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Clarity in the Eye of the Storm: The Role of Attentional Control in  
Adolescents' Daily Stress Regulation

A dissertation submitted in partial satisfaction of the  
requirements for the degree Doctor of Philosophy  
in Education

by

Brian Matthew Galla

2012



## ABSTRACT OF THE DISSERTATION

### Clarity in the Eye of the Storm: The Role of Attentional Control in Adolescents' Daily Stress Regulation

by

Brian Matthew Galla

Doctor of Philosophy in Education

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Arguably one of the most important developmental milestones in the life of any human is the onset of self-regulation. The development and refinement of attentional control—the top-down regulation of attention to facilitate self-regulatory goals—seems to undergird the capacity to direct behavior, thoughts, and emotions in accordance with one's goals. To date few studies have examined the impact of attentional abilities on day-to-day self-regulation success. This study sought to address this limitation in the literature and examined whether individual differences in attentional control were associated with adolescents' day-to-day regulation of stress-induced negative mood and rumination. Participants drawn from two public high schools in the northeastern United States completed both objective and self-report assessments of attentional control, as well as measures of stress coping. Following these assessments, participants reported on daily experiences of stress, mood, and rumination for 14 consecutive

days. Adolescents with higher levels of self-reported attentional control reported less stress-induced negative mood and rumination than adolescents lower in attentional control. Adolescents who performed better on an objective measure of attentional control (Operation Span) also showed less stress-related rumination compared with adolescents who did not perform as well. Results also indicated that involuntary stress responses and perceived stress mediated the associations between attentional control and stress-induced negative mood. Together, the results of this study offer support for the role of attentional control in regulating the emotional and cognitive effects of daily stress.

The dissertation of Brian Matthew Galla is approved.

Adriana Galvan

Sandra Graham

Carrollee Howes

Jeffrey J. Wood, Committee Chair

University of California, Los Angeles

2012

For my parents.

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Galla, B. M., Flook, L., Kitil, J., Flaxman, G., Kaiser-Greenland, S., & Smalley, S. L. (May 2010). Mindful awareness practices to promote executive functions in childhood. Symposium

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Galla, B. M., & Kaiser-Greenland, S. (forthcoming, 2012). The use of mindful awareness practices to promote attention and executive functions in early education: The effects of the "Inner Kids" program. In K. Schonert-Reichl and R. W. Roeser (Eds.), *Handbook of research on mindfulness in education*. Springer Press.

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## CHAPTER 1: INTRODUCTION

**...Set your mind to concentrate.  
For those whose minds are slack and wandering  
Are caught between the fangs of the afflictions.**  
Shantideva, *The Way of the Bodhisattva*

**The greatest weapon against stress is our ability to choose one thought over another.**  
William James, *Principles of Psychology*

Arguably one of the most important developmental milestone in the life of any human is the onset of self-regulation—the ability to control behaviors, emotions, and attention in the service of valued goals (Baumeister & Vohs, 2004; Shonkoff & Phillips, 2000). It is now widely recognized that self-regulation ability is related to a variety of positive developmental outcomes, from social-emotional health and adjustment (N. Eisenberg, Hofer, & Vaughan, 2007) to academic achievement (e.g., Duckworth & Seligman, 2005). On the contrary, many of society's most intractable problems—from addiction and crime to psychopathology and obesity—can be framed, at least in part, in terms of self-regulatory failure (Moffitt et al., 2011). While this capacity appears to emerge during the second year of life (Garon, Bryson, & Smith, 2008), it is not an "all-or-nothing" achievement: the change from being governed by the whims of external circumstances to being more self-governed follows a protracted developmental wave that crests in early adulthood (Giedd et al., 1999). The development and refinement of *attentional control*—the top-down regulation of attention to facilitate self-regulatory goals—seems to undergird the capacity to direct behavior, thoughts, and emotions according to one's internally-derived (or socially-determined) goals (Posner & Rothbart, 2000; Rueda, Posner, & Rothbart, 2004). A number of studies have now offered compelling evidence that attentional control is related to a host of self-regulation competencies and positive youth outcomes. However, to date few studies have examined the impact of attentional abilities on day-to-day self-regulation success. The



current study seeks to address this limitation in the literature and will examine whether individual differences in attentional control influence adolescents' day-to-day regulation of stress-induced negative emotion and rumination.

### Attentional Control & Self-regulation

The recognition of the connections between attention, self-regulation, and human flourishing has a long and rich history. The central teachings of the Buddha (Analayo, 2003), as well as the opening passage attributed to Shantideva (Chodron, 2005), delivered millennia ago, unambiguously relate human happiness to the cultivation of controlled attention, in addition to highlighting the psychological consequences of a "slack and wandering" mind (see also, Killingsworth & Gilbert, 2010). Many centuries after the Buddha and Shantideva, at the outset of modern psychological inquiry, William James (1890) also highlighted the role of attention in human well-being, and remarked, "The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will. No one is *compos sui* [master of thyself] if he have it not" (p. 424). A century following James, in his extensive research on the deep creative absorption known as "flow," Csikszentmihalyi (1990) reiterated the importance of a regulated attention, noting, "The mark of a person who is in control of consciousness is the ability to focus attention at will, to be oblivious of distractions, to concentrate for as long as it takes to achieve a goal...And the person who can do this usually enjoys the normal course of everyday life" (p. 31). The consequences of a wandering mind have also been elucidated in clinical contexts, with routine emphasis being placed on the relation between attention and psychopathology. Various disorders are often characterized by a lack of control over attention, including among others, anxiety and attention-deficit hyperactivity

disorder (Barkley, 1997; Derryberry & Reed, 2002). Broadly speaking, most modern notions of self-regulation and psychological well-being highlight—and some give prominence to—the importance of the capacity for a controlled attention (e.g., Baumeister, Heatherton, & Tice, 1994; Carver & Scheier, 1981; Kaplan & Berman, 2010; Norman & Shallice, 1986; Posner & Rothbart, 2007).

Based on these strong introspective and empirical linkages between attention and self-regulation, the question becomes, why is attention so important to self-regulation and human flourishing? In the current investigation we draw upon the insights of dual process models of information processing to help situate the role of attention in self-regulation (e.g., Barrett, Tugade, & Engle, 2004). Though dual process theories diverge in their specific empirical aims, a core aspect shared generally among them is that thoughts, emotions, and behaviors are determined by an interaction between automatic and controlled processes (Chaiken & Trope, 1999). Automatic processes, which encompass the vast majority of information processing (Bargh & Morsella, 2008), are associative, unintentional, are triggered involuntarily, and can be carried out with little to no conscious awareness or intervention (Bargh & Chartrand, 1999; Botvinick, Braver, Barch, Carter, & Cohen, 2001; Smith & DeCoster, 2000; Strack & Deutsch, 2004). Bargh and Chartrand (1999) use the analogy of a button being pressed on a machine to illustrate automatic processing. For example, pressing the power button on a computer will initiate the same series of operations required to "boot up" the system every time, through the process of spreading activation. Similarly, once certain mental representations stored in long-term memory have been activated ("pushed") by sensory input, they in turn activate associated schemas, which then automatically set in motion a series of defined operations. Often behaviorally-oriented (Strack & Deutsch, 2004), these activated representations can "endow the

organism with a sense of preparedness, that is, the ability to evaluate and respond to the environment quickly in accordance with one's needs and previous learning experiences" (Hofmann, Friese, & Strack, 2009, p. 165). Stated more concretely, suppose a hungry person who also happens to enjoy sushi walks past an advertisement for sushi, showcasing a variety of lunchtime options. The mere perception of these images might reactivate his "sushi" representation, which like the computer's power button, would spread its activation to associated schemas—involving a change in the core affective state, pleasant or desirous thoughts, etc.—and ultimately trigger a corresponding behavioral impulse to get sushi (Hofmann, Friese, & Strack, 2009). This cascade of events is, as Bargh and Chartrand (1999, p. 476) note, "unintended, effortless, very fast," and is designed to elicit quick and simple actions.

In this way, automatic processing (which is considered to be the default mode of human mental processing; Bargh & Morsella, 2008) frees the individual from having to make deliberate, energy-consuming choices for the majority of life's daily activities. It would not be particularly useful to have to deliberately scour one's mental "rolodex" of faces to recognize a dear friend with every encounter, or to ponder over whether it is appropriate to approach or avoid that vaguely recognizable four-legged creature on the horizon. However, automatic processes tend to operate through the activation of decontextualized scripts (or, schemas) based on idiosyncratic learning histories or biologically-endowed differences, and are not sensitive to the needs of the specific situation or how and why they were activated. Automatic processes enable fast responses, but do so on the basis of a crude, or low resolution sampling of the available environmental data (LeDoux, 2000). Therefore the endowed response may not always be context-appropriate, in line with established goals (e.g., the sushi-loving person has recently committed to a vegetarian diet), or socially-acceptable. When conflict between automatically

activated representations and situational demands reach a certain threshold, attentional control must be brought online to help resolve the conflict (Barrett et al., 2004; Botvinick et al., 2001; Norman & Shallice, 1986).

Controlled attention allows information to be processed in a more conscious, deliberate manner, rather than simply proceeding according to whichever mental representation is most active (MacCoon, Wallace, & Newman, 2004; Strack & Deutsch, 2004). Norman and Shallice (1986) referred to this as the *supervisory attention system* (SAS), and suggested that attentional control serves as the gateway for further processing resources to be brought online to assist specific processing goals. By bringing more cognitive resources to bear on the situation, attentional control allows for a more detailed, higher resolution sampling of the available environmental data, which can then be used to inform decision-making. For example, the sushi aficionado can search his memory in an attempt to rekindle the motivating influence to become a vegetarian (and also anticipate the remorse he might experience if he caves in to the temptation or the pride he might feel by remaining steadfast), or he can peruse the advertisement for information about vegetarian options, or he might inhibit the impulse and continue walking past the sushi restaurant. Similarly, automatically activated emotions (e.g., anxiety) are not always adaptive for the current goal demands (e.g., giving a public talk), and attentional control can be brought online to help down-regulate this emotion. The SAS thus, "provides a flexible correction tool permitting a fairly large degree of control over decisions and actions" (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008, p. 963) that is not possible through automatic processing alone. However, this flexibility comes at a cost; attentional control is an exhaustible resource, is relatively slow to action, and can be consumed by disproportionately challenging situations, such as stress.

Given the centrality of attentional control in these models of self-regulation, a growing research enterprise has been directed toward examining the impact of individual differences in attentional control on a variety of self-regulation domains (Barrett et al., 2004; Brown & Ryan, 2003; Posner & Rothbart, 2007). While this work varies according to the specific definition of attentional control (e.g., effortful control, mindfulness, working memory capacity), it takes the general form that, depending on their levels and functioning of attention, certain individuals should be more or less able to exert control over (or, bias) the information processing stream and determine, to some degree, the influence of automatic processes over their thoughts, emotions, and behaviors (Barrett et al., 2004). Individuals with lower levels of attentional resources should be less able to control information processing when conflict arises, and therefore might appear less flexible and more stereotyped in their responses (be they emotions, behaviors, or thoughts). Conversely, individuals with higher levels of attentional control should have a surplus of resources to bring to bear on the situation, especially in the face of challenges, which would increase their potential to respond in a more flexible, goal-directed fashion. In the following sections, I will highlight the literature from three areas of research relating individual differences in attentional control to self-regulatory competencies.

### Effortful Control & Self-regulation

The impact of individual differences in attentional control on emotional self-regulation has been extensively explored through the study of child temperament. One prominent area of inquiry within this discipline is the study of individual differences in effortful control (N. Eisenberg et al., 2007). Effortful control (EC) is a multi-faceted construct of temperament that is widely assumed to be dependent on the functioning of the executive attention network (Rothbart,

Sheese, & Posner, 2007), which is subserved mainly by frontal midline areas and the lateral prefrontal cortex (Botvinick et al., 2001; Bush, Luu, & Posner, 2000; Posner & Rothbart, 2007). Effortful control is broadly defined by the abilities to sustain focus and shift attention as necessary, as well as to voluntarily inhibit habitual or dominant reactions or response tendencies and activate subdominant responses (Rothbart & Bates, 2006). A baseball player "checking" his swing as he notices the ball curve outside the strike zone is an example of EC in action.

Effortful control (EC)—and by proxy, attentional control—is assessed through a variety of methods, most commonly through questionnaire batteries that tap combinations of attentional, inhibitory, and activation control (e.g., Rothbart, Ahadi, Hersey, & Fisher, 2001). It is also assessed through tasks that require the resolution of cognitive conflict, where a dominant, but inappropriate response must be overcome and a subdominant response activated, such as the Stroop test (Stroop, 1935) and the Attention Network Test (Fan, McCandliss, Sommer, Raz, & Posner, 2002). In the classic Stroop test, participants must name the font color of a written word rather than the semantic meaning of the color word. For example, if the word "GREEN" is displayed in blue ink, the correct response is "blue" rather than "green." The quicker, automated process of reading the word interrupts the more deliberate process of naming the color, and the resolution of this competing response tendency is a measure of the efficiency of effortful control (Ehrenreich & Gross, 2002; Riggs, Greenberg, Kusche, & Pentz, 2006). A battery of behavioral tasks has also been developed to tap other putative EC processes, such as delay of gratification (Mischel & Ebbesen, 1970; Murray & Kochanska, 2002; Spinrad, Eisenberg, & Gaertner, 2007).

An extensive body of research now documents the importance of effortful control in the self-regulation of emotional and behavioral processes, both contemporaneously and over longer periods of time (N. Eisenberg, Spinrad, & Eggum, 2010). Like "swinging away" on every pitch,

low levels of EC can leave an individual at risk for enacting automatic or poorly considered cognitive or behavioral strategies, particularly in situations involving a high degree of conflict or load. Also, difficulties with shifting attention, filtering distracting stimuli from ongoing information processing goals, or maintaining focus on goal-directed behaviors, all would seem to carry important emotional and behavioral consequences. For example, several recent laboratory studies investigated whether young children's ability to regulate emotional processes in an evocative situation was associated with EC (Carlson & Wang, 2007; Kieras, Tobin, Graziano, & Rothbart, 2005; Liebermann, Giesbrecht, & Müller, 2007; Simonds, Kieras, Rueda, & Rothbart, 2007). For example, Kieras, Tobin, Graziano, and Rothbart (2005) showed that preschool children with higher levels of EC were better able to manage expressions of frustration when being presented with an undesirable gift (Saarni, 1984). Specifically, they found that children higher in EC showed comparable amounts of positive expression following both the desirable and undesirable gifts. Conversely, children scoring lower in EC displayed fewer positive emotional expressions following the undesirable gift than the desirable one (Kieras et al., 2005).

A large number of studies also offer consistent evidence for an inverse relationship between effortful control and internalizing and externalizing syndromes. For example, Eisenberg and colleagues have shown that children with elevated externalizing and internalizing problems display lower levels of EC compared with non-disordered children (N. Eisenberg et al., 2001; N. Eisenberg et al., 2005; N. Eisenberg et al., 2004). Several studies by Dennis and colleagues (2003; 2007) further highlight the negative associations between effortful control and aggressive behaviors in preschool children. Ellis, Rothbart, and Posner (2004) also provided evidence for a negative association between anti-social behaviors and attentional control in a sample of adolescents. Across several studies, Muris and colleagues have also provided evidence that

attentional control is negatively related to psychological symptoms in youth samples (Muris, 2006; Muris, De Jong, & Engelen, 2004; Muris, Mayer, van Lint, & Hofman, 2008; Muris, Meesters, & Rompelberg, 2006; Muris, van der Pennen, Sigmond, & Mayer, 2008). Furthermore, Muris (2006) found that attentional control interacted with neuroticism to predict emotional problems. Specifically, children with high levels of neuroticism showed increased psychopathological problems if they were also low in attentional control. Children with high levels of both attentional control and neuroticism were protected from increases in symptoms. This finding corroborates the findings from Derryberry and Reed's (2002) influential study of attentional control and anxiety-related attentional biases. They showed that anxious participants with lower levels of attentional control showed an attentional bias toward threatening stimuli, whereas participants with higher levels of attentional control were more skilled at shifting away from threatening stimuli.

Several other longitudinal studies have examined the mental health impact of effortful control over time. In a two-year study involving 235 first grade students, Nigg and colleagues (1998) found baseline differences in effortful control (assessed via Stroop test) contributed to fewer externalizing problems and higher social competency two years later. Another two-year longitudinal study involving first grade children similarly found that effortful control predicted decreases in both externalizing and internalizing problems two years later (Riggs, Blair, & Greenberg, 2003).

### Mindfulness & Self-regulation

Individual differences in attentional control have also been explored through research on mindfulness. Mindfulness refers to a state of consciousness involving a receptive attention to and



awareness of present moment experiences (Analayo, 2003; Brown & Ryan, 2003). When mindfulness is actively engaged in consciousness, attention is directed to any perceptual input that enters awareness with an attitude of openness and curiosity. Just as a mirror clearly reflects its object, mindful attention on sensory input simply reveals what is occurring in any given moment of experience (e.g., thoughts, emotions, sensations). Importantly, when a phenomenal event (e.g., a painful sensation) is received with mindful awareness, there are no attempts made to control, suppress, or get involved with it. While a spectator might affectively engage in a theatre production, she does not climb on stage and enter the drama, no matter how compelling the story. For this reason, mindfulness has been described as a kind of participatory observation that allows the individual to fully experience an event without dictating its course or becoming entangled in it.

For example, the quotidian experience of an itch is likely to be composed of automatic negative evaluations and affective tone, thoughts and judgments (e.g., "I don't like this"), and a behavioral-motivational stance (e.g., "scratch this itch"). In a non-mindful state these features of the perceptual process are hardly recognized, leaving little opportunity to interrupt their extraordinary and swift "push" on behavior. This entire process unfolds in what seems instantaneous to our experience, and before we even realize what we are doing, we may have already instantiated the action of scratching the itch. Met with mindfulness however, the full range of these events can be observed and received as "raw," or non-elaborated sensory input (e.g., temperature, intensity, location, emotional tone, thoughts), without the necessity to alter the situation in any way.

By maintaining an undistracted and curious attention toward sensory experience, the individual can gain awareness of how moment-to-moment experience is typically overlaid with

emotional reactions, evaluations, and attempts to escape or perpetuate the moment according to its emotional tone. Once recognized, these implicit features of subjective experience can be investigated, rather than reacted upon or suppressed, allowing for the development of meta-cognitive insight. Over time meta-cognitive insight can gradually reinforce a degree of "de-automatization," providing the basis for altering or even reducing compulsive mental habits that reinforce psychological suffering.

