CONSIDERING THE ROLE OF CARDIAC VAGAL TONE IN ADOLESCENTS' BEHAVIORS WITHIN FRIENDSHIPS

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By

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ABSTRACT

Despite the theorized importance of cardiac vagal tone for functioning in close relationships (Porges, 2001) and the critical role of friendships in adolescents' development (Furman & Rose, 2015), there is a lack of research that considers vagal tone in relation to adolescents' friendship functioning. To address this gap, the currents study considers vagal tone (indexed using respiratory sinus arrythmia; RSA) in relation to adolescents' behaviors within the context of problem disclosures with a close friend. Participants were 200 adolescents (67% girls; M_{age} = 14.16 years; 79% White) who participated in a lab-based study with a same-gender friend (100 dyads). Adolescents' heart rate and respiration were continuously monitored to assess RSA during resting baseline tasks and a problem disclosure task with their friends. Researchers coded friendship interactions for supportive and unsupportive responses to problem disclosures. Results indicated that adolescents with higher levels of resting RSA activity received more support from friends during their interactions. During the interaction, providing friends with support was associated with subsequent RSA increases, and in turn, RSA increases were associated with subsequent provisions of support. Further, friends demonstrated RSA coregulation when the interaction was characterized by high levels of validation and empathy. Implications of vagal tone for adolescents' socioemotional development are discussed.

Chapter 1: Introduction

Cardiac vagal tone has been identified as a biomarker of emotional dysregulation and psychopathology (Beauchaine, 2015) and plays a critical role in social functioning within close relationships (Porges, 2009). Past research on close relationships has considered vagal tone in the contexts of mother-child relationships (e.g., Moore et al., 2009) and adult romantic relationships (Helm et al., 2014). However, vagal tone has not been considered in the context of adolescent friendships (Murry-Close, 2013b). This is problematic because the prevalence of psychopathology increases during adolescence and because close friendships become increasingly central relationships and critical sources of social support by adolescence (Furman & Rose, 2015; Twenge & Nolen-Hoeksema, 2002). Clarifying the associations between vagal tone and adolescent friend interactions could be a critical step in elucidating the potential transactional pathways among friendships, psychophysiology, and the development of psychopathology during adolescence.

Vagal tone indexes parasympathetic nervous system (PNS) regulation of cardiac activity (Beauchaine, 2001; Porges, 2007). The PNS contributes to regulating heartrate via the vagus nerve, which has both afferent fibers and efferent fibers. Afferent fibers originate in the SA node (i.e., the cardiac pacemaker) and project to the brain. The PNS receives feedback regarding heartrate through afferent fibers of the vagus nerve which aid its regulation of cardiac activity. In contrast, efferent fibers originate in the brain and project to the SA node. Vagal efference (i.e., activity along efferent fibers of the vagus nerve) inhibits firing of the SA node, resulting in a decrease in heartrate. Importantly, vagal efference increases during exhalation (decreasing heartrate) and decreases during inhalation (increasing heartrate). As such, vagal tone is frequently measured using respiratory sinus arrhythmia (RSA) which indexes high frequency heartrate variability over the respiration cycle.

RSA activity during resting conditions is a purported biomarker for emotional self-regulation (Beauchaine, 2015). Specifically, higher levels of resting RSA suggest greater parasympathetic regulation of heartrate. Given that higher levels of RSA reflect higher variability in heartrate over the respiration cycle, the individual has more flexibility in increasing or decreasing heartrate via the PNS to meet environmental demands. In contrast, low resting RSA activity reflects less variability in heart rate. As such, the individual has a lower capacity for flexible increases or decreases in heartrate to meet environmental demands. Resting RSA activity is thought to be a trait-like measure. Although resting RSA levels have been found to increase from toddlerhood to childhood, they have been found to stabilize by middle childhood (Bornstein & Suess 2000; Dollar et al., 2020). Because a greater capacity for self-regulation and appropriate management of emotional expressivity is theorized to have positive implications for social relationships (Butler & Gross, 2009; Cole, 2014), higher levels of resting RSA should confer benefits for close interpersonal relationships. Indeed, resting RSA has been linked to global relationship qualities (e.g., attachment security to adult romantic partners; Diamond & Hicks, 2005) and qualities of social interactions (e.g., social connectedness during daily interactions in adult relationship partners, Kok & Frederickson, 2010; warmth during a parent-child conflict discussion, Diamond & Cribbet, 2013).

RSA reactivity in response to environmental demands is also theorized to play an integral role in social functioning. Increases in RSA are thought to reflect positive feelings of affiliation in a perceived safe interpersonal environment whereas decreases in

RSA (i.e., RSA withdrawal) reflect engaged attention to a threatening or challenging interpersonal situation (Butler et al., 2006; Porges, 2001, 2009). In fact, during positive interactions with romantic partners, individuals' RSA has been found to increase (e.g., Schwederdtfeger & Friedrich-Mai, 2009; Smith et al., 2011); whereas during negative or conflictual social interactions, individuals have been found to exhibit RSA withdrawal (Smith et al., 2011).

In addition, emerging evidence indicates that coregulation of RSA between social partners is important. Attachment Theory (Bowlby, 1969, 1982) conceptualizes well-functioning close relationships as sources of affect regulation, given their security-providing and distress-reducing functions (Feldman, 2012). Other theories emphasize that using close relationship partners to regulate arousal should be more metabolically efficient than self-regulation. As such, coregulation should relate to positive psychological, social, and even physical health outcomes (i.e., Social Baseline Theory; Beckes & Coan, 2011; Timmons et al., 2015). A growing number of studies are considering coregulation of RSA and its significance for social relationships, but there is a lack of attention to the significance of coregulation within adolescent friendships.

The proposed study considers interrelations between different measures of vagal tone (indexed using RSA) and adolescents' behaviors during interactions with close friends. Friends' interactions will be considered in the context of problem talk. Friends are primary sources of emotional support during adolescence and talking about problems is a common approach to coping. As such, how friends talk about problems, and respond to one another's problem disclosures, should influence their relationship quality and emotional well-being (Leaper et al., 1995; Rose et al., 2016). In fact, Rose and colleagues (e.g., Rose et al., 2014; Rose et al., 2016) have examined friends' responses to each other's statements about problems. These responses were grouped conceptually as supportive engaged responses (e.g., supporting/agreeing with the friend, asking questions) and unsupportive disengaged responses (i.e., changing the topic, minimizing the problem, being explicitly unsupportive). Supportive engaged responses predicted feelings of closeness to friends whereas negative responses did not.

The proposed study will consider: (1) how adolescents' resting RSA activity relates to their behaviors during problem talk, (2) potential bidirectional links between RSA reactivity and friends' behaviors during problem talk, and (3) coregulation of RSA between friends during problem talk. By considering relations between RSA and friends' problem talk, the proposed study integrates and extends previous research on both psychophysiology and on youths' friendships. Despite research indicating associations between RSA and functioning in parent-child and romantic relationships, no previous work has considered associations between RSA and adolescents' friendships. Given that RSA is an indicator of emotional (dys)regulation that has important implications for psychopathology and that adolescence is a developmental period characterized by increases in psychopathology, this is a critical gap in the literature.

Cardiac Vagal Tone and Social Functioning

Theoretical perspectives. Several theoretical frameworks have proposed that cardiac vagal tone has critical implications for social functioning. Polyvagal Theory (Porges, 1995) explains the phylogenic roots of vagal tone and how it functions to regulate cardiac activity. Further, evidence linking vagal tone to prefrontal cortex activity provides support for the use of vagal tone as a biomarker for emotion regulation (Beauchaine, 2015; Thayer et al., 2009).

Porge's (1995) Polyvagal Theory proposes the existence of two vagal fibers that influence heartrate: the vegetative vagus and the smart vagus. Both are involved in cardiac regulation and terminate in the SA node in the heart (i.e., the cardiac pacemaker) but originate from different brain areas. The vegetative vagus connects to the motor cortex in the brain. Activation of the vegetative vagus allows for orientation and attention to a stimulus. The smart vagus involves more complex responding and connects to the nucleus ambigus which also to the larynx and facial nerves (i.e., components of vocal and facial emotional responding). When facing an environmental challenge, vagal activity is thought to reflect engagement with the situation at hand (i.e., orientation via the vegetative vagus, complex responding via the smart vagus; Beauchaine, 2001; Porges, 1995).

Importantly, vagal tone is proposed to facilitate social engagement (Porges, 2009). The nervous system evolved in such a way to promote survival in dangerous settings (i.e., flight-or-fight situations) and in safe settings (e.g., within close relationships). During safe interactions, the more primal nervous system structures (i.e., the SNS, limbic system) should be disengaged and the PNS should engage to allow for calm, complex responding (i.e., vocalizations and facial expressions; Porges, 2009). As such, increases in vagal tone should represent calm responding in a perceived safe environment whereas vagal withdraw (i.e., decreases in vagal tone) should represent a response to a threatening situation (Butler et al., 2006; Porges 2001, 2009).

Thayer's neurovisceral integration theory links vagal tone to the brain's prefrontal cortex, providing support for the perspective that vagal activity is related to emotional self-regulation (Beauchaine, 2015; Thayer et al., 2009). During emotional arousal or stress, RSA decreases as does prefrontal cortex activation. Prefrontal cortex responses are slower than instinctual, rapidly-responding brain areas (e.g., amygdala). In a modern society that values cooperative social interactions, it is advantageous to inhibit rapid, instinctual responses so that the prefrontal cortex can generate a self-regulated response. In support for the possibility that vagal tone relates to self-regulation, studies find that higher levels of resting RSA are linked to greater prefrontal cortex activation during stressful tasks (Thayer et al., 2009).

Empirical Findings Regarding RSA and Social Functioning Within Dyadic Relationships

Research examining physiological responding and social functioning in childhood and adolescence has primarily focused on the broader peer group. For example, RSA has been linked to peer aggression, with youth who have lower levels of resting RSA demonstrating greater aggressive peer behaviors (for a review of psychophysiology and peer relations, see Murray-Close, 2013a). Researchers have noted the lack of research examining psychophysiological measures in conjunction with dyadic friendships within adolescent samples (Giletta et al., 2016; Murray-Close, 2013b). This is problematic given that adolescence is a critical developmental stage in which youth focus less on their broader peer group relations and prioritize dyadic relationships with friends (Furman & Rose, 2015). RSA could have important implications for a variety of social outcome measures specific to dyadic relationships.

Resting RSA activity. Research has linked higher levels of resting RSA activity to more positive social relationships and social behaviors. This research has examined resting RSA in relation to global qualities of relationships (e.g., attachment security; Diamond & Hicks, 2005), qualities of day-to-day social interactions (e.g., social connectedness during daily interactions; Kok & Frederickson, 2010), and specific behaviors during social interactions (e.g., observed warmth during a conflict discussion; Diamond & Cribbet, 2013).

In terms of global relationship qualities, studies consistently find that higher levels of resting RSA have positive implications for dyadic relationships. One study found that adult men with higher resting RSA had more secure global attachments styles and reported greater relationship security with their current romantic partners and close friends (Diamond & Hicks, 2005). Another study of adult romantic couples found relational effects of resting RSA on husbands' and wives' reports of relationship quality. Women with higher levels of resting RSA reported greater relationship quality with their husband. Men's higher levels of resting RSA predicted both greater wife- and husband-reported relationship quality (Smith et al., 2011).

Regarding the qualities of day-to-day social interactions, studies have used ecological momentary assessments to examine how resting RSA relates to daily experiences with social partners. In one study, researchers related resting RSA to social coping strategies in an undergraduate sample (Geisler et al., 2013). Participants completed a seven-minute resting RSA measure at an initial lab visit and then reported on their emotions four times daily for four weeks. Every time the participants reported that another person caused them to feel sad or angry, they also reported on their social coping strategies. Higher levels of resting RSA predicted greater use of instrumental support-seeking (e.g., asking for help) and lower disengaged coping strategies (e.g., avoidance; Geisler et al., 2013).

Studies using daily diary approaches have similarly found links between resting RSA and positive social interactions. In one study, a community sample of adults reported on social connectedness (e.g., feeling close to the other person) within three social interactions per day and rated their overall daily emotional experiences for approximately two months. Resting levels of RSA predicted increases in social connectedness and positive emotions over time (Kok & Frederickson, 2010). In a similar study, cohabitating romantic couples reported on their daily emotional experiences, positive interactions (e.g., feeling close to each other), and negative interactions (e.g., having conflict with each other) for three weeks (Diamond et al., 2011). Men with higher resting RSA reported a greater number of positive interactions. Women with higher resting RSA also reported a greater number of positive interactions, but only if they also reported experiencing positive emotions. In contrast, men with lower resting RSA reported a greater number of negative interactions, but only if they also reported experiencing negative emotions (Diamond et al., 2011).

Research using observational methodologies has also found that individuals with higher levels of resting RSA have more positive social interactions. In a longitudinal study, researchers examined adolescents' changes in resting RSA in relation to the qualities of their interpersonal interactions with their mothers. Adolescents completed resting measures of RSA and engaged in an observed conflict discussion with their mothers at an initial visit and again two years later. Adolescents who increased in resting

RSA over time also experienced an increase in their observed warmth (e.g., disclosure, friendly listening) during the conflict discussion (Diamond & Cribbet, 2013). A study in which men completed resting RSA measures and a conflict discussion with their romantic partners found similar effects. Both partners reported on relationship quality. Men assessed the degree to which they suppressed negative emotional expressions during the conflict task and were rated for constructive social behaviors (e.g., conflict resolution, establishing equality) during the interaction. Men with higher resting RSA who suppressed negative emotional expressions were judged to display more constructive social behaviors. Further, their partners reported greater relationship satisfaction (Geisler & Schröder-Abé, 2015).

