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Moderating Effects of Coping on Associations Between Stress Reactivity and Internalizing and Externalizing Problems

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MODERATING EFFECTS OF COPING ON ASSOCIATIONS BETWEEN STRESS REACTIVITY AND INTERNALIZING AND EXTERNALIZING PROBLEMS

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Abstract

The present study was motivated by a need to employ multilevel studies to better understand why the experience of stressful life events is predictive of increased rates of psychopathology. Specifically, this study aimed to test the moderating role of coping on associations between stress reactivity (autonomic arousal) and broad-spectrum internalizing and externalizing problems in a normative sample. Participants were 140 adolescents and emerging adults (ages 14-30 years; 60% female) who completed questionnaires on coping, stressful life events, personality, and behavioral/emotional problems. Skin conductance and heart rate data were also measured while participants completed two laboratory stress tasks: a public speaking task and a task involving serial subtraction. Path analytic results suggested negative main effects for primary and secondary control coping, and positive main effects for disengagement coping, on internalizing and externalizing problems. Evidence was also found for interactive effects of skin conductance reactivity to the public speaking task and secondary control coping on externalizing problems for adolescents only, such that there was a negative association between SCL reactivity and externalizing problems for individuals reporting low use of secondary control coping, but SCL reactivity and externalizing problems were unrelated for individuals reporting high use of secondary control coping. Associations were also found between personality variables and both coping and internalizing and externalizing problems, but not with autonomic arousal. Although *a priori* hypotheses regarding interaction effects were mainly unsupported, results from the present study suggest that future research examining the interplay among stress reactivity, coping, and personality will be important in furthering our understanding of the development of psychopathology and helping to tailor effective efforts at prevention and intervention.

TABLE OF CONTENTS

List of Tables

List of Figures

Introduction

In modern industrialized societies, adolescence has been described as a period of "storm and stress" (Hall, 1904), during which increases are often present in conflict with parents, mood disruptions, and risk behavior (Arnett, 1999). During this time, adolescents are typically becoming more independent from their parents, which may lead to increased levels of stress as they attempt to navigate life challenges on their own (Waaktaar, Borge, Fundingsrud, Christie, & Torgersen, 2004). Adolescence is also a time during which overall rates of psychopathology increase. For example, evidence suggests that rates of depression increase from childhood into adolescence (Costello, Copeland, & Angold, 2011) and rates of the onset of depressive symptoms appear to peak between the ages of 15 to 18, particularly for females (Hankin et al., 1998). Results from the National Comorbidity Survey Replication (NCS-R) suggest that rates of major depressive disorder remain low until adolescence, at which time rates of the disorder increase in a fairly linear fashion, such that as people get older, the number of individuals diagnosed with major depressive disorder increases (Kessler et al., 2003). Additionally, anxiety problems, particularly in females, and conduct problems, particularly in males, peak during adolescence (Zahn-Waxler, Shirtcliff, & Marceau, 2008).

Following adolescence is a developmental period referred to as emerging adulthood, which spans the late teens through the twenties. Emerging adulthood can also be a unique and challenging time for many individuals given that decisions and experiences during this time lay the foundation for an adult life (Arnett, 2000). According to Arnett, certain risk behaviors such as unprotected sex, substance use, high-speed driving, and drunk driving peak during this time. He posits that the increase of

these behaviors may be due to the feeling of freedom from parental monitoring and supervision but not yet having the sense of responsibility that comes with marriage and parenting. While the navigation of independence from their parents into the transition to college and/or work can be a stressful experience for emerging adults, the increase of certain risky behaviors and increased rates of some forms of psychopathology can be even more troubling. For example, the onset of schizophrenia tends to occur during the emerging adulthood years and rates of mood disorders continue to remain elevated during this developmental period, particularly for females (Hankin & Abramson, 2001). Rates of binge drinking and substance use disorders peak during this time as well (Masten, Faden, Sucker, & Spear, 2008). Due to these challenges and the continuing onset of psychopathology, both adolescence and emerging adulthood are crucial developmental periods for researchers interested in alleviating the burden of behavioral and emotional problems.

While examining specific forms of psychopathology during these two developmental periods certainly has merit in efforts to understand specific disorders, it can also be useful to examine broad factors of internalizing and externalizing problems. Multiple factor analytic studies have found that anxiety and mood disorders load onto a factor termed "internalizing problems," whereas more aggressive, rule-breaking, and substance use behaviors load onto a factor termed "externalizing problems" (Achenbach, 1966; Krueger, 1999). One advantage of measuring these broadband categories in psychological research instead of more narrowly focused categories is that it accounts for the observation that many of the symptoms and diagnoses within each factor commonly co-occur and are likely to have common etiologies (Krueger, 1999). Utilizing these two

dimensional models also allows researchers to understand elevated levels of broad problems within a wider population, rather than studying a particular disorder on its own. Thus, prevention and intervention programs have the ability to target individuals who may have elevated symptomatology, but do not necessarily fall into any particular diagnostic category.

Because of the increases in stress and the emergence of psychopathology across these two developmental periods, the present study was motivated to help identify constructs that can be used to identify individuals most at risk for the development of psychopathology, as well as constructs that may be used in effective prevention and intervention programs. More specifically, this study aimed to investigate the moderating role of coping in associations between psychophysiological stress reactivity and broad internalizing and externalizing problems. Interactions between coping and psychophysiological stress reactivity were chosen given that they are both responses to stress, with psychophysiological stress reactivity being conceptualized as an involuntary response, whereas coping is conceptualized as a voluntary or volitional response. Furthermore, both psychophysiological stress reactivity and coping have been linked to psychopathology, but few studies have examined how they may interact in forming associations with psychopathology.

Below, the background literature motivating the present study is discussed. First, the well-documented links between stress and psychopathology are presented, followed by a review of the literature on psychophysiological responses to stress, specifically within the autonomic nervous system (ANS), and related associations with psychopathology. Third, the literature on coping, as a volitional response to stress, and

associations with psychopathology are discussed. Next, the small body of literature that has examined the moderating role of coping in associations between life stress or physiological stress reactivity and psychological functioning is reviewed. Finally, the aims and hypotheses of the current study are presented.

Stress and Psychopathology

In understanding normal development and psychopathology, including broad internalizing and externalizing problems, it is necessary to acknowledge the role of life stress, which has been found to play a role in both the onset and maintenance of many mental health problems (e.g., Dohrenwend & Dohrenwend, 1974; McMahon, Grant, Compas, Thurm, & Eye, 2003). Stressors such as low socioeconomic status, uncontrollable negative life events, and severe traumatic events have been positively associated with a wide range of symptoms and psychopathology, including posttraumatic stress disorder (PTSD), depression, substance use disorders, antisocial personality disorder, and overall higher levels of general distress (Dohrenwend, 2000). The association between stress and psychopathology has also been fairly well studied in samples of children and adolescents. Measures of cumulative numbers of stressful life events and more specific individual stressors such as divorce and poverty have each been prospectively and positively associated with both internalizing and externalizing symptoms in children and adolescents, with stronger effects for internalizing symptoms (Grant, Compas, Thurm, McMahon, & Gipson, 2004). However, according to Grant et al., growing evidence also suggests that stress and psychopathology may act in a dynamic and reciprocal way, such that life stress may lead to psychopathology, but psychopathology may also lead to increases in life stress.

Studies have also found predictive links between stressful life events in childhood and later functioning in adulthood, although many of these studies have relied on retrospective reports by adults of stressful life events that occurred when they were children (Green et al., 2010). Retrospective reports have the potential to be biased since it has been found that individuals with current psychological disorders, most notably depression, have a tendency to over-report negative events (Clark & Teasdale, 1982). Available evidence from the NCS-R suggests that elevated levels of stress in childhood, particularly stressors associated with maladaptive family functioning (e.g., parental mental illness, substance use disorders, criminal behavior, family violence, abuse, neglect) are positively associated with the first onset of psychological disorders through early adulthood, with little specificity in the particular type of disorder (Green et al., 2010). Elevated levels of childhood stress have also been found to be associated with higher levels of functional impairment for mood, anxiety, and disruptive behavior disorders, as well as the general persistence of psychological disorders through late adulthood (McLaughlin et al., 2010). Here, functional impairment was partially measured by the number of days in the past year that participants were unable to work or perform their normal daily activities as a result of their psychopathology, in addition to a questionnaire asking about impairment in various domains (i.e., work, household maintenance, social life, and intimate relationships). Thus, in addition to the personal toll mental health problems can take on individuals and families, there is a broader societal impact for psychopathology contributing to occupational impairment, including lost work hours.

Although the evidence is strong for a general prospective association between stress and psychopathology, most stressors examined in the literature with regard to children and adolescents (e.g., exposure to violence, abuse, divorce/marital conflict, poverty, illness, and cumulative stress) have been associated with a variety of psychological symptoms, rather than predictive links to specific problems or disorders (McMahon et al., 2003). For example, McMahon et al. found that exposure to domestic, community, and war violence, as well as physical abuse, was associated with both internalizing and externalizing problems. The only exception that McMahon et al. found to this lack of specificity was for sexual abuse in children, which was specifically associated with internalizing problems and PTSD. Whereas more general prevention and intervention programs may be of benefit for individuals who experience more stressful life events, the lack of specificity in associations between stress and psychopathology makes it difficult to target these efforts more specifically for disorders at greatest risk. Because evidence-based treatments for internalizing versus externalizing problems are quite different from each other, structuring prevention efforts in the same manner as these different treatments may be of most benefit. For example, in children and adolescents, treatments consisting of cognitive-behavioral principles appear to have the most empirical support for internalizing problems, whereas behavioral parent training has the most empirical support for treating externalizing problems in youth (Weisz, Hawley, & Doss, 2004). The lack of specificity in these associations points to a need to examine other aspects of the stress-psychopathology association, in addition to other variables that may help to predict or explain individual trajectories towards psychopathology. Further

examination of these associations is especially important given that the experience of early life stress can lead to future maladjustment throughout the life span.

Physiological Responses to Stress

One way to further investigate the stress-psychopathology association is to examine the links between psychopathology and how individuals respond physiologically when they experience stressful situations. Because much remains unknown about associations between stress and psychopathology, there is a need for studies using a multilevel approach, including both biological (e.g., psychophysiology) and psychological (e.g., coping) constructs to further our understanding (Cicchetti & Curtis, 2007). Utilizing a multilevel approach is also related to the developmental psychopathology concepts of equifinality and multifinality. The term equifinality refers to the concept that individuals will demonstrate multiple pathways to the same outcome or disorder, whereas the term multifinality refers to the concept that individuals will demonstrate different outcomes given the same starting point (Cicchetti & Rogosch, 1996). The lack of specificity in the effects of stress described above exemplifies the concept of multifinality; specifically, individuals who experience similar stressful life events may go on to develop very different forms of psychopathology, but importantly, not everyone who experiences stressful life events will go on to experience clinical levels of psychopathology. Multilevel studies are thus potentially important to help identify why these differences in pathways occur and to highlight what can be done to prevent the occurrence of psychopathology.

Over the last 20 years, investigations of psychophysiology, including both the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system (ANS),

have been on a steep increase. Relevant to the current study, the ANS primarily regulates involuntary actions within the body, including heart rate, digestion, metabolism, and body temperature. The ANS helps to regulate the body's responses to stress, and therefore may be involved in the association between stress and psychopathology.