In the past decade, concerted efforts have been devoted to the development of psychometrically sound self-report measures of mindfulness. These instruments attempt to capture individual differences in various qualities of mind hypothesized to underlie such a mindful state of consciousness (Baer, Smith, & Allen, 2004; Baer et al., 2008; Brown & Ryan, 2003), and in particular, controlled attention (Brown & Ryan, 2003). For example, one of the most widely used self-report measures of mindfulness, the Mindful Awareness Attention Scale (MAAS; Brown & Ryan, 2003), assesses the perceived ability to sustain conscious awareness in everyday activities (or, its conceptual opposite, inattentiveness or mindlessness). A growing body of research now provides support for self-report measures of mindfulness to tap important aspects of attentional control (Anicha, Ode, Moeller, & Robinson, 2011; Cheyne, Carriere, & Smilek, 2006; Galla, Hale, Shrestha, Loo, & Smalley, 2011; Josefsson & Broberg, 2010; Moore & Malinowski, 2009; Schmertz, Anderson, & Robins, 2009). For example, both Cheyne and colleagues (2006) and Schmertz and colleagues (2009) showed that lower scores on the MAAS were related to attentional lapses on an objective measure of sustained attention. Furthermore, Galla et al. (2011) showed that higher scores on a related measure of mindful attention were associated with improved inhibitory control and sustained attention abilities.

As with the other notions of attentional control, mindfulness involves the ability to control attention in the service of goal-directed processing and counteract automatic processing (Brown & Ryan, 2003; Brown, Ryan, & Creswell, 2007), and should therefore be associated with improved abilities to regulate emotions and behavior. Indeed, self-report measures of mindfulness have also shown robust associations with emotion regulation. For example, Creswell, Way, Eisenberger, and Lieberman (2007) found that higher levels of dispositional mindfulness predicted more robust activity in prefrontal neural regions associated with emotion regulation during an affect labeling task. In a follow-up study, Way, Creswell, Eisenberger, and Lieberman (2010) showed that dispositional mindfulness predicted reduced amygdala reactivity to evocative faces. The results from this study, as Williams (2010, p. 4) noted, "reminds us that inattentiveness is not merely a neutral, mildly inconvenient state of mind. Rather this state of constantly being "drawn away" from moment-to-moment experience by self-related concerns is closely related to stress and affective reactivity." In line with these findings, others have also reported significant associations between mindfulness and emotion regulation strategy use and/or reduced emotional reactivity (e.g., Baer et al., 2004; Barnhofer, Duggan, & Griffiths, 2011; Brown & Ryan, 2003; Carriere, Cheyne, & Smilek, 2008; Coffey & Hartman, 2008; Coffey, Hartman, & Fredrickson, 2010; Fetterman, Robinson, Ode, & Gordon, 2010; Hill & Updegraff, 2011), with higher levels of mindfulness predicting improved ability to regulate emotions.

A number of studies have also explored the associations between self-reported mindfulness and behavior self-regulation (Bowlin & Baer, 2012; Evans, Baer, & Segerstrom, 2009; Kirk, Downar, & Montague, 2011; Lakey, Campbell, Brown, & Goodie, 2007; Niemiec et al., 2010). For example, across two studies Lakey and colleagues (2007) showed that dispositional mindfulness was associated with less severe gambling outcomes. In the second

study, they found that mindfulness predicted performance on two risk-taking procedures, which in turn, mediated the associations between mindfulness and gambling problems. In a direct test of dual process models of self-regulation, other studies have provided evidence that individual differences in mindfulness can impact the sway of automatic processing on behavior (Brown & Ryan, 2003; Hooper, Villatte, Neofotistou, & McHugh, 2010; Koole, Govorun, Cheng, & Gallucci, 2009; Levesque & Brown, 2007; Ostafin & Marlatt, 2008; Papies, Barsalou, & Custers, 2011). For example, Ostafin and Marlatt (2008) showed that automatic positive attitudes toward alcohol predicted hazardous drinking only in individuals with lower levels of mindfulness. A related study by Levesque and Brown (2007) showed that dispositional mindfulness modified the behavioral expression of implicit autonomy orientation in daily life.

Recent efforts have also been directed to evaluate the associations between self-reported mindfulness and emotion regulation and well-being among youth populations (Black, Sussman, Johnson, & Milam, 2012; Brown, West, Loverich, & Biegel, 2011; de Bruin, Zijlstra, van de Weijer-Bergsma, & Bögels, 2011; Laurie A. Greco, Baer, & Smith, 2011; L. A. Greco, Lambert, & Baer, 2008). For example, Ciarrochi and colleagues (2011) showed that mindfulness was associated with a host of positive emotional indices, including emotional awareness and experiential acceptance. Furthermore, the authors showed that mindfulness predicted less hostility and sadness one year following the initial assessment. Work in this area is just beginning to emerge (Black, Milam, & Sussman, 2009), and with the recent psychometric validation of various mindfulness scales for adolescents (e.g., Brown et al., 2011), instruments are now available to more properly assess the role of mindful attention in youth self-regulation and well-being.

## Working Memory Capacity & Self-regulation

Another area of research that has capitalized on the study of individual differences in attentional control involves *working memory capacity*. Engle (2001) and others (e.g., Barrett et al., 2004; Schmeichel, Volokhov, & Demaree, 2008) have defined working memory capacity (WMC) as, "the ability to sustain goal-directed information processing in the presence of alternative goals or other distractions" (Schmeichel et al., 2008, pg. 1527). Modern conceptualizations of WMC are based in large part on Baddeley and Hitch's (1974) multi-faceted model of working memory. At the heart of this model is a controlled attention system, often dubbed "the central executive," that helps implement the top-down control of attention resources for the execution of flexible, controlled processing of information in the service of task goals (Engle, 2002).

The assessment of individual differences in working memory capacity—and by proxy, executive attention (Engle, 2002)—has been a mainstay of scientific research for several decades. It often involves performance on complex span tasks, such as the Operation Span (OSPAN; Turner & Engle, 1989), which combines a serial recall task (a string of letters) with a decision-making task (solving math problems). For example, the participant would see a series of items similar to the following: "Does  $(3 \times 6) - 2 = 20$  ? H." Each block of trials varies from 3 to 7 math problem/letter combinations, and at the end of each block the test taker is asked to recall the letters in *serial order*. Performance on the OSPAN task is determined by the total number of letters recalled in the appropriate order. Therefore, individual differences in WMC reflect the ability to consciously guide information processing (encoding and recalling a series of letters) while simultaneously overcoming distractions that interfere with ongoing responding (Redick, Heitz, & Engle, 2007). Rather than testing memory storage per se, which may be primarily

determined by the "slave" storage systems, complex span test performance is more specifically related to the capacity which with attentional resources can be brought to bear on current information in the service of task goals (Engle, 2002; Hofmann, Schmeichel, Frieese, & Baddeley, 2011; Kane, Bleckley, Conway, & Engle, 2001).

Indeed, individual differences in WMC have been shown to correlate with performance on a number of putative measures of executive attention. In one study, Kane and Engle (2003) tested performance on the Stroop test as a function of individual differences in WMC. They found that individuals high in WMC performed better on a Stroop interference test than those low in WMC, especially in "interference-rich" blocks (e.g., those involving a large number of incongruent trials, thus requiring more frequent instances of inhibition). Another study compared individuals high vs. low in WMC on their ability to control visual attention in the presence of salient, but distracting cues (Unsworth, Schrock, & Engle, 2004). The authors found that individuals with greater WMC were less vulnerable to reflexive responding on the saccade task, more likely to make correct choices on the anti-saccade trials, and more likely to correct their performance errors than were individuals with low WMC (Unsworth et al., 2004). Further studies have found WMC to be related to performance on several flanker tests, including the Attention Network Test (Heitz & Engle, 2007; Redick & Engle, 2006) and a dichotic listening task (Conway, Cowan, & Bunting, 2001).

Individual differences in WMC have also been related to a number of "real-world" cognitive skills and academic competencies (for a comprehensive review, see Barrett et al., 2004). To name a few, WMC has been related to reading and language comprehension (Daneman & Carpenter, 1980), complex logic learning (Kyllonen & Stephens, 1990), novel reasoning and problem-solving ability (Engle, Tuholski, Laughlin, & Conway, 1999), vocabulary

learning (Daneman & Green, 1986), and performance on standardized tests, such as the SAT (Engle, Tuholski et al., 1999). WMC has also repeatedly shown to strongly relate to general fluid intellectual abilities—supposedly due to a common reliance on controlled attention (Conway, Kane, & Engle, 2003; Engle, Kane, & Tuholski, 1999; Engle, Tuholski et al., 1999; Heitz, Unsworth, & Engle, 2005).

As can be seen, a substantial body of research has established the importance of WMC on a number of important cognitive abilities. In the past few years however, research has begun to explore the influence of WMC on the self-regulation of emotional and behavioral processes (Hofmann et al., 2011; Ilkowska & Engle, 2010). Earlier work in this area has focused on the effects of certain emotional processes on WMC. For example, Ashcroft and Kirk (2001) studied the influence of math anxiety on two operation span tasks. They found that individuals with high test anxiety had significantly more difficulties on a computation span task—both more errors and longer response times—than individuals with low math anxiety (Ashcroft & Kirk, 2001). The authors reasoned that anxiety, and the resultant intrusive worries, consumed the limited resources of the central executive that were necessary for the complex span task. The competition of limited resources (or cognitive load) has been demonstrated in a variety of other studies involving stress (Klein & Boals, 2001), high pressure situations (Beilock & Carr, 2005), and stereotype threat (Schmader & Johns, 2003). In all these situations, performance on working memory tasks diminished as the competing variables increased in potency—greater life stress in the case of Klein and Boals' (2001) study. This work on WMC, as well as on executive functions more generally, does convincingly argue that strong emotional states can impair the functioning of the central executive

The present study is more concerned with the contributions of WMC in the self-regulation of emotions to stressful events. While the work in this area is less established, there are compelling empirical and theoretical arguments for the central role of WMC in the self-regulation of emotional and behavioral processes (Hofmann, Friese, & Roefs, 2009; Hofmann, Friese, & Strack, 2009; Hofmann et al., 2008; Hofmann et al., 2011; Ochsner & Gross, 2007; Schmeichel et al., 2008). To the degree that WMC is a domain-general capacity (e.g., the same executive attentional processes are activated regardless of the particular situation), and serves to shield controlled, intelligent processing from distractions, irrelevant information, or automatic processes, it may exert a powerful influence over whether someone can control their emotional reactivity (Barrett et al., 2004; Compas, Campbell, Robinson, & Rodriguez, 2009; Mischel & Ayduk, 2002, 2004; Wranik, Barrett, & Salovey, 2007).

Wranik, Barrett, & Salovey (2007) referred to individuals high in WMC as "motivated tacticians" who have "multiple information processing strategies available to them and can select among them on the basis of goals, motives, and the constraints of the environment" (p. 401). Conversely, they considered individuals low in WMC as possible "cognitive misers" with limited abilities to control attention, who will more likely adopt processing strategies with fewer attention requirements. In situations involving interference or greater load, individuals with low WMC may have a reduced flexibility with which they can respond to situation-specific cues and/or maintain goal-relevant processing. Even if individuals with low WMC have the proper explicitly stated processing goals (e.g., forgo eating excessive sweets to maintain diet), these highly valued goals may not be sufficient in situations requiring a high degree of executive control (e.g., walking down the candy aisle of the grocery store). High WMC individuals, on the



other hand, may be more able to maintain and implement the same goal motives in the face of challenging situations.

Several recent laboratory-based experiments have provided supportive evidence for individual differences in WMC to influence emotion regulatory processes. Schmeichel, Volokhov, and Demaree (2008) conducted a series of investigations on the influence of WMC in the self-regulation of emotions. In study 3, for example, participants watched a gruesome film clip and were asked to watch the film either in a normal manner or to reappraise the images in neutral, non-emotional terms. Results revealed that individuals high in WMC were better able to implement the reappraisal strategy and reduce their negative affect than were individuals low in WMC. The results of the other three studies corroborated the findings of study 3, despite alterations in the experimental paradigm, further supporting the role of WMC in moderating the effectiveness of emotion regulation strategies.

In another series of studies, Hofmann and colleagues (2008, 2009) related WMC with the differential ability to self-regulate both automatic and explicit behavioral tendencies in provocative situations. Using a false-feedback scenario (study 3; Hofmann et al, 2008), results indicated that the relations between implicit anger and giving negative social feedback were moderated by WMC. Specifically, individuals low in WMC with high automatic anger-self associations rated others more negatively following their own negative feedback than individuals high in both WMC and automatic associations. This study provided evidence that high WMC enabled individuals to modulate impulses of anger proneness (toward retaliation) and provide more reasonable, objective feedback. In support of the contention that WMC influences emotional and behavioral self-regulation, the authors concluded (p. 973), "WMC may function like a gatekeeper by inhibiting the influence of automatic precursors and simultaneously foster

the influence of self-regulatory goal standards, by maintaining these standards in an active, conscious state so that they can be successfully used for goal-directed self-regulation."

For adolescents, there is a sizeable body of evidence that deficits in working memory capacity are associated with severe adolescent maladjustment, such as physical aggression, violence, theft, and incarceration status (Barker et al., 2007; Cauffman, Steinberg, & Piquero, 2005; Séguin, Arseneault, & Tremblay, 2007; Séguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Séguin, Pihl, Harden, Tremblay, & Boulerice, 1995; White et al., 1994). Other work has found WMC to moderate the relations between drug-related memory associations and substance use in seriously at-risk adolescents (Grenard et al., 2008; Thush et al., 2008). While these studies do support the role of working memory in adolescents' social and behavioral adjustment, nearly all of this work has been conducted in clinical, juvenile, or otherwise at-risk groups. To the degree that WMC relates to the self-regulation of emotional processes in non-clinical adolescents however, remains uncertain and will be a focus of this study.

### The Current Study: Attentional Control & Daily Self-regulation

This survey of the empirical literature largely converges—albeit with some qualifications and exceptions—on the view that the ability to control attention (regardless of how one defines attentional control) is related to a number of self-regulatory competencies, as well as many positive outcomes. In fact, the cumulative evidence marshaled from all three domains of inquiry has made the assertion that attention and self-regulation are intimately related a decidedly uncourageous endeavor. Despite many significant contributions to the field, gaps remain in current understanding that requires further clarification. For example, nearly all of the supporting evidence for the role of attentional control on self-regulation and positive youth outcomes is

derived from observational studies conducted in laboratory settings (e.g., Carlson & Wang, 2007), or from longitudinal studies in which responses are collected months or years after an initial assessment (Moffitt et al., 2011; Nigg et al., 1998; Riggs et al., 2003). To date, fewer studies—and to our knowledge, none with adolescents—have investigated whether individual differences in factors like attentional control influence short-term, daily self-regulatory processes. Many of the accumulated positive outcomes of successful self-regulation (e.g., mental health) addressed in long-term studies should theoretically be determined by a series of contextualized, shorter-term self-regulatory actions (e.g., being able to regulate *this* negative emotion, rather negative emotions in general). Given that momentary or short-term self-regulatory efforts throughout the course of daily living are likely to carry substantial long-term effects, it is important that research be able to document these processes (e.g., Berkman, Falk, & Lieberman, 2011). In the current study, we link more traditional laboratory and self-report methods with methods capable of capturing shorter-term, within-person patterns of self-regulatory efforts. To this end, we focused on the role of individual differences in attentional control to predict the daily self-regulation of stress-induced negative emotions and rumination.

Stress is ubiquitous to human experience; among the few absolutes in life is the certainty that everyone will, from time to time, experience something they do not want to. From time to time, feeling pressured by academics, arguing with a parent or friend, etc. are likely going to be a part of adolescents' daily experience. Fuligni et al. (2009) referred to these quotidian events as relatively low-frequency, high-impact problems, meaning that while daily stressors of this sort may occur infrequently, when they do occur, they often carry a heavy psychological burden. For example, while the daily experience of witnessing or being the victim of peer harassment occurs relatively infrequently, these experiences are associated with significant increases in anxiety,

depression, and humiliation (Nishina & Juvonen, 2005). Other studies have reported similar associations between self-reports of daily stress and negative mood (Larson & Ham, 1993; Larson & Lampman-Petratis, 1989; Larson, Moneta, Richards, & Wilson, 2002; Lehman & Repetti, 2007; Repetti, 1996; Reynolds & Repetti, 2008; Schneiders et al., 2007; Schneiders et al., 2006). Furthermore, daily stressors are thought to be a larger contributor to psychopathologies than are major life events, such as a divorce (Almeida, 2005; Repetti, McGrath, & Ishikawa, 1999). Studies with both children and adolescents have shown clear associations between daily stress and increased psychopathological symptoms (Banez & Compas, 1990; Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Compas, Howell, Phares, Williams, & Giunta, 1989; DuBois, Felner, Brand, Adan, & Evans, 1992; Sim, 2000; Wagner, Compas, & Howell, 1988).

How adolescents negotiate their experience of stressful events can moderate, potentially to a large degree, the impact that these events have on their psychological well-being. Indeed, coping effectively with the resulting negative emotions of daily hassles is seen as one of the most important protective factors in adolescents' long-term adjustment (Compas et al., 2001; Compas & Reeslund, 2009). Therefore, understanding the sources of individual variation in the ways adolescents manage the emotional correlates of daily hassles is important not only for determining adolescent risk and resiliency, but also for the development and evaluation of educational programs aimed at helping youth cope with the vicissitudes of daily life.

There are a variety of factors that have been shown to moderate the associations between psychological distress and daily stressors, including gender (Almeida & Kessler, 1998), ethnicity (Kiang, Yip, Gonzales-Backen, Witkow, & Fuligni, 2006), and personality characteristics (Bolger & Zuckerman, 1995; Gable, Reis, & Elliot, 2000). For example, individuals who score

high on the personality trait neuroticism consistently show stronger emotional reactivity to daily stressful events than individuals with low neuroticism scores (Bolger & Schilling, 1991; Bolger & Zuckerman, 1995; Gable et al., 2000). On the contrary, in a study of ethnic Chinese and Mexican adolescents, Kiang et al. (2006) found that ethnic identity protected against the effects of daily hassles. Specifically, the authors found that adolescents with a greater regard for their ethnic group exhibited higher levels of daily happiness and less daily anxiety in the face of daily stressors than adolescents with low ethnic regard.

Presently however, we are unaware of any published studies in adolescent populations examining whether individual variations in attentional control influence the ability to regulate the negative emotional and cognitive effects of daily stressors. Because attentional control permits a degree of control over information processing (Botvinick et al., 2001), in recent years it has figured more prominently into models of stress coping (e.g., Compas, 2006, 2009; Derryberry, Reed, & Pilkenton-Taylor, 2003; N. Eisenberg, Valiente, & Sulik, 2009). Similar to many dual process models of information processing, models of stress coping also suggest that responses to stress are composed of both automatic and controlled processes (Compas, 2006; Compas et al., 2009). Automatic responses to stress would be involuntarily, or unintentionally, triggered on the perception (real or imagined) of a threat or challenge in the environment. These automatic responses might include physiological and emotional arousal, increases in rumination or intrusive thoughts, impulsive behaviors, and/or escape behaviors (Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000; Derryberry et al., 2003). On the other hand, controlled responses to stress, or "coping," involve those deliberate efforts to regulate emotions, thoughts, and behaviors and/or the environment (Connor-Smith et al., 2000; Lazarus & Folkman, 1984). Because many of these putative coping strategies (e.g., distraction, reappraisal, suppression) are

assumed to be effortful processes, they are thought to be dependent upon available attentional resources (Compas, Connor, Osowiecki, & Welch, 1997; Ochsner & Gross, 2008). Conversely, automatic processes can be activated and carried out without attentional control being brought to bear. However, while automatic stress responses might be activated involuntarily, attentional resources might be used to reign in or counteract, to some degree, the impact that automatic stress responses have on emotional reactivity (Bargh & Morsella, 2008). Therefore, as "motivated tacticians," individuals high with levels of attentional control should be better able to counteract the emotional effects of maladaptive automatic processes and/or to activate controlled coping efforts to down regulate negative emotions resulting from or occurring with daily stress. Conversely, under increased load of stress, the cognitive resources necessary for effectively implementing regulatory strategies may not be available for adolescents with low or inefficient attentional control (Wranik et al., 2007).