In sum, research examining resting RSA finds that higher levels of resting RSA typically relate to better social functioning within dyadic relationships. This has been found using different methodologies (e.g., survey measures of relationship quality, daily diary reports of closeness, observations of warmth) within different types of dyadic relationships (parent-child, friendships, romantic couples). Importantly, findings regarding resting RSA and its interactive effects with experienced emotions (Diamond et al., 2011) and regulatory efforts (Geisler & Schröder-Abé, 2015) on social functioning support that this measure likely assesses an individual's capacity for emotional self-regulation.

Findings regarding the link between resting RSA and dyadic social functioning present clear implications for how resting RSA might relate to adolescent friendships. As stated, across multiple studies examining resting RSA and social functioning, higher levels of resting RSA predicted more positive outcomes. Although no study has directly examined friendships during adolescence, there is strong evidence that the associations would be similar. First, although evidence suggests possible differences in the relations between resting RSA and functioning across development (Beauchaine, 2001), one of the studies reviewed did include an adolescent sample who interacted with mothers and found the expected pattern of effects (i.e., higher resting RSA predicted more positive social functioning; Diamond & Cribbet, 2013). Second, studies that specifically considered friendship outcomes found positive effects of higher resting RSA on friendship adjustment in adult samples (e.g., Diamond & Hicks, 2005).

Within adolescent friends' problem talk, resting RSA is likely to have implications for how friends' respond to one another. Given that individuals with higher levels of resting RSA have better quality interactions (e.g., Kok & Frederickson, 2010), it could be that higher resting RSA reflects a greater, more flexible self-regulatory capacity to positively engage their intimate relationship partners. As such, it is expected that adolescents' higher baseline RSA will relate to greater use of supportive engaged responses and lower use of unsupportive disengaged responses to friends' problem statements.

RSA reactivity. Reactivity measures of RSA reflect responses to environmental cues. In line with Polyvagal Theory and the proposed social engagement functions of vagal tone (Porges, 2009), research has found that RSA increases from resting levels when individuals are with intimate relationship partners. Further, studies have found that RSA decreases in response to stressful or challenging tasks predicts positive functioning with close relationship partners. This research takes the perspective that RSA withdrawal under stressful conditions reflects normative regulation (e.g., Obradovic et al., 2010).

At least two studies support that RSA levels increase in the context of close relationships. Using an ecological momentary assessment design, Schwederdtfeger and Friedrich-Mai (2009) examined relations between depressive symptoms and ambulatory RSA. Although depressive symptoms were associated with lower resting RSA activity overall, even individuals with higher depressive symptoms experienced an increase in RSA when with a close friend or romantic partner (Schwerdtfeger & Friedrich-Mai, 2009). Building on these findings, Smith and colleagues (2011) found that when men described their wives' positive characteristics to them, the wives' RSA increased from before to after the task. In contrast, when men described their wives' flaws to them, the wives demonstrated a decrease in RSA (Smith et al., 2011).

RSA withdrawal has been studied within challenging caregiving contexts (e.g., Groh et al., 2017) but is more commonly examined during cognitively-challenging tasks in relation to child and adolescent social functioning. RSA withdrawal in response to cognitively-challenging tasks (an adaptive response indicating engagement) is related to youths' warmth in interactions with mothers (Diamond & Cribbet, 2013), being well liked by peers (Graziano & Derefinko, 2013), and lower levels of withdrawal from romantic partners' later in development (i.e., during early adulthood; Loeb et al., 2021). Further, one meta-analysis found that only typically developing youth, and not youth with psychopathologies, demonstrated RSA withdrawal in response to challenging tasks (Shahrestani et al., 2015). A few studies have examined RSA withdrawal in adolescents' during challenging *social* tasks. Specifically, RSA withdrawal during an anger discussion task with parents (Cui et al., 2015) and while watching a video that simulated bullying in the peer group (Cui et al., 2019) were both associated with adolescents' greater prosocial behaviors. Altogether, these findings support that RSA withdrawal is the expected response to stressors and should also occur in response to negative social interactions (e.g., Smith et al., 2011).

The available research examining RSA reactivity during social interactions has several methodological limitations. First, studies examining RSA reactivity tend to use change scores, which involves looking at the difference between baseline RSA and RSA averages during a task (e.g., Diamond & Cribbet, 2013). This is problematic because the PNS is thought to be a flexible and rapidly moving system for self-regulation (e.g., Muhtadie et al., 2015) and many fluctuations in RSA can occur throughout an interaction without resulting in a net change. Second, studies typically assess global qualities of interactions in relation to RSA reactivity (e.g., warmth; Diamond & Cribbet, 2013) rather than considering how specific behaviors relate to changes in RSA. Third, studies have not considered the possibility that bidirectional relationships likely exist between RSA reactivity and behaviors. That is, behaviors likely influence changes in physiology, but it is also possible that physiological changes could influence behaviors.

The limitations of past research can be addressed using a more nuanced approach to measuring RSA reactivity. This approach involves examining changes in RSA in segments throughout an interaction (e.g., in 30 second segments; Moore & Calkins, 2004) which captures variation in RSA reactivity more sensitively than change scores from start to end of an interaction do. Further, examining shorter segments of RSA throughout an interaction allows researchers to link behaviors directly to RSA reactivity and to consider bidirectional relations between physiology and behavior. That is, behaviors in one 30-second segment can be linked to changes in RSA in the next 30 seconds and vice versa.

Within the context of adolescent problem talk, friends' responses to problem statements can be directly linked to RSA reactivity using the above approach. For example, an adolescent's supportive engaged response in one moment (e.g., agreeing with a friends' problem statement) might relate to increases in the friend's RSA in the next moment given that research has found RSA to increase in affectively positive interactions (e.g., Smith et al., 2011). In contrast, unsupportive disengaged responses in one moment (e.g., invalidating a friend's problem statement) should relate to RSA decreases in the next given that decreases in RSA may indicate active coping with a stressor (Beauchaine, 2001; Diamond & Cribbet, 2013).

Regarding the opposite direction of effect, RSA increases, which indicate that the adolescent is in a state of calm and positive affect (Porges, 2009), should predict their producing supportive engaged responses. Predictions regarding RSA decreases, which are the expected response to challenging or stressful situations and indicate engagement in the situation (Beauchaine, 2001; Diamond & Cribbet, 2013) are more difficult to make. Adolescents may produce subsequent unsupportive disengaged responses if the decreases reflect feelings of heightened stress but could produce supportive engaged responses if the decreases reflect engagement with the stressful situation.

RSA coregulation. When studying RSA within social relationships, coregulation is an important consideration (Butler & Randall, 2013). Social baseline and attachment theories support the importance of studying coregulation. Social baseline theory refers to the idea that it is more metabolically efficient to use one's social partners to regulate than to regulate individually (Beckes & Coan, 2011; Timmons et al., 2015). Therefore, successful coregulation with a close relationship partner should be associated with positive psychological, social, and even health outcomes. Attachment theorists have similarly conceptualized intimate relationships as sources of affect regulation, given their security-providing and distress-reducing functions (Diamond, 2001; Porges, 2003). These relationships should be especially relevant to parasympathetic regulation and maintaining homeostasis (Diamond, 2001). Despite its theorized importance, coregulation has not been consistently defined within psychological research and empirical studies examining coregulation are limited (e.g., Butler & Randall, 2013; Helm et al., 2014; Li et al., 2020; McAssey et al., 2013; Palumbo et al., 2017).

In comparison to research examining more egalitarian relationships (e.g., friends, romantic partners), there is a greater amount of research examining RSA coregulation within caregiver-child relationships. During infancy and childhood, coregulation with a caregiver is proposed to promote self-regulation, improve social communication, and encourage a secure attachment style (Harrist & Waugh, 2002). In infancy, studies have found that RSA coregulation varies depending on the nature of the task. Mother-infant RSA has been found to be positively correlated during non-stressful tasks (habituation task, Bornstein & Suess, 2000) but negatively correlated during stressful tasks (Ostlund et al., 2017). In contrast, research examining mother-child pairs found that that mother-child RSA was positively correlated during both positive and negative discussion tasks (Woody et al., 2016). Although research is needed to clarify developmental changes in coregulation, the shift from negative concordance in mother-infant pairs (Ostlund et al., 2017) to positive concordance in mother-child pairs (Woody et al., 2016) during stressful tasks could reflect the child's increasing ability to participate in social interactions. Whereas infants may be dependent on their mothers' ability to soothe them, older children are better able to self-regulate and actively use caregivers to regulate during stressful experiences (Thompson, 1994).

Research examining coregulation in adolescence and adulthood is limited. Coregulation during adulthood is proposed to promote feelings of intimacy or connectedness between intimate relationship partners and provide support for the management of stress or negative emotions (Sbarra & Hazan, 2008). Initial studies have considered RSA coregulation within the context of adolescent-parent relationships (e.g., Li et al., 2020; McKillop & Connelll, 2018; Oshri et al., 2021) and adult romantic relationships (Helm et al., 2014).

Coregulation research examining adolescents has found evidence for mother-adolescent coregulation during conflict and that mother-adolescent coregulation is an adaptive process. Two studies examined coregulation by considering *concurrent synchrony*; that is, the extent to which parent and adolescents' RSA were interrelated during the same time period. One study measured RSA during a conflict discussion among mothers, fathers, and adolescents. Mothers and adolescents demonstrated evidence of coregulation such that when one individual fluctuated from their mean RSA, the other fluctuated in the same direction within the same time period. Further, mother-adolescent coregulation was evident only when parents reported low levels of coparenting conflict (Li et al., 2020). In another study examining concurrent associations between mothers' and preadolescents' RSA during a conflict task, the effect of mother RSA on adolescent RSA was nonsignificant. However, there was variability in the extent to which mother-adolescent dyads demonstrated coregulation that ranged from negative synchrony (i.e., lack of concordance) to positive synchrony (i.e., coregulation). When mothers and adolescents demonstrated coregulation, positive parenting was associated with lower adolescent internalizing symptoms (Oshri et al., 2021). A third study considered *lagged synchrony* to assess coregulation between mothers and adolescents. This study found that mothers' RSA in one moment predicted changes in the adolescents' RSA in the next (i.e., increases predicted increases; decreases predicted decreases). The degree of coregulation was influenced by maternal characteristics, such that coregulation was only evident at lower levels of maternal depressive symptoms and negative affect (McKillop & Connell, 2018).

Helm and colleagues (2014) examined coregulation of RSA among heterosexual, romantic couples. Coregulation was defined as *lagged synchrony* between relationship partners during their interactions together. That is, the extent that one partners' RSA from 30 seconds prior was related to the other partners' RSA 30 seconds later (while accounting for the same partners' RSA in the prior 30 seconds). The couples also reported on the quality of their romantic relationship with one another. Results provided evidence for coregulation in that the lagged synchrony effect was positive and significant. Further, relationship satisfaction moderated the coregulation effect, such that there was stronger coregulation in couples who reported higher levels of relationship satisfaction (Helm et al., 2014). This supports that coregulation is associated with positive psychosocial functioning, given that more satisfied romantic partners displayed stronger coregulatory effects.

Overall, evidence from mother-child and adult romantic partner research supports that co-regulation is an adaptive process. In particular, coregulation defined as positive concurrent or lagged synchrony between relationships partners is associated with positive characteristics of the relationship partner (e.g., low maternal depressive symptoms; McKillop & Connell, 2018) or the relationship (e.g., higher relationship satisfaction; Helm et al., 2014). One implication of past findings is that relationship partners with more positive characteristics are interacting in more positive ways that support RSA coregulation. Examining actual behaviors within dyadic interactions could be an important next step for confirming this possibility and clarifying the conditions in which RSA coregulation occurs.

As mentioned, during problem talk, adolescent friends' responses to each other's problem statements predict subsequent behaviors within the interaction and global feelings about the relationship (Rose et al., 2014; 2016). Responses to problem talk will likely relate to RSA coregulation, in addition to RSA reactivity, because friends' behaviors should influence the extent to which an adolescent's RSA influences the friend's RSA. For example, if the friend perceives an adolescent's positive responses as sensitive and experiences feelings of connection, then an adolescent who produces many positive engaged responses should *influence* the friends' RSA especially strongly (i.e., the adolescent's RSA should predict the friend's subsequent RSA especially strongly). In contrast, negative responses may be perceived by the friend as off-putting and create distance, resulting in lower levels of friend physiological responsiveness.

Current Study

The current study examined associations between RSA and functioning within adolescent friendships. Specifically, the current project tests links among different measures of RSA (resting activity, reactivity, coregulation) and specific behaviors during adolescent friends' problem talk that have established links to adolescent socioemotional adjustment (supportive engaged responses, unsupportive disengaged responses; Rose et al., 2014; 2016).

Regarding resting RSA activity, despite its important implications for functioning within close interpersonal interactions, there is a striking lack of research examining the significance of resting RSA for youth's close friendships. The current project addresses this gap by examining links between resting RSA and adolescents' responses to friends' problem talk. Higher levels of resting RSA were hypothesized to relate to greater supportive engaged responses and fewer negative responses to friends (H1). This response pattern during problem talk is associated with having high quality friendships (Rose et al., 2016).

The current study also extends past research in important ways in regards to *RSA reactivity*. In prior studies, RSA reactivity has typically been examined by computing change scores that consider the difference between resting RSA scores and RSA averages across a task. In the current study, RSA is coded in 30-second segments throughout adolescents' friend interactions. Further, the current study considers specific behaviors during problem talk (i.e., supportive engaged, unsupportive disengaged responses) in 30-second segments, allowing us to test how specific behaviors relate to changes in RSA across 30-second segments. Namely, friends' supportive engaged responses were expected to predict subsequent increases in adolescents' RSA, whereas friends' unsupportive disengaged responses were expected to predict subsequent decreases in adolescents' RSA (H2). It is also possible that RSA could influence subsequent behaviors; thus, this direction of effect also was tested (H3). RSA increases were expected to predict adolescents producing supportive engaged responses. Although RSA decreases have been generally linked to stressors or cognitive challenges, it unclear how RSA decreases might predict behaviors. As such, no specific hypotheses were made regarding how RSA decreases would relate to subsequent behaviors.