Within the ANS, two separate branches are responsible for causing and regulating physiological arousal: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS is activated under threat or stress and triggers the "fight or flight" response, including increased heart rate and oxygen flow. SNS activation is also indicated by an increase in sweat gland production, which increases the electrical conductivity of the skin and makes skin conductance level (SCL), or electrodermal responses, a method for measuring SNS activity (Boucsein, 1992). On the other hand, the PNS primarily functions to reduce physiological arousal (e.g., slowing heart rate) and stimulates the "rest and digest" response. One method for measuring PNS activity is respiratory sinus arrhythmia (RSA), an indicator of vagal tone. The vagus nerve is responsible for increasing or decreasing PNS input into the heart and can be thought of as a brake; high vagal tone (increase in PNS activity, high RSA) slows heart rate whereas low vagal tone (decrease in PNS activity, low RSA) increases heart rate (Beauchaine, 2001; Porges, 2003, 2007). Although SNS and PNS activity are often studied separately, theorists have proposed that the two systems do not always operate in a reciprocal manner, with coactivation and coinhibition both feasible (Berntson, Cacioppo & Quigley, 1991).

Evidence suggests that certain levels of both baseline SCL and RSA and levels of SCL and RSA reactivity during stress are associated with behavioral and emotional

problems. First looking at SCL, according to stimulation-seeking theory, individuals with low SCL may theoretically engage in more externalizing behaviors in order to alleviate an uncomfortably low physiological state of arousal (Ortiz & Raine, 2004). Consistent with this theory, results from a meta-analysis by Lorber (2004) examining associations between psychophysiology and psychopathology showed that low levels of SCL were associated with higher levels of externalizing problems, specifically psychopathy/sociopathy in both adults and adolescents and conduct problems in children. High baseline SCL, alternatively, has been associated with internalizing problems in children, potentially due to shyness or higher levels of behavioral inhibition (Kagan Reznick, & Snidman, 1987).

Additionally, according to fearlessness theory, low physiological arousal in response to mild stressors is an indicator of low levels of fear, which may be associated with higher levels of aggressive and/or antisocial behavior (Ortiz & Raine, 2004). These individuals with low arousal and low fear are also less likely to respond to social consequences in shaping their behavior, potentially also contributing to difficulties in developing a sense of conscience (Raine, 1993). Despite this theoretical rationale, the literature linking SCL reactivity and externalizing problems has been mixed. Lorber (2004) found that SCL reactivity was positively associated with aggression and negatively associated with psychopathy/sociopathy in adults, whereas other studies have found SCL reactivity to be negatively associated with externalizing problems in children and adolescents (Fung et al., 2005; Herpertz et al., 2005). However, high SCL reactivity has also been associated with internalizing problems in normative youth (El-Sheikh, 2005). Overall, the findings in the literature provide fairly consistent evidence for the

associations between high baseline SCL and SCL reactivity and internalizing problems, as well as low baseline SCL and externalizing problems, but the findings regarding SCL reactivity and externalizing problems have been more variable (El-Sheikh, Keller, & Erath, 2007). Ortiz and Raine (2004) suggest that according to biosocial theory, which posits that biological and social factors interact to predict outcomes, it is more likely that levels of arousal interact with other psychosocial constructs to predict externalizing problems, which may account for some of these mixed findings. However, studies have only recently begun to investigate this theory without any consistent findings to date.

For RSA, high baseline levels and reliable RSA suppression (vagal withdrawal or low vagal tone) under stress have been considered indicators of social and emotional regulation, whereas low resting levels of RSA and unreliable changes in RSA are more indicative of difficulties with social and emotional regulation (Porges, 2007). A decrease in RSA during stressful situations is thought to be adaptive in the sense that it signals a need to act, cope, and/or regulate emotions associated with the stressor (Calkins & Keane, 2004). At baseline, low RSA has consistently been associated with internalizing problems (Beauchaine, 2001; Crowell et al., 2005; Dietrich et al., 2007; Forbes, Fox, Cohn, Galles, & Kovacs, 2006). Low baseline RSA has also been associated with externalizing problems, though this pattern has generally been found in clinical, rather than community, samples (Beauchaine, 2001; Beauchaine, Katkin, Strassberg, & Snarr, 2001).

For RSA reactivity, although it has been argued that excessive RSA withdrawal during stress is indicative of general emotional lability and dysregulation (Beauchaine, 2001), a meta-analysis examining RSA withdrawal in children and adolescents found that

high RSA withdrawal is negatively associated with internalizing and externalizing problems (Graziano & Derefinko, 2013). Graziano and Derefinko also found that a failure to exhibit RSA withdrawal, involving either particularly low withdrawal or augmentation (an increase in PNS activity) may be an indicator of poor regulatory capabilities, thus serving as a risk factor for behavioral and emotional problems. Consistent with results from this meta-analysis, other evidence has shown that a failure to exhibit RSA withdrawal is associated with externalizing problems (Beauchaine et al., 2001), particularly when combined with low baseline RSA (Hinnant & El-Sheikh, 2009).

Whereas most researchers generally agree that RSA withdrawal in the presence of a stressor is adaptive, the degree of withdrawal may make a difference, with excessive withdrawal being associated with poorer outcomes, including rage and panic (Beauchaine, 2001). The discrepancy in the amount of RSA withdrawal demonstrates one of the difficulties in examining physiological reactivity; specifically, descriptors of "high" and "low" reactivity are sample-specific. General cutoff values have yet to be identified and will likely vary by population and context, making it difficult to quantify if or when RSA withdrawal in the face of stress moves from being adaptive to being maladaptive. This problem is particularly relevant for RSA because depending on the sample mean, values for "high" and "low" (often represented by +/- one standard deviation from the mean) may simply represent higher or lower levels of RSA withdrawal, but they may also represent RSA withdrawal (at -1 standard deviation) and RSA augmentation (at +1 standard deviation). Theoretically, "high" and "low" RSA could also be measuring differing degrees of RSA augmentation, but this is less often the case when examining

responses to stress. Ongoing research examining RSA is likely to help clarify this problem.

Coping with Stress

In the same way that individuals have varying physiological responses to stress, individuals also differ in the ways they choose to manage, or cope with, those stressful situations. Although there is not a consistently agreed upon definition of coping, the most common comes from Lazarus and Folkman, who define coping as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (1984, p. 141). This definition suggests that coping can either be addressed cognitively, by means of addressing thoughts and feelings, or behaviorally, by means of changing behaviors to manage the situation. There is a wide range of possibilities for how individuals choose to cope with stress, but evidence suggests that some strategies are likely to lead to better outcomes than others.

Compas, Connor-Smith, Saltzman, Thomsen and Wadsworth (2001) reviewed the literature on coping and summarized coping strategies into four broad categories: problem-focused (e.g., problem solving, information seeking, problem-focused support), emotion-focused (e.g., emotional expression, denial, wishful thinking), engagement (e.g., problem solving, emotional expression, support seeking), and disengagement (e.g., problem avoidance, cognitive avoidance, social withdrawal). Raters reviewed studies and decided whether measures of coping could be classified as problem-focused or emotion-focused and as engagement or disengagement. The authors note that these categories are rather broad and therefore certain coping strategies can fall within multiple

categories. In their review, they found the most empirical evidence for a negative association between engagement coping and both internalizing and externalizing symptoms. Conversely, there was a positive association between disengagement coping and internalizing symptoms, although evidence was mixed for externalizing symptoms. Fewer studies examined coping strategies that fell under the problem-focused and emotion-focused categories, although some evidence was found for a negative association between problem-focused coping and internalizing and externalizing symptoms, whereas a positive association was found between emotion-focused coping and both internalizing and externalizing symptoms. Although causality cannot be inferred given that most of the studies reviewed were nonexperimental and not prospective, the results strongly suggest that engagement and problem-focused coping are associated with better mental health outcomes than disengagement and emotion-focused coping.

Despite evidence for links between problem-focused and emotion-focused coping and mental health problems, Compas et al. (2001) found the most empirical support for conceptualizing coping on factors of engagement and disengagement coping, which were derived from factor-analytic studies and are more widely used and recognized in the coping literature (Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000). From this perspective, engagement coping generally involves volitional responses to stress aimed directly towards the stressor and/or associated thoughts and emotions and disengagement coping involves avoidance of the stressor and any thoughts or emotions associated with it. Although it is plausible that coping with life stress by means of trying to either change the problem or associated thoughts and emotions leads to better

psychological outcomes, it may also be the case that higher levels of psychological problems leads to more avoidance and thus poorer coping (Compas et al., 2001). Because most work in this area has been cross-sectional, future longitudinal studies in this area are needed in order to better elucidate causality and the direction of effects.

Whereas evidence suggests links between the broad factor of engagement coping and psychopathology, a factor analytic study showed that engagement coping could also be broken down further into two more specific groups of coping strategies termed primary control coping and secondary control coping (Connor-Smith et al., 2000). In this conceptualization, primary control coping refers to direct attempts to solve the problem or alleviate any emotional or physiological response and secondary control coping refers to attempts to adapt to the situation by means of distraction, acceptance, or positive thinking (Connor-Smith & Compas, 2004).

Evidence suggests that primary control coping and secondary control coping may be differentially beneficial under different conditions. For example, primary control coping may be associated with better outcomes when the stressor is controllable by the individual compared to secondary control coping, which may be associated with better outcomes under uncontrollable stress (Wadsworth & Compas, 2002). However, in general primary control coping and secondary control coping appear to lead to better outcomes whereas disengagement coping has generally, but notably not always, led to worse outcomes. For example, primary and secondary control coping have been associated with lower levels of internalizing and externalizing problems, whereas disengagement coping has been associated with increases in psychological distress and poorer adjustment (Compas et al., 2001). More specifically, forms of disengagement

coping have been found to be positively associated with both internalizing and externalizing problems (Downey, Johnston, Hansen, Birney, & Stough, 2010) and positively associated with posttraumatic stress and general psychiatric distress in a sample of Israeli adolescents during ongoing terrorist attacks (Braun-Lewensohn et al., 2009). Furthermore, despite the fact that primary and secondary control coping are associated with fewer psychological difficulties than disengagement coping, some evidence suggests that individuals who experience higher levels of stress are more likely to engage in disengagement coping strategies and are less likely to engage in primary and secondary control coping strategies (Wadsworth & Compas, 2002).

Additionally, developmental differences have been found in the types of coping responses employed, with changes and advances in coping responses most prominent from infancy to toddlerhood, from late childhood to early adolescence, from early to mid adolescence, and from middle adolescence to emerging adulthood (Skinner & Zimmer-Gembeck, 2007). As expected, coping responses of infants and toddlers primarily involves the help of caregivers; however, according to Skinner and Zimmer-Gembeck's review of the literature, coping begins to include more distraction and problem-solving strategies in middle childhood due to increased cognitive abilities. Coping also begins to include collaboration with coping efforts of others (e.g., peers, family) during this time. By later adolescence, metacognitive abilities are present, allowing individuals to incorporate their thoughts about future goals and concerns into their coping responses. As expected due to developmental capabilities of children and adolescents, coping repertoires generally become broader and more diverse with age (Zimmer-Gembeck &

Skinner, 2011). This broadening of coping skills is adaptive, given the increase in responsibilities as individuals mature out of childhood.