Despite theoretical arguments linking attentional control to stress coping, few studies have examined these associations. Several studies have provided evidence for the role of effortful control in adaptive responding to stress (N. Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994; Lengua & Long, 2002; Lengua & Sandler, 1996; Valiente, Lemery-Chalfant, & Swanson, 2009). For example, Valiente et al. (2009) showed that children with high levels of EC reported using more controlled stress responses and fewer automatic responses compared with children with low EC. Furthermore, they found that both controlled and automatic responses to stress mediated the associations between EC and fewer adjustment problems, suggesting that EC facilitated flexible responses to managing the effects of stress. However, a limitation of this study is that "stress" was not directly assessed, so it is uncertain whether EC and coping responses predicted lower *stress*-related behavior problems (rather than just behavior problems

in general). A study by Campbell et al. (2009) examined the role of executive functions (including WMC) in coping responses in a sample of survivors of childhood acute lymphocytic leukemia (ALL). Working memory capacity positively predicted controlled coping responses (secondary coping) and negatively predicted total problem behaviors. As with Valiente et al. (2009), controlled coping responses were shown to partially mediate the negative associations between WMC and problem behaviors. However, results of this study were also constrained by a lack of stress assessment, small sample size, and with a focus on childhood cancer survivors, the results cannot be generalized to a broader population of youth. Research with adults has linked mindfulness with reduced stress reactivity and the use of adaptive coping strategies (e.g., Baer et al., 2004; Brown & Ryan, 2003; Weinstein, Brown, & Ryan, 2009), although work with youth is quite limited. A notable exception is the aforementioned study in which levels of mindfulness moderated the associations between stressful life events and symptoms of anxiety and depression Australian youth (Marks, Sobanski, & Hine, 2010).

In the current study we take a daily, naturalistic approach—one that is able to capture short-term, within-person fluctuations in stress and emotions as they occur in real life (Almeida, 2005; Bolger, Davis, & Rafaeli, 2003). In daily diary studies, participants report the daily stressors they experience over the course of several days, as well as their behaviors and emotions on these days. Scholars have noted several strengths of daily diary methods, particularly for studying stress processes (Almeida, 2005; Bolger et al., 2003). First, because participants report on their lived experiences, daily report studies have an ecological (or, external) validity that is not always possible with laboratory studies. However, daily stressors—such as being reprimanded by a teacher or an argument with a friend—can act as naturally occurring analogues to the laboratory paradigms that induce emotions by presenting the individual with an

unexpected and challenging situation (e.g., disappointing gift). The emotional reactions that accompany these stressors (or lack thereof) can also serve as a natural proxy for successful regulation efforts in laboratory studies. Therefore, support for the hypotheses stemming from the current investigation will increase our confidence that attentional control actually benefits youth in the course of their day-to-day lives outside the lab. Secondly, by having participants report on very recent experiences, daily reports obviate many of the reporting biases and memory distortions that can constrain traditional questionnaire methods that rely on a single, retrospective report (Paulhus, 1984). Almeida (2005) remarked that perhaps the most valuable feature of daily diary methods is the ability to capture within-person processes. Rather than simply asking whether individuals with high vs. low levels of stress exhibit more negative emotions (group-level processes), a more appropriate question might be to ask whether a particular *individual* shows more negative emotions on high stress vs. low stress days. This shift from a between-person to within-person analysis is more theoretically aligned with the subjective nature of stress, and it also allows for the identification of stable personality factors that might influence those within-person associations. For example, the current investigation will examine how individual differences in attentional control impact the within-person, short-term stress-emotion/cognition associations.

We are aware of three studies that have investigated in adults the associations between individual differences in cognitive functioning and the day-to-day regulation of stress-related negative emotions (Compton et al., 2011; Compton et al., 2008; Stawski, Almeida, Lachman, Tun, & Rosnick, 2010). Two studies by Compton and colleagues (2008; 2011) found that success in error monitoring—the ability to correct performance following the commission of errors—effectively moderated the within-person associations between daily stress and negative



affect. Compton et al. (2011) also reported that error monitoring ability predicted greater use of daily coping strategies (task-focused coping) in response to stress, suggesting that coping strategy usage is dependent upon attentional resources. In a sample of older adults, Stawski et al. (2010) found that higher levels of fluid cognitive abilities were associated with increased exposure to daily stressors, but smaller stress-related increases in negative mood compared with individuals with lower levels of fluid cognitive abilities. To date, no studies in adolescent samples have examined the role of individual differences in attentional control abilities to manage the emotional and cognitive effects of daily stress. Furthermore, existing daily diary studies have not fully addressed the psychological mechanisms through which attentional control might confer its beneficial effects. In response to these current gaps in understanding, the current study used a daily diary methodology to clarify and strengthen the body of evidence documenting the important role attentional control plays in managing stress-related negative emotions in adolescents.

### Summary of Research Aims, Questions, & Hypotheses

1. **Aim 1:** Determine relations between individual differences in attentional control and short-term emotional and cognitive outcomes associated with daily stress.
  - a) Question 1a: Does attentional control influence the average level of daily negative affect an adolescent experiences on a typical day?
    - *Hypothesis 1a:* Attentional control will be associated with lower levels of average daily negative affect.

- b) Question 1b: Does attentional control influence the average level of daily rumination an adolescent experiences on a typical day?
- *Hypothesis 1b*: Attentional control will be associated with lower levels of average rumination.
- c) Question 1c: Does attentional control moderate the relations between daily stress and short-term negative mood?
- *Hypothesis 1c*: Adolescents with higher attentional control will show less negative mood in response to daily stress compared with adolescents lower in attentional control.
- d) Question 1d: Does attentional control moderate the relations between daily stress and rumination?
- *Hypothesis 1d*: Adolescents with higher attentional control will show less rumination in response to daily stress compared with adolescents lower in attentional control.
2. **Aim 2**: Assess the relations between attentional control, responses to stress, and stress-related emotional outcomes.
- a) Question 2a: Does attentional control predict more adaptive responses to stress?
- *Hypothesis 2a*: Adolescents with higher attentional control will report using more controlled coping responses (e.g., cognitive reappraisal) and fewer automatic coping responses (e.g., rumination) compared with adolescents lower in attentional control.
- b) Question 2b: Do responses to stress mediate the associations between attentional control and stress-related negative emotions?

- *Hypothesis 2b*: Responses to stress will mediate the associations between attentional control and stress-related negative emotions.

## CHAPTER 2: METHODS

### Participants

In September 2011, participants were recruited from two public high schools (one urban magnet high school and one rural traditional high school) in the northeastern United States.

During either a homeroom period or a class assembly, research staff described the project to all 9th grade students and what would be requested of students if they participated in the study.

These recruitment meetings took approximately 10 minutes. Following this short description, each student was provided with a packet containing a letter from the school principal, a detailed description of the study, a parental consent form, and a demographics form. Students were asked to share and discuss the materials with their parent(s), and to return a signed consent form and a completed demographics form to their school's main office (within a two-week deadline).

Students who return a signed parent consent form (regardless of whether they are allowed to participate or not) within two weeks received a UCLA pen and entry into a raffle for a \$20 gift card (3 raffles per school).

A total of 377 packets were distributed between the two schools, and 166 (44%) were returned within two weeks. Of the 166 packets returned, 146 students (88%) received parental consent to participate. Twelve students subsequently dropped out of the study before data collection began, leaving a final sample of 134 students ( $M = 14.6$  years,  $SD = .36$ ). Slightly more than half of the participants were girls ( $n = 79$ , 59%). The sample consisted mainly of Caucasian youth ( $n = 112$ , 84.2%), but also included African-American ( $n = 6$ , 4.5%), Asian ( $n = 4$ , 3%), Latino ( $n = 1$ , 0.8%), and mixed-race ( $n = 10$ , 7.5%) youth. The majority of participants came from two-parent ( $n = 98$ , 73% married) and mostly middle-class households, as indexed by

parent educational attainment. Eighteen percent of mothers (fathers in parentheses; 19%) had a high school diploma or less, 11% (10%) graduated from technical/trade school, 20% (23%) completed some college or a junior college degree, and 51% (48%) held a college degree or higher.

### Procedure

During October 2011, students given parent permission were invited to a one-hour session in their school's computer lab where they provided written assent and completed a computerized WMC task. The WMC task was accessible via a secure website and was administered to groups of students ( $n = 15-25$ ) in the computer labs by trained research assistants.

After completing the WMC task, participants were given verbal instructions, as well as a packet of information, for how to access and complete a battery of online questionnaires at home. The questionnaires were accessible via a secure website and participants were given up to 5 days to complete them. Participants were also given verbal and written instructions for how to access and complete the online daily diary checklists at home. On the Monday following completion of the questionnaire battery, participants completed a brief checklist once per day for 14 consecutive days. Participants were instructed to complete the checklists on a secure website approximately 30 minutes before bed each night for 14 days. The checklists took an average of 6 minutes to complete. Checklists completed by noon the following day were included as "on time," which is common for daily diary studies with youth (e.g., Flook & Fuligni, 2008). Only those diaries completed on time were included in the following analyses. Overall, participants showed adequate compliance on the diary checklists, with 81% of all diaries being completed on

time. This rate of compliance with daily instruments compares favorably to previous diary studies with adolescents (e.g., Chung, Flook, & Fuligni, 2009; Flook & Fuligni, 2008).

Seven participants asked to complete paper-and-pencil versions of the daily checklists. These students were asked to return their completed daily checklists to their school's main office each morning for pick up by the research staff. Furthermore, each participant was given three paper diary checklists to use if problems with their internet access arose, or for when internet access was not otherwise available (e.g., out of town travel). The research staff sent daily e-mail and text message reminders to complete the daily checklists in a timely manner (participants were reimbursed \$0.25 per text message sent by the researchers). Participants without cell phone numbers or e-mail accounts were contacted regularly by home phone during the 2-week period to answer questions about the procedures and/or to monitor the status of their diary completion.

Based on their level of participation in the study, students were eligible to receive a gift card worth up to \$50 (\$15 for completing the background questionnaires and WMC task; \$2 for each online daily checklist completed on time (\$28 total possible); and \$7 bonus for completing 12 or more checklists on time). The PI worked with the principals of the schools to determine which store(s) or service(s) (e.g., movie passes) were appropriate for the students' gift cards.

### Background questionnaires

*Attentional Control.* Adolescents rated their attentional control using the **Early Adolescent Temperament Questionnaire, Revised** (EATQ-R; Capaldi & Rothbart, 1992). For the purposes of the present study, we only report scores from the 7-item Attentional Control subscale which taps the abilities to both focus and shift attention to pursue goal-directed aims (EATQ-Att; e.g., "It is easy for me to really concentrate on homework problems," "I am good at

keeping track of several different things that are happening around me."). Items were rated on a 5-point scale (1 = almost always true of me to 5 = almost always true of me). The total attentional control score was calculated by taking the mean of the subscale's items, with higher scores representing higher attentional control ( $\alpha = .61$ ). The EATQ is one of the most widely used (and one of the only) self-report measures of attentional control for adolescent populations. It has been used successfully in previous studies and has shown significant relations to constructs of interest for this study (e.g., coping strategies, externalizing and internalizing problems) (Capaldi & Rothbart, 1992; Putnam, Ellis, & Rothbart, 2002; Valiente et al., 2009).

Adolescents also rated their attentional control using the **Mindful Awareness Attention Scale, Adolescent version** (MAAS-A; Brown et al., 2011). The MAAS-A is derived from the widely used adult-report scale (MAAS; Brown & Ryan, 2003), and several validation studies have shown robust psychometric properties for the MAAS-A across a variety of adolescent samples (Black et al., 2012; Brown et al., 2011; de Bruin et al., 2011). Similar to the MAAS, the MAAS-A taps individuals' perceptions of their tendency to be attentive to and aware of present moment experiences, as well as their ability to consciously guide behavior. Participants rated on a 6-point scale (1 = almost always to 6 = almost never) the frequency with which they experience 14 different items (e.g., "I find it difficult to stay focused on what's happening in the present," "I do jobs or tasks automatically, without being aware of what I'm doing," "I rush through activities without being really attentive to them."). Scores on the MAAS-A were calculated by taking the mean of all item responses, with higher scores indicating higher levels of mindfulness. The scale showed adequate internal reliability in the current sample ( $\alpha = .87$ ).

*Responses to Stress.* To assess coping responses to social stress, adolescents completed various subscales of the **Response to Stress Questionnaire** (RSQ; Connor-Smith et al., 2000).

The RSQ is derived from a multifaceted model of coping (Compas et al., 2001) that distinguishes between voluntary and involuntary responses to stress. Voluntary coping responses are within conscious awareness and are oriented toward regulating one's cognitive, behavioral, emotional, or physiological responses to a stressor or to the stressor itself. Involuntary responses to stress, on the other hand, include automatic reactions to stressors that are not necessarily within conscious awareness nor do they require voluntary control.

The RSQ measures adolescents' tendencies to engage in both voluntary and involuntary responses to stress. There are three aspects of voluntary responses: (1) primary control coping (problem solving, emotion regulation, and emotion expression), (2) secondary control coping (cognitive restructuring, positive thinking, acceptance, and distraction), and (3) disengagement coping (denial, avoidance, and wishful thinking). The involuntary coping responses are divided into two aspects, but only the involuntary engagement subscale (rumination, intrusive thoughts, emotional arousal, physiological arousal, and involuntary action) was assessed in this study.

In previous studies, both primary and secondary coping responses were associated with lower emotional and behavioral problems in adolescents, and appear to be generally adaptive means for coping with stress (Connor-Smith et al., 2000; McLaughlin & Hatzenbuehler, 2009; Silk, Steinberg, & Sheffield Morris, 2003). Conversely, disengagement coping, which is characterized by attempts to orient oneself away from a stressor or one's emotional responses, was found to be positively related to higher levels of emotional and behavioral problems (Connor-Smith et al., 2000; McLaughlin & Hatzenbuehler, 2009; Silk et al., 2003), and is generally considered a maladaptive method of coping. Involuntary engagement has also been found to correlate positively with reports of higher emotional and behavioral problems (Connor-Smith et al., 2000; McLaughlin & Hatzenbuehler, 2009; Silk et al., 2003).



The full scale consists of 57 items, but with the exclusion of the involuntary disengagement scale, the current study included 45 items. Items were rated on a 4-point scale that indicates the degree to which or the frequency with which each response option is enacted to cope with stressful experiences (1 = not at all to 4 = a lot). The RSQ's factor structure has been confirmed in several adolescent samples (Connor-Smith et al., 2000; Valiente et al., 2009), and the scales demonstrated adequate internal consistency in the current sample (primary engagement  $\alpha = .80$ ; secondary engagement  $\alpha = .80$ ; disengagement  $\alpha = .69$ ; involuntary engagement  $\alpha = .92$ ).

Adolescents also reported on their general tendency to appraise situations as stressful using the **Perceived Stress Scale** (PSS; S. Cohen, Kamarck, & Mermelstein, 1983). The PSS is one of the most widely used psychological measure of general stress appraisals, and has been related to a variety of health outcomes (Cobb & Steptoe, 1996; S. Cohen & Williamson, 1988; Epel et al., 2004). Participants responded to 10 items on a 5-point scale (1 = never to 5 = very often) about how frequently they experienced situations as stressful, unpredictable, and uncontrollable (e.g., "In the last month, how often have you felt nervous and 'stressed'?", "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?"). The scale demonstrated adequate internal consistency in the current sample ( $\alpha = .88$ ).

### Working Memory Capacity

The automated Operation Span task (OSPAN; Unsworth, Heitz, Schrock, & Engle, 2005) was used to assess working memory capacity (WMC). The OSPAN is a psychometrically sound and widely used measure of WMC that combines a serial recall task (a string of letters) with a

decision task (solving math problems). The task consists of 15 blocks, with each block containing between 3 and 7 trials. During each trial the subject silently solves a math problem (e.g.,  $(3 \times 6) - 2 = ?$ ), then navigates to the next screen to verify the answer, and then on the final screen is presented with a letter to be memorized. At the end of each task block the subject is asked to recall the letters in serial order. Performance is determined by the total number of letters recalled in the appropriate order across all blocks, with higher scores reflective of higher WMC.<sup>1</sup>

### Daily checklist measures

*Daily Mood.* Negative mood was measured using the tension/anxiety and depression/dejection items from the **Profile of Mood States** (POMS; Lorr & McNair, 1971) and **Profile of Mood States, Adolescent version** (POMS-A; Terry, Lane, Lane, & Keohane, 1999). Items on each subscale were as follows: tension/anxiety (anxious, nervous, worried, tense) and depression/dejection (hopeless, sad, discouraged). Positive mood was assessed using items from a happiness scale (happy, joyful, excited) used in previous research (Kiang et al., 2006; Telzer & Fuligni, 2009). On all three scales, participants indicated on a 5-point scale (1 = not at all to 5 = extremely) the extent to which they experienced each feeling during the previous day. Subscale items were averaged to create separate indices of anxiety, depression, and positive mood, with higher scores reflecting higher distress. The anxiety and depression scores were averaged to create a negative mood index. To compute internal consistency, item scores were averaged across days and reliability was determined using these average item means (negative mood:  $\alpha = .94$ ; positive mood:  $\alpha = .88$ ).

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<sup>1</sup> Four participants scored 3 or more standard deviations below the mean accuracy for math performance (70% math accuracy or lower). Removing these participants from the multilevel level analyses did not change the statistical significance for the OSPAN on outcome variables. Therefore, every subject who provided OSPAN data is included in the multilevel analyses.

*Daily stressors.* Borrowing closely from many previous diary studies (Almeida & Kessler, 1998; Bolger, DeLongis, Kessler, & Schilling, 1989; Chung, Flook, & Fuligni, 2011; Stawski et al., 2010), participants reported whether they experienced any of the following 14 stressors ("yes" or "no") during the day: (1) argument with mother, (2) argument with father, (3) argument with another family member, (4) punished by parents, (5) parents had an argument with each other, (6) had a lot of work at home, (7) had a lot of demands made by your family, (8) had an argument or were punished by an adult at school, (9) had a lot of work at school, (10) had a lot of demands made by your teachers, (11) had a deadline for school to think about, (12) had a lot of demands made by your friends, (13) argued with a close friend, (14) argued with a boyfriend or girlfriend. These events relate to daily conflict stress, overload stress, and demand stress, and have consistently shown to predict negative mood in previous diary studies (e.g., Bolger et al., 1989; Chung et al., 2009; Kiang et al., 2006). The total number of events endorsed ("yes" events) were summed to create an index of daily stress, with higher scores representing more daily stress ( $\alpha = .82$ ).