In terms of *RSA coregulation,* the current project defines coregulation as lagged synchrony between friends RSA (i.e., relations between the friend's RSA in the prior 30 seconds and the adolescents' RSA in the following 30 seconds, while accounting for adolescents' RSA in the prior 30 seconds). The current study extends previous work on RSA coregulation in three important ways. First, the study will be the first to examine RSA coregulation between friends. Second, the study will test how specific behaviors during problem talk are associated with RSA coregulation, which will be important for identifying targeted points of intervention. Specific behaviors that are linked to the adaptive process of coregulation might be important behaviors to promote within interventions aimed at improving youths' socioemotional functioning. Third, the current study offers specificity not only in the behaviors considered, but also in the timing between behaviors and RSA coregulation by examining responses to problem talk in the same 30-second segments as RSA.

In the current project, coregulation between adolescent friends' RSA was expected such that changes in an adolescent's RSA across segments were expected to predict changes in the friend's RSA across the subsequent segments (H4). In addition, the friends' responses to problem talk were expected to be associated with the degree of coregulation (H5). Receiving many supportive engaged responses was expected to result in stronger coregulation whereas unsupportive disengaged responses were expected to be related to lower coregulation.

Differences between girls and boys in the associations between RSA and problem talk responses also were tested. Gender was not expected to moderate the relations between resting RSA and friends' behaviors (H6). Resting RSA is thought to reflect better emotional self-regulatory capacity (Beauchaine, 2001), which should predict more positive friend behaviors for both girls and boys. In contrast, the relations between friends' problem talk responses and adolescents' subsequent changes in RSA was expected to be stronger girls than boys' (H7). This hypothesis is based on research indicating that girls' emotional states are influenced by friends more strongly than boys' emotional states (Schwartz-Mette & Rose, 2012) and that women's RSA reactivity is influenced by partners' behaviors more strongly than men's RSA reactivity (Smith et al., 2011). Regarding the other direction of effect, gender is not expected to moderate the effect of RSA reactivity on subsequent problem talk as previous research has not found gender differences in the effects of RSA reactivity on social skills or behaviors (H8; Graziano et al., 2007; Diamond & Cribbet, 2013). Last, given that girls demonstrate greater empathy in friendships than boys (e.g., Smith & Rose, 2011) and women are more physiologically responsive to romantic partners than men (e.g., Smith et al., 2011), girls were expected to display greater levels of RSA coregulation than boys (H9) and RSA coregulation was expected to be affected by problem talk behaviors more strongly for girls than boys (H10).

As in Rose et al. (2016), both overall supportive engaged responses, overall unsupportive disengaged responses, and specific responses will be considered. The supportive engaged and unsupportive disengaged responses each encompass several specific behaviors (see below). Although specific hypotheses are not made for each response, it is possible that certain responses will be more strongly associated with RSA than others. For example, in the supportive engaged category, support/agree responses encompass responses that are *explicitly supportive and agree with the speaker*. Consequently, support/agree responses might be more strongly associated with RSA compared to responses that are more ambiguous and/or neutral in valence (e.g., opinion/comment response that involve relevant, but neutral comments about the problem). Similarly, nonsupport/disagree responses involve responses that are *explicitly unsupportive* and might be more influential compared to other unsupportive disengaged responses (e.g., silence responses, which are disengaged but potentially open to interpretation by the recipient).

Chapter 2: Method

Participants

To recruit participants, announcements were emailed to parents at local schools (i.e., through Peachjar; see https://www.cpsk12.org/vb) and through the local university's listserv announcements (i.e., MU Info; see https://muinfo.missouri.edu/). In addition, flyers were distributed locally in areas and businesses that are frequented by adolescents (e.g., coffee shops, recreation center) and ads were displayed on social media platforms (i.e., Facebook, Instagram). Researchers also made announcements through local youth organizations (e.g., sports teams, church groups) and events that catered to families (e.g., farmer's markets).

As in previous research (e.g., Rose et al., 2014, 2016), youth participated with a close friend who was their same gender and within one year of their age. Participants were 200 adolescents in 100 friend dyads who were between 12 and 16 years old (M = 14.16, SD = 1.02). There were 134 girls (M_{age} = 14.18, SD = 1.05) and 66 boys (M_{age} = 14.11, SD = 0.95). In terms of race, the majority of participants were White (79%). A small portion of the sample reported being Hispanic or Latinx (5%). Information adolescents provided about their parental education suggested a largely middle-class background. Demographic information for the sample is displayed in Table 1.

Procedure

The adolescent friends participated in the project in the Peer Relations Lab at the University of Missouri (Columbia, Missouri). Two research assistants were present for each lab session. Before participation, written parental consent and written youth assent was obtained for each adolescent. Participants first completed a survey assessment lasting approximately one hour. Then, the physiological equipment (i.e., disposable sensors and mobile devices) was applied, with each adolescent assisted separately by a researcher. Resting RSA was first measured while adolescents sat quietly in separate rooms for three minutes (Resting Baseline Task I). Consistent with past research (e.g., Helm et al., 2014) a second measure of resting RSA was taken while adolescents sat side-by-side for three minutes without talking (Resting Baseline Task II) before the Problem Talk Task. Adolescents then completed the Problem Talk Task. RSA was assessed continuously throughout the task. Adolescents were compensated for their time with a $20 gift card.

Survey Assessment

Participants reported on their demographic characteristics (i.e., gender, age, and racial and ethnic background) and information about their families (e.g., parental education). To account for health-related characteristics that might affect the measurement of RSA, participants also reported on their height and weight, as well as their current and typical intake of coffee/caffeinated cola, caffeinated tea, cigarettes, over-the-counter medications, and prescription medications. Last, participants were asked to "list a problem they have" for use in the Problem Talk Task. Specifically, they were instructed to think of a personal problem they would be comfortable talking to their friend about, but not a problem within their friendship. Participants completed additional survey measures not used in the current study.

Physiological Equipment and Assessment

Physiological (cardiac and respiration) data were collected with a system of two PCs, BioLab (v. 3.3.1) acquisition software, two mobile cardiograph devices, and EPrime (v. 2) software for epoching furnished by MindWare Technologies (Gahanna, OH). Three disposable electrodes were applied to participants' torsos to monitor electrocardiogram (ECG) data and a belt designed to monitor respiration data was applied around their diaphragms. ECG data was sampled at a rate of 500 ms and bandpass filtered at 40 and 250 Hz was applied. Participants' physiological data was synchronized and continuously monitored at rest and during the problem talk task. The RSA data was analyzed offline using the Mindware editing program, MindWare HRV (v.3.3). The software identifies inter-beat-intervals (IBIs) and detects physiologically improbable intervals based on the overall distribution using a validated algorithm (Berntson et al., 1990). Data was visually inspected for artifact identification and editing. Using the Mindware HRV program, data were detrended with a first-order polynomial to remove the mean and any linear trends, cosine tapered, and submitted to fast Fourier transform (FFT). The RSA power band was set at 0.18 to 0.50 Hz for 16-year-olds, 0.20 to 0.50 for 14 and 15-year-olds, and 0.22 to 0.50 for 13-year-olds (as recommended; Shader et al., 2018). RSA was operationalized as the natural log integral of the power band and was calculated in 30-second segments during the Resting Baseline Tasks and the Problem Talk Task. For resting RSA, the 30-second segments were averaged across the three-minute resting period to compute a resting RSA activity score. For hypotheses regarding RSA reactivity and coregulation, the 30-second segments during the Problem Talk Task are used in analyses.

Observational Assessment of the Problem Talk Task and Coding Problem Talk Responses

The observational assessment was video- and audio-recorded using three high resolution Panasonic pan/tilt/zoom cameras and speaker that were synchronized with the physiological data using BioLab (v. 3.3.1) software furnished by Mindware Technologies

(Gahanna, OH). Adolescents completed the Problem Talk Task developed and validated in previous research (Rose et al., 2014; 2016; Borowski & Zeman, 2018). Adolescents were told that they would have 16 minutes to discuss each friend's problem and that they could spend as much time as they would like on each friend's problem. Adolescents were not given a specific amount of time to talk about each problem. The task is designed to be relatively long and unstructured so that natural variation in problem talk engagement and balance in discussing each friend's problem can be assessed.

Adolescents' interactions were transcribed and segmented into *thought units*, which represent logical divisions of speech (e.g., are separated by pauses, changes in speakers, or shifts in ideas; Leaper et al., 1999; Strough & Berg, 2000). Two coders completed the thought units coding. To determine reliability, percentage agreement was computed on 27% of the transcripts. Percent agreement was 90.25%. Across all participants, 42,784 thought units were identified. The number of thought units per participant ranged from 70 to 333 (M = 222.00, SD = 52.30).

Thought units in which an adolescent makes a statement regarding his/her own problem were next identified (i.e., *own problem statements*; see Rose et al., 2014, 2016). The coding team for own problem statements included a team of four coders. Kappas were computed to assess reliability in 29% of the coding cases. All four coders overlapped on 50% of the reliability cases (κs = 0.66-0.86) and two coders overlapped on all reliability cases (κ = 0.83). Across all participants, 9,665 own problem statements were identified. The number of own problem statements per participant ranged from 0 to 280 (M = 50.50, SD = 46.8).

Next, responses to problem statements were coded. Each time an adolescent made an own problem statement, what the friend says next was coded (see Rose et al., 2014, 2016). Friends' responses were coded in 30-second segments matching the 30-second segments used for RSA reduction. The responses to problem statements coding included two parts: (1) identifying thought units that could be categorized as responses to problem statements, (2) coding the responses to problem statements into different categories of response types.

There were ten responses categories that were considered *supportive engaged responses* and five response categories that were considered *unsupportive disengaged responses*. The ten supportive engaged responses included: *acknowledge* (demonstrating that the listener is paying attention, e.g., "Uh-Huh", "Oh"), *add information* (expands on information about the problem previously stated, e.g., "And her parents let her do whatever she wants!"), *advice-giving (I)* (giving advice in the form of what the speaker would do, e.g., "I would call her."), *advice-giving (you)* (giving advice in the form of what the listener should do, e.g., "You should call her."), *opinion/comment* (relatively neutral statements about the problem, e.g., "I don't know"), *own experience (non-distracting)* (sharing a related experience without drawing attention away from the person's problem, e.g., "I get sad when she doesn't call me too."), *prompt* (explicitly encourages speaker to say more about the problem, e.g., "Let's talk more about your problem."), *question (encourage)* (asking speaker to keep talking or repeat themselves, e.g., "Really?", "Oh yeah?"), *question (information)* (asking speaker for more information, e.g., "When did that happen?"), and *support/agree* (explicitly conveys support or agreement, e.g., "Exactly", "I think you did the right thing.").

The five unsupportive disengaged responses included: *change subject* (statements unrelated to the original problem statement, e.g., “I’m hungry”), *minimization* (implies the problem is not that important, e.g., “That’s not a problem), *nonsupport/disagree* (explicitly non-supportive statements, e.g., “Everyone hates it when you say that.”), *own experience (distracting)* (related experience that draws attention away from the speaker, e.g., “Well, the person who she ignores most is me!”), and *Silence/No Response* (friend does not respond, silence for approximately 15 seconds or longer).

To establish interrater reliability for coding Responses to Problem Statements, two coders overlapped on 30% of the dyads. The kappa for identifying responses was 0.94 and the kappa for categorizing responses was 0.78. Additional descriptions of the coding categories and examples of Responses to Problem Statements are available in Table 2. Descriptive statistics for Thought Units, Own Problem Statements, and Responses to Problem Statements are displayed in Table 3.

Data Analysis Plan

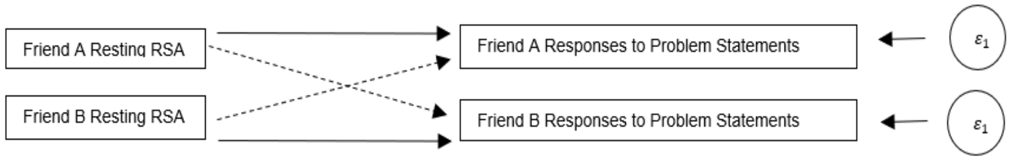
Analyses were conducted using the *dyadr* (Garcia & Kenny, 2022) package in RStudio (RStudio Team, 2021). For H1, which considers adolescents’ resting RSA activity in relation to the total number of supportive engaged and unsupportive disengaged responses during the conversation, actor partner interdependence models (APIMs) were conducted to account for similarity between friends. Specifically, mixed-effects models were tested in which adolescents were nested in dyads and both actor (intrapersonal) and partner (interpersonal) effects are tested. As recommended for indistinguishable dyads (same-gender, same-age friends), effects are constrained to be equal between dyad members (Kenny et al., 2006). For example, the effect of Friend A’s behavior on Friend B's physiology is constrained to be equal to the effect of Friend B's behavior on Friend A's physiology. Similarity between friends was modeled using a compound-symmetry correlation structure. For these analyses, adolescents' and their friends' responses to problem statements were totaled for the entire Problem Talk Task for each response.

For hypotheses considering RSA reactivity (H2-H3) and RSA coregulation (H4-H5), prospective change APIMs were conducted with adolescents nested in dyads and repeated measures of the 30-second segments of behavior and physiology nested in adolescents. An autoregressive correlation structure was specified to account for correlations among the repeated measures of behavior and physiology over time. For these analyses, adolescents' and their friends' responses to problem statements were totaled for each of the 32 30-second segments of the Problem Talk Task for each response.

Respiration is included as a covariate in all analyses (as recommended, Beauchaine, 2001; Berntson et al., 1997). In the analyses considering RSA reactivity and RSA coregulation, the resting RSA measure from Resting Baseline Task II was also included as a covariate. Separate models were tested for the supportive engaged response composite and the unsupportive disengaged composite as well as the individual responses involved in each composite score.

