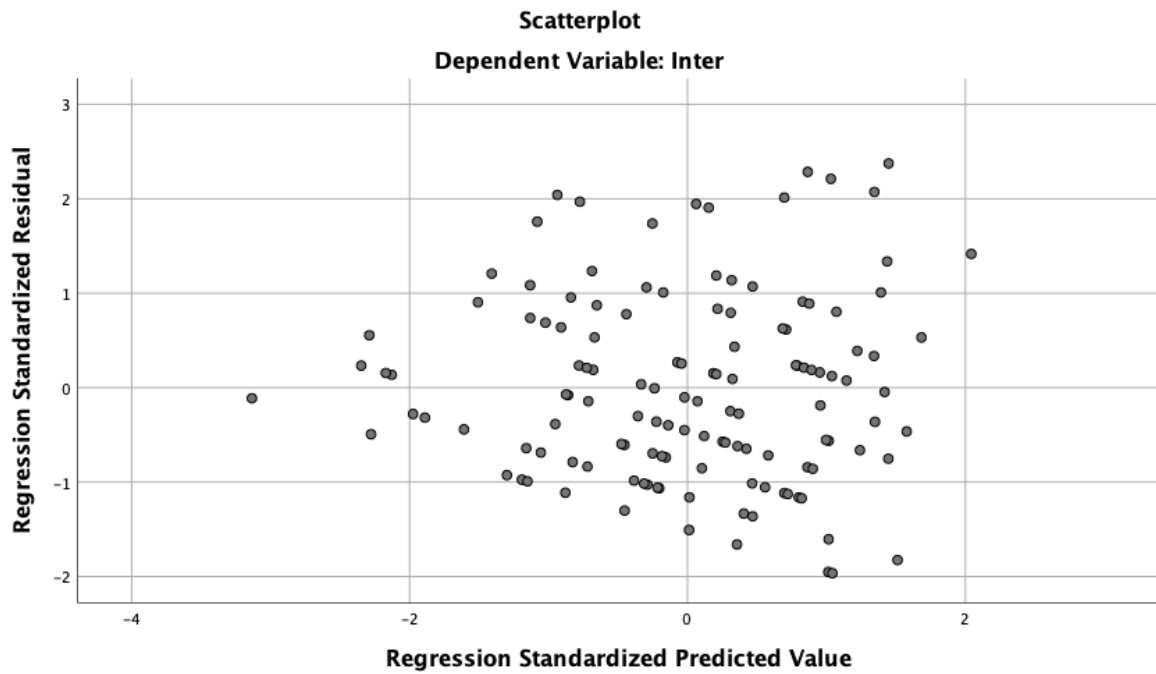


Figure 4

Checking Linearity, Independence of Observations, and Homoscedasticity: Residuals vs. Predicted Values Plot for Model 2: Assessing the Interaction of BI with Each of the Four EC Subscales in Contributing to the Prediction of Internalizing Problems.