*Daily rumination/mindlessness.* Adolescents rated their daily experience of rumination (or, mind wandering) using the **Mindful Attention Awareness Scale, state version** (MAAS-state; Brown & Ryan, 2003). The MAAS-state is based on the trait version of the MAAS, and has shown excellent psychometric properties (Brown & Ryan, 2003). Participants rated how much they experienced five items tapping daily inattentiveness or rumination (e.g., "I was preoccupied with the future or the past," "I was finding it difficult to stay focused on what was happening") on a 7-point scale (1 = not at all to 7 = very much). Scores were computed by taking the mean of the 5 item responses, with higher scores indicating *higher* rumination (or, mind

wandering). To compute internal consistency, item scores were averaged across days and reliability was determined using these average item means ( $\alpha = .94$ ).

## CHAPTER 3: RESULTS

### *Descriptive Statistics*

Independent samples t-tests were conducted to examine the effects of gender and school affiliation on major study variables (-1 = girl, 1 = boy; -1 = traditional school, 1 = magnet school). Girls reported more primary engagement coping responses ( $t = 5.25, p < .01$ ), involuntary engagement coping strategies ( $t = 1.98, p = .05$ ), higher average number of daily stressors ( $t = 2.00, p = .05$ ), higher average negative mood ( $t = 2.37, p < .05$ ), and higher average rumination ( $t = 2.33, p < .05$ ) compared with boys. Participants from the urban magnet school performed better on the OSPAN task ( $t = -2.49, p < .05$ ) and reported more primary engagement coping ( $t = -2.56, p < .05$ ) compared with participants from the rural high school. Because of this pattern of findings, both gender and school affiliation were included as control variables in the multilevel analyses reported below.

Table 1 presents zero-order correlations (and descriptive statistics) for major study variables. In general, the EATQ-Att and MAAS-A were mostly related to both individual difference and daily variables in expected directions. However, neither the EATQ-Att or the MAAS-A were related to primary or secondary stress responses. Performance on the OSPAN was uncorrelated with every major study variable. Finally, responses to stress displayed associations in the expected directions with one exception. Primary engagement responses were positively related to involuntary stress responses ( $r = .21, p < .05$ ) and average levels of daily stress ( $r = .23, p < .01$ ).

Because the two self-report measures of attentional control were positively correlated ( $r = .51, p < .01$ ), a composite score was created to increase robustness of the measure and to reduce

the number of analyses conducted. The composite score was calculated as the mean of the standardized scores for the EATQ-Att and MAAS-A scales. As with both independent scales, higher scores on the composite measure reflected higher attentional control ( $M = .00$ ,  $SD = .87$ ). The EATQ-Att and MAAS-A were highly correlated with the composite measure of attentional control ( $r = .87$ ,  $p < .01$ ;  $r = .87$ ,  $p < .01$ , respectively). The composite measure of attentional control was used in all subsequent analyses.

### *Aim 1: Moderating Effects of Attentional Control on Daily Stress and Negative Mood*

The basic approach to the following analyses was to examine the influence of individual differences in attentional control on within-person changes in daily mood stemming from stressful events. Based on the nested structure of the data, in which daily reports were nested within individuals, we conducted a series of multilevel modeling analyses using hierarchical linear modeling software (HLM) to test our hypotheses (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011). Specifically, we used intercepts- and slopes-as-outcomes models with random coefficients (Raudenbush & Bryk, 2002). An important feature of multilevel modeling is that it provides simultaneous estimates of both daily- and individual-level equations. In the following analyses, daily-level (Level-1) equations provided estimates of the relations between daily stress and negative mood (and rumination), while individual-level (Level-2) equations provided estimates of how individual differences in attentional control interacted with the daily-level associations. The daily- and individual-level equations for assessing stress-related negative mood are shown here:

#### Level-1 (daily level):

$$\text{Negative Mood}_{ij} = B_{0j} + B_{1j} (\text{day of study}) + B_{2j} (\text{positive mood}) + B_{3j} (\text{daily stressors}) + e_{ij} \quad (1)$$

Level-2 (individual level):

$$B_{0j} = \gamma_{00} + \gamma_{01} (\text{attentional control/OSPAN}) + \gamma_{02} (\text{gender}) + \gamma_{03} (\text{school}) + u_{0j} \quad (1a)$$

$$B_{1j} = \gamma_{10} + u_{0j} \quad (1b)$$

$$B_{2j} = \gamma_{20} + u_{0j} \quad (1c)$$

$$B_{3j} = \gamma_{30} + \gamma_{31} (\text{attentional control/OSPAN}) + \gamma_{32} (\text{gender}) + \gamma_{33} (\text{school}) + u_{0j} \quad (1d)$$

In the daily level model (Level-1), Negative Mood<sub>ij</sub> refers to negative mood for student "i" on day "j." The intercept, B<sub>0j</sub>, refers to baseline negative mood. B<sub>1j</sub> represents the within-person change in negative mood over time. Here, time refers to the day of the study, and it was used to control for the effects of repeated exposure to the daily report instrument (to improve interpretation of the models, we centered the day of study around the first day, 0, while 1, 3,..., 13 refer to subsequent time points). B<sub>2j</sub> represents the within-person slope between daily positive mood and negative mood<sup>2</sup>. Finally, B<sub>3j</sub> represents the within-person slope between daily stress and negative mood (centered around, "0," indicating no daily stress), and e<sub>ij</sub> is a random-effects term (error) for each person. As is common for multi-level models, Level-1 positive mood was centered around the individual's mean (Raudenbush & Bryk, 2002).

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<sup>2</sup> While positive and negative affect are thought to be somewhat independent constructs (e.g., Watson & Clark, 1994), recent studies suggest that the experience of positive affect is related to symptoms of mood disorders (e.g., Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008), and may also play a role in the maintenance of psychiatric conditions (e.g., Heller et al., 2009). Indeed, in the current sample average within-person correlations between daily positive and negative mood were significant ( $r = -.16, p < .01$ ), which mirrors findings from other diary studies (e.g., L. H. Cohen et al., 2008; Gable et al., 2000). In light of these findings, we included daily positive mood in the multilevel model equation predicting negative mood to ensure that associations between daily stress and negative mood (and cross-level interactions) were independent of positive affect.

Each daily level parameter was simultaneously estimated as a function of the overall sample grand mean and a random coefficient term ( $u$ ). In equations (1a) and (1d) the within-person parameter was also modeled as a function of individual differences in attentional control. Therefore, equation (1a) examined whether attentional control moderated the intercept ( $B_{0j}$ ), and equation (1d) examined whether attentional control moderated the within-person slope between daily stressors and negative mood ( $B_{3j}$ ). To control for possible confounding effects, gender and school affiliation were also included as Level-2 predictors of the intercept and stress slope. In all Level-2 models, the attentional control composite scale was  $z$ -standardized, OSPAN scores were grand mean centered, and demographic variables were effects coded (-1 = girl, 1 = boy; -1 = traditional school, 1 = magnet school).

The full maximum likelihood procedures in HLM are robust to missing data at Level-1 only, and as a consequence five participants were excluded from the following analyses due to missing data at Level-2, leaving a final sample of 129 for analyses. A completely unconditional Level-1 model (outcome as a function of the intercept only), was first run to determine whether sufficient variation in the negative mood and rumination outcome variables warranted further tests for cross-level interactions. The interclass correlation (ICC) indicated that 58% of the variance in negative affect and 71% of the variance in rumination was attributable to between-subjects differences. This also suggests that a substantial portion of the variation in the model was due to within-person differences, which makes the use of multilevel modeling appropriate.

Next, using a model with only the Level-1 predictors, daily stress ( $\gamma_{30}$ ) was associated with increases in daily negative mood ( $B = .07$ ,  $t(127) = 6.30$ ,  $p < .01$ ). Daily positive mood ( $\gamma_{20}$ ) was strongly inversely related to daily negative mood ( $B = -.18$ ,  $t(127) = -7.14$ ,  $p < .01$ ). Furthermore, time ( $\gamma_{10}$ ) also predicted daily negative mood ( $B = -.02$ ,  $t(127) = -5.04$ ,  $p < .01$ ),



and the direction of the association suggested that participants reported lower levels of negative affect as they progressed through the study.

Table 2 presents results of the analyses for the attentional control composite variable. As hypothesized, attentional control ( $\gamma_{01}$ ) predicted baseline levels of daily negative mood ( $B = -.20$ ,  $t(124) = -3.53$ ,  $p < .01$ ). Importantly, between-person attentional control ( $\gamma_{31}$ ) also significantly moderated the within-person associations between daily stress and negative mood ( $B = -.03$ ,  $t(124) = -2.62$ ,  $p < .05$ ). Figure 1 shows that individuals with low attentional control had a steeper stress-negative mood slope than individuals with high attentional control, indicating greater emotional distress to daily stress. The flatter stress-negative mood slope in participants with high attentional control indicates they were better able to regulate their negative mood in response to comparable amounts of daily stress. Results also indicated that girls ( $B = -.02$ ,  $t(124) = -2.19$ ,  $p < .05$ ) were more emotionally reactive to daily stress than boys.

Parallel analyses to those above were then conducted for OSPAN performance. Table 3 presents results of the analyses for OSPAN scores. As can be seen, OSPAN performance ( $\gamma_{01}$ ) was unrelated to baseline daily negative mood ( $B < -.01$ ,  $t(124) = -.03$ ,  $p = .97$ ). Furthermore, OSPAN performance ( $\gamma_{31}$ ) did not significantly moderate the within-person stress-negative affect slope ( $B < -.01$ ,  $t(124) = -1.17$ ,  $p = .25$ ), although the effect was in the expected (negative) direction.

### *Aim 2: Moderating Effects of Attentional Control on Daily Stress and Rumination*

Another series of multilevel analyses were conducted with daily rumination as the dependent variable:

Level-1 (daily level):

$$\text{Rumination}_{ij} = B_{0j} + B_{1j} (\text{day of study}) + B_{2j} (\text{negative mood}) + B_{3j} (\text{daily stressors}) + e_{ij} \quad (2)$$

Level-2 (individual level):

$$B_{0j} = \gamma_{00} + \gamma_{01} (\text{attentional control/OSPAN}) + \gamma_{02} (\text{gender}) + \gamma_{03} (\text{school}) + u_{0j} \quad (2a)$$

$$B_{1j} = \gamma_{10} + u_{1j} \quad (2b)$$

$$B_{2j} = \gamma_{20} + u_{2j} \quad (2c)$$

$$B_{3j} = \gamma_{30} + \gamma_{31} (\text{attentional control/OSPAN}) + \gamma_{32} (\text{gender}) + \gamma_{33} (\text{school}) + u_{3j} \quad (2d)$$

Daily stress ( $\gamma_{20}$ ) predicted higher levels of daily rumination ( $B = .08$ ,  $t(127) = 4.41$ ,  $p < .01$ ). Time ( $\gamma_{10}$ ) also predicted daily rumination ( $B = -.02$ ,  $t(127) = -2.51$ ,  $p < .05$ ), and the direction of the association suggested that participants reported lower levels of daily rumination as they progressed through the study. Furthermore, daily negative mood ( $\gamma_{20}$ ) was strongly related to daily rumination ( $B = .32$ ,  $t(127) = 5.79$ ,  $p < .01$ ).

Table 4 presents results of the analyses for the attentional control composite variable. As hypothesized, attentional control ( $\gamma_{01}$ ) predicted baseline levels of daily rumination ( $B = -.63$ ,  $t(124) = -5.64$ ,  $p < .01$ ). Importantly, between-person attentional control ( $\gamma_{21}$ ) also (marginally) moderated the within-person associations between daily stress and rumination ( $B = -.03$ ,  $t(124) = -1.75$ ,  $p = .08$ ). Figure 2 shows that individuals with low attentional control have slightly steeper stress-rumination slopes than individuals with high attentional control, indicating greater increases in stress-related rumination. Gender marginally predicted baseline rumination ( $B = -.19$ ,  $t(124) = -1.92$ ,  $p = .06$ ), with girls reporting more baseline rumination than boys. Gender

was unrelated to the stress-rumination slope, and school affiliation was unrelated to baseline and stress-induced rumination.

Parallel analyses were conducted for OSPAN performance. Table 5 presents results of the analyses for OSPAN scores. As can be seen, OSPAN performance ( $\gamma_{01}$ ) was unrelated to baseline levels of daily rumination ( $B < -.01$ ,  $t(124) = -.61$ ,  $p = .54$ ). However, OSPAN performance ( $\gamma_{21}$ ) did significantly moderate the within-person stress-rumination slope ( $B < -.01$ ,  $t(124) = -2.25$ ,  $p < .05$ ). Figure 3 shows that individuals with low OSPAN scores had a steeper stress-rumination slope than individuals with high OSPAN scores.

### *Aim 3: Mediating Effects of Coping Strategies and Perceived Stress on Stress-related Negative Mood*

Finally, we assessed whether responses to stress mediated the relations between attentional control and stress-related negative mood through a series of linked hierarchical multiple regressions (because OSPAN performance was unrelated to stress-induced negative mood, it is not considered further). Because we were interested in computing whether responses to stress mediated the associations between attentional control and stress-related negative mood, rather than average negative mood, it was not appropriate to simply use average negative mood scores across the 14 daily reports as the outcome variable. Instead, we created a within-person index of *stress reactivity* based on the linear association between daily stress and negative mood (e.g., L. H. Cohen, Gunthert, Butler, O'Neill, & Tolpin, 2005). Using Equation (1) of the previously described multilevel model, the empirical Bayes slope estimate between daily stressful events and negative mood ( $B_{3j}$ ) served as our index of within-person stress reactivity. These empirical Bayes slopes were then averaged across each participant's 14 days of diary

checklists to create a between-subjects variable of stress reactivity to be used in the mediation analyses ( $M = .07$ ,  $SD = .04$ ). A large slope indicated greater negative mood in response to daily stressful events, whereas a small slope indicated that negative mood was less affected by daily stressful events.

Different models were then specified to examine whether stress responses (primary, secondary, disengagement, involuntary, and perceived stress) mediated the associations between attentional control and stress reactivity. Mediation was tested using Preacher and Hayes' (2004, 2008) bootstrapping procedure with bias-corrected and accelerated confidence intervals. This method, which is recommended for assessing mediation (MacKinnon, Fairchild, & Fritz, 2007), repeatedly samples the data set (e.g., 5,000 times) and estimates the indirect effect ( $\alpha\beta$ ) for each resampled data set (Preacher & Hayes, 2008). An empirical estimate of the distribution of all the indirect effects is constructed from these repeated analyses, which is then used to create a confidence interval (e.g., 95%) for the indirect effect. A confidence interval that does not include a value of zero indicates that the indirect (or, mediated) effect is significant.

Two conditions must be met before testing the indirect effect: the  $\alpha$  and  $\beta$  paths must each be statistically significant (Preacher & Hayes, 2008). Path  $\alpha$  indicates the effect of the independent variable (attentional control) on the mediator, or intervening variable (stress response). Path  $\beta$  represents the effect of the mediator on the dependent variable (stress reactivity) when controlling for the independent variable. Thus, the first prerequisite is that attentional control predicts the mediator (stress response). Initial bootstrap analyses suggested that attentional control did not predict either primary ( $t = 1.25$ ,  $p = .21$ ) or secondary responses to stress ( $t = .44$ ,  $p = .66$ ), so these models were not tested further. The second prerequisite is that the mediator predicts stress reactivity when controlling for attentional control. Disengagement ( $t$

= .89,  $p = .38$ ) stress responses did not predict stress reactivity, so this response was not considered further. Only involuntary stress responses and perceived stress met the two conditions necessary for testing indirect effects.

Unstandardized regression coefficients corresponding to their respective mediation pathways (see Figure 4) are summarized in Table 6. The bootstrapped confidence intervals indicated that involuntary stress responses were a significant mediator of the associations between attentional control and stress reactivity. A significant Sobel's (1982) test also indicated that the total effect of attentional control on stress reactivity was significantly reduced with the inclusion of involuntary stress responses. However, despite the significant reduction in the total effect, attentional control remained a significant predictor of stress reactivity when involuntary stress responses were included in the model, suggesting only a partial mediation effect.

Results also indicated that perceived stress was a significant mediator of the associations between attentional control and stress reactivity (the confidence interval did not include zero). A significant Sobel's (1982) test further indicated that the total effect of attentional control on stress reactivity was significantly reduced with the inclusion of perceived stress. Also, the effects of attentional control on stress reactivity were rendered non-significant with the inclusion of perceived stress, again suggestive of a mediation effect.

## CHAPTER 5: DISCUSSION

A growing body of research now documents the associations between attentional control and important self-regulatory competencies, findings that were largely confirmed in the current study. However, the majority of existing research has largely been limited to observational studies conducted in laboratory settings. Because many of the long-term outcomes of self-regulatory success (e.g., mental health) are likely determined in large part by a series of momentary or short-term self-regulatory behaviors, it is imperative that research methods capture these short-term behaviors. Using a combination of self-report and objective assessments of individual differences and daily diary methodologies, the current study took a more dynamic, naturalistic approach to the study of attentional control, and to our knowledge, is the first study with adolescent youth that explored how individual differences in attentional control related to within-person variability in daily self-regulation success.

Results indicated that adolescents with higher levels of attentional control reported lower average levels of daily negative affect compared with adolescents with lower levels of attentional control. This finding corroborates previous observational studies documenting the negative associations between aspects of attentional control and emotional problems (e.g., Brown & Ryan, 2003; Carriere et al., 2008; N. Eisenberg et al., 2001; Muris, Mayer et al., 2008). Results also indicated that higher levels of attentional control predicted lower average levels of daily rumination. To our knowledge this finding is the first of its kind, although it does generally support the results of previous single-time studies examining the associations between attentional control and trait rumination, particularly in the mindfulness literature (e.g., Brown & Ryan, 2003; Marks et al., 2010).

More importantly, the current findings also suggested that individual differences in attentional control were related to short-term, within-person self-regulatory success. Individual differences in attentional control were shown to significantly moderate within-person stress-related increases in negative emotions and rumination. Specifically, multilevel model analyses revealed that adolescents with lower levels of attentional control showed steeper increases in both negative affect and rumination with concomitant increases in daily stress. On the other hand, adolescents with higher levels of attentional control seemed more adept at regulating stress-induced negative emotions and rumination. Together these findings help confirm previously cited introspective reports (e.g., Chodron, 2005), and a mounting empirical basis for the central role of attention in self-regulation success.