Interactions between Coping and Psychophysiology

Although substantial evidence exists to link stress and psychopathology and growing evidence is linking physiological stress reactivity to psychopathology, much less work has been done to understand what other variables, such as coping, may influence these associations. In 2006, Grant et al. reviewed the existing literature on moderators and mediators of the stress-psychopathology association in children and adolescents, but did not include research on psychophysiology. They found mixed support for the moderating role of fixed individual characteristics (e.g., age, sex, race/ethnicity) and environmental contexts (e.g., social support, family environment, peer environment). However, they found more promising support for the moderating effects of relatively malleable individual characteristics, which includes constructs such as cognitions, competence, and coping.

Overall, research has demonstrated fairly consistent associations between coping and psychopathology and psychophysiological stress reactivity and psychopathology, but the moderating role of coping in these associations has received very little attention. Examining the interaction between coping and psychophysiology is important given that it provides information on both involuntary responses to stress (e.g., physiological stress reactivity) as well as more voluntary or volitional responses to stress (e.g., coping). Furthermore, it is often the case that individuals are employing volitional coping strategies in response to changes in physiological arousal, although the effects of these

constructs interacting with each other currently remain unknown (Connor-Smith and Compas, 2004).

There are theoretical reasons to expect that coping may moderate the association between psychophysiology and psychopathology. First, coping may act as a risk-activated moderator, which according to Masten (2001) is a variable that influences an outcome given a particular at-risk scenario. Masten posits that a risk-activated moderator can be equated to the way an airbag works in an automobile accident, that is, it only inflates when an accident occurs and then affects safety. In the case of coping and physiological reactivity, physiological reactivity is conceptualized as an involuntary risk signaling a need for a volitional coping response. It may be the case that without the physiological reactivity, individuals do not employ coping strategies because they do not sense the need for their use. However, whether or not individuals have increased psychopathological symptoms may depend on the use of various coping strategies given particular patterns of physiological reactivity. For example, high levels of primary and secondary control coping may be particularly beneficial for those with stronger physiological reactivity responses, since individuals may feel more stressed under these conditions, whereas disengagement coping may be more problematic.

Furthermore, the idea of coping as a risk-activated moderator relates to evidence-based treatments for psychopathology. For example, individuals often first learn to recognize their physiological responses, followed by implementing effective coping strategies (e.g., relaxation, cognitive restructuring, problem-solving) to help alleviate symptoms (Weisz et al., 2004). Because these strategies are effective in reducing symptoms in clinical populations, it may be the case that individuals who have

physiological profiles associated with adjustment difficulties but do not exhibit elevated symptoms are already employing some of these strategies. Therefore, it is plausible that higher use of effective coping strategies (i.e., primary control or secondary control coping) may attenuate the association between psychophysiological arousal and behavioral and emotional problems whereas disengagement coping may amplify the same associations.

To date, very few studies have examined the moderating role of coping in the association between physiological stress reactivity and mental health problems. In a preliminary investigation of these associations among undergraduate students, Connor-Smith and Compas (2004) found that higher levels of primary control coping, secondary control coping, and (contrary to their hypothesis) disengagement coping buffered the association between heart rate reactivity in response to a laboratory stress task involving judgment of social ability and personality and poor physical health. Additionally, secondary control coping buffered the association between self-reported arousal and internalizing symptoms.

Additionally, though not looking directly at psychopathology, Erath and Tu (2013) examined the moderating role of coping in associations between SCL and RSA and social competence in real-time peer-stress situations in a sample of preadolescents. Positive correlations were found between engagement coping responses (i.e., primary or secondary control coping responses) and baseline RSA, whereas negative correlations were found between SCL reactivity and disengagement coping responses to peer victimization. Furthermore, interactions were found between RSA reactivity and coping responses such that for individuals with more disengagement, and fewer engagement,

coping responses, a failure to exhibit RSA withdrawal was associated with lower teacher-rated social competence. No associations were found between RSA reactivity and social competence for individuals with more engagement, or less disengagement, coping responses. Results from this study suggest that poorer coping is particularly problematic for youth who do not exhibit adaptive physiological responses (RSA withdrawal) under stress.

The only other known study to examine these associations occurred in this laboratory (Paysnick & Burt, 2014) and was designed to extend the work of Connor-Smith and Compas (2004) by examining interactions between coping and autonomic arousal (SCL/RSA) and associations with both internalizing and externalizing symptoms in a sample of 16- and 17-year-old adolescents. Coping was not measured or conceptualized in the same way as Connor-Smith and Compas or Erath and Tu, who both used the Responses to Stress Questionnaire (RSQ; Connor-Smith et al., 2000) to measure coping on the primary control, secondary control, and disengagement coping scales described above. Instead, this study measured productive and nonproductive forms of coping more broadly through use of the Adolescent Coping Scale (Frydenberg & Lewis, 1993). Here, productive coping refers to strategies aimed at solving the problem or increasing positive emotions whereas nonproductive coping refers to avoidance and self-blame. Reactivity was measured during a laboratory stress task consisting of the Social Competence Interview (Ewart, Jorgensen, Suchday, Chen & Matthews, 2002; Ewart & Kolodner, 1991), a semi-structured interview designed to elicit feelings of re-experiencing a recent stressor.

Results showed interactions between baseline SCL and SCL reactivity and productive coping predicting adolescent- and parent-reported internalizing problems and parent-reported externalizing problems, such that generally, there was no significant association between SCL and internalizing/externalizing problems for individuals reporting high productive coping, but there was a positive association between SCL and internalizing/externalizing problems for individuals reporting low productive coping. Contrary to hypotheses, results also provided some support for a positive (rather than negative) association between SCL (both baseline and reactivity) and externalizing problems for individuals reporting high nonproductive coping and a negative or non-significant association for individuals reporting low nonproductive coping.

Though few statistically significant findings were found for RSA, results suggested that low baseline RSA and a failure to exhibit RSA withdrawal were associated with parent-reported externalizing problems, which is consistent with prior literature (Graziano & Derefinko, 2013). However, it was unexpected that this association was only found for individuals reporting high productive, but not nonproductive, coping. Despite some findings that were contrary to prediction, this study provided preliminary support for the buffering effect of productive coping in the association between SCL and internalizing and externalizing problems, although results were more inconsistent for both nonproductive coping and RSA.

Aims of the Present Study

Because the studies described in the prior section are the only known investigations to examine the associations between coping and psychophysiological reactivity to stress, further investigation using diverse samples and various measurements

of stress reactivity are necessary. The current study aimed to replicate and extend the previous work in this area in several ways. First, this study aimed to provide support for the moderating role of coping in the associations between physiological stress reactivity and internalizing and externalizing problems using two different types of laboratory stress tasks. Though differences between tasks are primarily exploratory, some previous research suggests that outcomes may differ depending on the type of stressor experienced. For example, developmental differences in other types of physiological responding have been found across types of tasks between children and adolescents. Specifically, though adolescents were found to have more pronounced stress responses in general, differences in cortisol and diastolic blood pressure were stronger for performance stressors (public speaking, mental arithmetic, and mirror tracing), whereas developmental differences in increases in alpha amylase and systolic blood pressure were stronger for peer rejection stressors (Stroud et al., 2009). Furthermore, in an examination of interactions between baseline RSA and RSA reactivity predicting comorbid internalizing and externalizing problems, Hinnant and El-Sheikh (2013) found that RSA reactivity in response to a social stress task was more strongly related to internalizing problems only, whereas RSA reactivity to a cognitive task was more strongly related to both internalizing and externalizing problems. In order to explore whether interactions between coping and psychophysiology have differential associations with psychopathology depending on the type of stress experienced, this study will utilize measures of RSA and SCL reactivity during both social and cognitive laboratory stress tasks.

Next, this study sought to extend the age range of previous work in this area to a sample of 14- to 17-year-old adolescents and 18-to 30-year old emerging adults.

Adolescents and emerging adults were identified for the current study for several reasons. First, adolescents were recruited for the study due to the increase in stressful life events (Waaktaar et al., 2004) and psychopathology in this period, as well as the reciprocal nature of stress and psychopathology during this time (Grant et al., 2004). Because of these increases during adolescence, it is a particularly important time to study constructs such as coping that may help improve the understanding of the stress-psychopathology or physiological stress reactivity-psychopathology associations, with the ultimate goal of informing prevention and intervention programs. Second, this study recruited emerging adults because it is also a vulnerable time for mental health problems, including the onset of schizophrenia, high rates of mood disorders consistent from adolescence, particularly for females (Hankin & Abramson, 2001), and peak rates of substance use disorders (Masten et al., 2008). However, emerging adulthood also marks a time of opportunity for improvement in individuals who are able to positively adapt to their circumstances, despite maladaptation during adolescence (Burt & Masten, 2010). Because of the documented increases in stress and mental health problems in these developmental stages, they are particularly vulnerable times during which identifying individuals most at risk and implementing effective prevention and intervention programs are needed to reduce the risk and/or impact of psychopathology.

Additionally, whereas individual differences in autonomic functioning begin to emerge during childhood, evidence suggests these differences may remain malleable throughout adolescence as individuals continue to learn strategies for emotional regulation (Diamond & Cribbet, 2012). In addition, the many life changes in adolescence through emerging adulthood described above (e.g., increases in stress and

psychopathology) are likely to relate either directly or indirectly to ANS functioning (Hollenstein, McNeely, Eastabrook, Mackey, & Flynn, 2012). Further work is needed to more fully understand individual differences in ANS activity during these developmental periods, as well as how these processes relate to psychological functioning.

Finally, this study explored these associations using the Responses to Stress Questionnaire (Connor-Smith et al., 2000), a more widely-used measure of coping, which enabled results to be more directly comparable to the work of Connor-Smith and Compas (2004), as well as others conceptualizing coping on the engagement and disengagement factors. Although evidence suggests that coping is associated with mental health and may influence the association between stressful life events/stress reactivity and mental health, the lack of consensus of conceptualizations and measurements of coping across researchers in the literature thus far has made it difficult to demonstrate replication of results and draw firm conclusions about how coping relates to mental health.

Follow-up analyses in this study were conducted with the Big Five personality traits, other facets of personality (sensation seeking, behavioral inhibition, behavioral approach), age, body mass index (BMI), and a measure of life stress as covariates given their observed and theoretical associations with physiological stress responses and psychopathology. Although BMI is included simply to control for body-size variation in psychophysiological measurements, life stress and personality are of more conceptual interest to the present study. For example, the Big Five personality traits, most notably neuroticism, are associated with psychopathology (e.g., Krueger, 2005), but less has been studied regarding their associations with psychophysiology and coping. Furthermore, the behavioral approach system (BAS) and the behavioral inhibition system (BIS) have been

implicated in both physiological arousal, particularly SNS arousal, as well as psychopathology (Beauchaine, 2001). According to Beauchaine, although empirical research linking the BAS and psychopathology is still needed, aggression is empirically associated with low BIS, low baseline RSA, and high RSA reactivity, as well as theoretically high BAS. Anxiety and depression, on the other hand, are associated with high BIS and low baseline RSA, whereas depression is also theoretically related to low BAS. Sensation seeking was hypothesized to function similarly to the BAS. In addition, due to the wider age range of participants in the present study compared with prior research, core results were run with age in years as a covariate.