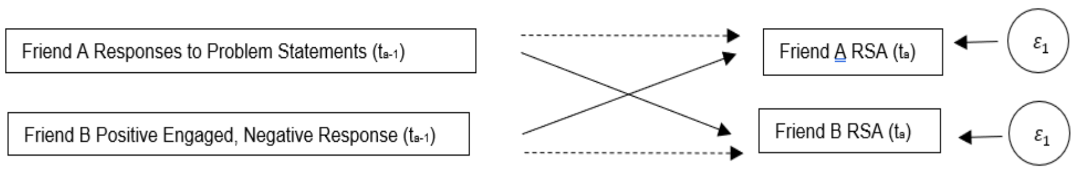
Models first tested the hypothesis that adolescents' higher resting RSA is related to their producing many supportive engaged responses and few unsupportive disengaged responses (*actor effects*; H1). In Figure 1, the horizontal arrows represent the hypothesized effects. Partner effects were included (dashed diagonal lines) in the models.

Figure 1



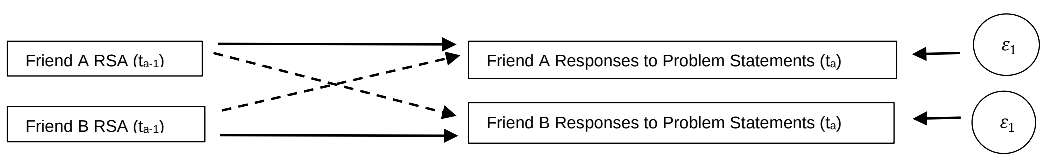
Models next tested the hypotheses that adolescents' behaviors (supportive engaged or unsupportive disengaged responses) would predict changes in their friends' RSA in the next 30 seconds (*partner effects*; H2). In Figure 2, the hypothesized partner effect is represented by the diagonal lines. Actor effects were included (dashed horizontal lines) in the models as well.

Figure 2



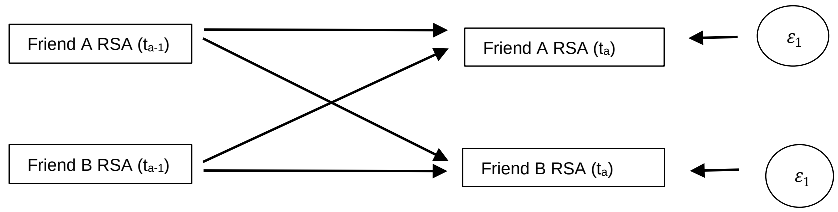
Models also tested the opposite direction of effect, that adolescents' RSA would predict their responses in the next 30 seconds (*actor effects;* H3). In Figure 3, the hypothesized actor effect is represented by the horizontal lines. Partner effects were also included in the models (diagonal dashed lines).

Figure 3



To test for RSA coregulation between friends, models tested whether adolescents' RSA predicts their friends' RSA in the following 30 seconds (*partner* effects; H4). In Figure 4, the diagonal lines represent the hypothesized partner effects. The horizontal lines are the actor effects, which represents the autoregressive effect of each adolescents' own RSA in the previous 30 seconds.

Figure 4



To test whether adolescents' behaviors moderate the extent to which their RSA influences their friends' RSA, the interaction between the friends' RSA and the behaviors were added to the models (H5).

To test gender differences, the main effects of gender and the interactive terms of gender with the effects of interest were added to the models tested in H1-H5. For H1, the interaction between gender and resting RSA on adolescents' behaviors was not expected to be significant (H6). For H2, the interaction between gender and friends' behaviors on adolescents' RSA reactivity was expected to be significant such that the effect would be stronger for girls than boys (H7). Also, for H2, the interaction between gender and adolescents' RSA on their behaviors was not expected to be significant (H8). For H3, the interaction between gender and coregulation was expected to be significant such that the effect of the friends' RSA on adolescents' RSA in the following 30 seconds would be stronger for girls than boys (H9). For H3, the three-way interaction between gender, friends' RSA (i.e., coregulation), and friends' behaviors tested whether the effect of behaviors on RSA coregulation is stronger for girls than boys (H10).

Chapter 3: Results

Missing Data

Several dyads had missing data for the physiological assessment or the observational assessment. Two dyads had missing data for the coded behavioral variables due to equipment failure and the adolescents' speaking a language the coders did not speak, respectively. These two dyads were included in analyses that only involved physiology (H4; coregulation) but were excluded from analyses involving the behavioral data. Two additional dyads had partially missing data due to equipment failures during the Problem Talk Task. The two dyads were therefore excluded from analyses involving the total number of responses to problem statements across the problem talk task (H1; resting RSA) but were included in all other analyses that considered within-person effects (i.e., interrelations between behaviors and RSA from one segment of problem talk to the next). As result, sample sizes were: 192 (96 dyads) for H1 and 196 (98 dyads) for H2, H3, and H5. The full sample of 200 adolescents (100 dyads) was used for analyses to test H4.

Additional friend dyads (*n* =2) were excluded from analyses examining gender differences (H6-H10) because the dyads were other-gender dyads. That is, each of the two dyads included one friend who was transgender such that the friends had the same sex as assigned at birth, but different gender identities. As such, for these dyads, gender would represent a with-dyad effect rather than a between-dyad effect. Thus, the dyads were included in all analyses that did not involve gender as a predictor but were excluded from all analyses that did. Sample sizes were 190 (95 dyads) for H6, 194 (97 dyads) for H7, H8, and H10, and 196 (98 dyads) for H9.

Descriptive Statistics

Tables with means, standard deviations, and other descriptive statistics are displayed in Table 3 for the behavioral coding variables and Table 4 for the physiological variables. Correlations among study variables were examined. For the correlation tables with gender and age (Tables 5-8), only actor effects are considered (e.g., the correlation between gender and the number of Own Problem Statements an adolescent made). For Table 9, which examines correlations among the physiological variables and the behavioral variables, both actor and partner effects are reported as are the intraclass correlations between friends.

Table 5 displays correlations among gender, age, and the supportive engaged responses to problem statements. Gender was significantly related to the supportive engaged composite score, add information, own experience (non-distracting), question (information), and support/agree responses with girls making more of these responses than boys did (r's = -0.15 to -0.26, p's < .05). The specific responses were all significantly correlated with the composite score (r's = 0.19-0.79, p's < .01). The majority of specific supportive engaged responses were positively and significantly correlated with one another with few exceptions. Most notably, advice-giving (I) was only significantly associated with advice-giving (you), $r = 0.40$, $p < .01$. Age was not associated with any of the supportive engaged responses.

Table 6 displays correlations among gender, age, and the unsupportive disengaged responses to problem statements. Gender was significantly associated with change subject responses, with girls making more of the response than boys did ($r = -0.17$, $p < .05$), and with nonsupport/disagree responses, with boys making more of the response than girls did ($r = 0.15$, $p < .05$). All of the specific responses were significantly related to the composite score with the exception of silence responses ($r = 0.14$, $p > .05$). The specific responses demonstrated mixed patterns of associations with one another. Silence was not associated with any of the other specific responses (*r*'s = -0.07 to 0.03, *p*s > .05). Change subject responses were significantly associated with minimize responses (r = 0.27, $p = .01$), minimize responses were also significantly associated with nonsupport/disagree responses ($r = 0.17$, $p < .05$), and nonsupport/disagree responses were also associated with own experience (distracting) responses ($r = 0.23$, $p < .01$). Age was not associated with any of the unsupportive disengaged responses.

The correlations among gender, age, total thought units, own problem statements, and responses to problem statements are displayed in Table 7. Gender was associated with own problem statements and responses to problem statements, with girls making more statements and responses than boys (*r*s = -0.23, -0.21, *p*'s < .01). Total thought units, own problem statements, and responses to problem statements were all significantly related (*r*s = 0.25-0.41, *p*s < .01). Age was not associated with any of the behavioral codes.

In Table 8, the correlations among gender, age, and the physiological variables are considered. Gender was associated with the average respiration rate during the Resting Baseline II Task such that girls had a higher respiration rate than boys ($r = -0.15$, $p < .05$), and during the Problem Talk Task, such that boys had a higher respiration rate than girls did ($r = 0.19$, $p < .01$). Age was significantly associated with resting RSA during Resting Baseline Task I ($r = -0.15$, $p < .05$) and Resting Baseline Task II ($r = -0.17$, $p < .05$) such that older adolescents had lower levels of resting RSA. Age was also associated with the average respiration rate during the Problem Talk Task such that older adolescents had lower respiration rates, $r = -0.37$, $p < .01$. Average RSA levels during the Resting Baseline Tasks and during the Problem Talk Task were all significantly associated (rs = 0.70 to 0.76, ps < .01). Resting RSA during the Resting Baseline I task was negatively associated with respiration during both Resting Baseline Tasks (rs = -0.15, -0.19, ps < .05). Average respiration rates during the Resting Baseline Tasks were significantly correlated with one another ($r = 0.24$, $p < .01$).

Last, correlations among adolescents' and their friends' scores for the resting RSA, average Problem Talk RSA, supportive engaged responses, and unsupportive disengaged responses were examined (see Table 9). Adolescents' resting RSA during the Resting Baseline Task II was associated how many supportive engaged responses they made ($r = 0.15$, $p < .05$) and received from friends ($r = 0.23$, $p < .01$) such that higher levels of resting RSA were associated with more supportive engaged responses. Adolescents' higher levels of RSA during the Problem Talk Task were associated with receiving supportive engaged responses from friends ($r = 0.17$, $p < .05$). Intraclass correlations between friends' scores on the same variables indicated little evidence of similarity in friends' average levels of RSA at rest or during the Problem Talk Task (ICCs = -0.00 to 0.05) and moderate similarity for supportive engaged responses (ICC = 0.47) and unsupportive disengaged responses (ICC = 0.32).

Health-related characteristics. The health-related characteristics adolescents reported on were examined in relation to the physiological variables. Results indicated that coffee/cola consumption, tea consumption, over-the-counter medication consumption, prescription medication consumption, weight, and height were not significantly associated with any of the physiological variables (r's = -0.14-0.13, p's > .05).

COVID-19. Data collection took place between spring of 2019 and summer of 2021. For a period of time, data collection was shut down due to the COVID-19 pandemic (March 2020 through June 2020). A portion of the sample participated following the COVID-19 shutdown (25%). Correlational analyses were conducted to determine whether adolescents who participated before the March 2020 (coded 0) differed from adolescents who participated after June 2020 (coded 1). Adolescents who participated after June 2020 made more own problem statements ($r = 0.22$, $p = .003$) and received more responses to problem statements ($r = 0.19$, $p = .01$). Regarding type of response, adolescents who participated after June 2020 received more supportive engaged responses ($r = 0.17$, $p = .02$) but did not differ from adolescents who participated before March 2020 in unsupportive disengaged responses ($r = -0.08$, $p = .28$). Time of participation was not significantly associated with any of the physiological variables.

Resting RSA in Relation to Responses to Problem Statements

Actor partner interdependence models first examined whether resting RSA levels were associated with adolescents making more supportive engaged responses and fewer unsupportive disengaged responses during the Problem Talk Task (H1). In these models, all variables were between-person centered. The total number of responses made during the problem talk task served as the dependent variable in each model. Actor and partner respiration (averaged across Resting Baseline Task I) were included as covariates. Of primary interest, actor and partner resting RSA (averaged across Resting Baseline Task I) were included as predictors. In these models, a significant actor effect indicates that adolescents resting RSA was associated with them *making or providing* the response of interest to their friend. A significant partner effect indicates that adolescents' resting RSA was associated with them *receiving* the response of interest from their friend.

Supportive engaged responses. Full model estimates for the supportive engaged composite and the individual supportive engaged responses for H1 are reported in Table 10. In the model examining the supportive engaged composite variable, there was a significant partner effect such that adolescents' higher levels of resting RSA were associated with receiving more supportive engaged responses from friends, $b = 5.00$, $p = .01$.

Analyses next considered the specific supportive engaged responses. Two responses showed the same pattern of findings as the supportive engaged composite variable. Specifically, higher levels of resting RSA were associated with adolescents receiving more add information ($b = 1.70$, $p = .03$) and support/agree responses ($b = 0.70$, $p = .01$). For several other responses, the partner effect was in the same direction as the supportive engaged composite but marginally significant: acknowledge ($b = 0.88$, $p = .08$), advice giving (I) ($b = -.18$, $p = .07$), and own experience (non-distracting) ($b = 0.95$, $p = .09$). For prompt responses, higher resting RSA was associated with receiving fewer prompt responses ($b = -0.11$, $p = .03$). The actor effect was non-significant but in the same direction such that higher RSA was associated with adolescents making fewer prompt responses ($b = -0.08$, $p = .10$). Actor and partner resting RSA levels were not significantly nor marginally significantly associated with responses for advice-giving (you), opinion/comment, question (encourage), or question (information).

Unsupportive disengaged responses. Full model estimates for the unsupportive disengaged composite and the individual unsupportive disengaged engaged responses for H1 are reported in Table 11. In the model examining the unsupportive disengaged composite, effects were non-significant.

Analyses next considered specific unsupportive disengaged responses. In the model examining own experience (distracting) responses, there was a significant actor effect. Consistent with hypotheses, adolescents with higher levels of resting RSA made fewer own experience (distracting) responses to friends (b = -0.22, p = .046). The effects of actor and partner RSA on unsupportive disengaged responses were non-significant in the models examining change subject, minimize, non-support/disagree, and silence responses.

Supplementary analyses with covariates. Based on the pattern of correlations among demographic variables and time of participation (COVID-19), supplementary analyses were conducted. The above models were again tested with age (years), gender (0=girl, 1=boy), and time of participation (0=before March 2020, 1 = after June 2020) as covariates. The pattern of significant findings was unaffected and only the more parsimonious models (without covariates) are presented.