The ability to endogenously control attention, rather than attention being controlled by the constantly fluctuating circumstances of the environment, thus appears to be a crucial instrument for directing the course of everyday life (Csikszentmihalyi, 1990). In the context of the current investigation, attentional control facilitated greater regulation of day-to-day stress-induced negative emotions and rumination. Novel and unpredictable challenges and stressors can arise every day, and when they do occur they often carry emotional and cognitive consequences, such as increases in negative mood (e.g., Chung et al., 2009; Nishina & Juvonen, 2005; Reynolds & Repetti, 2008). Absent the ability to bring attentional resources to bear on a situation, emotions and cognitive processing are more prone to being dictated by automatic processing (Barrett et al., 2004; Hofmann, Friese, & Strack, 2009; Wranik et al., 2007), which is by definition reactive, and not always context-appropriate. Of course, a degree of reactivity to stress is probably expected, and perhaps even adaptive, although persistent day-to-day emotional and cognitive reactivity can have important health implications. Over time, for example, excessive

emotional and cognitive reactivity to stress can increase the risk of various psychopathology (Nolen-Hoeksema, 1991). However, longitudinal studies also suggest that attentional control helps protect against long-term mental health risks associated with emotional reactivity (N. Eisenberg et al., 1997; N. Eisenberg, Valiente, Spinrad et al., 2009; Valiente et al., 2003; Zhou et al., 2007). It is possible that these long-term protective effects are ultimately realized—at least in part—by the consistent application of attentional control to meet (and succeed at) most of life's day-to-day self-regulatory demands. Additional research that links short-term self-regulatory success with long-term health outcomes is still needed, although the current investigation, coupled with previous diary studies (e.g., Compton et al., 2008; Weinstein et al., 2009), suggests that attentional control can help protect emotional and cognitive health from the winds of everyday misfortunes.

While the findings from self-reported attentional control were consistent with hypotheses, the results for OSPAN performance were more mixed. Results revealed that performance on the OSPAN—often considered a robust measure of attentional control (e.g., Engle, 2002; Kane et al., 2001)—did not relate to average levels of daily negative mood. Furthermore, no evidence was marshaled in favor of OSPAN performance predicting within-person regulation of stress-induced negative mood (although the association was in the expected direction). The current findings were inconsistent with the results of several previous studies examining the role of WMC in emotion regulation. For example, a series of studies by Schmeichel et al. (2008) showed that individuals with higher WMC were more adept at suppressing emotional expressions and reappraising emotional stimuli in neutral terms. Furthermore, it was shown that reappraisal ability was effective in reducing negative emotions (e.g., disgust) for individuals with higher WMC. McRae, Jacobs, Ray, John, and Gross (2012) also showed that reappraisal ability



was related to performance on an OSPAN task similar to the one used in the current study. The discrepant results from the current study might be due in part to the fact that these studies examined the associations between WMC and success in implementing particular types of emotion regulation strategies (e.g., suppression, reappraisal), whereas the current study focused on spontaneous, daily emotion regulation. While Schmeichel and Demaree (2010) did report associations between WMC and spontaneous emotion regulation, they focused on a particular experience involving negative feedback, whereas the current investigation focused on a more broad range of naturalistic, daily stresses. In a study bearing the closest resemblance to the current methodology, Stawski et al. (2010) showed that fluid cognitive ability (including WMC) predicted lower emotional reactivity to daily stress in a sample of older adults. However, they utilized a battery of neurocognitive tests, and while this might have increased the robustness of their measure, it not possible to determine what effect WMC had specifically on daily stress reactivity. Unfortunately, time constraints inherent to school-based studies did not allow for the implementation of a battery of neurocognitive tests, but future research should consider utilizing more than one test of WMC (Conway et al., 2005). Finally, it is important to acknowledge that research linking aspects of cognitive control (e.g., WMC) to emotion regulation success is still in a nascent stage—particularly among youth—and there is still inconsistency across studies that is yet in need of further resolution.

Despite the discrepant findings for negative mood, results did support the hypothesis that OSPAN performance would buffer against stress-induced rumination. Specifically, the analyses indicated that individuals with higher levels of WMC showed reduced stress-related rumination compared with individuals lower in WMC (when controlling for school affiliation). Interestingly however, OSPAN performance was unrelated to average levels of daily rumination. This pattern

of findings complements the results from several related studies examining the associations between OSPAN performance and the regulation of ruminative thoughts (Brewin & Beaton, 2002; Brewin & Smart, 2005; Kane et al., 2007). For example, Brewin and Smart (2005) showed individuals with higher OSPAN performance were more successful in suppressing intrusive thoughts when explicitly asked to do so during a brief verbal reporting paradigm. However, OSPAN performance was unrelated to suppression during a comparison "expression" condition, and OSPAN performance was also unrelated to general tendencies to ruminate in daily life (or negative mood). Similarly, Kane and colleagues (2007) showed that OSPAN performance moderated the associations between momentary attention lapses in daily life and the task demands. During challenging tasks, which required concentration and mental effort, individuals with lower WMC were less able to maintain attention on the task compared with individuals with higher WMC. Again though, there was no association between WMC and average levels of daily mind wandering. The results of the current study support these previous findings in at least two important ways. First, we found no association between OSPAN performance and average levels of daily rumination, suggesting that in the absence of a situational challenge (such as stress), individual differences in WMC are less consequential for current cognitive/attentional functioning. Secondly, and consistent with both attentional control theories of WMC (Engle & Kane, 2004; Kane et al., 2001) and dual-process models (Barrett et al., 2004) which argue that the effects of individual differences in WMC should be more pronounced in situations that require the maintenance of goal-directed processing in the face of distractions or challenges, we showed that WMC predicted reduced rumination (or, mind wandering) when doing so would require considerable mental effort—in this case, reducing stress-induced rumination.

Taken as a whole, results of the current investigation do suggest that attentional control facilitates successful regulation of daily stress in adolescent youth, despite some variations in outcomes based on the type of attentional assessment. Of course, the initial step of showing an association between attentional control and daily self-regulation is critical, but so is identifying the process(es) through which attentional control might confer these positive benefits. To date, this question remains to be fully explored. Drawing upon insights from dual process models of stress (Compas, 2006; Compas et al., 2009; Compas et al., 2001; Connor-Smith et al., 2000), the second major goal of this study was to examine whether the stress-buffering effects of attentional control were attributable to variations in responding to stress. Dual process models of self-regulation suggest that attentional control—the ability to focus and shift attention as needed and to remain presently aware of current subjective experience—might aid self-regulatory behaviors through two possible mechanisms. First, attentional control might be helpful in counteracting the downstream emotional effects of automatic processes, such as rumination or intrusive thoughts. Second, attentional control might be used to help instantiate controlled coping responses to down-regulate stress-induced negative mood.

In general, attentional control was significantly related to various styles of stress responses. As predicted, attentional control was negatively related to disengagement and involuntary stress responses, as well as perceived stress. Contrary to expectations, attentional control was not related to either primary or secondary stress responses. Given the positive associations between primary responses and involuntary responses and increased daily stress, it seems as though primary response strategies were not particularly effective methods of coping with stress in the current sample (for other examples see, Compas et al., 2001).

Results of bootstrapping procedures (Preacher & Hayes, 2008) indicated that the associations between attentional control and stress reactivity (defined as the between-person stress-negative mood slope) were mediated by both automatic and controlled responses to stress. Specifically, the results showed that attentional control reduced stress reactivity through a reduced tendency to respond to stress with rumination, intrusive thoughts, impulsive behaviors, etc. It is widely acknowledged that the habitual tendency to ruminate in response to stress can exacerbate and prolong negative emotional responses (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), and that it signifies a strong vulnerability to the onset of emotional disorders (Mor & Winquist, 2002). Several models of stress coping suggest that these responses can be an automatic and involuntary aspect of the unfolding stress process (Compas et al., 2009; Compas et al., 2001), such that they are activated without the need for attentional resources. Once activated however, intrusive and repetitive thoughts can usurp attentional resources that might otherwise be brought online to help reduce the ruminative thoughts (Klein & Boals, 2001). Attentional control might be thought of as the conceptual opposite of rumination to the degree that it involves controlling the contents of consciousness and maintaining goal-directed processing in the face of intrusions. Indeed, a growing body of research suggests that attentional control is negatively related to rumination and intrusive thoughts (e.g., Brown & Ryan, 2003). The current findings provided further evidence that the ability to maintain control over attention, particularly when stressed, appears to protect against automatic ruminative tendencies, which in turn reduce emotional reactivity. This (partial) mediation effect also supports our multilevel analyses which indicated that attentional control predicted lower average levels of daily rumination and an attenuated stress-rumination association. The present results also build on the findings of Valiente et al.'s (2009) study by

showing that involuntary responses to stress mediated the associations between attentional control and *stress*-related emotional reactivity, rather than general emotional problems as were assessed in that study.

Secondly, results also suggested that attentional control reduced stress reactivity through a reduced tendency to appraise situations as stressful, overwhelming, and uncontrollable. A central tenet of cognitive appraisal theories is that the evaluations individuals make about a situation determines, at least in part, their emotional responses to the situation (Lazarus & Folkman, 1984). Cognitive appraisal theories have offered a compelling framework to explain the between-person variability in emotional reactivity to a similar stressful event. For example, evaluating a situation as overwhelming and uncontrollable, as opposed to challenging but manageable, is likely to produce a different suite of emotional, cognitive, motivational, and behavioral responses. Predating the major theoretical advances of appraisal theory by decades, James (1890) was then correct in surmising that one of the greatest weapons against the effects of stress is the ability to choose one evaluation rather than another.

Attentional control might play a role in stress appraisals in multiple ways. First, the ability to control the contents of consciousness might allow for more accurate appraisals of the situation. As mentioned earlier, attentional control permits a higher resolution sampling of the environmental data, which in turn might facilitate making more empirical or well-informed assessments of the situation. The open receptivity of mindful attention, for example, allows a fuller spectrum of data to be consciously processed, putting the individual in a better situation to make a less threatening and more benign assessment of the situation (Brown et al., 2007; Weinstein et al., 2009). Conversely, a non-mindful mode of processing will be driven more by automatic processes, which by definition are more reactive and lower resolution. Thus, an

inability to control attention will likely result in a moment-to-moment experience that is governed by automatic, self-focused information processing, which tends to make an individual more reactive to emotionally-salient stimuli (Way et al., 2010; Williams, 2010). In fact, the findings of the current investigation corroborate previous research in which individuals with higher levels of mindfulness tended to appraise situations arising during the course of daily life as less threatening (Weinstein et al., 2009).

Second, attentional control might be related to the ability to reappraise a situation. A compelling body of research now suggests that reappraising a potentially stressful situation, by reconstruing its meaning and/or personal significance, can have a profound effect on emotional responses. These findings have been confirmed across a wide range of reappraisal strategies, populations, and outcomes (Ochsner & Gross, 2008). Attentional control is thought to play a role in both the frequency of reappraisal use, as well as reappraisal ability, given that these strategies are controlled, deliberate processes. However, results of the current investigation do not entirely support this contention. Contrary to hypotheses, attentional control was unrelated to secondary stress responses, which included coping strategies such as cognitive restructuring. This might be largely attributed to the parallel findings that secondary coping responses were unrelated to any of the daily outcome variables. As mentioned above, these findings suggest that, in the current sample, secondary coping responses were not particularly effective in managing stress. Another reason for the non-significant associations might be due to the fact that mindful attention (which was part of the attentional control composite scale) is sometimes considered to be a form of "non-appraisal," rather than reappraisal (Grant, Courtemanche, & Rainville, 2011; Holzel et al., 2011). Mindful attention involves a receptive monitoring of experiences where evaluations and cognitive elaborations about the experience are withheld (e.g., the experience is not judged to be

either "good" or "bad"). Supporting this contention, previous research has also found non-significant associations between mindful attention and cognitive reappraisal use (Weinstein et al., 2009). Of course, it should be kept in mind that the associations between attentional control and reappraisal were assessed using only one measure of reappraisal that also included other strategies (e.g., positive thinking), so further research is necessary before ruling out positive associations.

However, these findings also help to draw an important conceptual distinction between attentional control as a domain-general cognitive resource, and attentional control as a specific coping strategy. Throughout the literature attentional control is often equated with strategies such as "distraction" (Mischel & Ebbesen, 1970; Ochsner & Gross, 2005). Choosing to focus on one stimulus (or one *aspect* of the stimulus) rather than another is clearly an example of using attention in an attempt to control information processing, and in turn influence emotions, thoughts, and behaviors (e.g., consider where most people place their focus when using a portable toilet). However, the current findings speak to a different conceptualization of attentional control—as a domain-general cognitive resource (Barrett et al., 2004; Engle, 2002; Kaplan & Berman, 2010)—that is not just a "coping strategy." In our conceptualization, attentional control can be used *in order to* cope with or manage situational demands, and in certain situations, this might outwardly manifest as distraction. But, in other situations, attentional control will not be related to distraction, perhaps because other responses are more appropriate. As mentioned above, attentional control was unrelated to secondary stress responses which included strategies such as distraction. Other studies have also found that individual differences in attentional control were unrelated to using distraction as a strategy to delay gratification (Raver, Blackburn, Bancroft, & Torp, 1999). This suggests, that at least as assessed

in the current study, attentional control can be differentiated from the classification of attentional control as distraction.

This study had several strengths of note. First, this is the first study in adolescent samples to combine neuropsychological and self-report measures with daily diary methods to examine how attentional control influences self-regulation of daily experiences. By linking these methodologies we were able to show that individual differences in attentional control did influence intra-individual variability in daily instances of self-regulation of stress. Because many of the long-term beneficial outcomes of self-regulation are likely determined by a series of short-term processes, this study offered initial evidence for the utility of these methods to capture these short-term aspects of self-regulation. However, future work should examine whether these daily regulatory efforts do positively influence long-term outcomes, a topic of research that is slowly beginning to emerge (Berkman et al., 2011). Secondly, we sampled youth from two different high schools from a variety of socio-economic backgrounds which increases the generalizability of the current findings.

Despite these strengths, there are several limitations that should be addressed in future research. First this study was non-experimental in nature, and thus limits our ability to make causal inferences about the role of attentional control daily stress regulation. However, our findings are in close agreement with a number of randomized controlled studies showing that increases in attentional control mediate reductions in emotional distress (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Sahdra et al., in press; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). For example, Jha et al. (2010) found that improvements in working memory capacity following participation in a mindfulness training intervention mediated post-test reductions in negative mood. Similarly, Shapiro and colleagues (2008) found that improvements in mindful



attention following participation in a mindfulness intervention mediated reductions in stress and rumination at post-test. A growing body of promising research involving youth samples also suggests that attentional control (or cognitive functioning more generally) is amenable to training (e.g., Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Diamond, Barnett, Thomas, & Munro, 2007; Flook et al., 2010; Klingberg et al., 2005; Napoli, Krech, & Holley, 2005; Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005), although more work is needed to determine the causal role of increases in attention on treatment outcomes, particularly for managing stress.

Second, while our sample was socio-economically diverse, it was mostly composed of Caucasian youth. While this is mostly consistent with the demographics of the area, future research should incorporate, to whatever degree possible, a wider range of races and ethnicities. Third, our study relied mostly on self-report questionnaires. While the daily diary methods are generally considered to be less susceptible to some of the vulnerabilities associated with self-report instruments (Almeida, 2005; Bolger et al., 2003), future research should consider incorporating more performance-based or reaction-time measures of the relevant constructs. For example, assessing coping strategy *ability* can help distinguish between the efficacy of one's efforts from the frequency of attempts (Troy, Wilhelm, J., & Mauss, in press). Also, automatic processes, such as the tendency to appraise situations as threatening, might be usefully assessed with implicit measures (e.g., Moeller, Robinson, & Bresin, 2010; Robinson, Vargas, Tamir, & Solberg, 2004), which would help minimize possible contaminating effects of conscious reflection (Hofmann, Friese, & Strack, 2009). Finally, while this study was limited to the associations between attentional control and stress regulation, future research should consider the role of attentional control in other daily self-regulatory efforts (e.g., health behaviors such as

dieting and exercise, academic behaviors such as studying), and the effects these short-term processes have on long-term outcomes (e.g., weight gain, academic achievement). Current efforts of this sort are underway.

In conclusion, the current investigation provided evidence for the importance of attentional control in adolescents' day-to-day well-being. These findings contribute to a research literature which suggests that attentional control is central to self-regulatory competencies and youth well-being (e.g., N. Eisenberg et al., 2007; Rueda et al., 2004). The data presented from this study indicated that adolescents with higher levels of attentional control showed lower average levels of daily negative mood and rumination compared with adolescents lower in attentional control. Results also indicated that adolescents with higher attentional control were better able to manage stress-induced negative emotions and rumination compared with adolescents lower in attentional control. Although further studies linking both the short- and long-term effects of attentional control are required, the present findings offer novel evidence that individual differences in attentional control impact short-term, daily instances of self-regulation in youth.

Table 1

*Correlations between major study variables*

variable	<i>M</i>	<i>SD</i>	2	3	4	5	6	7	8	9	10	11	12
1. EATQ-Att	3.27	.60	.51**	.87**	.12	.05	-.41**	-.40**	-.47**	-.03	-.26**	-.15	-.33**
2. MAAS-A	3.80	.87	--	.87**	.07	.05	-.47**	-.51**	-.56**	-.01	-.41**	-.29**	-.53**
3. ACS	.00	.87		--	.11	.06	-.50**	-.52**	-.60**	-.02	-.39**	-.25**	-.49**
4. RSQ-Primary	2.61	.61			--	.45**	.02	.21**	.01	.04	.14	.23**	.10
5. RSQ-Secondary	2.69	.55				--	.08	-.08	-.23**	.02	-.12	-.03	.07
6. RSQ-Disengagement	2.32	.52					--	.66**	.39**	-.04	.29**	.31**	.42**
7. RSQ-Involuntary	2.10	.71						--	.50**	-.03	.45**	.34**	.48**
8. PSS	2.87	.73							--	.01	.52**	.42**	.42**
9. OSPAN	34.53	16.12								--	-.05	-.02	-.13
10. Daily Negative Mood	1.81	.67									--	.55**	.68**
11. Daily Stress	2.61	1.61										--	.63**
12. Daily Rumination	2.48	1.28											--

*Note.*  $N = 129-132$ , \*  $p < .05$ , \*\*  $p < .01$ .

Table 2  
*Hierarchical Linear Model Predicting Daily Negative Mood  
from Attentional Control*

Variable	Negative Mood	
	Estimate	SE
<i>Fixed Effects</i>		
Intercept, $\gamma_{00}$	1.79***	.06
Attentional Control, $\gamma_{01}$	-.20***	.06
School affiliation, $\gamma_{02}$	-.02	.06
Gender, $\gamma_{03}$	-.04	.05
Day of Study, $\gamma_{10}$	-.02***	<.01
Positive Mood, $\gamma_{20}$	-.18***	.02
Daily Stress, $\gamma_{30}$	.05***	.01
Attentional Control, $\gamma_{31}$	-.03*	.01
School affiliation, $\gamma_{32}$	.02	.01
Gender, $\gamma_{33}$	-.02*	.01
<i>Random Effects</i>		
Intercept, $u_{0j}$	.24***	
Day of Study, $u_{1j}$	<.01***	
Positive Mood, $u_{2j}$	.02***	
Daily Stress, $u_{3j}$	<.01***	
Residual, $e_{ij}$	.21	

*Note.* Fixed effects estimates are unstandardized beta coefficients; Random effects terms are estimates of variance.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ .

Table 3  
*Hierarchical Linear Model Predicting Daily Negative Mood  
from OSPAN Performance*

Variable	Negative Mood	
	Estimate	SE
<i>Fixed Effects</i>		
Intercept, $\gamma_{00}$	1.77***	.07
OSPAN, $\gamma_{01}$	<-.01	<.01
School affiliation, $\gamma_{02}$	-.01	.06
Gender, $\gamma_{03}$	-.05	.05
Day of Study, $\gamma_{10}$	-.02***	<.01
Positive Mood, $\gamma_{20}$	-.18***	.02
Daily Stress, $\gamma_{30}$	.05***	.01
OSPAN, $\gamma_{31}$	<-.01	<.01
School affiliation, $\gamma_{32}$	.02†	.01
Gender, $\gamma_{33}$	-.02*	.01
<i>Random Effects</i>		
Intercept, $u_{0j}$	.28***	
Day of Study, $u_{1j}$	<.01***	
Positive Mood, $u_{2j}$	.02***	
Daily Stress, $u_{3j}$	<.01**	
Residual, $e_{ij}$	.21	

*Note.* Fixed effects estimates are unstandardized beta coefficients; Random effects terms are estimates of variance.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ .

Table 4  
*Hierarchical Linear Model Predicting Daily Rumination from  
Attentional Control*

Variable	Rumination	
	Estimate	SE
<i>Fixed Effects</i>		
Intercept, $\gamma_{00}$	2.42***	.11
Attentional Control, $\gamma_{01}$	-.63***	.11
School affiliation, $\gamma_{02}$	-.14	.11
Gender, $\gamma_{03}$	-.19†	.10
Day of Study, $\gamma_{10}$	-.02*	.01
Negative Mood, $\gamma_{20}$	.31***	.05
Daily Stress, $\gamma_{30}$	.07***	.02
Attentional Control, $\gamma_{31}$	-.03†	.02
School affiliation, $\gamma_{32}$	.01	.02
Gender, $\gamma_{33}$	<.01	.02
<i>Random Effects</i>		
Intercept, $u_{0j}$	.98***	
Day of Study, $u_{1j}$	<.01***	
Negative Mood, $u_{2j}$	.12***	
Daily Stress, $u_{3j}$	.01**	
Residual, $e_{ij}$	.42	

*Note.* Fixed effects estimates are unstandardized beta coefficients; Random effects terms are estimates of variance.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ .

Table 5  
*Hierarchical Linear Model Predicting Daily Rumination from  
 OSPAN Performance*

Variable	Rumination	
	Estimate	SE
<i>Fixed Effects</i>		
Intercept, $\gamma_{00}$	2.38***	.13
OSPAN, $\gamma_{01}$	<-.01	.01
School affiliation, $\gamma_{02}$	-.09	.12
Gender, $\gamma_{03}$	-.21†	.11
Day of Study, $\gamma_{10}$	-.02*	.01
Negative Mood, $\gamma_{20}$	.31***	.05
Daily Stress, $\gamma_{30}$	.07***	.02
OSPAN, $\gamma_{31}$	<-.01*	<.01
School affiliation, $\gamma_{32}$	.03	.02
Gender, $\gamma_{33}$	.01	.02
<i>Random Effects</i>		
Intercept, $u_{0j}$	1.30***	
Day of Study, $u_{1j}$	<.01***	
Negative Mood, $u_{2j}$	.13***	
Daily Stress, $u_{3j}$	.01**	
Residual, $e_{ij}$	.42	

*Note.* Fixed effects estimates are unstandardized beta coefficients; Random effects terms are estimates of variance.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ .

Table 6

*Testing the Intervening Effect of Stress Responses on the Associations Between Attentional Control and Stress Reactivity*

mediator	Path $c$ Estimate	Path $\alpha$ Estimate	Path $\beta$ Estimate	Path $c'$ Estimate	$z$	Lower CI	Upper CI
Involuntary Stress Responses	-.02***	-.42***	.01*	-.01*	-2.26*	-.0099	-.0003
Perceived Stress	-.02***	-.49***	.02***	-.01	-3.25**	-.0159	-.0042

*Note.* \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$



Figure 1. *Estimated daily stress-negative mood slopes for participants with low (-1 SD below the mean), average (mean level), and high (+1 SD above the mean) levels of attentional control. Participants with lower levels of attentional control showed a steeper slope indicating greater emotional reactivity with increasing amounts of daily stress.*

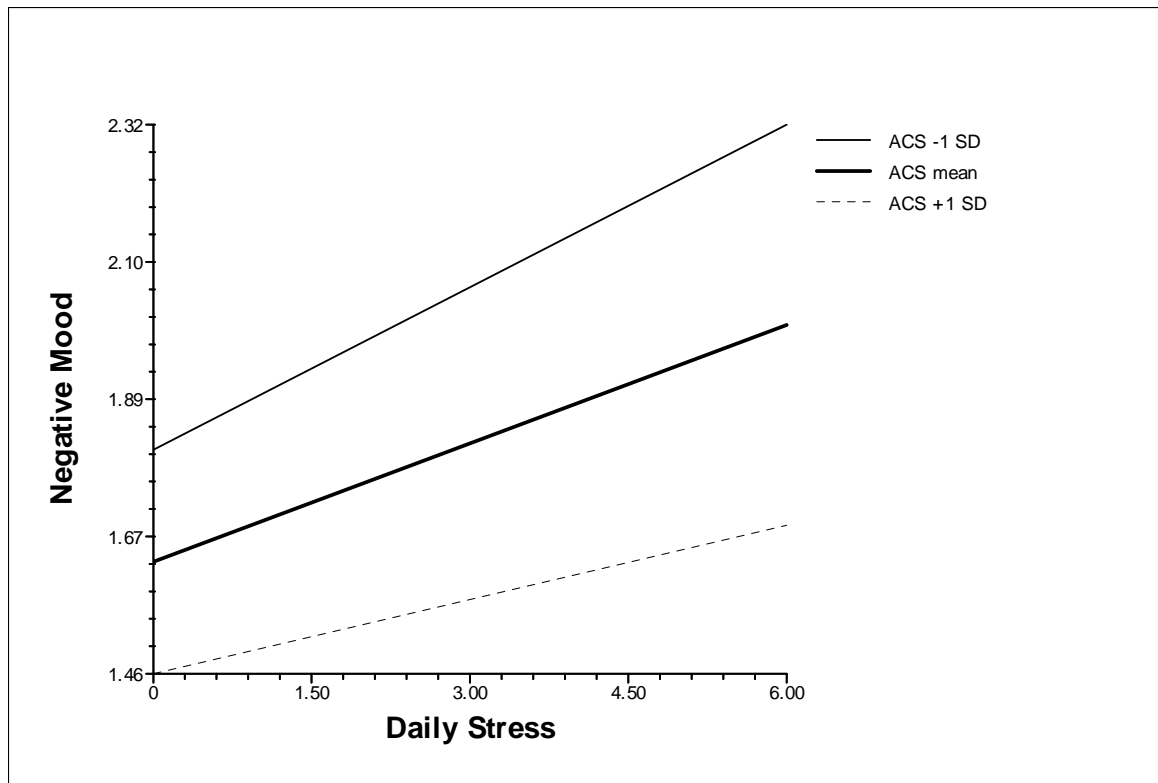


Figure 2. *Estimated daily stress-rumination slopes for participants with low (-1 SD below the mean), average (mean level), and high (+1 SD above the mean) levels of attentional control. Participants with lower levels of attentional control showed a steeper slope indicating greater rumination with increasing amounts of daily stress.*

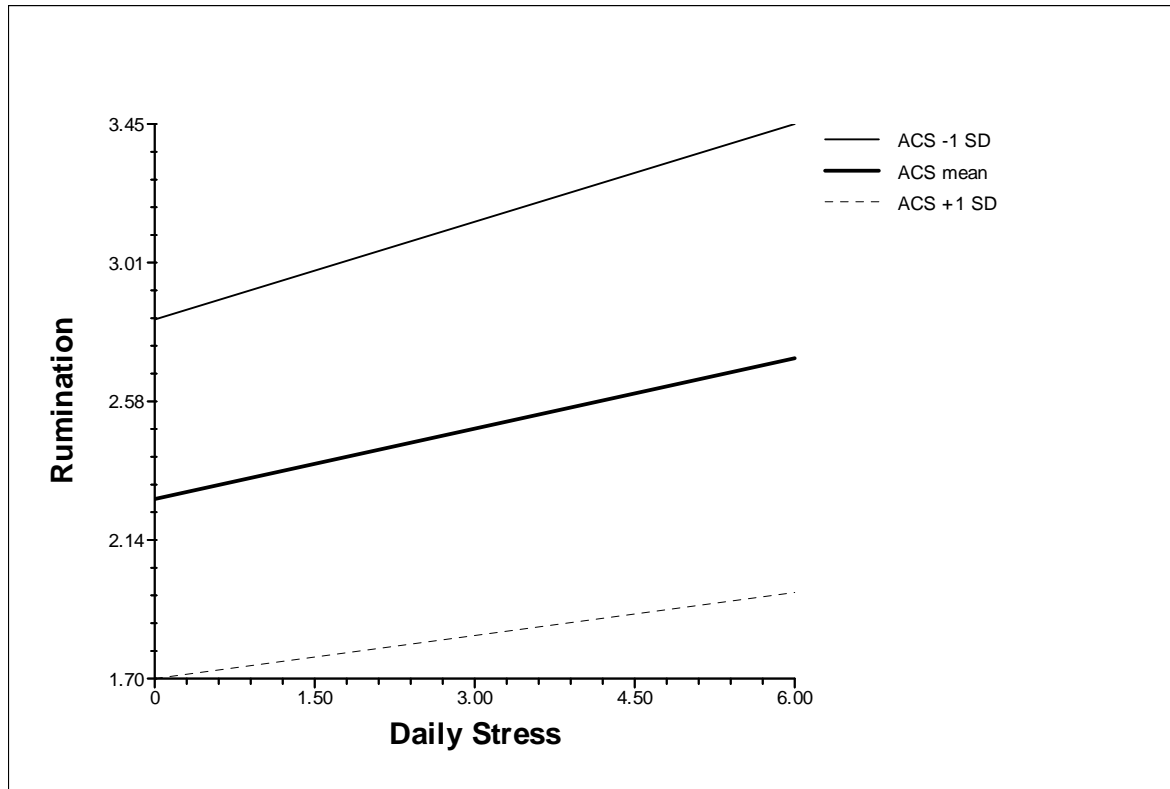


Figure 3. *Estimated daily stress-rumination slopes for participants with low (-1 SD below the mean), average (mean level), and high (+1 SD above the mean) OSPAN scores. Participants with lower OSPAN scores showed a steeper slope indicating greater rumination with increasing amounts of daily stress.*

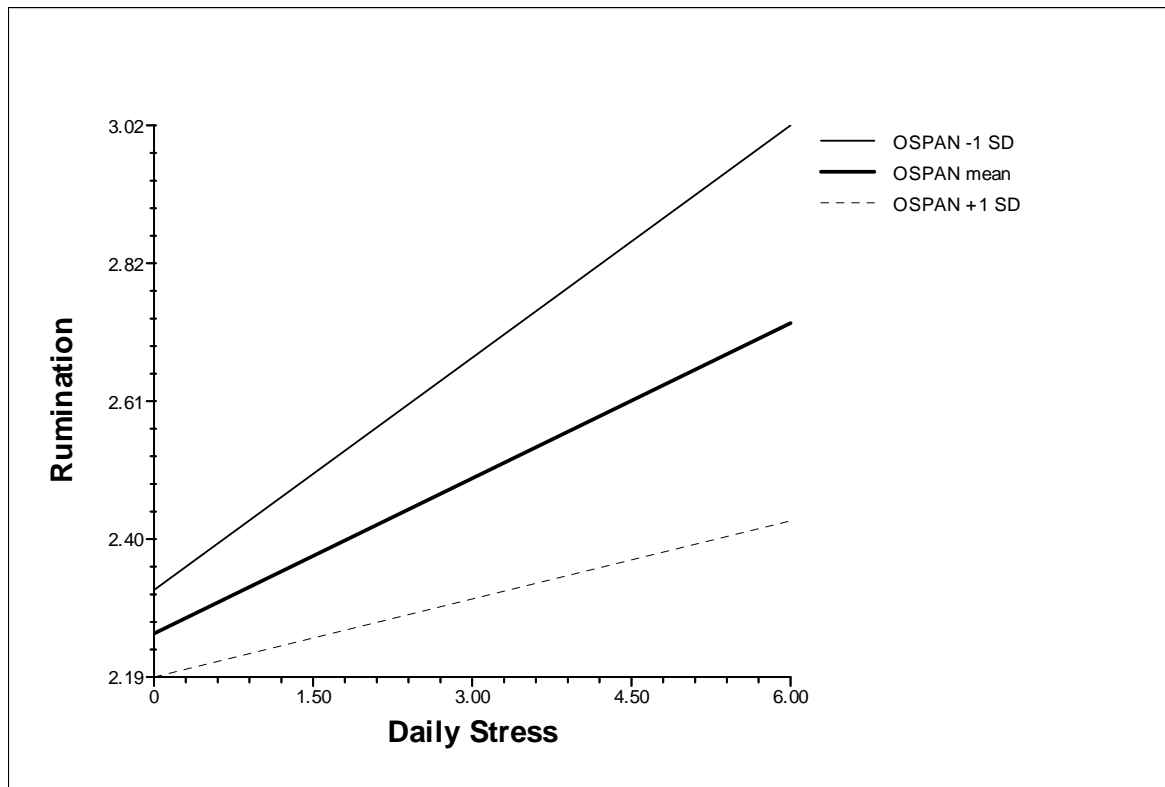
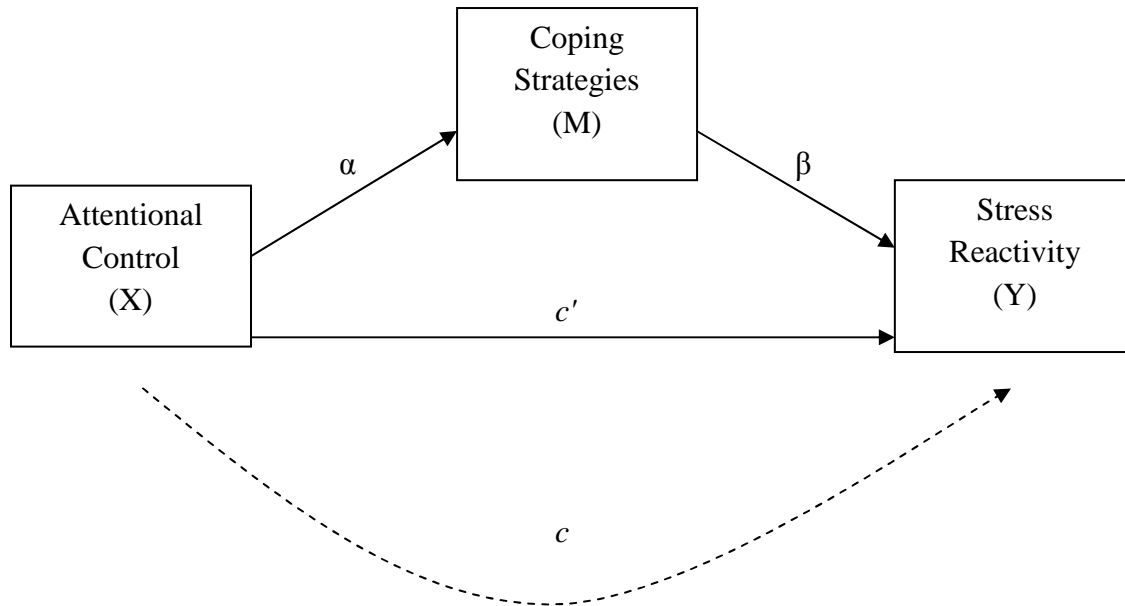


Figure 4. Path diagram depicting our proposed mediation model. Separate models were conducted for each stress response (primary, secondary, disengagement, involuntary, and perceived stress). Path (c) represents the total effects of the independent variable (attentional control) on the dependent variable (stress reactivity). Path ( $\alpha$ ) represents the total effects of attentional control on the mediator (stress response). Path ( $\beta$ ) represents the direct effects of stress response on stress reactivity while controlling for the effects of attentional control. Finally, path ( $c'$ ) represents the direct effect of attentional control on stress reactivity when controlling for stress response.




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Note: ( $\alpha$ ) represents the total effects of X on M; ( $\beta$ ) represents the direct effects of M on Y while controlling for X; ( $c'$ ) represents the direct effects of X on Y while controlling for M; ( $c$ ) represents the total effects of X on Y

## References

- Almeida, D. M. (2005). Resilience and vulnerability to daily stressors assessed via diary methods. *Current Directions in Psychological Science*, 14, 64-68.
- Almeida, D. M., & Kessler, R. C. (1998). Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*, 75(3), 670-680.
- Analayo. (2003). *Satipatthana: The direct path to realization*. Birmingham: Windhorse.
- Anicha, C. L., Ode, S., Moeller, S. K., & Robinson, M. D. (2011). Toward a cognitive view of trait mindfulness: Distinct cognitive skills predict its observing and non-reactivity facets. *Journal of Personality*.
- Ashcroft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General*, 130(2), 224-237.
- Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. Bower (Ed.), *The psychology of learning and motivation* (Vol. 8, pp. 47-89). New York: Academic Press.
- Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky inventory of mindfulness skills. *Assessment*, 11(3), 191-206.
- Baer, R. A., Smith, G. T., Lykins, E. L. B., Button, D., Krietemeyer, J., Sauer, S., et al. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*, 15(3), 329-342.
- Banez, G. A., & Compas, B. E. (1990). Children's and parents' daily stressful events and psychological symptoms. *Journal of Abnormal Child Psychology*, 18(6), 591-605.
- Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, 54(7), 462-479.

- Bargh, J. A., & Morsella, E. (2008). The unconscious mind. *Perspectives on Psychological Science*, 3(1), 73-79.
- Barker, E. D., Séguin, J. R., White, H. R., Bates, M. E., Lacourse, E., Carbonneau, R., et al. (2007). Developmental trajectories of male physical violence and theft: relations to neurocognitive performance. *Arch Gen Psychiatry*, 64(5), 592-599.
- Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin*, 121(1), 65-94.
- Barnhofer, T., Duggan, D. S., & Griffith, J. W. (2011). Dispositional mindfulness moderates the relation between neuroticism and depressive symptoms. *Personality and Individual Differences*, 51(8), 958-962.
- Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin*, 130(4), 553-573.
- Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation*. San Diego: Academic.
- Baumeister, R. F., & Vohs, K. D. (2004). *Handbook of self-regulation: Research, theory, and applications* (1st ed.). New York: Guilford.
- Beilock, S. L., & Carr, T. H. (2005). When high-powered people fail: Working memory and "choking under pressure" in math. *Psychological Science*, 16(2), 101-105.
- Berkman, E. T., Falk, E. B., & Lieberman, M. D. (2011). In the trenches of real world self-control: Neural correlates of breaking the link between craving and smoking. *Psychological Science*, 22(4), 498-506.

- Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology*, 20(3), 821-843.
- Black, D. S., Milam, J., & Sussman, S. (2009). Sitting-Meditation Interventions Among Youth: A Review of Treatment Efficacy. *Pediatrics*, 124(3), e532-541.
- Black, D. S., Sussman, S., Johnson, C. A., & Milam, J. (2012). Psychometric properties of the mindful awareness attention scale (maas) among Chinese adolescents. *Assessment*, 19(1), 40-50.
- Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, 54, 579-616.
- Bolger, N., DeLongis, A., Kessler, R. C., & Schilling, E. A. (1989). Effects of daily stress and negative mood. *Journal of Personality and Social Psychology*, 57(5), 808-818.
- Bolger, N., & Schilling, E. A. (1991). Personality and the problems of everyday life: The role of neuroticism in exposure and reactivity to daily stressors. *Journal of Personality*, 59, 355-386.
- Bolger, N., & Zuckerman, A. (1995). A framework for studying personality in the stress process. *Personality Processes and Individual Differences*, 69(5), 890-902.
- Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. *Psychological Review*, 108(3), 624-652.
- Bowlin, S. L., & Baer, R. A. (2012). Relationships between mindfulness, self-control, and psychological functioning. *Personality and Individual Differences*, 52, 411-415.
- Brewin, C. R., & Beaton, A. (2002). Thought suppression and working memory. *Behaviour Research and Therapy*, 40, 923-930.

- Brewin, C. R., & Smart, L. (2005). Working memory capacity and suppression of intrusive thoughts. *Journal of Behavior Therapy and Experimental Psychiatry*, 36(1), 61-68.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822-848.
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, 18(4), 211 - 237.
- Brown, K. W., West, A. M., Loverich, T. M., & Biegel, G. M. (2011). Assessing adolescent mindfulness: Validation of an adapted mindful attention awareness scale in adolescent normative and psychiatric populations. *Psychological Assessment*, 23(4), 1023-1033.
- Bush, G., Luu, P., & Posner, M. I. (2000). Cognitive and emotional influences in anterior cingulate cortex *Trends in Cognitive Sciences*, 4(6), 215-222.
- Campbell, L. K., Scaduto, M., Van Slyke, D., Niarhos, F., Whitlock, J. A., & Compas, B. E. (2009). Executive function, coping, and behavior in survivors of childhood acute lymphocytic leukemia. *Journal of Pediatric Psychology*, 34(3), 317-327.
- Capaldi, D. M., & Rothbart, M. K. (1992). Development and validation of an early adolescent temperament measure. *Journal of Early Adolescence*, 12, 153-173.
- Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development*, 22(4), 489-510.
- Carriere, J. S. A., Cheyne, J. A., & Smilek, D. (2008). Everyday attention lapses and memory failures: The affective consequences of mindlessness. *Consciousness and Cognition*, 17(3), 835-847.
- Carver, C. S., & Scheier, M. F. (1981). *Attention and self-regulation: A control-theory approach to human behavior*. New York: Springer.



- Cauffman, E., Steinberg, L., & Piquero, A. R. (2005). Psychological, neuropsychological and physiological correlates of serious antisocial behavior in adolescence: The role of self-control. *Criminology: An Interdisciplinary Journal*, 43(1), 42.
- Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology*. New York: Guilford.
- Cheyne, J. A., Carriere, J. S. A., & Smilek, D. (2006). Absent-mindedness: Lapses of conscious awareness and everyday cognitive failures. *Consciousness and Cognition*, 15, 578-592.
- Chodron, P. (2005). *No time to lose: A timely guide to the way of the Bodhisattva*. Boston: Shambhala.
- Chung, G. H., Flook, L., & Fuligni, A. J. (2009). Daily family conflict and emotional distress among adolescents from Latin American, Asian, and European backgrounds. *Developmental Psychology*, 45(5), 1406-1415.
- Chung, G. H., Flook, L., & Fuligni, A. J. (2011). Reciprocal associations between family and peer conflict in adolescents' daily lives. *Child Development*, 82(5), 1390-1396.
- Ciarrochi, J., Kashdan, T. B., Leeson, P., Heaven, P., & Jordan, C. (2011). On being aware and accepting: A one-year longitudinal study into adolescent well-being. *Journal of Adolescence*, 34(4), 695-703.
- Cobb, J. M. T., & Steptoe, A. (1996). Psychosocial stress and susceptibility to upper respiratory tract illness in an adult population sample. *Psychosomatic Medicine*, 58, 404-412.
- Coffey, K. A., & Hartman, M. (2008). Mechanisms of action in the inverse relationship between mindfulness and psychological distress. *Complementary Health Practice Review*, 13(2), 79-91.

- Coffey, K. A., Hartman, M., & Fredrickson, B. L. (2010). Deconstructing mindfulness and constructing mental health: Understanding mindfulness and its mechanisms of action. *Mindfulness, 1*(4), 235-253.
- Cohen, L. H., Gunthert, K. C., Butler, A. C., O'Neill, S. C., & Tolpin, L. H. (2005). Daily affective reactivity as a prospective predictor of depressive symptoms. *Journal of Personality, 73*(6), 1687-1714.
- Cohen, L. H., Gunthert, K. C., Butler, A. C., Parrish, B. P., Wenz, S. J., & Beck, J. S. (2008). Negative affective spillover from daily events predicts early response to cognitive therapy for depression. *Journal of Consulting and Clinical Psychology, 76*(6), 955-965.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 385-396.
- Cohen, S., & Williamson, G. (1988). Psychological stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health: Claremont Symposium on Applied Social Psychology* (pp. 31-67). Newbury Park, CA: Sage.
- Compas, B. E. (2006). Psychobiological processes of stress and coping. *Annals of the New York Academy of Sciences, 1094*(1), 226-234.
- Compas, B. E. (2009). Coping, regulation, and development during childhood and adolescence. In E. A. Skinner & M. J. Zimmer-Gembeck (Eds.), *Coping and the development of regulation. New Directions for Child and Adolescent Development* (pp. 87-99). San Francisco: Jossey-Bass.
- Compas, B. E., Campbell, L. K., Robinson, K. E., & Rodriguez, E. M. (2009). Coping and memory: Automatic and controlled processes in adaptation to stress. In J. A. Quas & R.

- Fivush (Eds.), *Emotion and memory in development: Biological, cognitive, & social considerations* (pp. 121-141). New York: Oxford University Press.
- Compas, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological Bulletin*, 127(1), 87-127.
- Compas, B. E., Connor, J., Osowiecki, D., & Welch, A. (1997). Effortful and involuntary responses to stress: Implications for coping with chronic stress. In B. H. Gottlieb (Ed.), *Coping with chronic stress* (pp. 105-130). New York: Plenum.
- Compas, B. E., Howell, D. C., Phares, V., Williams, R. A., & Giunta, C. T. (1989). Risk factors for emotional/behavioral problems in young adolescents: A prospective analysis of adolescent and parental stress and symptoms. *Journal of Consulting and Clinical Psychology*, 57, 732-740.
- Compas, B. E., & Reeslund, K. L. (2009). Processes of risk and resilience in adolescence. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology: Individual bases of adolescent development* (3rd ed., Vol. 1). Hoboken, New Jersey: John Wiley & Sons.
- Compton, R. J., Arnstein, D., Freedman, G., Dainer-Best, J., Liss, A., & Robinson, M. D. (2011). Neural and behavioral measures of error-related cognitive control predict daily coping with stress. *Emotion*, 11(2), 379-390.
- Compton, R. J., Robinson, M. D., Ode, S., Quandt, L. C., Fineman, S. L., & Carp, J. (2008). Error-monitoring ability predicts daily stress regulation. *Psychological Science*, 19(7), 702-708.

- Connor-Smith, J. K., Compas, B. E., Wadsworth, M. E., Thomsen, A. H., & Saltzman, H. (2000). Responses to stress in adolescence: Measurement of coping and involuntary stress responses. *Journal of Consulting and Clinical Psychology, 68*(6), 976-992.
- Conway, A. R. A., Cowan, N., & Bunting, M. F. (2001). The cocktail party phenomenon revisited: The importance of working memory capacity. *Psychonomic Bulletin & Review, 8*(2), 331-335.
- Conway, A. R. A., Kane, M. J., Bunting, M. F., Hambrick, D. Z., Wilhelm, O., & Engle, R. W. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic Bulletin & Review, 12*, 769-786.
- Conway, A. R. A., Kane, M. J., & Engle, R. W. (2003). Working memory capacity and its relation to general intelligence. *Trends in Cognitive Sciences, 7*, 547-552.
- Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine, 69*(6), 560-565.
- Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. New York: Harper & Row.
- Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior, 19*(4), 450-466.
- Daneman, M., & Green, I. (1986). Individual differences in comprehending and producing words in context. *Journal of Memory and Language, 25*(1), 1-18.
- de Bruin, E. I., Zijlstra, B. J. H., van de Weijer-Bergsma, E., & Bögels, S. M. (2011). The mindful attention awareness scale for adolescents (MAAS-A): Psychometric properties in a Dutch sample. *Mindfulness, 2*(3), 201-211.

- Dennis, T. A., & Brotman, L. M. (2003). Effortful control, attention, and aggressive behavior in preschoolers with risk for conduct problems. *Annals of the New York Academy of Sciences*, 1008, 1-4.
- Dennis, T. A., Brotman, L. M., Huang, K. Y., & Gouley, K. K. (2007). Effortful control, social competence, and adjustment problems in children at risk for psychopathology. *Journal of Clinical Child and Adolescent Psychology*, 36(3), 442-454.
- Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, 111(2), 225-236.
- Derryberry, D., Reed, M. A., & Pilkenton-Taylor, C. (2003). Temperament and coping: Advantages of an individual differences perspective. *Development and Psychopathology*, 15, 1049-1066.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science*, 318, 1387-1388.
- DuBois, D. L., Felner, R. D., Brand, S., Adan, A. M., & Evans, E. G. (1992). A Prospective Study of Life Stress, Social Support, and Adaptation in Early Adolescence. *Child Development*, 63(3), 542-557.
- Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, 16(12), 939-944.
- Ehrenreich, J. T., & Gross, A. M. (2002). Biased attentional behavior in childhood anxiety a review of theory and current empirical investigation. *Clinical Psychology Review*, 22(7), 991-1008.

- Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., et al. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112-1134.
- Eisenberg, N., Fabes, R. A., Nyman, M., Bernzweig, J., & Pinuelas, A. (1994). The relations of emotionality and regulation to children's anger-related reactions. *Child Development, 65*, 109-128.
- Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S. M., et al. (1997). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child Development, 68*(4), 642-664.
- Eisenberg, N., Hofer, C., & Vaughan, J. (2007). Effortful control and its socioemotional consequences. In J. J. Gross (Ed.), *Handbook of emotion regulation*. New York: Guilford.
- Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H., Valiente, C., et al. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: Concurrent relations and prediction of change. *Developmental Psychology, 41*(1), 193-211.
- Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495-525.
- Eisenberg, N., Spinrad, T. L., Fabes, R. A., Reiser, M., Cumberland, A., Shepard, S. A., et al. (2004). The relations of effortful control and impulsivity to children's resiliency and adjustment. *Child Development, 75*(1), 25-46.
- Eisenberg, N., Valiente, C., Spinrad, T. L., Cumberland, A., Liew, J., Reiser, M., et al. (2009). Longitudinal relations of children's effortful control, impulsivity, and negative

- emotionality to their externalizing, internalizing, and co-occurring behavior problems. *Developmental Psychology*, 45(4), 988-1008.
- Eisenberg, N., Valiente, C., & Sulik, M. J. (2009). How the study of regulation can inform the study of coping. *New Directions for Child and Adolescent Development*, 2009(124), 75-86.
- Ellis, L. K., Rothbart, M. K., & Posner, M. I. (2004). Individual differences in executive attention predict self-regulation and adolescent psychosocial behaviors. *Annals of the New York Academy of Sciences*, 1021, 337-340.
- Engle, R. W. (2001). What is working memory capacity? In H. L. R. III & J. S. Nairne (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder* (pp. 297-314). Washington, DC: American Psychological Association.
- Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science*, 11, 19-23.
- Engle, R. W., & Kane, M. J. (2004). Executive attention, working memory capacity, and a two-factor theory of cognitive control. In B. Ross (Ed.), *The psychology of learning and motivation* (pp. 145-199). New York: Academic Press.
- Engle, R. W., Kane, M. J., & Tuholski, S. W. (1999). Individual differences in working memory capacity and what they tell us about controlled attention, general fluid intelligence and functions of the prefrontal cortex. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control* (pp. 102-134). London: Cambridge University Press.

- Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. A. (1999). Working memory, short-term memory and general fluid intelligence: A latent variable approach. *Journal of Experimental Psychology: General*, 128, 309-331.
- Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D., et al. (2004). Accelerated telomere shortening in response to life stress. *Proceedings of the National Academy of Sciences*, 101, 17312-17315.
- Evans, D. R., Baer, R. A., & Segerstrom, S. C. (2009). The effects of mindfulness and self-consciousness on persistence. *Personality and Individual Differences*, 47(4), 379-382.
- Fan, J., McCandliss, B. D., Sommer, T., Raz, A., & Posner, M. I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience*, 14, 340-347.
- Fetterman, A. K., Robinson, M. D., Ode, S., & Gordon, K. H. (2010). Neuroticism as a risk factor for behavioral dysregulation: A mindfulness-mediation perspective. *Journal of Social and Clinical Psychology*, 29(3), 301-321.
- Flook, L., & Fuligni, A. J. (2008). Family and school spillover in adolescents' daily lives. *Child Development*, 79(3), 776-787.
- Flook, L., Smalley, S. L., Kitil, J., Galla, B. M., Kaiser-Greenland, S., Locke, J., et al. (2010). Effects of mindful awareness practices on executive functions in elementary school children. *Journal of Applied School Psychology*, 26(1), 70-95.
- Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology*, 95(5), 1045-1062.



- Fuligni, A. J., Telzer, E. H., Bower, J., Cole, S. W., Kiang, L., & Irwin, M. R. (2009). A preliminary study of daily interpersonal stress and C-reactive protein levels among adolescents from Latin American and European backgrounds. *Psychosomatic Medicine*, 71, 329-333.
- Gable, S. L., Reis, H. T., & Elliot, A. J. (2000). Behavioral activation and inhibition in daily life. *Journal of Personality and Social Psychology*, 78(6), 1135-1149.
- Galla, B. M., Hale, T. S., Shrestha, A., Loo, S. K., & Smalley, S. L. (2011). The disciplined mind: Associations between the Kentuck inventory of mindfulness skills and attention control. *Mindfulness*.
- Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function in preschoolers: A review using an integrative framework. *Psychological Bulletin*, 134(1), 31-60.
- Giedd, J. N., Blumenthal, J., Jeffries, N. O., Castellanos, F. X., Liu, H., Zijdenbos, A., et al. (1999). Brain development during childhood and adolescence: A longitudinal MRI study. *Nature Neuroscience*, 10, 861-863.
- Grant, J. A., Courtemanche, J., & Rainville, P. (2011). A non-elaborative mental stance and decoupling of executive and pain-related cortices predicts low pain sensitivity in Zen meditators. *Pain*, 152(1), 150-156.
- Greco, L. A., Baer, R. A., & Smith, G. T. (2011). Assessing mindfulness in children and adolescents: Development and validation of the Child and Adolescent Mindfulness Measure (CAMM). *Psychological Assessment*, 23(3), 606-614.
- Greco, L. A., Lambert, W., & Baer, R. A. (2008). Psychological inflexibility in childhood and adolescence: Development and evaluation of the Avoidance and Fusion Questionnaire for Youth. *Psychological Assessment*, 20(2), 93-102.

- Grenard, J. L., Ames, S. L., Wiers, R. W., Thush, C., Sussman, S., & Stacy, A. W. (2008). Working memory capacity moderates the predictive effects of drug-related associations on substance use. *Psychology of Addictive Behaviors*, 22(3), 426-432.
- Heitz, R. P., & Engle, R. W. (2007). Focusing the spotlight: Individual differences in visual attention control. *Journal of Experimental Psychology: General*, 136, 217-240.
- Heitz, R. P., Unsworth, N., & Engle, R. W. (2005). Working memory capacity, attentional control, and fluid intelligence. In O. Wilhelm & R. W. Engle (Eds.), *Handbook of understanding and measuring intelligence* (pp. 61-78). London: Sage Publications.
- Heller, A. S., Johnstone, T., Shackman, A. J., Light, S. N., Peterson, M. J., Kolden, G. G., et al. (2009). Reduced capacity to sustain positive emotion in major depression reflects diminished maintenance of fronto-striatal brain activation. *Proceedings of the National Academy of Sciences*, 106(52), 22445-22450.
- Hill, C. L. M., & Updegraff, J. A. (2011). Mindfulness and its relationship to emotional regulation. *Emotion*.
- Hofmann, W., Friese, M., & Roefs, A. (2009). Three ways to resist temptation: The independent contributions of executive attention, inhibitory control, and affect regulation to the impulse control of eating behavior. *Journal of Experimental Social Psychology*, 45(2), 4.
- Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, 4(2), 462-479.
- Hofmann, W., Gschwendner, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behavior: Toward an individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology*, 95(4), 962-977.