Hypotheses

Based on previous research in the areas of stress, psychophysiological stress reactivity, coping, internalizing, and externalizing problems, hypotheses are as follows:

Main Effects

1. Baseline SCL/SCL reactivity will be positively associated with internalizing problems.
2. Baseline SCL will be negatively associated with externalizing problems.
3. Baseline RSA will be negatively associated with internalizing and externalizing problems.
4. RSA reactivity (in the form of withdrawal) will be negatively associated with internalizing and externalizing problems.
5. Negative associations will be found between primary control and secondary control coping and internalizing and externalizing problems.

6. Positive associations will be found between disengagement coping and internalizing and externalizing problems

Interaction Effects

7. Primary control and secondary control coping will moderate associations between baseline SCL and SCL reactivity and internalizing problems, such that there will be no association for individuals reporting high primary and secondary control coping, but a positive association between SCL and internalizing problems for individuals reporting low levels of primary and secondary control coping.
8. Primary control and secondary control coping will moderate associations between baseline SCL and externalizing problems, such that there will be no association for individuals reporting high primary and secondary control coping, but a negative association between baseline SCL and externalizing problems for individuals reporting low levels of primary and secondary control coping.
9. Primary control and secondary control coping will moderate associations between baseline RSA and internalizing and externalizing problems, such that there will be no association for individuals reporting high primary and secondary control coping, but a negative association between baseline RSA and internalizing and externalizing problems for individuals reporting low levels of primary and secondary control coping.
10. Primary control and secondary control coping will moderate associations between RSA withdrawal and internalizing and externalizing problems, such that there will be no association for individuals reporting high primary and secondary control coping, but a negative association between RSA withdrawal and internalizing and

externalizing problems for individuals reporting low levels of primary and secondary control coping.

11. It is also hypothesized that disengagement coping will moderate all of the associations described above, such that the associations between physiological stress reactivity and internalizing/externalizing problems described in previous hypotheses will be amplified for individuals with high levels of disengagement coping.

Although evidence is limited to guide specific hypotheses about differences between stress tasks, preliminary evidence (Hinnant & El-Sheikh, 2013) suggests that associations involving the social task may be specific to internalizing problems, whereas the cognitive task may be related to both internalizing and externalizing problems. Exploratory analyses will also examine age group (adolescent versus emerging adult) and gender differences in all primary analyses. Though speculative, it is hypothesized that associations may be stronger among females and adolescents for the social task, given the presumed greater saliency of this task to their daily lives. There is also preliminary evidence to guide hypotheses that associations between SCL and externalizing problems may only be present for males (Isen et al., 2010).

Method

Participants

A total of 140 individuals participated in this study (60% female). The sample was composed of 50 adolescents (14 to 17 years old) and 90 emerging adults (18-30 years old). The mean age for the total sample was 18.95 years (*SD* = 3.75). The ethnic

background of the sample was primarily Caucasian (79%) with remaining responses divided between Asian (4%), Latino (2%), African-American (1%), and other ethnicity (1%), reflective of the population in the local region from which the sample was drawn. A total of 18 participants (12%) declined to report their ethnic background.

Fifty-five emerging adults were undergraduate students at a small university and were recruited through psychology courses in which they were enrolled. The remaining 35 emerging adults were recruited from the community (i.e., were not undergraduate students) through flyers and online advertisements. Adolescent participants were primarily recruited from five area high schools via advertisements during lunch periods. Interested participants received follow up phone calls with additional information and to obtain parental consent prior to scheduling. Adolescents were also recruited through flyers and online advertisements. Undergraduate students received course credit for participation, whereas adolescents and emerging adults from the community received gift cards as compensation. The sponsoring institution's human subjects review board approved all study procedures.

Measures

Coping. To assess strategies used for coping with stress, the *Responses to Stress Questionnaire* (RSQ; Connor-Smith et al., 2000) was used. On this measure, participants first choose how often particular stressors have occurred in the recent past from a checklist of common stressors. They are then asked to keep those particular stressors in mind as they rate how often they use each method of coping or experience each item of involuntary stress response on a scale from 1 (not at all) to 4 (a lot). The RSQ measures three factors of coping and two factors of involuntary stress responses. For the current

study, the coping factors—primary control coping, secondary control coping, and disengagement coping—were the primary analytic focus. Examples of items include "I try to think of different ways to change the problem or fix the situation" (primary control coping), "I think about the things that I am learning from the situation, or something good that will come from it" (secondary control coping), and "I try to stay away from people and things that make me feel upset or remind me of the problem" (disengagement coping). As recommended by the measure's authors, proportion scores were used to control for base rates in item endorsement. That is, we calculated the proportion of total coping responses that fell into each category, expressed as a decimal ranging from 0 to 1. This measure has demonstrated adequate internal consistency and test-retest reliability, as well as concurrent validity (Connor-Smith et al., 2000). In the current sample, coefficient alphas were .77 for primary control coping, .80 for secondary control coping, and .81 for disengagement coping.

Internalizing/Externalizing Problems. To assess levels of internalizing and externalizing problems, adolescents completed the *Youth Self Report* (YSR; Achenbach & Rescorla, 2001), whereas the emerging adults completed the *Adult Self Report* (ASR; Achenbach & Rescorla, 2004). Both the YSR and ASR are self-report measures of demographic information, behavioral and emotional problems, and adaptive functioning. In addition to several open-ended questions, including questions about interpersonal relationships, education, and work/activities, participants are asked to rate the degree to which statements describe them on a scale of 0 to 2 (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). The ASR consists of 126 items whereas the YSR contains 112. Strong reliability and validity of the YSR and ASR have been

documented with high test-retest reliability and evidence of content, criterion, and construct validity (Achenbach & Rescorla, 2001, 2004). Coefficient alphas in the current sample were .88 for ASR internalizing, .82 for ASR externalizing, .88 for YSR internalizing, and .90 for YSR externalizing.

Stress Reactivity. The stressors employed in this study were closely adapted from the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993), which is widely used and well-supported in the literature for investigating physiological stress responses in a laboratory setting. The social stress task consisted of a video recorded public speaking task, which evidence has supported as an effective laboratory stressor for both children and adults (Dickerson & Kemeny, 2004). Participants were given five minutes to prepare a five-minute speech on any topic they chose (e.g., Popma et al., 2006) and were told that a panel would judge the tapes on their content, use of voice, posture, and nonverbal behavior (Kirschbaum et al., 1993). If participants stopped speaking during the five minutes, the research assistant told them to continue speaking until five minutes had passed.

The cognitive stress task consisted of a five-minute mental arithmetic task involving serial subtraction; participants were told to serially subtract the number 13 from 1,022 as quickly and as accurately as they could. If the participant made a mistake, the research assistant said, “stop” and told the participant to start again from the beginning until five minutes had passed. Serial subtraction by the number 13 was chosen for the present study because it was used in the original TSST study with 15- to 33-year-old participants, as well as an adaptation of the TSST for 10- to 14-year-old children (Buske-Kirschbaum et al., 1997). The social and cognitive tasks were counterbalanced in order

to better identify differential effects from stressors, rather than the order of the tasks. Physiological data were reduced to create mean scores for baseline and reactivity scores for SCL and RSA (see below). Coefficient alphas for physiological data computed across 30-second intervals were 1.0 for baseline SCL, 1.0 for SCL reactivity in response to the cognitive task, 1.0 for SCL reactivity in response to the social task, .97 for baseline RSA, .97 for RSA reactivity in response to the cognitive task, and .95 for RSA reactivity in response to the social task.

Personality. The *NEO-FFI-3* (Costa & McCrae, 2010) is a 60-item self-report measure of the Big Five personality traits (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness). The NEO-FFI-3 is a short form of the widely used and well-validated NEO-PI-3, which measures both Big Five traits and related facets. In both adolescents and adults, the NEO-FFI-3 has demonstrated good internal consistency (.72 to .88), has consistently replicated the factor structure of the NEO-PI-3, and has shown cross-observer validity with the NEO-PI-3 (McCrae & Costa, 2007). In the current sample coefficient alphas were .95 for neuroticism, .78 for extraversion, .82 for openness to experience, .83 for agreeableness, and .88 for conscientiousness.

To measure additional facets of personality, the *BIS/BAS Scale* (Carver & White, 1994) and the *Brief Sensation Seeking Scale* (BSSS; Hoyle, Stephenson, Palmgreen, Pugzles Lorch, & Donohew, 2002) were used. The BIS/BAS scale measures the behavioral approach system (BAS) and the behavioral inhibition system (BIS) and is broken down into four scales: BIS, BAS drive, BAS fun seeking, and BAS reward responsiveness. According to Carver and White, the three BAS scales emerged

empirically and it is not encouraged to combine them. Examples include, "When I want something I usually go all-out to get it" (drive), "I'm always willing to try something new if I think it will be fun" (fun seeking), and "When I get something I want, I feel excited and energized" (reward responsiveness). The factor structure of this scale has been replicated and it has shown good construct validity (Jorm et al., 1998). The BSSS measures the personality facet of sensation seeking and has been found to have good reliability and construct validity (Hoyle et al., 2002). An example item is, "I would like to explore strange places." The personality scales were primarily used as covariates in the current study. Coefficient alphas were .81 for BIS, .77 for BAS drive, .70 for BAS reward responsiveness, .70 for BAS fun seeking, and .82 for the BSSS.

Stressful Life Events. Stressful life events were measured based on two different life event inventories asking participants to recall the six months prior to the study visit. In both measures, a sum of the number of events endorsed with a negative valence were used as a covariate in primary analyses. All participants completed the *Adolescent Perceived Events Scale* (APES; Compas, Davis, Forsythe, & Wagner, 1987), which includes 90 events spanning several domains such as relationships with others, illness/injury/death, and school. Participants rated the valence and severity of each item that has happened on a scale from -4 (extremely bad) to +4 (extremely good). The APES has demonstrated good two-week test-retest reliability and concurrent validity (Compas et al., 1987). Coefficient alpha was .82 for the present study.

An adapted version of the *Life Experiences Survey* (LES; Sarason, Johnson, & Siegel, 1979) was also used to measure stressful life events. This measure consists of 56 life events such as changes in family makeup, personal illness and injury, and illness or

death of a loved one. Individuals indicated the valence and severity of the impact of that event on a 7-point Likert Scale from -3 (extremely negative) to +3 (extremely positive). Two independent studies of the LES yielded test-retest reliability coefficients of .63 and .64 (Sarason, Johnson, & Siegel, 1978). Coefficient alpha was .59 in the current sample. The life stress variable was calculated as the sum of the items rated with a negative valence on both measures combined, with redundant items removed.

Body Mass Index (BMI). Participants' height and weight were assessed at the time of physiological data collection for calculation of BMI to be used as a covariate in all analyses involving psychophysiological data.

Procedure

Following informed consent/assent procedures upon arrival to the study session, participants completed the series of self-report measures described above. The measures were administered first because they are fairly unobtrusive and may have eased any anticipatory anxiety about the study session. Each participant completed the study during one individual session, lasting approximately 1.5 hours.

Following the completion of the questionnaires and the opportunity to take a short break, participants' height and weight were assessed to calculate BMI. To minimize discomfort with weight measurements, the scale measured in kilograms rather than pounds. Next, participants were connected to the psychophysiological data collection device, which recorded heart rate (electrocardiogram) and skin conductance data. First, a trained research assistant guided participants to place three electrodes on their upper body; one electrode on either side of the rib cage and one at the top of the sternum. The electrodes were connected to a BioLog UFI 3991 portable bioamplifier (UFI corporation,

Moro Bay, CA), which continuously measured cardiac inter-beat intervals (IBI), assessed as time in milliseconds between successive R waves of the electrocardiogram. These data were used to calculate RSA. Second, the research assistant helped the participant fasten two Ag/AgCL electrodes around the middle segment of their index and ring fingers on their non-dominant hand. Isotonic citrate salt electrode gel was used with the electrodes to increase conduction. These electrodes were also connected to the bioamplifer to record SCL data.