Summary of findings for resting RSA and responses to problem statements. Findings provided mixed support for the hypothesis that resting RSA would be associated with adolescents making more supportive engaged problem statements and fewer unsupportive disengaged problem statements (H1). Results for supportive engaged responses indicated that higher levels of resting RSA were generally associated with higher levels of supportive engaged responses. Unexpectedly, however, the results indicated significant *partner* effects rather than actor effects, such that adolescents with higher levels of resting RSA received more supportive engaged responses. Analyses examining specific responses indicated a similar pattern of findings for acknowledge, add information, advice-giving (I), advice-giving (you), own experience (non-distracting), and support/agree responses. Adolescents' resting RSA was not associated with the unsupportive disengaged composite. Examination of the specific unsupportive disengaged responses, however, indicated that one response supported hypotheses: adolescents' higher levels of resting RSA were associated with them making fewer own experience (distracting) responses.

One non-hypothesized effect emerged: prompt responses (categorized as a supportive engaged response) demonstrated a pattern of effects opposite of hypotheses. Adolescents' higher resting RSA was associated with them providing and receiving fewer prompt responses.

Responses to Problem Statements in Relation to Subsequent RSA Reactivity

Prospective change actor partner interdependence models next examined whether receiving supportive engaged responses would be associated with subsequent RSA increases and receiving unsupportive disengaged responses would be associated with subsequent RSA decreases during the Problem Talk Task (H2). In these three-level models, adolescents were nested in dyads and the 32 30-second segments of RSA and responses to problems statements from the Problem Talk Task were nested in adolescents. Adolescents' RSA was the dependent variable. These models included several covariates: adolescents' resting RSA levels from the Resting Baseline II Task (i.e., pre-Problem Talk Task), adolescents' respiration from the previous 30-second segment, and adolescents' respiration from the current 30-second segment. To assess change in RSA from one segment to the next, adolescents' RSA from the previous 30-second segment was also included as a covariate.

Of primary interest were the effects of actor and partner responses to problem statements from the previous 30-second segment. A significant actor effect indicates that *making or providing* a response to friends is associated with subsequent (i.e., in the next 30 seconds) RSA reactivity. A significant partner effect indicates that *receiving* a response from friends is associated with subsequent RSA reactivity.

All variables were within-person centered for analyses, with one exception. Resting RSA was between-person centered.

Supportive engaged responses. Full model estimates for the supportive engaged composite and the individual supportive engaged responses for H2 are reported in Table 12. In the model examining the supportive engaged composite, there was a significant actor effect such that when adolescents provided supportive engaged responses to friends, they experienced RSA increases in the following segment, $b = 0.03$, $p < .001$.

Analyses next considered specific supportive engaged responses. Three specific supportive engaged responses showed the same pattern of effects as the composite, such that providing the responses to friends were associated with subsequent RSA increases: acknowledge ($b = 0.06$, $p = .009$), own experience (non-distracting) ($b = 0.04$, $p = .006$), and question (information) ($b = 0.07$, $p = .04$). For advice giving (you) responses, the actor effect was in the same direction as the supportive engaged composite, but the effect was marginally significant, $b = 0.05$, $p = .08$. One supportive engaged response showed the hypothesized partner effect. When adolescents' friends responded to their problem disclosure with add information responses, adolescents experienced subsequent RSA increases ($b = 0.03$, $p = .04$). Advice giving (I), opinion/commentary, prompt, question (encourage), and support/agree responses were not significantly nor marginally significantly associated with RSA reactivity.

Unsupportive disengaged responses. Full model estimates for the unsupportive disengaged composite and the individual unsupportive disengaged engaged responses for H2 are reported in Table 13. In the model examining the unsupportive disengaged composite, the effects of unsupportive disengaged responses on RSA reactivity were non-significant.

Analyses next considered the specific unsupportive disengaged responses. Receiving minimize responses from friends was associated with subsequent RSA decreases, $b = -0.21$, $p = .03$. Providing silence responses was associated with subsequent RSA increases ($b = 0.40$, $p = .001$) and receiving silence responses was marginally significantly associated with RSA increases ($b = 0.19$, $p = .09$). Change subject, non-support/disagree, and own experience (distracting) responses were not associated with RSA reactivity.

Summary of findings for responses to problem statements in relation to subsequent RSA reactivity. Findings provided mixed support for the hypothesis that receiving supportive engaged responses would be associated with subsequent RSA increases and receiving unsupportive disengaged responses would be associated with subsequent RSA decreases (H2). Analyses examining supportive engaged responses indicated that these responses were associated with subsequent RSA increases but results largely supported effects for *providing* rather than receiving supportive engaged responses. Analyses examining specific results indicated a similar pattern of effects for acknowledge, advice-giving (you), own experience (non-distracting), and question (information) responses. For add information responses, results supported H2 in that receiving add information responses was associated with subsequent RSA increases. For unsupportive disengaged responses, only one specific response supported hypotheses. Receiving minimize responses from friends was associated with subsequent RSA decreases.

Two non-hypothesized effects emerged. Unexpectedly, both providing and receiving silence responses (categorized as unsupportive disengaged) were associated with subsequent RSA increases.

RSA Reactivity in Relation to Responses to Problem Statements

Prospective change actor partner interdependence models next examined whether RSA reactivity was associated with adolescents' subsequent responses to problem statements (H3). It was expected that RSA increases would be associated with adolescents providing subsequent supportive engaged responses to friends. Specific hypotheses were not put forth for unsupportive disengaged responses.

Analyses were again conducted using three-level multilevel models in which adolescents were nested in dyads and the 32 30-second segments of RSA and responses to problems statements from the Problem Talk Task were nested in adolescents. Adolescents' responses to problem statements were the dependent variable. These models included covariates: adolescents' resting RSA levels from the Resting Baseline II Task (i.e., pre-Problem Talk Task), adolescents' respiration from the previous 30-second segment, and respiration from the current 30-second segment. To assess change in responses to problem statements from one segment to the next, adolescents' responses to problem statements from the previous 30-second segment was also included as a covariate.

Of primary interest were the effects of actor and partner RSA from the previous 30-second segment. A significant actor effect indicates that adolescents' RSA reactivity is associated with them *making or providing* subsequent (i.e., in the next 30 seconds) responses to friends. A significant partner effect indicates that adolescents' RSA reactivity is associated with them *receiving* subsequent responses from friends.

All variables were within-person centered for analyses except for resting RSA, which was between-person centered.

Supportive engaged responses. Full model estimates for the supportive engaged composite and the individual supportive engaged responses for H3 are reported in Table 14. In the model examining the RSA composite, RSA was not associated with adolescents providing subsequent supportive engaged responses.

Next, the specific supportive engaged responses were considered. Two responses supported hypotheses in that RSA increases were associated with adolescents making subsequent responses: add information ($b = 0.01$, $p = .02$) and advice-giving (I) ($b = 0.01$, $p = .02$). For some responses, the actor effect was in the hypothesized direction but was marginally significant: advice-giving (you) ($b = 0.01$, $p = .08$), prompt ($b = 0.003$, $p = .09$), question (encourage) ($b = 0.01$, $p = .09$), and support/agree ($b = 0.01$, $p = .07$). In two cases, the partner effect was significant, indicated that friends' RSA increases were associated with adolescents making the response: opinion/comment ($b = 0.01$, $p = .04$)

and question (information) ($b = 0.01$, $p = .02$). RSA reactivity was not associated with acknowledge, or own experience (non-distracting) responses.

Unsupportive disengaged responses. Full model estimates for the unsupportive disengaged composite and the individual unsupportive disengaged engaged responses for H3 are reported in Table 15. For the model examining the unsupportive disengaged composite, there was a marginally significant actor effect such that RSA increases were associated with subsequent unsupportive disengaged responses, $b = 0.01$, $p = .06$.

Next, analyses considered specific unsupportive disengaged responses. In the model examining silence responses, RSA increases were associated with adolescents both providing ($b = 0.003$, $p = .02$) and receiving ($b = 0.003$, $p = .02$) silence responses. RSA reactivity was not associated with change subject, minimize, nonsupport/disagree, or own experience distracting responses.

Summary of findings for RSA reactivity in relation to subsequent responses to problem statements. Findings generally supported the hypothesis that RSA increases would be associated with adolescents making subsequent supportive engaged responses (H3). Although the effect was not significant for the supportive engaged composite, RSA increases were significantly associated with adolescents making subsequent add information and advice-giving (I) responses and marginally significantly associated with advice-giving (you), prompt, question (encourage), and support/agree responses.

A few non-hypothesized effects were found. RSA increases were associated with adolescents receiving opinion/comment and question (information) responses (categorized as supportive engaged). RSA increases were also associated with adolescents providing and receiving silence responses (categorized as unsupportive disengaged).

RSA Coregulation and Responses to Problem Statements

Another set of three-level prospective change actor partner interdependence models examined hypotheses related to RSA coregulation. It was expected that adolescents' RSA in the previous 30-second segment would be positively associated with their friends' RSA in the subsequent 30-second segment (H4). In this model, adolescents' RSA was predicted from several covariates: resting RSA, respiration from the previous 30-second segment, respiration from the current 30-second segment, and RSA from the previous 30-second segment. Of primary interest, adolescents' RSA was also predicted from their friends RSA in the previous 30-second segment. This partner effect is also referred to as the *coregulation effect* in the results.

In addition, friends' responses to problem statements were expected to moderate the coregulation effect. Specifically, the coregulation effect was expected to be stronger when friends provided higher levels of supportive engaged responses in the previous segment and weaker when friends provided higher levels of unsupportive disengaged responses (H5). To test this possibility, actor and partner responses to problem statements from the previous 30-second segment were added as predictors to the above model that tested coregulation. Of primary interest, the interaction between the coregulation effect and partner responses to problem statements was tested to determine whether received responses to problem statements moderated the coregulation effect.

In all models, resting RSA was between-person centered and all other variables were within-person centered for analyses.

RSA Coregulation Between Friends. The full estimates for the model examining RSA coregulation are displayed in Table 16. In the model, the partner effect indicating coregulation was not significant.

Supportive engaged responses. Analyses next considered whether supportive engaged responses moderated the coregulation effect (H5). Full model estimates for the supportive engaged composite and the individual supportive engaged responses for H5 are reported in Table 17. In the model for the supportive engaged composite, the moderation effect was not significant.

Next, specific supportive engaged responses were considered as moderators of the coregulation effect. The interaction between support/agree and the coregulation effect was significant, $b = 0.12$, $p = .001$. To interpret the interaction, the coregulation effect was tested at high (+ 1 SD) and low (-1 SD) levels of support/agree responses. When friends provided higher levels of support/agree responses, the coregulation effect was significant, such that friends' higher levels of RSA in the previous segment were associated with adolescents' higher levels of RSA in the following segment, $b = 0.04$, $p = .046$. At lower levels of support/agree, the coregulation effect was significant, but in the opposite direction, such that friends' higher levels of RSA in the previous segment were associated with adolescents' lower levels of RSA in the following segment, $b = -0.05$, $p = .01$. The interaction is displayed in Figure 5.

None of the other individual supportive engaged responses emerged as significant moderators of the coregulation effect.

Unsupportive disengaged responses. The next set of analyses consider whether unsupportive disengaged responses moderated the coregulation effect (H5). Full model estimates are displayed in Table 18. The unsupportive disengaged composite did not moderate the coregulation effect. Similarly, none of the specific unsupportive disengaged responses were significant moderators of the coregulation effect.

Summary of findings for RSA coregulation and responses to problem statements. Findings did not support H4 that friends would demonstrate RSA coregulation such that one friend's RSA reactivity would be associated with the other friend's RSA reactivity in the next 30-second segment. Overall, findings also did not support that supportive engaged responses would strengthen the coregulation effect and that unsupportive disengaged responses would weaken the coregulation effect (H5). Nonetheless, there was one notable exception. Support/agree responses significantly moderated the coregulation effect, such that when friends provided higher levels of support/agree responses, their RSA increases were associated with RSA increases in their friend in the next 30-second segment. In contract, when friends provided low levels of support/agree responses, the coregulation effect was negative, such that one friend's RSA increases were associated with the other friend's RSA decreases in the next 30-second segment.

Gender Differences

To test for potential gender differences, gender (coded 0 = girls, 1 = boys) was added to the above models as a main effect and as an interaction term with the effects of interest.

Gender differences in resting RSA and responses to problem statements. Gender was not expected to significantly affect the relation between resting RSA and responses to problem statements (H6). Consistent with this hypothesis, there were no gender differences in the association between resting RSA and the supportive engaged composite nor in any of the specific supportive engaged responses. The main effect of gender was significant, however, for the supportive engaged composite (b = -12.07, p = .02) and support/agree responses (b = -2.18, p = .01), with girls providing more of these responses than boys did. These main effects demonstrated a similar pattern as the bivariate correlations described above.

For unsupportive disengaged responses, there were no significant gender effects in the unsupportive disengaged composite model nor for nonsupport/disagree, minimize, and silence responses. For change subject responses, the main effect of gender was significant such that girls made more change subject responses than boys did, b = -0.56, p= .02. In the own experience (distracting) model, the interaction between the partner effect and gender was significant, b = 0.49, p = .04. The individual simple slopes did not reach significance for boys or girls, but indicated that the effect of partner RSA on adolescents' provided own experience (distracting) responses was in opposite directions for boys (b = 0.32, p = .12) and girls (b = -0.16, p = .12).

Gender differences in responses to problem statements and subsequent RSA reactivity. Gender differences were expected in the association between responses to problem statements and RSA reactivity such that the effect was expected to be stronger for girls than boys (H7).

Analyses examining the supportive engaged responses did not support gender difference hypotheses. None of the gender effects were significant in the models examining the supportive engaged composite or the majority of the specific supportive engaged responses. One gender effect was significant: in the model examining own experience (non-distracting) responses, the interaction between the partner effect and gender was significant, *b* = 0.10, *p* = .01. Simple slopes examining the effects separately for boys and girls. Contrary to hypotheses, these analyses indicated that for girls, receiving own experience (non-distracting) responses was associated with RSA decreases (*b* = -0.04, *p* = .04) whereas for boys, receiving own experience (non-distracting) responses was associated with RSA increases (*b* = 0.06, *p* = .04).