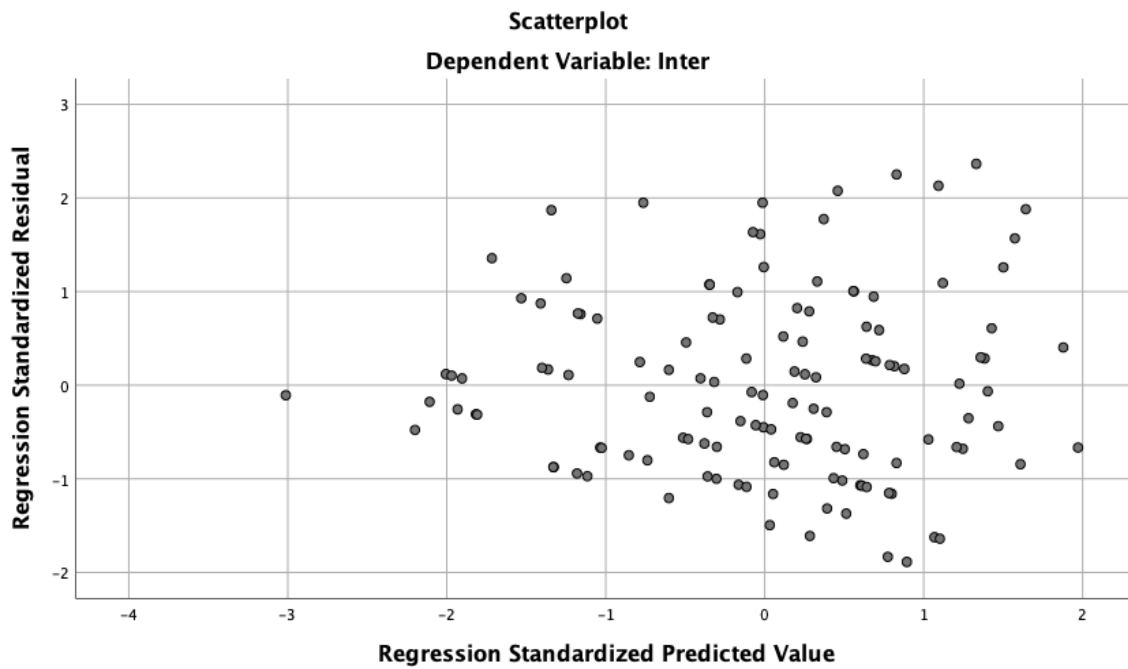


Figure 5

Checking Normality: Scatterplot of residuals against predicted values for Model 1, Assessing the Moderation Effect of Aggregate EC on the Relationship between BI and Internalizing problems.

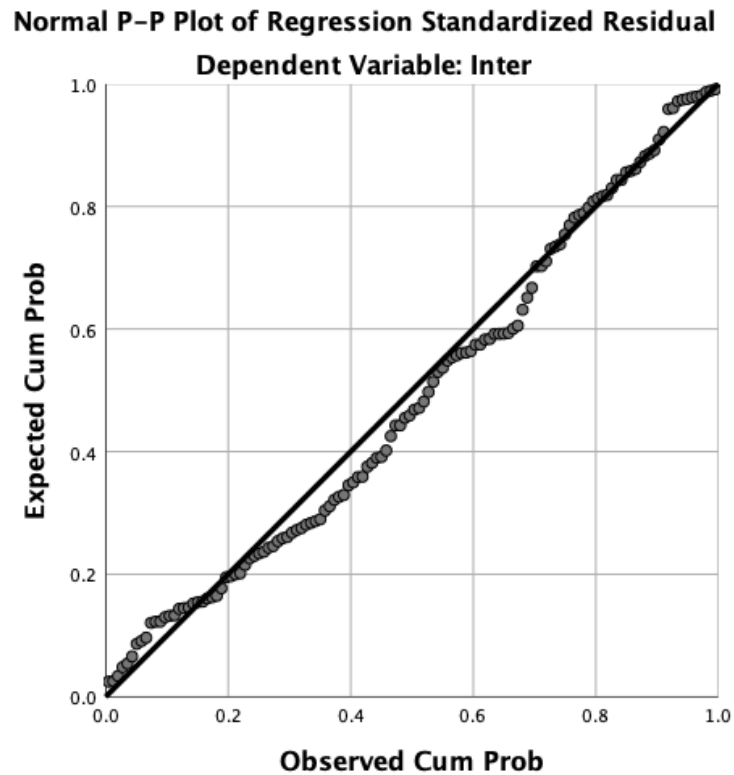
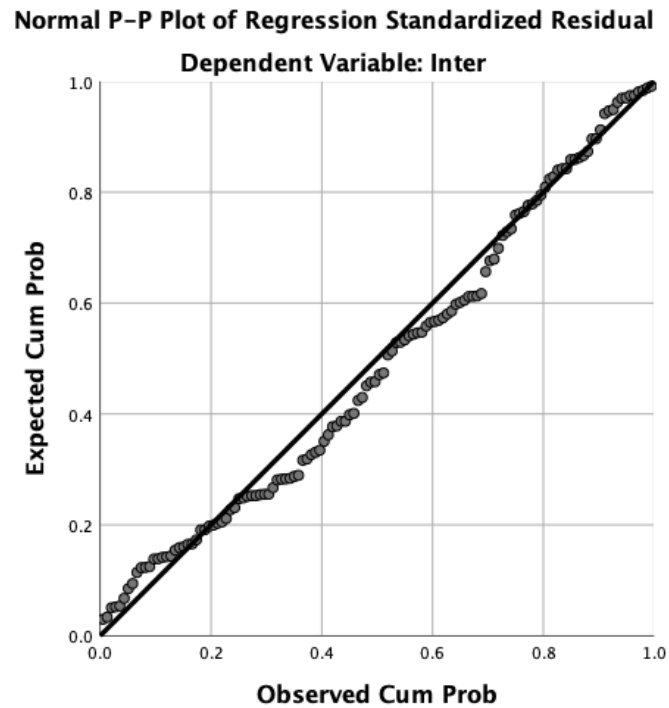


Figure 6

Checking Normality: Scatterplot of residuals against predicted values for Model 2, evaluating the interaction of BI with each of the four EC subscales in predicting internalizing problems.



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