Once fully connected to the bioamplifier, participants were asked to sit still and relax while a five-minute period of baseline data was recorded, followed by the first counterbalanced stress task. Once the task was complete, participants were again asked to sit and relax for another five minutes so an additional baseline period of physiological data could be recorded. Next, participants were guided through the remaining stress task. Finally, participants were again asked to sit and relax while physiological data were being recorded for five minutes so that they were not leaving the lab immediately after participating in a laboratory stress task. Participants were then debriefed about the public speaking task and were notified that their video would not be judged and would be permanently deleted immediately following the session.

Physiological Data Reduction

To calculate RSA reactivity, IBI artifacts due to movement or digitizing error were manually edited using the CardioEdit software program (Brain-Body Center, 2007) and RSA estimates were calculated using the CardioBatch software program in procedures outlines by Porges (U.S. Patent No. 4,510,944, 1985). Estimates of RSA were calculated separately for each baseline/rest period and each laboratory stress task in

CardioBatch, which provides the mean RSA score across 30-second epochs. SCL and RSA reactivity were calculated by taking the mean RSA and SCL values across each stress task and subtracting the mean during the first baseline period.

Analysis Plan

First, zero-order correlations among all primary variables were examined. Next, a measurement model for internalizing and externalizing problems was estimated in Mplus version 6 (Muthén & Muthén, 2010). For a latent internalizing problems variable, the ASR/YSR Anxious/Depressed, Withdrawn/Depressed, and Somatic Complains subscales were used as indicators and the Aggressive Behavior and Rule-Breaking Behavior subscales were used as indicators for a latent externalizing problems variable. Due to poor fit of this measurement model, hypotheses were tested using path analysis with the broad internalizing and externalizing scales from the ASR and YSR as manifest variables. Full information maximum likelihood estimation was used to incorporate all available data points from each participant.

In total, 18 path models were initially estimated (see Figure 1 for illustrative model): each of six indices of psychophysiology (baseline SCL, cognitive SCL reactivity, social SCL reactivity, baseline RSA, cognitive RSA reactivity, social RSA reactivity) was crossed with each of three types of coping (primary control, secondary control, disengagement). Internalizing and externalizing problems were analyzed together in all initial models. For models demonstrating non-convergence or poor fit, analyses were broken down to analyze internalizing and externalizing problems in separate models. For each model, directional paths were estimated from psychophysiology, coping, and a psychophysiology*coping interaction term (created from mean-centered versions of each

predictor) to internalizing and externalizing problems. Residual covariances were included between internalizing and externalizing problems. For statistically significant interactions, simple slopes were calculated by re-analyzing each model with coping centered at one standard deviation above and one standard deviation below the mean value for coping to test whether psychophysiology was differentially associated with internalizing or externalizing problems at different levels of coping (Aiken & West, 1991). Follow-up analyses were also conducted that added age, BMI, stressful life events, and personality as covariates by estimating additional model paths from these variables to each dependent variable.

Results

Preliminary Analyses

Initial data screening showed that data were missing for one participant on the NEO, six participants on the BIS/BAS, six participants on the BSSS, three participants for baseline RSA, 4 participants for RSA reactivity on the cognitive stressor, five participants for RSA reactivity on the social stressor, and one participant for SCL reactivity on the social stressor. One participant declined to complete the NEO and missing data on the BIS/BAS and BSSS were due to recruitment of six participants prior to a change in study design that added these measures. For psychophysiological measures, missing data were due to experimenter error or equipment malfunction, with the exception of one participant who withdrew from the study prior to completing the social stressor. Additionally, outliers were noted for some measures of psychophysiology. To address outliers, Z-scores of +/- 2.5 on psychophysiological data were replaced with

the next closest value. Four participants had values replaced for RSA and five participants had values replaced for SCL.

Zero-order correlations, means, and standard deviations for all primary variables are presented in Table 1. Primary control coping was negatively associated with internalizing and externalizing problems, whereas disengagement coping was positively associated with internalizing and externalizing problems. Secondary control coping was negatively associated with internalizing, but not externalizing problems. Generally, no zero-order associations were seen between psychophysiology and internalizing and externalizing problems, with the exception of a negative association between SCL reactivity on the cognitive stress task and internalizing problems. There was also a significant positive association between secondary control coping and SCL reactivity on the cognitive stress task. Stressful life events were negatively associated with primary and secondary control coping and positively associated with internalizing and externalizing problems. BMI was positively associated with internalizing problems and internalizing and externalizing problems were themselves positively correlated.

Surprisingly, personality variables were largely uncorrelated with all psychophysiological variables, with the exception of a negation correlation between neuroticism and SCL reactivity in response to the cognitive stress task. However, as expected, neuroticism was positively correlated with stress, internalizing problems, externalizing problems, disengagement coping, and BIS and was negatively correlated with primary control coping, secondary control coping, extraversion, and conscientiousness. Conversely, extraversion was positively correlated with primary control coping, secondary control coping, conscientiousness, sensation seeking, BAS

drive, BAS reward seeking, and BAS fun seeking, and negatively correlated with disengagement coping, internalizing problems, and neuroticism. Openness to experience was positively correlated with stress, internalizing problems, externalizing problems, sensation seeking, BAS drive, BAS reward seeking, and BAS fun seeking. Agreeableness was negatively correlated with disengagement coping, externalizing problems, sensation seeking, and BAS drive, but positively correlated with conscientiousness and BIS. Conscientiousness was positively correlated with primary control coping and BAS drive, but negatively correlated with stress, internalizing problems, externalizing problems, and sensation seeking. Sensation seeking was negatively correlated with secondary control coping and BIS, but positively correlated with stress, internalizing problems, externalizing problems, and BAS reward seeking. Finally, the three BAS scales were all positively correlated with each other, in addition to BAS drive being positively correlated with externalizing problems and BAS reward seeking being negatively correlated with disengagement coping.

Mean scores for internalizing and externalizing problems were consistent with a normative sample. The mean *T*-score for internalizing problems was 52.60 (*SD* = 10.63) whereas the means *T*-score for externalizing problems was 50.68 (*SD* = 9.29). The mean proportion scores for coping (out of the total for both voluntary and involuntary responses to stress) were .20 for primary control coping (*SD* = .04), .25 for secondary control coping (*SD* = .05) and .14 for disengagement coping (*SD* = .03). These responses suggest that overall, participants reported more volitional coping responses (a proportion of .60) than involuntary responses to stress, which totaled to a proportion of .40. Moreover, participants endorsed about the same frequency of primary and secondary

control coping, each of which was generally endorsed more than disengagement coping. In other words, participants reported engaging in more problem-solving, emotional regulation, emotional expression, positive thinking, cognitive restructuring, and distraction strategies than strategies aimed at avoidance, denial, and wishful thinking. In comparison to other studies utilizing the RSQ, participants in this sample reported using similar levels of secondary control coping, but slightly higher use of primary control coping and lower use of disengagement coping (DeCarlo Santiago & Wadsworth, 2009; Jaser et al., 2011; Wadsworth & Compas, 2002).

To determine whether the stress tasks elicited the expected stress responses, paired *t*-tests were conducted comparing mean scores during baseline to the mean RSA and SCL scores during each of the stress tasks. Results showed significant differences for all measures: For baseline SCL ($M = 5.62$, $SD = 3.21$) and the cognitive stress task ($M = 9.80$, $SD = 5.14$), $t(139) = -17.27$, $p < .001$; for baseline SCL ($M = 5.60$, $SD = 3.22$) and the social stress task ($M = 10.75$, $SD = 5.20$), $t(138) = -20.77$, $p < .001$; for baseline RSA ($M = 6.86$, $SD = 1.00$) and the cognitive stress task ($M = 6.28$, $SD = 0.96$), $t(135) = 8.33$, $p < .001$; and for baseline RSA ($M = 6.87$, $SD = 0.99$) and the social stress task ($M = 6.41$, $SD = 1.07$), $t(134) = 5.48$, $p < .001$. These results suggest that the stress tasks successfully elicited both SNS and PNS responses. For the cognitive stress task, 78% of the sample demonstrated RSA withdrawal, whereas the remaining participants demonstrated RSA augmentation. For the social stress task, 76% of the sample demonstrated RSA withdrawal. Furthermore, examination of RSA reactivity means and standard deviations suggests that for both tasks, one standard deviation below the mean

refers to RSA withdrawal (negative values) whereas one standard deviation above the mean refers to RSA augmentation (positive values).

Primary Analyses

Of the 18 core path models, four models resulted in non-convergence errors and one model (the interaction between cognitive RSA reactivity and disengagement coping) demonstrated poor fit to the data as well as a non-positive definite matrix error (χ^2 [6, N = 140] = 21.13, p = .002, CFI = .71, TLI = .67, RMSEA = .13, SRMR = .09). Of these problematic models, one included secondary control coping and cognitive RSA reactivity whereas the remainder included disengagement coping. These five models were subsequently analyzed separately with only internalizing or externalizing problems included in each model. For models that continued to have problems with non-convergence, non-focal associations were constrained to zero. For example, in the model including the interaction between disengagement coping and baseline RSA on externalizing problems, the associations between disengagement coping and baseline RSA, disengagement coping and the interaction between disengagement coping and baseline RSA, and baseline RSA and the interaction between disengagement coping and baseline RSA were constrained to zero. This decision was made based on examinations in prior runs of estimated associations among these variables, which were close to zero. Despite additional constraints in models with only one outcome, two models (disengagement coping with cognitive RSA reactivity and disengagement coping with baseline RSA, both predicting externalizing problems) continued to demonstrate non-positive definite matrix errors. These problematic models were subsequently tested in

SPSS to examine consistency of estimation across software packages, which was supported.

Main Effects

Contrary to hypotheses 1-4, no consistent main effects were found for psychophysiology measures on either internalizing or externalizing problems (see Table 2 for numerical results). However, results suggested consistent negative main effects for primary control coping on internalizing (βs ranging from -0.50 to -0.52) and externalizing (βs ranging from -0.44 to -0.46) problems, significant negative main effects for secondary control coping on internalizing problems (βs ranging from -0.44 to -0.46) with some evidence of a negative main effect for externalizing problems (βs ranging from -0.14 to -0.17), and significant positive main effects for disengagement coping on internalizing (βs ranging from 0.37 to 0.38) and externalizing (βs ranging from 0.25 to 0.26) problems. Thus, hypotheses 5 and 6 were supported.

Interaction Effects

Analyses resulted in a total of three significant interactions between psychophysiology and coping, each of which is displayed graphically in Figure 2. Two of these models (secondary control coping*cognitive SCL reactivity and primary control coping*baseline RSA) showed good fit to the data including both internalizing and externalizing problems as outcome variables (range of fit statistics: df = 3, CFI = 1.00, TLI = 1.01, RMSEA = .00, SRMR = .03 - .04). The model including both internalizing and externalizing problems for disengagement coping*baseline RSA was one that did not converge and therefore was broken down into simpler models including just internalizing or externalizing problems separately. The interaction was significant in the model with

internalizing problems and the model demonstrated good fit to the data (*df* = 3, CFI = 1.00, TLI = 1.09, RMSEA = .00, SRMR = .02).