Analyses examining unsupportive disengaged responses found limited support for H6. In the models examining the unsupportive disengaged composite, the gender effects were nonsignificant. Two specific unsupportive disengaged responses had significant gender effects. First, in the model examining nonsupport/disagree responses, the interaction between gender and the partner effect was significant, *b* = 0.25, *p* = .03. Simple slopes analyses tested the partner effect separately for girls and boys. For girls, receiving nonsupport/disagree responses was associated with RSA decreases (*b* = -0.25, *p* = .02) whereas, for boys, nonsupport/disagree responses were unrelated to RSA reactivity (*b* = 0.003, *p* = .94). Second, the interaction between gender and the actor effect was significant in the model examining silence responses, *b* = 0.63, *p* = .01. For girls, providing silence responses was unrelated to RSA reactivity, *b* = 0.22, *p* = .11. For boys, providing silence responses was associated with RSA increases, *b* = 0.86, *p* < .001. Gender effects were not significant in the models examining change subject, minimize, or own experience distracting responses.

Gender differences in RSA reactivity and subsequent responses to problem statements. Gender differences were not expected in the association between RSA reactivity and subsequent responses to problem statements (H8). Analyses were consistent with hypotheses. None of the gender effects were significant in any of the models tested.

Gender differences in RSA coregulation. Gender differences were expected in the coregulation models such that the coregulation effect would be stronger for girls than boys (H9) and that the effect of behaviors on coregulation would be stronger for girls than boys (H10). Contrary to hypotheses, the hypothesized gender effects were not significant in the model examining coregulation nor in the models examining supportive engaged responses and unsupportive disengaged responses as moderators of coregulation.

Summary of gender difference findings. Overall, few gender differences emerged in analyses, providing little support for gender difference hypotheses (H6-H10). As hypothesized (H6), gender differences did not emerge in the association between resting RSA and responses to problem statements. The one exception was own experience (distracting) responses, although the individual slopes for girls and boys did not reach significance.

Findings largely did not support that the effect of responses to problem statements on RSA reactivity would be stronger for girls than boys (H7). Only one gender difference was in the hypothesized direction: receiving nonsupport/disagree responses was associated with RSA decreases for girls, but not for boys. Other, non-hypothesized, gender differences emerged in models examining responses to problem statements and subsequent RSA reactivity. Receiving own-experience (non-distracting) responses was associated with RSA increases for boys and RSA decreases for girls. Providing silence responses was associated with RSA increases for boys, but not girls.

No gender differences emerged in the association between RSA reactivity and subsequent responses to problem statements, supporting H8. Findings did not support H9 and H10 in that no gender differences were found in the RSA coregulation effect or in the effect of responses to problem statements on RSA coregulation.

Chapter 4: Discussion

The current study addresses a critical gap in the literature by providing initial evidence for links between vagal tone (indexed using RSA) and adolescents' behaviors within the developmentally significant context of close friendship interactions. Results indicate that adolescents with a better capacity for individual self-regulation (i.e., higher levels of resting RSA) receive more supportive and engaged responses from friends when they disclose problems. During disclosure interactions, providing friends with support was associated with calming, positive physiological responses (i.e., RSA increases), and in turn, calming, positive physiological responses were associated with adolescent providing friends with support. In addition, friends demonstrated RSA coregulation when their interactions were characterized by high levels of empathetic, validating responses to problem disclosures. Altogether, these findings align with theoretical perspectives (Porges, 1995; 2009) that vagal tone has important implications for close relationship functioning and provide a strong foundation for future research examining the role of physiological functioning in adolescents' social development.

Resting RSA Activity and Behaviors During Problem Talk

Resting RSA activity was expected to be associated with adolescents' making more supportive engaged responses to friends and fewer unsupportive disengaged responses because resting RSA is a purported biomarker for emotional self-regulation (Beauchaine, 2015) and has been linked to better relationship functioning (e.g., Diamond & Cribbet, 2013; Kok & Frederickson, 2010). Consistent with hypotheses, resting RSA was linked to higher levels of supportive engaged responses. However, results indicated that adolescents with higher levels of resting RSA *received* more supportive engaged responses from friends. In contrast, adolescents' resting RSA was not related to them *providing* supportive engaged response to friends. Resting RSA was associated with adolescents making fewer own experience (distracting) responses to friends providing limited support for hypotheses regarding unsupportive disengaged responses.

Although hypotheses did not focus on partner effects (i.e., the extent that adolescents received support), the finding that adolescents with higher levels resting RSA activity are the recipients of more supportive engaged behaviors is consistent with theory and past empirical findings. The study of Gene X Environment correlations (*r*GE) proposes that several processes through which genes and environment work together to influence development. Through evocative *r*GE processes, individuals' genetic predispositions elicit reactions from social partners (Knafo & Jaffee, 2013; Plomin et al., 1977). As noted, resting RSA activity is generally thought to be a trait-like measure that stabilizes by adolescence (Dollar et al., 2020) and reflects individual capacity for self-regulation (Beauchaine, 2015). In the context of the current study, it is possible that adolescents with higher levels of resting RSA actively elicited more supportive engaged responses from their friends by disclosing about problems in a socially competent and regulated manner during the interaction. Similarly, throughout the history of the friendship, adolescents with higher resting RSA may have behaved in ways that elicit more supportive behaviors from their friends across contexts, including problem talk.

Indeed, studies examining resting RSA activity within dyadic relationships support that individuals' resting RSA activity are related to their partners' behaviors during interactions and their partners' perception of the relationship. In addition to displaying higher levels of warmth themselves, adolescents with higher levels of resting

RSA activity were the recipients of higher levels of warmth from their mothers during a conflict discussion (Diamond & Cribbet, 2013). Further, when women's partners had higher levels of resting RSA, the women reported higher levels of relationship satisfaction (Geisler & Schroder-Abe, 2015). Although there is a dearth of research examining youths' resting RSA in relation to how peers and friends perceive and respond to them, there is substantial research indicating that youth with better emotion self-regulation (assessed using survey measures) have higher levels of peer acceptance, indicating that they are perceived more positively by peers (Blair et al., 2015; Blandon et al., 2010; Kim & Cicchetti, 2010).

Future work is needed to clarify the mechanisms through which higher levels of resting RSA are linked to relationship partners' more positive interaction behaviors. Although adolescents' resting RSA was not associated with their responses to friends' problem statements, the current study did not examine adolescents' resting RSA in relation to their own disclosure behaviors. Thus, an unexplored possibility is that adolescents with higher levels of resting RSA disclosed problems in ways that elicited more supportive engaged responses from friends. Past work indicates that relationship partners' disclosures may encompass a wide variety of behaviors, some of which are linked with better relationship outcomes and others with relationship difficulties (Coyne, 1976a, 1976b; Joiner, 1999; Starr & Davila, 2008). Youth who have difficulties with emotional self-regulation are more likely to engage in maladaptive behaviors such as conversational self-focus (i.e., redirection of the conversation to oneself), excessive reassurance-seeking (i.e., repetitive confirmation of others' care or liking), and negative feedback-seeking (i.e., soliciting confirmation of one's own negative self-perception;

Schwartz-Mette et al., 2021). Exploring whether adolescents with higher levels of resting RSA engaged in fewer maladaptive behaviors during their own disclosures, therefore eliciting more positive responses from their friends, will be an important step for future studies.

One finding from the current study supports the possibility that adolescents with higher resting RSA might disclose in more socially competent and regulated ways. Adolescents' higher resting RSA activity was associated with them using fewer responses to their friends that involved sharing their own experiences in ways that distracted from their friends' disclosures. Such behaviors might overlap with conversational self-focus, a disclosure behavior that has been linked to poor emotional self-regulation (Schwartz-Mette et al., 2021) and friendship difficulties (Schwartz-Mette & Rose, 2009; 2016). It is important to note, however, that this finding was the only significant actor effect out of many tested and should be interpreted with caution.

It is also important to consider why the current study did not find significant associations between adolescents' resting RSA and their responses to friends' problem statements. The lack of findings is inconsistent with other work demonstrating links between resting RSA and more positive social behaviors during dyadic interactions (Diamond & Cribbet, 2013; Geisler & Schroder-Abe, 2015). Notably, however, there are other studies reporting null effects between resting RSA levels and social outcomes (e.g., Kalvin et al., 2016; Tu et al., 2017) or that indicate resting RSA has an interactive effect on adolescent adjustment rather than a main effect (e.g., Cai & Tu, 2020; McLaughlin et al., 2015). Another possibility is that resting RSA has a small effect on adolescents' own social behaviors, which the current study was underpowered to detect. Additional work with a larger sample size is needed to clarify the effect of resting RSA on adolescents' responses to friends.

Behaviors During Problem Talk and RSA Reactivity

Given theoretical work that proposes RSA should increase in the context of positive interactions with close relationship partners (Porges, 2009) and empirical evidence that RSA increases in positive interaction contexts (Schwerdtfeger & Friedrich-Mai, 2009; Smith et al., 2009), we hypothesized that adolescents would experience RSA increases after receiving supportive engaged responses from friends. In contrast to predictions, results indicated that *providing* rather receiving supportive engaged responses was associated with subsequent RSA increases. Add information responses were the only supportive engaged responses that supported hypotheses, in that receiving the response was associated with subsequent RSA increases.

Additional research is needed to determine why providing rather than receiving supportive engaged responses was associated with RSA increases. If RSA increases in the context of social interactions indeed reflect feelings of calm, positive affiliation (Porges, 2009), results would indicate that providing support to friends is a particularly positive experience. This finding is consistent with research examining affective responses to prosocial behaviors. Engaging in prosocial behaviors has generally been linked to experiencing positive affect (Adcock et al., 2021; Snippe et al., 2018) and even better physiological stress recovery (Lazar & Eisenberger, 2021). Recent work also indicates that engaging in supportive, prosocial behaviors towards friends (e.g., helping them out; making them feel as though their thoughts and feelings are important) was associated with more positive daily mood even when accounting for support received from friends. Further, in this study, provided support but not *received* support was associated with daily positive mood (Schacter & Margolin, 2019).

The lack of findings regarding the link between receiving supportive engaged responses from friends and subsequent RSA increases merits further investigation. The friends' perception of adolescents' behaviors could be an important consideration. Several responses in the current study were coded as being supportive engaged responses and past studies have linked such responses to increased friendship closeness (Rose et al., 2016). Nonetheless, there may be variation in the extent to which supportive engaged responses are *perceived* as supportive within the context of problem disclosures to friends. For example, advice given to a friend, although intended to be supportive, might be unwelcome to a friend who is looking for validation and understanding. Similarly, received validation and understanding might not be well-received if it is perceived to be insincere. Adolescents' perceptions of support during the interaction could be an important moderator of the link between received support and RSA reactivity.

It is also important to note that adolescents received support within the context of disclosing about personal problems that may have been upsetting to them. As such, their own emotional reaction to their problem might have overridden positive physiological responses to received support. In fact, past work has linked behaviors during problem disclosures to friends to physiological stress responses (Byrd-Craven et al., 2011) as well as negative mood (White & Shih, 2012). To address this possibility, adolescents' perceptions of their problem's severity as well as their subjective emotional response to the interaction could be additional moderators to consider in evaluating the relation between received support and RSA reactivity.

Only one supportive engaged response supported hypotheses. When adolescents received add information responses from their friends in response to problem disclosures, they experienced subsequent RSA increases. Given the number of analyses conducted and lack of findings for all other supportive engaged responses, it is possible that this finding was spurious. In particular, there is a lack of theoretical and empirical support for why *add information* responses would be associated with RSA increases over the other supportive engaged responses.

Regarding unsupportive disengaged responses, we expected that receiving such responses would be associated with RSA decreases given past work documenting RSA decreases in response to challenges or stressors (e.g., Cui et al., 2019; Shahrestani et al., 2015). Only one response demonstrated the hypothesized pattern of effects. When adolescents' friends responded to their problem statements by minimizing the problem, adolescents experienced subsequent RSA decreases. As with the supportive engaged responses, adolescents' perceptions of the received unsupportive disengaged responses might have contributed to the lack of findings. It is also important to note that unsupportive disengaged responses were rare (n = 467; M = 2.4) in comparison to supportive engaged responses (n = 5,009; M = 26.1), which may have made it more difficult to detect significant effects.

A potential fruitful avenue for future work will be to consider individual variation in adolescents' RSA reactivity to receiving supportive or unsupportive responses from friends. In particular, considering variability in RSA reactivity may be especially important for unsupportive disengaged responses. RSA withdrawal (i.e., decreases) are the expected, adaptive response when faced with a stressor or challenge (Beauchaine, 2001; Shahrestani et al., 2015). Thus, this pattern of physiological responding to unsupportive disengaged responses might indicate that youth are regulating appropriating in response to a potential friendship conflict. Youth who do *not* demonstrate RSA withdrawal in response to unsupportive disengaged responses might have regulatory difficulties that could be linked to poorer outcomes over time (e.g., Erath & Tu, 2014). Supplementary analyses were conducted to examine variability in adolescents' RSA reactivity in response to unsupportive responses from friends by extracting an individual regression coefficient for each adolescent (RSA predicted from unsupportive responses in the previous segment). Result indicated that the effect of unsupportive responses from friends on subsequent RSA reactivity ranged from b = -11.19 to 23.62 (M = 0.70, SD = 4.93). Whether this variability in RSA is predictive of later adjustment will be an important question for future work.

Regarding variability in RSA reactivity to supportive engaged responses, it is possible that some youth might find such responses from friends to be especially comforting and calming and experience RSA increases. Other youth might be less reactive to friendship support. If this is the case, those youth that experience RSA increases in response to support from friends might experience more positive outcomes over time (e.g., increased friendship quality). As with unsupportive responses, supplementary analyses considered individual regression coefficients for each adolescent (RSA predicted from supportive responses in the previous segment). The effect of supportive responses on subsequent RSA reactivity ranged from b = -4.42 to 8.75 (M = 0.06, SD = 0.76). Again, additional work is needed to determine whether variability in adolescents' RSA reactivity to friendship support has meaningful implications for adolescent adjustment.