- Hofmann, W., Schmeichel, B. J., Friese, M., & Baddeley, A. (2011). Working memory and self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation* (Vol. 2). New York: Guilford.
- Holzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science*, 6(6), 537-559.
- Hooper, N., Villatte, M., Neofotistou, E., & McHugh, L. (2010). The effects of mindfulness versus thought suppression on implicit and explicit measures of experiential avoidance. *International Journal of Behavioral Consultation and Therapy*, 6(3), 233-244.
- Ilkowska, M., & Engle, R. W. (2010). Working memory capacity and self-regulation. In R. H. Hoyle (Ed.), *Handbook of personality and self-regulation* (pp. 265-290): Wiley-Blackwell.
- James, W. (1890). *Principles of psychology* (Vol. I): Harvard University Press.
- Jha, A. P., Stanley, E. A., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory and affective experience. *Emotion*, 10(1), 54-64.
- Josefsson, T., & Broberg, A. (2010). Meditators and non-meditators on sustained and executive attentional performance. *Mental Health, Religion & Culture*, 14(3), 291-309.
- Kane, M. J., Bleckley, K. M., Conway, A. R. A., & Engle, R. W. (2001). A controlled-attention view of working-memory capacity. *Journal of Experimental Psychology: General*, 130, 169-183.
- Kane, M. J., Brown, L. H., McVay, J. C., Silvia, P. J., Myin-Germeys, I., & Kwapil, T. R. (2007). For whom the mind wanders, and when: An experience-sampling study of

- working memory and executive control in daily life. *Psychological Science*, 18(7), 614-621.
- Kane, M. J., & Engle, R. W. (2003). Working memory capacity and the control of attention: The contributions of goal neglect, response competition, and task set to stroop interference. *Journal of Experimental Psychology: General*, 132, 47-70.
- Kaplan, S., & Berman, M. G. (2010). Directed attention as a common resource for executive functioning and self-regulation. *Perspectives on Psychological Science*, 5(1), 43-57.
- Kiang, L., Yip, T., Gonzales-Backen, M., Witkow, M., & Fuligni, A. J. (2006). Ethnic identity and the daily psychological well-being of adolescents from Mexican and Chinese backgrounds. *Child Development*, 77(5), 1338-1350.
- Kieras, J. E., Tobin, R. E., Graziano, W. G., & Rothbart, M. K. (2005). You can't always get what you want: Effortful control and children's responses to undesirable gifts. *Psychological Science*, 16(5), 391-396.
- Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, 330(6006), 932.
- Kirk, U., Downar, J., & Montague, P. R. (2011). Interoception drives increased rational decision-making in meditators playing the ultimatum game. *Frontiers in Neuroscience*, 5, 1-11.
- Klein, K., & Boals, A. (2001). The relationship of life event stress and working memory capacity. *Applied Cognitive Psychology*, 15, 565-579.
- Klingberg, T., Fernell, E., Olesen, P. J., Johnson, M., Gustafsson, P., Dahlstrom, K., et al. (2005). Computerized training of working memory in children with ADHD: A randomized, controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, 44(2), 177-186.

- Koole, S. L., Govorun, O., Cheng, C. M., & Gallucci, M. (2009). Pulling yourself together: Meditation promotes congruence between implicit and explicit self-esteem. *Journal of Experimental Social Psychology*, 45(6), 1220-1226.
- Kyllonen, P. C., & Stephens, D. L. (1990). Cognitive abilities as determinants of success in acquiring logic skill. *Learning and Individual Differences*, 2, 129-160.
- Lakey, C. E., Campbell, W. K., Brown, K. W., & Goodie, A. S. (2007). Dispositional mindfulness as a predictor of the severity of gambling outcomes. *Personality and Individual Differences*, 43(7), 1698-1710.
- Larson, R., & Ham, M. (1993). Stress and "storm and stress" in early adolescence: The relationship of negative events with dysphoric affect. *Developmental Psychology*, 29(1), 130-140.
- Larson, R., & Lampman-Petratis, C. (1989). Daily emotional states as reported by children and adolescents. *Child Development*, 60, 1250-1260.
- Larson, R., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development*, 73(4), 1151-1165.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- LeDoux, J. E. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience*, 23, 155-184.
- Lehman, B. J., & Repetti, R. L. (2007). Bad days don't end when the school bell rings: The lingering effects of negative school events on children's mood, self-esteem, and perceptions of parent-child interactions. *Social Development*, 16(3), 596-618.

- Lengua, L. J., & Long, A. C. (2002). The role of emotionality and self-regulation in the appraisal-coping process: Tests of direct and moderating effects. *Journal of Applied Developmental Psychology, 23*, 471–493.
- Lengua, L. J., & Sandler, I. N. (1996). Self-regulation as a moderator of the relation between coping and symptomatology in children of divorce. *Journal of Abnormal Child Psychology, 24*, 681–701.
- Levesque, C., & Brown, K. W. (2007). Mindfulness as a moderator of the effect of implicit motivational self-concept on day-to-day behavioral motivation. *Motivation and Emotion, 31*(4), 284-299.
- Liebermann, D., Giesbrecht, G. F., & Müller, U. (2007). Cognitive and emotional aspects of self-regulation in preschoolers. *Cognitive Development, 22*(4), 511-529.
- Lorr, M., & McNair, D. M. (1971). *The profile of mood states manual*. San Diego, CA: Educational and Industrial Testing Service.
- MacCoon, D. G., Wallace, J. F., & Newman, J. P. (2004). Self-regulation: Context-appropriate balanced attention. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (1st ed., pp. 422-444). New York: Guilford.
- MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analyses. *Annual Review of Psychology, 58*, 593-614.
- Marks, A. D. G., Sobanski, D. J., & Hine, D. W. (2010). Do dispositional rumination and/or mindfulness moderate the relationship between life hassles and psychological dysfunction in adolescents? *Australian and New Zealand Journal of Psychiatry, 44*(9), 831-838.

- McLaughlin, K. A., & Hatzenbuehler, M. L. (2009). Mechanisms linking stressful life events and mental health problems in a prospective, community-based sample of adolescents. *Journal of Adolescent Health, 44*(2), 153-160.
- McRae, K., Jacobs, S. E., Ray, R. D., John, O. P., & Gross, J. J. (2012). Individual differences in reappraisal ability: Links to reappraisal frequency, well-being, and cognitive control. *Journal of Research in Personality, 26*, 2-7.
- Mischel, W., & Ayduk, O. (2002). Self-regulation in a cognitive-affective personality system: Attentional control in the service of the self. *Self and Identity, 1*(2), 113-120.
- Mischel, W., & Ayduk, O. (2004). Willpower in a cognitive-affective processing system: The dynamics of delay of gratification. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of Self-regulation* (pp. 99-129). New York, NY: Guilford Press.
- Mischel, W., & Ebbesen, E. B. (1970). Attention in delay of gratification. *Journal of Personality & Social Psychology, 16*(2), 329-337.
- Moeller, S. K., Robinson, M. D., & Bresin, K. (2010). Integrating trait and social-cognitive views of personality: Neuroticism, implicit stress priming, and neuroticism-outcome relationships. *Personality and Social Psychology Bulletin, 36*(5), 677-689.
- Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., et al. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences, 108*(7), 2693-2698.
- Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition, 18*(1), 176-186.
- Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin, 128*, 638-662.

- Muris, P. (2006). Unique and interactive effects of neuroticism and effortful control on psychopathological symptoms in non-clinical adolescents. *Personality and Individual Differences, 40*, 1409-1419.
- Muris, P., De Jong, P. J., & Engelen, S. (2004). Relationships between neuroticism, attentional control, and anxiety disorders symptoms in non-clinical children. *Personality and Individual Differences, 37*, 789-797.
- Muris, P., Mayer, B., van Lint, C., & Hofman, S. (2008). Attentional control and psychopathological symptoms in children. *Personality and Individual Differences, 44*(7), 1495-1505.
- Muris, P., Meesters, C., & Rompelberg, L. (2006). Attention control in middle childhood: Relations to psychopathological symptoms and threat perception distortions. *Behaviour Research and Therapy, 45*, 997-1010.
- Muris, P., van der Pennen, E., Sigmond, R., & Mayer, B. (2008). Symptoms of anxiety, depression, and aggression in non-clinical children: Relationships with self-report and performance-based measures of attention, and effortful control. *Child Psychiatry & Human Development, 39*, 455-467.
- Murray, K. T., & Kochanska, G. (2002). Effortful control: Factor structure and relation to externalizing and internalizing behaviors. *Journal of Abnormal Child Psychology, 30*(5), 503-514.
- Napoli, M., Krech, P. R., & Holley, L. C. (2005). Mindfulness Training for Elementary School Students: The Attention Academy. *Journal of Applied School Psychology, 21*(1), 99-125.
- Niemiec, C. P., Brown, K. W., Kashdan, T. B., Cozzolino, P. J., Breen, W. E., Levesque-Bristol, C., et al. (2010). Being present in the face of existential threat: The role of trait



- mindfulness in reducing defensive responses to mortality salience. *Journal of Personality and Social Psychology*, 99(2), 344-365.
- Nigg, J. T., Quamma, J. P., Greenberg, M. T., & Kusché, C. A. (1998). A two-year longitudinal study of neuropsychological and cognitive performance in relation to behavioral problems and competencies in elementary school children. *Journal of Abnormal Psychology*, 107, 51-63.
- Nishina, A., & Juvonen, J. (2005). Daily reports of witnessing and experiencing peer harassment in middle school. *Child Development*, 76, 435-450.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100, 569-582.
- Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, 3(5), 400-424.
- Norman, D. A., & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In R. J. Davidson, G. E. Schwartz & D. Shapiro (Eds.), *Consciousness and Self Regulation: Advances in Research and Theory* (Vol. 4, pp. 1-18). New York, NY: Plenum.
- Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences*, 9, 242-249.
- Ochsner, K. N., & Gross, J. J. (2007). The neural architecture of emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 87-109). New York: Guilford Press.
- Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science*, 17(2), 153-158.

- Ostafin, B. D., & Marlatt, G. A. (2008). Surfing the urge: Experiential acceptance moderates the relation between automatic alcohol motivation and hazardous drinking. *Journal of Social and Clinical Psychology, 27*, 426-440.
- Papies, E. K., Barsalou, L. W., & Custers, R. (2011). Mindful attention prevents mindless impulses. *Social Psychological and Personality Science*.
- Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology, 46*, 598-609.
- Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology, 12*(3), 427-441.
- Posner, M. I., & Rothbart, M. K. (2007). Research on attention networks as a model for the integration of psychological science. *Annual Review of Psychology, 58*(1), 1-23.
- Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments & Computers, 36*(4), 717-731.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.
- Putnam, S. P., Ellis, L. K., & Rothbart, M. K. (2002). The structure of temperament from infancy through adolescence. In A. Elias & A. Angleitner (Eds.), *Advances in research on temperament* (pp. 165–182). Germany: Pabst Scientist Publisher.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.

- Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., Congdon, R., & du Toit, M. (2011). HLM 7: Hierarchical linear and nonlinear modeling. Lincolnwood, IL: Scientific Software International.
- Raver, C. C., Blackburn, E. K., Bancroft, M., & Torp, N. (1999). Relations between effective emotional self-regulation, attentional control, and low-income preschoolers' social competence with peers. *Early Education and Development, 10*(3), 333-350.
- Redick, T. S., & Engle, R. W. (2006). Working memory capacity and attention network test performance. *Applied Cognitive Psychology, 20*(5), 713-721.
- Redick, T. S., Heitz, R. P., & Engle, R. W. (2007). Working memory capacity and inhibition: Cognitive and social consequences. *Gorfein, David S.*
- Repetti, R. L. (1996). The effects of perceived daily social and academic failure experiences on school-age children's subsequent interactions with parents. *Child Development, 67*(4), 1467-1482.
- Repetti, R. L., McGrath, E. P., & Ishikawa, S. S. (1999). Daily stress and coping in childhood and adolescence. In A. J. Goreczny & M. Hersen (Eds.), *Handbook of pediatric and adolescent health psychology* (pp. 343-360). Needham Heights, MA: Allyn & Bacon.
- Reynolds, B. M., & Repetti, R. L. (2008). Contextual variations in negative mood and state self-esteem. *Journal of Early Adolescence, 28*(3), 405-427.
- Riggs, N. R., Blair, C. B., & Greenberg, M. T. (2003). Concurrent and 2-year longitudinal relations between executive function and the behavior of 1st and 2nd grade children. *Child Neuropsychology, 9*(4), 267-276.
- Riggs, N. R., Greenberg, M. T., Kusche, C. A., & Pentz, M. A. (2006). The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in

- elementary school students: Effects of the paths curriculum. *Prevention Science*, 7(1), 91-102.
- Robinson, M. D., Vargas, P. T., Tamir, M., & Solberg, E. C. (2004). Using and being used by categories: The case of negative evaluations and daily well-being. *Psychological Science*, 15(8), 521-526.
- Rothbart, M. K., Ahadi, S. A., Hersey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development*, 72(5), 1394-1408.
- Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg, W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 3, Social, emotional, and personality development* (6 ed., pp. 99-166). Hoboken, NJ: John Wiley & Sons, Inc.
- Rothbart, M. K., Sheese, B. E., & Posner, M. I. (2007). Executive attention and effortful control: Linking temperament, brain networks, and genes. *Child Development Perspectives*, 1(1), 2-7.
- Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2004). Attentional control and self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 283-300). New York, NY: Guilford Press.
- Rueda, M. R., Rothbart, M. K., McCandliss, B. D., Saccomanno, L., & Posner, M. I. (2005). Training, maturation, and genetic influences on the development of executive attention. *Proceedings of the National Academy of Sciences of the United States of America*, 102(41), 14931-14936.
- Saarni, C. (1984). An Observational Study of Children's Attempts to Monitor Their Expressive Behavior. *Child Development*, 55(4), 1504-1513.

- Sahdra, B. K., MacLean, K. A., Ferrer, E., Shaver, P. R., Rosenberg, E. L., Jacobs, T. L., et al. (in press). Enhanced response inhibition during intensive meditation training predicts improvements in self-reported adaptive socio-emotional functioning. *Emotion*.
- Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology*, 85, 440-452.
- Schmeichel, B. J., & Demaree, H. A. (2010). Working memory capacity and spontaneous emotion regulation: High capacity predicts self-enhancement in response to negative feedback. *Emotion*, 10, 739-744.
- Schmeichel, B. J., Volokhov, R. N., & Demaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology*, 95(6), 1526-1540.
- Schmertz, S. K., Anderson, P. L., & Robins, D. L. (2009). The relation between self-report mindfulness and performance on tasks of sustained attention. *Journal of Psychopathology and Behavioral Assessment*, 31(1), 60-66.
- Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., deVries, M. W., & van Os, J. (2007). Mood in daily contexts: Relationship with risk in early adolescence. *Journal of Research on Adolescence*, 17(4), 697-722.
- Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., van Os, J., & deVries, M. W. (2006). Mood reactivity to daily negative events in early adolescence: Relationship to risk for psychopathology. *Developmental Psychology*, 42(3), 543-554.
- Séguin, J. R., Arseneault, L., & Tremblay, R. E. (2007). The contribution of "cool" and "hot" components of decision-making in adolescence: Implications for developmental psychopathology. *Cognitive Development*, 22(4), 530-543.

- Séguin, J. R., Boulerice, B., Harden, P. W., Tremblay, R. E., & Pihl, R. O. (1999). Executive functions and physical aggression after controlling for attention deficit hyperactivity disorder, general memory and IQ. *Journal of Child Psychology and Psychiatry*, 40(8), 1197-1208.
- Séguin, J. R., Pihl, R. O., Harden, P. W., Tremblay, R. E., & Boulerice, B. (1995). Cognitive and neuropsychological characteristics of physically aggressive boys. *Journal of Abnormal Psychology*, 104(4), 614-624.
- Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., & Flinders, T. (2008). Cultivating mindfulness: Effects on well-being. *Journal of Clinical Psychology*, 64(7), 840-862.
- Shonkoff, J. P., & Phillips, D. A. (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington DC: National Academy Press.
- Silk, J. S., Steinberg, L., & Sheffield Morris, A. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development*, 74(6), 1869-1880.
- Sim, H. (2000). Relationship of daily hassles and social support to depression and antisocial behavior among early adolescents *Journal of Youth and Adolescence*, 29(6), 647-659.
- Simonds, J., Kieras, J. E., Rueda, M. R., & Rothbart, M. K. (2007). Effortful control, executive attention, and emotional regulation in 7-10-year-old children. *Cognitive Development*, 22(4), 474-488.
- Smith, E. R., & DeCoster, J. (2000). Dual process models in social and cognitive psychology: Conceptual integration and links to underlying memory systems. *Personality and Social Psychology Review*, 4, 108-131.

- Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models. In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290-312). San Francisco: Jossey-Bass.
- Spinrad, T. L., Eisenberg, N., & Gaertner, B. M. (2007). Measures of effortful regulation for young children. *Infant Mental Health Journal*, 28(6), 606-626.
- Stawski, R. S., Almeida, D. M., Lachman, M. E., Tun, P. A., & Rosnick, C. B. (2010). Fluid cognitive ability is associated with greater exposure and smaller reactions to daily stressors. *Psychology and Aging*, 25(2), 330-342.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8, 220-247.
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18, 643-662.
- Telzer, E. H., & Fuligni, A. J. (2009). Daily family assistance and the psychological well-being of adolescents from Latin American, Asian, and European backgrounds. *Developmental Psychology*, 45(4), 1177-1189.
- Terry, P. C., Lane, A. M., Lane, H. J., & Keohane, L. (1999). Development and validation of a mood measure for adolescents. *Journal of Sports Sciences*, 17(11), 861 - 872.
- Thush, C., Wiers, R. W., Ames, S. L., Grenard, J. L., Sussman, S., & Stacy, A. W. (2008). Interactions between implicit and explicit cognition and working memory capacity in the prediction of alcohol use in at-risk adolescents. *Drug and Alcohol Dependence*, 94(1-3), 116-124.
- Troy, A. S., Wilhelm, F. H., J., S. A., & Mauss, I. B. (in press). Seeing the silver lining: Cognitive reappraisal ability moderates the relationship between stress and depressive symptoms. *Emotion*.

- Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language*, 28, 127-154.
- Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). An automated version of the operation span task. *Behavior Research Methods*, 37, 498-505.
- Unsworth, N., Schrock, J. C., & Engle, R. W. (2004). Working memory capacity and the antisaccade task: Individual differences in voluntary saccade control. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 30, 1302-1321.
- Valiente, C., Eisenberg, N., Smith, C. L., Reiser, M., Fabes, R. A., Losoya, S. H., et al. (2003). The relations of effortful control and reactive control to children's externalizing problems: A longitudinal assessment. *Journal of Personality*, 71(6), 1171-1196.
- Valiente, C., Lemery-Chalfant, K., & Swanson, J. (2009). Children's responses to daily social stressors: Relations with parenting, children's effortful control, and adjustment. *Journal of Child Psychology and Psychiatry*, 50(6), 707-717.
- Wagner, B. M., Compas, B. E., & Howell, D. C. (1988). Daily and major life events: A test of an integrative model of psychosocial stress. *American Journal of Community Psychology*, 16(2), 189-205.
- Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the positive and negative affect schedule-expanded form*. Iowa City: University of Iowa.
- Way, B. M., Creswell, J. D., Eisenberger, N. I., & Lieberman, M. D. (2010). Dispositional mindfulness and depressive symptomatology: Correlations with limbic and self-referential neural activity during rest. *Emotion*, 10(1), 12-24.



- Weinstein, N., Brown, K. W., & Ryan, R. M. (2009). A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *Journal of Research in Personality, 43*(3), 374-385.
- White, J. L., Moffitt, T. E., Caspi, A., Bartusch, D. J., Needles, D. J., & Stouthamer-Loeber, M. (1994). Measuring impulsivity and examining its relationship to delinquency. *Journal of Abnormal Psychology, 103*(2), 192-205.
- Williams, J. M. G. (2010). Mindfulness and psychological process. *Emotion, 10*(1), 1-7.
- Wranik, T., Barrett, L. F., & Salovey, P. (2007). Intelligent emotion regulation: Is knowledge power? In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 393-407). New York: Guilford.
- Zhou, Q., Hofer, C., Eisenberg, N., Reiser, M., Spinrad, T. L., & Fabes, R. A. (2007). The developmental trajectories of attention focusing, attentional and behavioral persistence, and externalizing problems during school-age years. *Developmental Psychology, 43*(2), 369-385.