Trending in the hypothesized direction (hypothesis 9), there was a significant interaction between baseline RSA and primary control coping predicting internalizing problems, such that there was no significant association between baseline RSA and internalizing problems for individuals reporting high primary control coping (*b* = 1.98, *p* = .11), but a marginal negative association between baseline RSA and internalizing problems for individuals reporting low primary control coping (*b* = -2.51, *p* = .05). There was also a significant interaction between RSA and disengagement coping for internalizing problems; however, simple slopes analyses tested at +/- one standard deviation of disengagement coping revealed no significant associations between baseline RSA and internalizing problems for either high (*b* = -1.78, *p* = .16) or low (*b* = 1.92, *p* = .10) levels of disengagement coping. Additionally, though no specific hypotheses were made with regards to SCL reactivity and externalizing problems, a significant interaction was found with secondary control coping, such that there was no association between SCL reactivity on the social stress task and externalizing problems for individuals reporting high secondary control coping (*b* = 0.45, *p* = .18), but a significant negative association between SCL reactivity and externalizing problems was found for individuals reporting low levels of secondary control coping (*b* = -0.80, *p* = .03). No support was found for hypotheses 7, 8, 10 or 11.

Models with significant interactions were further analyzed with age, stress, BMI, and personality factors as covariates. Personality variables included in each model were based on zero-order correlations with predictors and outcome variables (i.e., only

personality variables correlated with either predictor or the outcome were included as covariates). All three interactions remained significant when only age and BMI were included as covariates, though all were reduced to nonsignificance when life stress, calculated as a sum of the events that occurred in the past six months, was included in the model. Due to the high correlation between life stress and neuroticism ($r = .41$, $p < .01$), stress was subsequently examined as the number of stressful life events that were judged independent (i.e., not under the control of the individual), as well as the mean valence of the stressors endorsed. Independent stress was highly correlated with the total number of stressful life events endorsed ($r = .73$, $p < .001$) and the mean valence was more weakly and negatively related to the total number of stressful life events endorsed ($r = -.18$, $p < .05$). In other words, a higher number of stressors endorsed was associated with perceiving these stressors as more stressful. The correlation between neuroticism and the total number of independent stressful life events was reduced to $r = .25$, $p < .01$ and the correlation between neuroticism and mean valence ratings was $r = -.23$, $p < .01$.

Inclusion of independent stress in place of the total number of stressful life events yielded similar nonsignificant interactions, except the interaction including secondary control coping, social stress SCL reactivity, and externalizing problems remained significant ($\beta = .18$, $p = .04$). However, interaction effects remained significant with the inclusion of the mean valence of stressful life events for all three models. For the interaction between disengagement coping and baseline RSA predicting internalizing problems, the interaction remained significant when age, BMI, stress, openness to experience, agreeableness, and BAS reward seeking were included as covariates ($\beta = -.16$, $p = .03$). The interaction was reduced to marginal significance when extraversion and

conscientiousness were also included (β = -.13, p = .07) and reduced to nonsignificance with the inclusion of neuroticism. For the interaction between primary control coping and baseline RSA predicting internalizing problems, the interaction remained significant when age, BMI, stress, openness to experience, and BIS were added in the model (β = .14, p = .04). The interaction was reduced to marginal significance when extraversion and conscientiousness were also included in the model (β = .11, p = .09), and again to nonsignificance with the inclusion of neuroticism. For the interaction between secondary control coping and social stress SCL reactivity, the interaction remained significant when age, BMI, stress, extraversion, openness to experience, BIS, BAS drive, and BAS fun seeking were included as covariates (β = .16, p = .04). The interaction was reduced to marginal significance with the inclusion of neuroticism and agreeableness (β = .12, p = .08), but was reduced to nonsignificance with the inclusion of conscientiousness and sensation seeking.

Follow-up analyses also examined three-way interactions separately with gender and age group to see if there were differential associations between males and females or between adolescents and emerging adults. Because models including three-way interactions yielded non-convergence errors in Mplus, follow-up analyses were conducted using the PROCESS procedure in SPSS (Hayes, 2013). Results showed no significant three-way interactions with gender or age group.

Despite the lack of significant three-way interactions, select models were also analyzed separately for gender or age group. For example, because some evidence has been found to suggest that the association for SCL and externalizing problems is only present for males (Isen et al., 2010), models including SCL and externalizing problems

were analyzed separately for males and females. Consistent with three-way interaction results, no significant findings emerged for either gender. Additionally, due to the speculation that effects for the social stress task would be more demanding for adolescents and females, models including the social stress task were analyzed separately for males and females, and for adolescents and emerging adults. The only significant finding that emerged was that the interaction between SCL reactivity and secondary control coping with externalizing problems was significant for adolescents (β = .38, p = .002), but not emerging adults (β = -.02, p = .82), which was consistent with *a priori* hypothesis.

Finally, given that stress, calculated as the total number of stressful life events, consistently reduced interaction effects to nonsigificance, the three initially significant interactions were re-analyzed including life stress in a three-way interaction. Again, no significant three-way interactions emerged.

Discussion

This study sought to provide support for the moderating role of coping in associations between autonomic arousal (SCL and RSA) and internalizing and externalizing problems in a sample of adolescents and emerging adults. Despite the unexpected finding that SCL and RSA were mostly unrelated to internalizing or externalizing problems, hypotheses of negative main effects for primary and secondary control coping and positive main effects for disengagement coping were generally supported. Results were also partially consistent with prior literature (Wadsworth & Compas, 2002) suggesting that increases in stressful life events may be associated with

poorer coping. In the present study, life stress was negatively correlated with both primary and secondary control coping, but unrelated to disengagement coping. Additionally, although most hypotheses regarding interaction effects were not supported, results provided support for the moderating role of secondary control coping in the association between SCL reactivity in response to the social stress task and externalizing problems. Though significant interactions were also found between baseline RSA and primary control coping and between baseline RSA and disengagement coping with internalizing problems, analyses of simple slopes showed relatively few significant simple effects, with the exception of a marginal negative association between baseline RSA and internalizing problems for individuals reporting low levels of primary control coping.

Although the literature is mixed regarding associations between SCL reactivity and externalizing problems, and thus no specific hypotheses were made, results for individuals reporting low levels of secondary control coping are consistent with negative associations found in community samples of adolescents (Fung et al., 2005; Isen, Iacono, Malone, & McGue, 2012). Despite some research with community samples finding that the association between SCL and externalizing problems was present in males, but not females (Isen et al., 2010; Sylvers, Brennan, Lilienfeld, & Alden, 2010), results from the present study did not appear to differ between males and females. However, one age group difference was found, with the moderating role of secondary control coping in the association between SCL reactivity in response to the social stressor and externalizing problems to be present for adolescents, but not emerging adults. Furthermore, although secondary control coping can only be considered a subset of strategies involved in the

more general measure of productive coping, this finding is opposite from a previous finding that SCL reactivity was positively, rather than negatively, associated with parent-reported externalizing problems for individuals reporting low use of productive coping (Paysnick & Burt, 2014). In this prior study, the association between SCL reactivity and externalizing problems was not significant for individuals reporting high use of productive coping.

The interaction result with secondary control coping and SCL reactivity is also consistent with the more general hypothesis that high levels of secondary control coping, given a particular psychophysiology-psychopathology association, would be more beneficial than low secondary control coping. Here, for individuals experiencing lower SCL reactivity in response to a social stressor, those who more often employ strategies of acceptance, distraction, and positive thinking to adapt to or accept the situation (as opposed to problem-solving or avoidance) have lower externalizing problems than those who employ fewer of these strategies. Though it is interesting that a similar pattern was not found for primary control coping, evidence suggests that secondary control coping may be more beneficial when a stressor is uncontrollable (Wadsworth & Compas, 2002). Despite the fact that real-time coping during the stress tasks was not assessed, the tasks used were essentially uncontrollable unless the participant withdrew from the study and may have elicited similar physiological and coping responses to what is experienced in the natural environment. The finding for the moderating role of secondary control coping, but not primary control coping, is also consistent with Connor-Smith and Compas's (2004) finding that secondary control coping, but not primary control coping, buffered the positive association between self-reported arousal and internalizing problems.

Interestingly, a significant interaction was found for SCL reactivity in response to the social stress task, but not the cognitive stress task. This may be at least in part due to the fact that participants completed the RSQ about social stress in particular. Though this is a limitation of the present study given that coping with stress tends to be context-specific (Compas et al., 2001), the measure was deemed too lengthy to have participants complete an additional time in relation to cognitive stress. Furthermore, although research assistants commented subjectively that participants in general seemed to find the cognitive task more stressful than the social task, results suggest that the social task elicited a stronger average SCL response.

The lack of significant results may be partially due to the normative nature of this sample. While some associations between psychophysiology and psychopathology have been replicated in normative samples, until recently a majority of the research linking low baseline SCL and externalizing problems had been focused on primarily male and clinical or criminal samples. Additionally, the association between low baseline RSA and externalizing problems has been found primarily only in clinical, but not community, samples (Beauchaine, 2001; Beauchaine et al., 2001). As the body of literature examining psychophysiology continues to grow by including different samples as well as moderators and mediators, inconsistencies in patterns of physiological responses and psychopathology are likely to be clarified.

For example, a recent meta-analysis of heart rate variability in children found that both normative children, as well as those at risk or with psychopathology, demonstrated significant RSA withdrawal in response to the Trier Social Stress Test (Shahrestani, Quintana, Hicki, & Guastella, 2014). However, whereas normative children also

demonstrated RSA withdrawal in response to disengagement social dyad tasks (i.e., the still-face procedure, the Strange Situation), those at risk or with psychopathology had no changes in RSA. Based on this meta-analysis, it may be the case that despite having two different types of stressors in the present study, the two stressors were not sufficiently distinct from each other (i.e., the social task did not involve an interaction with another person) to elucidate differential associations among those with higher levels of symptomatology.

Furthermore, although coping did not act as a consistent moderator in the present study, the lack of main effects for psychophysiology on internalizing and externalizing problems may be masked by other variables influencing this association. Though not measured directly in this study, a history of life stress has been shown to influence psychophysiology, which may be adaptive in an effort to prepare individuals to respond to future stressful situations (Del Giudice, Hinnant, Ellis, & El-Sheikh, 2012). Evidence has also been found in support of an interaction between psychophysiology and stress predicting psychopathology (Obradović, Bush, & Boyce, 2011; El-Sheikh & Whitson, 2006). Although follow up analyses in the present study examined three-way interactions with life stress without significant findings, stress was only measured as the number of events that occurred within the past six months. Results may have yielded different results if the study had assessed a full history of life stress. Some evidence has also been found for the moderating role of coping in the association between life stress and psychopathology (see Grant et al., 2006 for a review). Given these associations, further examination of the role of life stress in the associations between autonomic arousal, coping, and psychopathology is warranted.

The significant interaction finding in the present study, in conjunction with prior literature, provides additional support for further investigating the role of coping in prevention and intervention programs. Efforts aimed at teaching individuals how to identify unhelpful coping strategies and increase their use of more helpful and effective coping strategies when faced with stress may be most beneficial for those with particular physiological responses. For example, based on results from the present study, teaching and encouraging individuals to accept or adapt to particular social stressors may be most beneficial in decreasing the risk of externalizing problems for those with lower SNS arousal. Future studies employing longitudinal and experimental methods are needed to further understand if and how coping may play a role in the prevention of psychopathology.