RSA Reactivity and Behaviors During Problem Talk

Hypotheses also addressed whether RSA was associated with subsequent behaviors. It was expected that higher levels of RSA would be associated with adolescents providing supportive engaged responses to friends because higher levels of RSA might indicate that adolescent is in a positive affective state (Porges, 2009). The results generally supported the hypotheses, with higher RSA being associated with the majority of individual supportive engaged responses either significantly or marginally significantly, although the association with the composite was not significant. In terms of unsupportive disengaged responses, specific predictions were not made given that RSA decreases might indicate either a stress response or active engagement with a challenge (Beauchaine, 2001; Diamond & Cribbet, 2013). Results indicated that RSA reactivity was not associated with unsupportive disengaged responses.

Results regarding supportive engaged responses suggest that being in a calm, positive physiological state may be important for adolescents' ability and/or willingness to provide their friends with support in the context of problem disclosures. Although the majority of past research considers the opposite direction of effect (i.e., how friendship support relates to physiological reactivity and/or mood), recent work using daily diary designs also provides support for this possibility. This research indicates that adolescents provide more support to friends on days that they demonstrate patterns of cortisol responses that correspond with better physiological regulation (Armstrong-Carter & Telzer, 2021a) and provide family members with instrumental support on days they had gotten more sleep (Armstrong-Carter & Telzer, 2021b). Altogether, there is growing evidence for the importance of adolescents' physiological state for their functioning within close relationships.

An important next step for this work will be to explore integrate analyses that examine associations between RSA reactivity and supportive engaged behaviors. Although analyses were conducted separately in the current study to examine associations between behaviors and subsequent RSA reactivity and RSA reactivity and subsequent behaviors, together the findings suggests that reciprocal associations exist. That is, higher levels of RSA predict supportive engaged responses and supportive engaged responses predict higher levels of RSA. Altogether, these finding provide insights into the dynamics of how physiology and behaviors work together to support positive friendship interactions.

RSA Coregulation and Problem Talk Behaviors

It was expected that friends would demonstrate RSA coregulation during their problem talk interactions and that behaviors during problem talk would moderate the strength of coregulation. Results indicated that overall, friends did *not* demonstrate coregulation in that one friend's RSA was unrelated to the other friend's RSA in the next thirty seconds. The nature of coregulation, however, was moderated by the amount of support/agree responses received from the friend such that friends exhibited positive coregulation at higher levels of support/agree responses and negative coregulation at lower levels of support/agree responses.

The lack of findings regarding coregulation were unexpected. One potential explanation for why we did not find significant effects for coregulation in the overall sample may be that there is variation in the extent to which friends demonstrate RSA coregulation. As with the effects of behaviors on RSA reactivity, supplementary analyses were conducted to compute separate regression coefficients for the extent to which each adolescents' RSA was associated with their friends' RSA from the previous segment. The regression coefficient indicating coregulation ranged from b = -1.04 to 1.06 (M = 0.01, SD = 0.25), indicating that extent to which dyads exhibited coregulation ranged from negative coregulation, to no coregulation, to positive coregulation. This finding is consistent with other work that has examined RSA coregulation in mother-adolescent dyads. One study found no evidence of mother-adolescent coregulation overall, but that the coregulation coefficient range from negative to positive. Positive coregulation was associated with lower internalizing symptoms (Oshri et al., 2021). Other studies have found that mothers and adolescents only demonstrate coregulation when parents had low levels of marital conflict (Liu et al., 2020) and when mothers had low levels of depressive symptoms (McKillop & Connell, 2018). It may be the case that coregulation only occurs in positive relationship contexts.

Indeed, a critical hypothesis in the current study was that the amount of supportive engaged and unsupportive disengaged responses would affect the extent to which adolescent friends demonstrated coregulation. Although supportive engaged responses altogether (i.e., the composite) were not significant moderators, support/agree responses significantly moderated the coregulation effect such that friends exhibited positive coregulation at high levels of support/agree responses. This finding needs to be replicated in future studies given that it was the only significant moderator out of several responses tested. Nonetheless, individual responses were tested because it was expected that some responses might be more influential than others. In particular, support/agree responses are responses that involve *explicitly agreeing with and validating the friend.* Such responses may have been especially relevant to the hypothesis that supportive engaged responses would increase coregulation because they may be perceived as sensitive, increasing feelings of connection to the friend. In contrast, other supportive engaged responses may be more ambiguous. For example, opinion/comment responses are engaged and relevant to the problem, but are neutral in valence (e.g., "I don't know"; "That's strange").

If replicated in future work, findings regarding RSA coregulation and support/agree responses to problem statements have important implications for adolescents' friendship adjustment and general well-being. Coregulation within close relationships is proposed to be an adaptive process that contributes to better adjustment outcomes (Beckes & Coan, 2011; Feldman, 2012; Timmons et al., 2015) and growing empirical evidence supports this possibility (e.g., Helm et al., 2014; McKillop & Connell, 2018; Oshri et al., 2021). If RSA coregulation is indeed an adaptive process, then support/agree responses might be an important behavior to target in interventions aimed at improving adolescents' close relationships. Teaching adolescents to respond to friends' disclosures with empathy and validation, compared to other responses (e.g., questions, sharing a related experience), could help adolescents foster connection and better relationship quality within their close friends. Of course, a critical next step will be to determine whether support/agree responses and RSA coregulation are linked with better social and emotional outcomes over time.

The Role of Gender in Problem Talk Behaviors and Physiological Responding

Several gender differences were hypothesized, but few significant findings emerged. Specifically, it was expected that girls would demonstrate a stronger association between RSA reactivity and problem talk behaviors than boys and that girls would demonstrate stronger coregulation than boys. Problem talk behaviors were also expected to more strongly affect the extent to which girls experienced coregulation compared to boys.

Only one response to problem statements supported hypotheses. Non-support/disagree responses were related to RSA reactivity for girls, but not boys, such that when friends responded to problem statements with nonsupport/disagree responses, girls experienced RSA decreases. This finding should be interpreted with caution, given the number of gender differences tested and the lack of other significant findings. In addition, non-support/disagree responses were rare – only 54 non-support/disagree responses were recorded, produced by only 19 of the adolescents. Consistent with past work (Rose et al., 2016), such responses were also less common within girls' conversations compared to boys' conversations. It is possible that girls' RSA withdrawal in response to friends' rare, explicitly unsupportive responses to problem disclosures represent active engagement or coping with a stressor (e.g., Obradovic et al., 2010; Porges, 2009). This would be consistent with work indicating that girls endorse more active, supportive strategies in response to friendship conflict whereas boys report more disengaged strategies (e.g., avoidance, denial; Glick & Rose, 2011; Rose & Asher, 2004). Regardless, the finding needs to be replicated in future work.

Additional research is needed to determine why gender differences did not emerge in the associations among friends' responses to problem statements, RSA reactivity, and RSA coregulation despite theoretical justification for hypotheses. One possibility is that, despite mean-level gender differences in problem talk behaviors, the significance of such behaviors for RSA reactivity and coregulation are similar for boys and girls. This possibility would be consistent with past work indicating that supportive engaged responses predicted increases in emotional closeness within friendships for both boys and girls (Rose et al., 2016). Indeed, other work on adolescent friendships has also found that despite mean-level differences in friendship behaviors, the significance of friendship behaviors for adjustment is similar for boys and girls (e.g., Rose & Asher, 2004; Spendelow et al., 2017). Alternatively, it may be the case that gender differences exist, but the current sample was underpowered to detect them. In particular, boys were underrepresented in the sample (33%; n = 66) compared to girls (67%; n = 134). A larger sample, balanced in terms of gender, is needed in future work to better detect gender differences.

Limitations

The current study had limitations that should be noted. Several limitations pertain to the sample. As mentioned, the sample was imbalanced in terms of gender such that there were more girls than boys in the sample and may have been underpowered to detect the hypothesized gender differences. In addition, the sample was relatively homogenous in terms of the racial composition and socioeconomic background. Specifically, the majority of the sample reported a White, middle-class background. This lack of diversity reflects other work in the peer relations literature and psychological research in general

(Graham & Echols, 2018; Roberts et al., 2020). Adolescents' racial identities and/or sociocultural contexts could affect their behavioral and physiological responses during their friendship interactions. For example, recent work highlights that support from same-race friends might be especially protective for racial minority youth (Derlan & Umaña-Taylor, 2015; Davis & High, 2019; Medina et al., 2019). Replicating the findings of the current study with a larger, more diverse sample will be critical for increasing the generalizability of the results and exploring how youths' identities and sociocultural contexts affect the physiological and behavioral dynamics of their friendship interactions.

Next, although nearly all adolescents (with the exception of n = 1) provided and received supportive engaged responses from friends in response to problem disclosures, fewer adolescents provided and received unsupportive disengaged responses (70%; n = 142 adolescents). This number is diminished substantially when the more explicitly unsupportive responses are considered (i.e., minimize: n = 20 adolescents; nonsupport/disagree: n = 19 adolescents). Given the rarity of these responses, the analyses were likely underpowered to detect significant effects for hypotheses regarding unsupportive disengaged responses. This limitation could be addressed in future work with a larger sample that increases the variability of behaviors that occur within friends' problem talk interactions (e.g., Rose et al., 2016). It is also probable that unsupportive behaviors would occur more frequently within other peer relationship types (e.g., a classmate or unfamiliar peer versus a best friend; Newcomb & Bagwell, 1995) or other interaction contexts (e.g., a conflict discussion; Abuhatoum et al., 2019).

The current study was also limited in considering a single autonomic physiological measure. In the current study, RSA was used as a measure of parasympathetic nervous system functioning. Incorporating sympathetic nervous system measures (e.g., skin conductance) into analyses would provide a more holistic picture of adolescents' physiological functioning or arousal. For example, in the current study, RSA increases were interpreting as being indicative of decreased arousal and therefore a more calm, positive affective state (e.g., Porges, 2009). Other work suggests, though, that this may only be the case when RSA increases are also accompanied by decreases in skin conductance reactivity. Likewise, RSA decreases may only be indicative of increased arousal when accompanied by increases in skin conductance reactivity (Murray-Close et al., 2017; see also Keller & El-Sheikh, 2009).

Future Directions

The findings from the current study make an important contribution by establishing that adolescents' physiological responses and support behaviors in the context of friendships are interrelated. This work lays the foundation for future research. Next steps will include a more nuanced statistical investigation of RSA coregulation, a wider assessment of friendship behaviors, and linking physiological responses during friendship interactions to adolescents' individual physiological regulation.

An important next step for examining physiological coregulation will be to employ more nuanced analyses that integrate RSA reactivity and coregulation. In the current study RSA coregulation was defined as lagged associations between friends' RSA while accounting for previous levels of RSA. Other work has proposed at least two patterns of coregulation between relationship partners. Morphostatic coregulation has been defined as linkage between partners that results in net stability whereas morphogenic coregulation refers to linkage that results in net arousal (Butler & Randall, 2013). Although in the current study, coregulation was presumed to be an adaptive process, if coregulation patterns are morphogenic they could contribute to negative outcomes for relationship partners. Recent advances in statistical approaches to examining coregulation permit the examination of both linkage and net change simultaneously. In addition, such approaches allow researchers to identify different patterns of coregulation within the sample (Butler & Barnard, 2019; Kuelz et al., 2022). It will be important in future work to both determine whether friendship support in response to problem disclosures contributes to adaptive (i.e., morphostatic) coregulation and whether there is variability in the types of coregulation friends demonstrate within the sample.

It will also be critical in future work to consider how other behaviors within the context of problem talk may affect RSA coregulation. In particular, over the past two decades, substantial research has accumulated on co-rumination within relationship partners' problem talk (for a review, see Rose, 2021). Co-rumination involves extensive, repetitive conversations that involve speculating about the causes and consequences of problems, dwelling on negative emotions, encouraging additional problem talk, and rehashing problems over and over (Rose, 2002). When friends engage in co-rumination, they experience both higher levels of friendship quality (e.g., Calmes & Roberts, 2008; Felton et al., 2019; Rose et al., 2007) but also higher internalizing difficulties (e.g., Hankin et al., 2018; Rose et al., 2007; Miller-Slough & Dunsmore, 2021; Schwartz-Mette & Rose, 2012). Physiological coregulation between friends could be a mechanism linking co-rumination to positive relationship quality. Further, it is likely that co-rumination will be linked to patterns of coregulation that result in increased physiological arousal for both friends (i.e., morphostatic processes; Butler & Randall, 2013), which may help explain co-rumination's link to increased internalizing symptoms.

As discussed, adolescents' own disclosure behaviors could also be important to consider in relation to their physiological responses during problem talk. Researchers have found that adolescents who experience elevated levels of depressive symptoms are more likely to engaged in aversive behaviors during friend interactions that ultimately lead to decreases in relationship quality and interpersonal rejection (e.g., Prinstein et al., 2005; Schwartz-Mette & Rose, 2016). Specifically, adolescents' excessive reassurance seeking (i.e., repeatedly asking for validation that one is liked; Prinstein et al., 2005), negative feedback seeking (i.e., soliciting criticisms from others; Borelli & Prinstein, 2006), and conversational self-focus (i.e., constantly turning the conversation to focus on oneself; Schwartz-Mette & Rose, 2016) might be linked to friends' RSA reactivity (i.e., withdrawal). In turn, friends' RSA reactivity in response to such behaviors might be linked to decreases in positive friendship quality and increases in friendship rejection (i.e., behavioral withdraw from the friend).