Surprisingly, personality was also unrelated to psychophysiology, with the exception of a negative association between neuroticism and SCL reactivity in response to the cognitive stressor. Based on the theory of fearlessness and low SCL (Ortiz & Raine, 2004), it was expected that low baseline SCL would be associated with personality variables such as extraversion, sensation seeking, and behavioral approach. Conversely, it was expected that high SCL would be associated with behavioral inhibition. It may be the case that the "low" levels of SCL obtained in the present normative sample were not sufficiently low enough to produce feelings of fearlessness that may be associated with these personality traits. Despite the lack of associations, personality did appear to be related to both coping and internalizing and externalizing problems, and inclusion of personality variables as covariates influenced associations.

Consistent with results from a meta-analysis examining associations between personality traits and anxiety, depressive, and substance use disorders (Kotov, Gamez, Schmidt, & Watson, 2010), neuroticism was the strongest correlate of internalizing and externalizing problems, and both problems were positively associated with neuroticism and negatively associated with conscientiousness. Also as expected, internalizing problems were negatively associated with extraversion and positively associated with BIS. Furthermore, although substance use disorders were the only disorders examined in the meta-analysis that fall under the category of externalizing problems, results from the current study were consistent, such that externalizing problems were negatively associated with agreeableness and positively associated with measures of behavioral disinhibition (sensation seeking, BAS drive, and BAS fun seeking).

For coping, results were also mostly consistent with a meta-analysis examining associations with personality (Connor-Smith & Flachsbart, 2007). Although personality did not map directly onto the narrow primary control and secondary control scales in the meta-analysis, consistent with the current study, neuroticism was found to be negatively associated with problem solving (a primary control strategy) and cognitive restructuring (a secondary control strategy) and positively associated with disengagement coping strategies. In addition, results from the current study were consistent with positive associations between both extraversion and conscientiousness and problem solving, as well as with extraversion and cognitive restructuring, though the positive association between conscientiousness and cognitive restructuring found in the meta-analysis was not found in the present study.

In sum, results were mostly consistent with previous literature linking personality to both psychopathology and coping. Moreover, in addition to these direct effects, evidence has also been found for both the moderating (see Connor-Smith & Flachsbart, 2007) and mediating (e.g., Hundt, Williams, Mendelson, & Nelson-Gray) role of coping in associations between personality and psychopathology. Although results of the current study did not support associations between personality and psychophysiology, theory and previous evidence in this domain suggests that longitudinal studies examining interactions between personality, autonomic arousal, and coping may help to understand the influence these constructs have on psychopathology, particularly in the face of stress or adversity, in order to best target and tailor future efforts for prevention.

Limitations

There are several limitations to the present study. First, this study was cross-sectional, restricting the interpretation of results in terms of direction of effects and/or the influence of additional confounding variables. Second, only self-reported data were obtained from questionnaires. Particularly with adolescents, the correlations between self- and parent-report for symptoms of psychopathology have been shown to be rather low, especially for externalizing problems (Hope et al., 1999), highlighting the potential utility of a multiple informant design that was not available in the present study. Third, as noted above, coping was assessed based on how individuals generally respond to social stress, but not cognitive stress. It is likely that individuals cope very differently with cognitive stress, given evidence that coping is context specific (Compas et al., 2001), and therefore may have contributed to why significant results were not obtained. Additionally, neither real-time coping responses, nor subjective assessment of stress

during the stress tasks were collected from participants. Though preliminary analyses suggested that both tasks elicited ANS responses, it is unclear if participants truly felt subjectively stressed, or if they employed any specific coping responses, during their participation. Furthermore, effect sizes from baseline to stressors were medium for RSA (Hedge's g = .42 for the social task and .56 for the cognitive task), which is lower than the average effect size found for other studies examining RSA in response to the Trier Social Stress Test (g = -1.06; Shahrestani et al., 2014). Effect sizes were large for SCL (g = -.98 for the cognitive task and -1.19 for the social task), however effect sizes for significant interaction terms were generally quite small. Furthermore, because some simple slopes effects were not significant despite a significant interaction term, it may be the case that the present study was statistically underpowered to detect significant findings. Finally, the participants in the present study were self-selected and relatively homogenous with respect to racial/ethnic diversity, potentially limiting the generalizability of the results.

Conclusion

Despite these limitations, the present study aimed to address a gap in the literature examining the moderating role of coping in associations between autonomic arousal (SCL and RSA) and internalizing and externalizing problems. Though several core predictions were unsupported, this study nonetheless provides additional evidence of the associations between coping and behavioral and emotional problems. Furthermore, it provides an additional examination of autonomic arousal among a normative sample of adolescents and emerging adults, as well as associations among the Big Five personality traits and related facets.

Consistent with prior literature and hypotheses, primary control coping and secondary control coping were inversely related to internalizing and externalizing problems whereas disengagement coping was positively associated with internalizing and externalizing problems. Despite the lack of main effects for autonomic arousal, three significant interactions between autonomic arousal and coping were obtained, albeit only one with a significant difference in simple slopes. Results from this interaction suggest that particularly for adolescents, high levels of secondary control coping (acceptance, distraction, positive thinking) eliminated the negative association between sympathetic nervous system arousal and externalizing problems, specifically in response to social stress.

Based on the results and limitations of the current study, future work is needed to help clarify how psychophysiology affects psychopathological functioning. Ideally, longitudinal studies will be employed with multiple assessments of psychophysiology, as well as assessment of real life stressors and how individuals are actually coping with the stress in order to best understand these associations. Further work in a laboratory setting assessing real-time coping, as Erath and Tu (2013) have done looking at associations with social competence, would also be an important contribution to this body of literature. Additionally, more recent research is highlighting the need to examine interactions both within and between psychophysiological systems. For example, Hinnant and El-Sheikh (2009, 2013) have found differential associations between RSA and psychopathology when examining the interaction between baseline and reactivity assessments, rather than for baseline and reactivity separately. Other work has elucidated differential associations when examining the interaction between the sympathetic and parasympathetic nervous

system (i.e., between SCL and RSA) predicting psychological adjustment (e.g., El-Sheikh et al., 2009). Whereas the current study provides some evidence for the moderating role of secondary control coping in associations between SCL reactivity and externalizing problems, further work utilizing methods described above will be important to determine if and how coping can play a role in prevention and intervention programs for individuals with particular patterns of autonomic arousal and/or personality.

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Table 1. Zero-order correlations, means, and standard deviations

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Primary Control	--												
2. Secondary Control	.19*	--											
3. Disengagement	-.60**	-.26**	--										
4. Baseline SCL	-.01	.03	-.08	--									
5. SCL-R (cognitive)	.02	.20*	.00	.43**	--								
6. SCL-R (social)	.03	.12	-.09	.43**	.53**	--							
7. Baseline RSA	-.09	.11	.02	-.13	-.10	.00	--						
8. RSA-R (cognitive)	.04	-.04	-.12	.11	.03	-.08	-.45**	--					
9. RSA-R (social)	.14	-.01	-.14	-.02	.02	-.06	-.42**	.53**	--				
10. BMI	-.11	-.12	.06	-.09	-.06	-.04	-.02	-.13	-.09	--			
11. Stress	-.22**	-.29**	.16	-.15	-.17	-.15	.02	-.02	.02	.13	--		
12. Internalizing	-.51**	-.44**	.37**	-.01	-.17*	-.07	.03	-.03	-.09	.25**	.45**	--	
13. Externalizing	-.45**	-.15	.25**	-.02	-.08	-.05	-.00	.05	.02	.13	.47**	.48**	--
14. Neuroticism	-.36**	-.50**	.20*	-.10	-.22**	-.13	-.03	.06	.03	.13	.41**	.69**	.32**
15. Extraversion	.41**	.21*	-.36**	-.10	-.01	-.04	.03	.00	.15	-.07	.04	-.38**	-.03
16. Openness	.03	-.05	-.06	.03	.03	.03	.00	-.06	.03	-.14	.38**	.18*	.27**
17. Agreeableness	.15	.15	-.19*	.04	.12	-.02	-.04	.14	.07	.01	-.15	-.06	-.45**
18. Conscientiousness	.36**	.09	-.21*	-.09	-.08	-.10	.12	-.13	-.09	-.16	-.24**	-.35**	-.38**
19. Sensation Seeking	-.14	.17*	-.04	.15	.05	.09	-.01	-.03	.10	-.12	.19*	.03	.38**
20. BIS	-.04	-.40**	-.05	-.10	-.11	-.11	-.02	.01	-.01	.12	.22*	.32**	-.09
21. BAS Drive	-.02	.03	-.06	-.04	-.08	-.09	.10	-.14	.00	-.05	.04	-.14	.21*
22. Bas Reward	-.07	.09	-.26**	-.08	-.04	-.09	.11	-.03	.05	.01	.14	-.05	.09
23. BAS Fun Seeking	-.16	.11	-.06	.05	.05	.02	.11	-.02	.12	-.14	.07	-.03	.21*
Mean	.20	.25	.14	5.62	4.19	5.16	6.85	-.58	-.47	24.47	14.11	52.60	50.68
Standard Deviation	.04	.05	.03	3.21	2.87	2.93	1.00	.81	.99	5.99	7.67	10.63	9.29

Table 1 continued.

	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
14. Neuroticism	--									
15. Extraversion	-.28**	--								
16. Openness	.10	.09	--							
17. Agreeableness	-.12	.12	-.02	--						
18. Conscientiousness	-.27**	.24**	-.12	.18*	--					
19. Sensation Seeking	.01	.24**	.34**	-.17*	-.18*	--				
20. BIS	.46**	.02	.01	.30**	.03	-.26**	--			
21. BAS Drive	-.07	.22*	.23**	-.37**	.19*	.36**	-.04	--		
22. Bas Reward	.07	.26**	.25**	.01	.04	.22*	.32**	.44**	--	
23. BAS Fun Seeking	-.03	.21*	.35**	-.11	-.13	.63**	-.06	.56**	.46**	--
Mean	51.11	52.32	57.71	52.55	49.40	3.42	2.98	2.81	3.51	3.09
Standard Deviation	10.70	10.43	10.77	12.33	11.09	.83	.57	.59	.42	.58

* $p < .05$; ** $p < .01$

Table 2. Path analytic results.

	Internalizing			Externalizing		
	B	SE	β	B	SE	β
Baseline SCL	-0.05	0.24	-0.01	-0.06	0.22	-0.02
Primary Control Coping	-135.01	18.96	-0.52***	-101.02	17.24	-0.45***
SCL X Primary Control	2.56	5.56	0.03	-4.84	5.01	-0.07
Baseline SCL	0.03	0.25	0.01	-0.03	0.24	-0.01
Secondary Control Coping	-98.30	16.71	-0.46***	-30.20	16.13	-0.16†
SCL X Secondary Control	4.50	5.46	0.07	3.62	5.27	0.06
Baseline SCL	0.07	0.26	0.02	-0.01	0.24	0.25**
Disengagement Coping	144.45	30.62	0.38***	82.63	27.93	-0.00
SCL X Disengagement	-5.25	8.51	-0.05	0.93	7.77	0.01
SCL Reactivity (cognitive)	-0.60	0.27	-0.16*	-0.17	0.25	-0.05
Primary Control Coping	-133.37	18.62	-0.51***	-102.23	17.15	-0.45***
SCL X Primary Control	1.68	6.59	0.02	-6.74	6.07	-0.09
SCL Reactivity (cognitive)	-0.47	0.31	-0.13	-0.26	0.30	-0.08
Secondary Control Coping	-93.16	16.43	-0.44**	-26.73	15.95	-0.14 †
SCL X Secondary Control	6.94	5.83	0.10	4.10	5.66	0.07
SCL Reactivity (cognitive)	-0.62	0.29	-0.17*	-0.25	0.26	-0.08
Disengagement Coping	142.56	29.85	0.37***	83.88	27.53	0.25**
SCL X Disengagement	8.44	11.95	0.05	9.22	11.02	0.07
SCL Reactivity (social)	-0.26	0.27	-0.07	-1.19	0.24	-0.06
Primary Control Coping	-132.55	18.85	-0.51***	-100.32	17.18	-0.44***
SCL X Primary Control	8.65	7.22	0.09	8.80	6.51	0.10
SCL Reactivity (social)	-0.13	0.28	-0.04	-0.25	0.27	-0.08
Secondary Control Coping	-96.37	16.25	0.45***	-30.58	15.38	-0.17*
SCL X Secondary Control	7.37	5.52	0.10	13.94	5.20	0.23**
SCL Reactivity (social)	-0.17	0.31	-0.05	-0.21	0.27	-0.07
Disengagement Coping	140.99	30.47	0.37***	82.93	27.63	0.25**
SCL X Disengagement	-6.83	12.31	-0.05	-13.98	11.04	-0.11

	Internalizing			Externalizing		
	B	SE	β	B	SE	β
Baseline RSA	-0.52	0.78	-0.05	-0.60	0.72	-0.06
Primary Control Coping	-129.08	18.83	-0.50***	-99.26	17.32	-0.44***
RSA X Primary Control	50.23	21.75	0.17*	31.90	20.09	0.12
Baseline RSA	0.83	0.81	0.08	0.14	0.79	0.02
Secondary Control Coping	-97.59	16.20	-0.46***	-28.68	15.69	-0.15†
RSA X Secondary Control	16.88	17.61	0.07	16.23	17.15	0.08
Baseline RSA	0.07	0.83	0.01	-0.09	0.77	-0.01
Disengagement Coping	142.50	29.95	0.37***	83.20	27.67	0.25**
RSA X Disengagement	-61.61	30.33	-0.16*	-9.37	28.14	-0.03
RSA Reactivity (cognitive)	0.23	1.0	0.02	0.88	0.91	0.08
Primary Control Coping	-129.72	19.11	-0.50***	-100.04	17.46	-0.44***
RSA X Primary Control	-43.32	30.95	-0.11	-24.02	28.15	-0.07
RSA Reactivity (cognitive)	-0.56	1.01	-0.04	0.45	0.98	0.04
Secondary Control Coping	-96.98	16.20	-0.46***	-27.66	15.69	-0.15†
RSA X Secondary Control	-27.42	25.97	-0.02	-7.84	25.26	-0.03
RSA Reactivity (cognitive)	0.69	1.14	0.05	0.99	1.03	0.09
Disengagement Coping	143.66	30.48	0.37***	86.34	27.79	0.26*
RSA X Disengagement	36.85	32.47	0.10	8.62	29.52	0.03
RSA Reactivity (social)	0.06	0.84	0.01	0.88	0.76	0.09
Primary Control Coping	-130.20	19.26	-0.50***	-103.73	17.56	-0.46***
RSA X Primary Control	-23.54	19.25	-0.10	-7.17	17.30	-0.03
RSA Reactivity (social)	-1.10	0.85	-.10	0.08	0.82	0.01
Secondary Control Coping	-93.76	16.23	-0.44***	-26.12	15.73	-0.14†
RSA X Secondary Control	10.26	20.07	0.04	11.94	19.48	0.05
RSA Reactivity (social)	-0.28	0.90	-0.03	0.65	0.81	0.07
Disengagement Coping	142.14	30.56	0.37***	87.03	27.91	0.26**
RSA X Disengagement	39.11	30.14	0.11	18.55	27.13	0.06

* $p < .05$; ** $p < .01$; *** $p < .001$; † = .06-.09

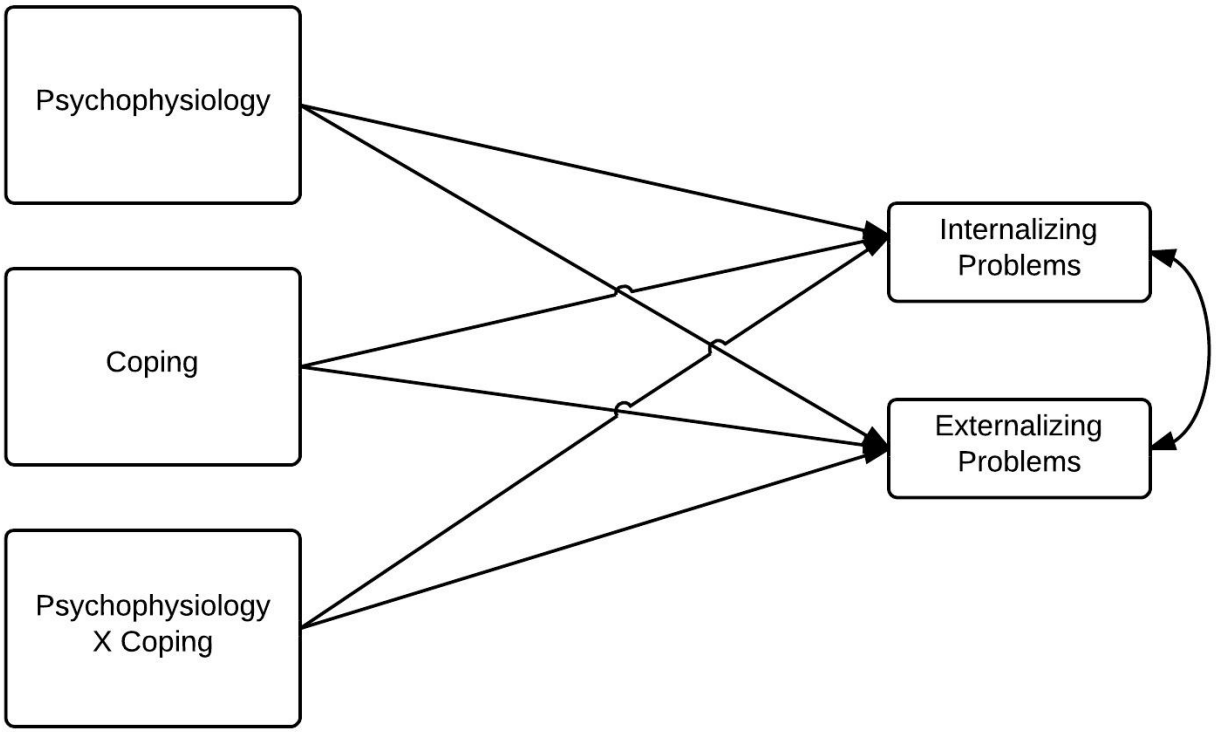

Figure 1. Illustrative path model. Note: Although not shown, follow-up analyses were also conducted controlling for age, body mass index, stressful life events, and personality.

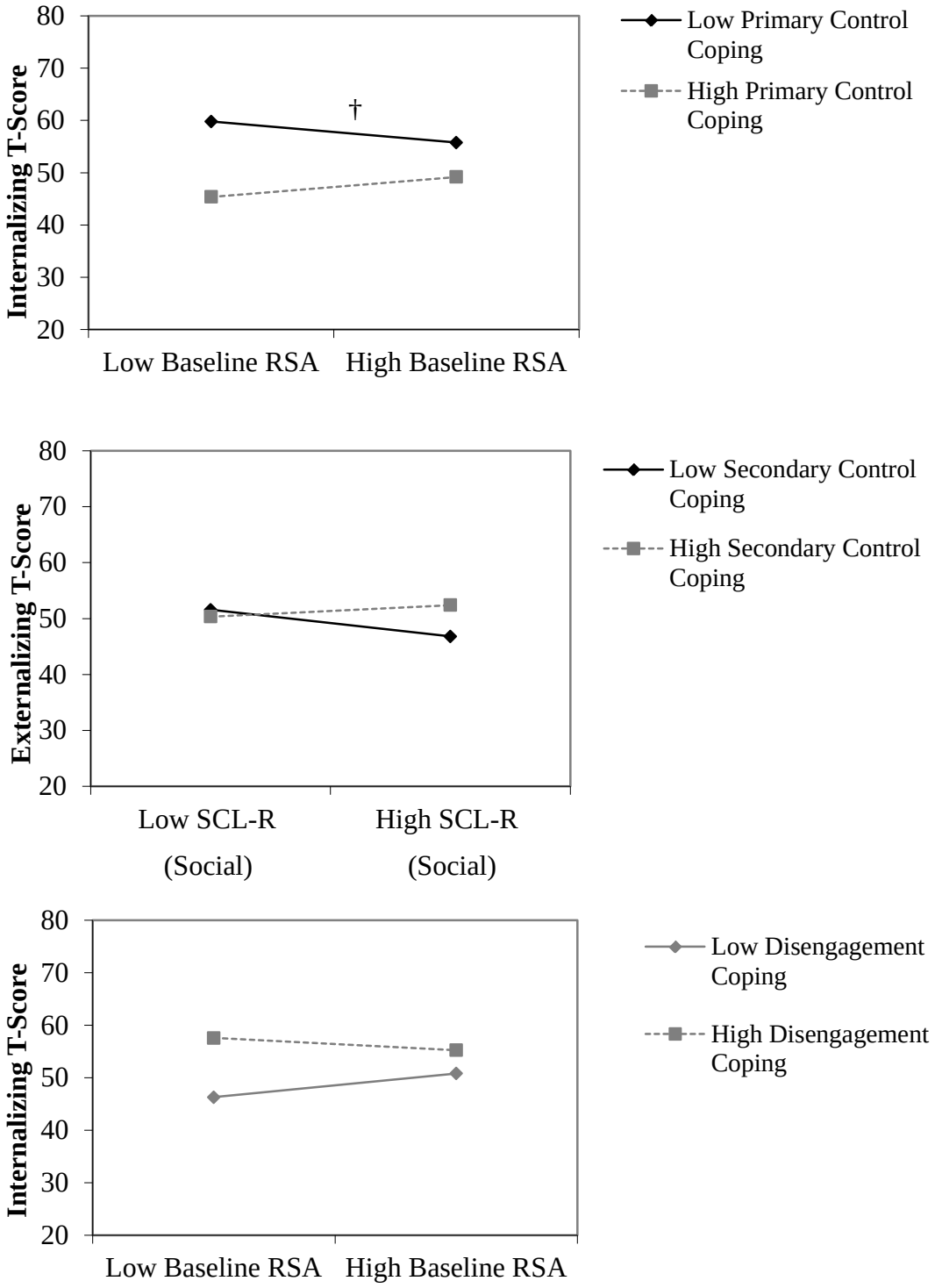

Figure 2. Significant interactions based on path model estimates. For predictors, "high" = +1 SD from the mean and "low" = -1 SD from the mean. Grayed-out lines = nonsignificant simple slope. † $p = .05$.