Future work is also needed to better understand interrelations between adolescents' individual physiological regulation and their behaviors and physiological responses during friendship interactions. In the current study, we considered adolescents' resting RSA activity as a biomarker for their capacity for individual self-regulation (Beauchaine, 2015). Although resting RSA activity is generally considered to be a stable, trait-like measure (Dollar et al., 2020), other work has linked positive interaction behaviors to increases in resting RSA activity over time (Diamond & Cribbet, 2013). In the current study we found that adolescents' resting RSA activity is related to them receiving more supportive engaged responses from friends in response to problem disclosures. A question for future work is whether supportive engaged responses from friends also contribute to increases in adolescents' resting RSA activity over time. Relatedly, although RSA reactivity was considered in the current study within the context of friendship interactions, including a measure of adolescents' RSA reactivity in response to a standardized task in future work (e.g., star-tracing task, LaFayette Instrument Company, Lafayette, IN; see Tu et al., 2017) could help clarify how adolescents' individual physiological regulation relates to their behavioral and physiological responses during friendship interactions.

Conclusions

By considering how vagal tone relates to adolescents' behaviors during friendship interactions, the current study addressed a critical gap in the literature. Findings indicated that adolescents' resting RSA activity and RSA reactivity are associated with the extent that they provide and receive support within the context of problem disclosures with close friends. In addition, initial evidence indicates that adolescent friends demonstrate RSA coregulation when friends provide many empathetic, validating responses to problem disclosures. Altogether, these findings have potential to unveil targets behavioral and physiological for interventions aimed at improving adolescents' socioemotional well-being and provide a foundation for future work on the psychophysiology of friendship interactions.

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Table 1

Demographic Characteristics of Sample

Variable	Total		
Gender			
Boy	66 (33%)		
Girl	134 (67%)		
Race			
White	158 (79%)		
Asian or Asian American	7 (4%)		
Black or African American	13 (7%)		
Biracial	18 (9%)		
Asian or Asian American & White	8 (4%)		
Black or African American & White	4 (2%)		
American Indian & White	6 (3%)		
Multiracial	3 (2%)		
Ethnicity			
Not Hispanic/Latino	195 (95%)		
Hispanic/Latino	10 (5%)		
Parents in Household			
Two Parents	163 (82%)		
Mother Only	31 (16%)		
Father Only	4 (2%)		
Mother Education			
High School or Less	3 (2%)		
High School Graduate	4 (2%)		
College or College Graduate	120 (60%)		
Graduate or Professional School	62 (31%)		
Unsure	9 (5%)		
Father Education			
High School or Less	6 (3%)		
High School Graduate	15 (8%)		
College or College Graduate	104 (52%)		
Graduate or Professional School	46 (23%)		
Unsure	10 (5%)		
Date of Participation			
Before March 2020	146 (73%)		
After June 2020	54 (27%)		
	Range	*M* (*SD*)	*Mdn*
Age (Years)	12-16	14.16 (1.48)	14
Girls	12-16	14.18 (1.05)	14
Boys	12-16	14.11 (0.95)	14

Table 2

Examples of Behavioral Coding Variables

	Description	Examples
Supportive Engaged		
Acknowledge	Verbalization that simply acknowledges that the speaker has been heard; this verbalization is likely to convey that the listener is paying attention and waiting for the speaker to go on.	A: *Because like, you know we were pretty good friends.* B: **Uh-huh.** A: *I mean like, she thought I was one of her better, like best friends.* B: **Yeah.**
Add Information	Verbalization that provides additional factual information related to the general problem topic. The information is new to the conversation (or an expansion on information previously stated).	A: *You know what I'm saying? Like why would you differentiate them like that?* B: **Yeah it's so much violence about it too! Like people getting beat up on the streets and stuff.**
Advice-Giving (I)	Verbalization that involves giving advice in the form of telling what the speaker would do in the situation.	B: *I'll figure it out.* A: **But yeah, I'd probably just take Honor's Geometry.**
Advice-Giving (You)	Verbalization that involves giving advice in the form of directly saying what the listener should do.	B: *And so I feel bad if I just ignore him.* A: **You just got to be nice. If he wants, if he starts talking about it and he asks about it just give him the happiest answer you can give.**

Table 2

Continued

	Description	Examples
Opinion/Comment	Verbalizations related to the problem that do not fit into one of the other categories, including verbalizations that give one's own opinion about the problem but cannot be coded into another category because they are relatively neutral in valence.	A: *And apparently JT and (inaudible name) broke up?* B: **I don't know. That was weird.**
Own Experience (ND[a])	Verbalization on the general problem topic that is about the speaker's own experience. This will be coded as non-distracting if it seems that the speaker is not trying to draw attention away from the other person's problems.	B: *I keep trying to ditch him and every time I feel guilty.* A: **Yeah I did that once.**
Prompt	Verbalization that explicitly encourages speaker to say more about their problem.	A: *Now I can think of a personal problem.* B: **Ooh, tell me, tell me!**
Question (Encourage)	Verbalization that asks a question that provides encouragement to the speaker to keep talking, or to repeat what was just said.	B: *I have English for the whole year.* A: **Really?**
Question (Information)	Verbalization that asks a question requesting more information.	A: *Um yeah me and Rachel used to be friends and she got mad at me because I couldn't hang out because I had to watch my brother and –* B: **When was this?**

Table 2

Continued

	Description	Examples
Support/Agree	Verbalization that explicitly conveys support or that conveys agreement with the speaker.	B: *And then she left and we haven't talked since. So Megan and I aren't friends anymore.* A: **I'm sorry.**
Unsupportive Disengaged		
Change Subject	Verbalization that changes the subject away from the general problem topic.	B: *We gotta keep our goals in mind, but still have fun.* A: **((singing Baby One More Time)) My loneliness, is killing me and I**
Minimize	Verbalization that conveys that the listener believes that the problem is less important than the speaker is portraying it to be. The tone of minimizations is negative.	A: *Uhm so as you know, October 5th my grandfather passed away.* B: **That's it?**
Nonsupport/Disagree	Verbalization that is explicitly non-supportive.	B: *So my problem is that I feel like I'm too scared that I won't do good in high school and I won't be able to graduate. I feel like I won't study enough and be too stressed to do anything.* A: **That's stupid.**

Table 2

Continued

	Description	Examples
Own Experience (D[b])	Verbalization on the general problem topic that is about the speaker's own experience. This will be coded as distracting if it seems that the speaker to trying to draw the attention away from the other person's problems.	B: *It's just my mom is stressing out. It's just making me stressed out. It's like calm down it's fine. I don't know.* A: **Yeah well my mom's stressed too because she had to take care of some legal stuff and we had to travel overseas… And I forgot to text you and I felt really bad and was like…okay I have an emergency trip gotta go!**
Silence	This code is used when there is no response from the listener, and the listener's silence is accompanied by a break in the conversation from the speaker.	B: *I want to lose weight because I feel fat.* A: **(pause)** B: *That's mine.*

Notes. [a]ND = non-distracting. [b]D = distracting. Own Problem Statements are italicized and the responses in the specified category are bolded. A refers to Friend A and B refers to Friend B (assigned at random).

Table 3

Descriptive Statistics for Behavioral Coding Variables

	Total[a]	*Mean*	*SD*	*Min.*	*Median*	*Max.*	*n* > 0[b]
Thought Units	42,784	222.0	52.3	70.0	224.0	333.0	192
Problem Statements	9,665	50.3	46.8	0.0	35.5	280.0	191
All Responses	7,130	37.1	32.9	0.0	27.0	162.0	191
Supportive Engaged[c]	5,009	26.1	27.9	0.0	17.0	139.0	189
Acknowledge	1,018	5.3	7.1	0.0	3.0	61.0	166
Add Information	1,336	7.0	11.1	0.0	3.0	65.0	152
Advice-Giving (I)	68	0.4	1.4	0.0	0.0	11.0	18
Advice-Giving (You)	270	1.4	3.6	0.0	0.0	31.0	65
Opinion/Comment	670	3.5	4.4	0.0	2.0	23.0	142
Own Experience (ND[d])	1,080	5.6	8.2	0.0	3.0	58.0	137
Prompt	57	0.3	0.8	0.0	0.0	5.0	35
Question Encourage	246	1.3	1.9	0.0	1.0	11.0	100
Question Information	400	2.1	2.9	0.0	1.0	15.0	107
Support/Agree	508	2.6	4.1	0.0	1.0	28.0	120
Unsupportive Disengaged[e]	467	2.4	3.1	0.0	1.0	19.0	142
Change Subject	225	1.2	1.5	0.0	1.0	7.0	111
Minimize	36	0.2	0.8	0.0	0.0	8.0	20
Nonsupport/Disagree	54	0.3	1.3	0.0	0.0	12.0	19
Own Experience (D[f])	101	0.5	1.6	0.0	0.0	9.0	32
Silence	51	0.3	0.6	0.0	0.0	3.0	38

Notes. [a]Total across all participants. [b]Number of participants who reported at least one response. [c]Composite score of supportive engaged responses (includes all responses indented below). [d]ND = non-distracting. [e]Composite score of unsupportive disengaged responses (includes all responses indented below). [f]D = distracting.

Table 4

Descriptive Statistics for Physiological Variables

	Mean	*SD*	*Min*	*Median*	*Max*
Resting RSA I[a]	6.6	1.1	4.0	6.6	9.7
Resting RSA II[a]	6.5	1.2	3.2	6.6	9.4
RSA Problem Talk[b]	5.7	1.1	2.2	5.7	9.0
Resting Respiration I[a]	16.0	3.2	10.0	16.3	28.5
Resting Respiration I[a]	16.0	3.1	9.8	15.7	26.8
Respiration Problem Talk[b]	14.9	1.3	12.0	14.7	18.9

Notes. [a]Averaged across the six 30-second segments during the Resting Baseline Tasks. [b]Averaged across the thirty-two 30-second segments during the Problem Talk Task. Resting RSA and Respiration I were measured during Resting Baseline Task I (adolescents sat quietly by themselves for 3 minutes). Resting RSA and Respiration II were measured during Resting Baseline Task II (adolescents and their friends sat quietly side-by-side for 3 minutes)

Table 5

Correlations Among Gender, Age, and Supportive Engaged Responses to Problem Statements

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Gender											
2. Age (Years)	-.05										
3. Supportive Engaged	-.20**	.04									
4. Acknowledge	-.14	-.04	.71**								
5. Add Information	-.16*	.00	.84**	.42**							
6. Advice-Giving I	.01	.06	.19**	-.02	.09						
7. Advice Giving You	.00	.09	.42**	.22**	.15*	.40**					
8. Opinion/Comment	-.12	.09	.62**	.44**	.47**	.04	.11				
9. Own Experience (ND)	-.16*	.03	.79**	.47**	.55**	.13	.43**	.30**			
10. Question Encourage	-.11	.05	.34**	.25**	.31**	.04	-.01	.31**	.26**		
11. Question Information	-.15*	.13	.27**	.26**	.15*	.07	.13	.41**	.12	.42**	
12. Support/Agree	-.26**	.06	.63**	.36**	.52**	.09	.10	.41**	.35**	.21**	.16*

Notes. [a]Composite score of all specific Supportive Engaged Responses. Gender is coded 0 = girls, 1 = boys. ND = non-distracting. $N = 192$ $*p < .05$. $**p < .01$.

Table 6

Correlations Among Gender, Age, and Unsupportive Disengaged Responses to Problem Statements

Variable	1	2	3	4	5	6	7
1. Gender							
2. Age (Years)	-.05						
3. Unsupportive Disengaged[a]	-.00	.03					
4. Change Subject	-.17*	.06	.60**				
5. Minimize	-.03	.10	.51**	.27**			
6. Nonsupport/Disagree	.15*	-.04	.60**	.10	.17*		
7. Own Experience Distracting	.06	.02	.63**	.04	.13	.23**	
8. Silence	-.03	-.09	.14	.02	.03	-.07	-.07

Notes. [a]Composite score of all specific Unsupportive Disengaged Responses. Gender is coded 0 = girls, 1 = boys.

N = 192 *p < .05. **p < .01.

Table 7

Correlations Among Gender, Age, Own Problem Statements, and Responses to Problem Statements

Variable	1	2	3	4
1. Gender				
2. Age (Years)	-.05			
3. Total Thought Units	-.10	.01		
4. Own Problem Statements	-.23**	.09	.40**	
5. Responses to Problem Statements	-.21**	.05	.25**	.41**

Notes. Gender is coded 0 = girls, 1 = boys. $N = 192$ *$p < .05$. **$p < .01$.

Table 8

Correlations Among Gender, Age, and Physiological Variables

Variable	1	2	3	4	5	6	7
1. Gender							
2. Age (Years)	-.05						
3. Resting RSA I[a]	-.05	-.15*					
4. Resting RSA II[b]	-.07	-.17*	.74**				
5. RSA Problem Talk[c]	-.02	-.13	.70**	.76**			
6. Resting Respiration I[a]	-.15*	-.08	-.15*	-.19**	-.11		
7. Resting Respiration II[b]	-.11	-.11	-.01	-.04	-.05	.24**	
8. Respiration Problem Talk[c]	.19**	-.37**	.06	.11	.12	.14	.01

Notes. [a]Assessed during the Resting Baseline I Task. [b]Assessed during the Resting Baseline II Task. [c]Averaged across the Problem Talk Task. Gender is coded 0 = girls, 1 = boys. $N = 192$ *$p < .05$. **$p < .01$.

Table 9

Correlations and ICC Among Adolescents' and Their Friends' Physiological and Behavioral Variables

Variable	1	2	3	4	5
1. Resting RSA I[a]	**.08**	.01	.09	.18*	-.02
2. Resting RSA II[b]	.75**	**.05**	-.01	.23**	-.11
3. RSA Problem Talk[c]	.70**	.76**	**-.00**	.17*	-.09
4. Supportive Engaged[d]	.09	.15*	.06	**.47**	-.05
5. Unsupportive Disengaged[d]	-.06	-.12	-.05	.04	**.32**

Note. [a]Assessed during the Resting Baseline I Task. [b]Assessed during the Resting Baseline II Task. [c]Averaged across the Problem Talk Task. [d]Totaled across the Problem Talk Task. Intrapersonal correlations (within actor effects; i.e., among adolescents' own scores) are presented below the diagonal. Interpersonal effects (between actor and partner effects; i.e., between adolescents' and their friends' scores) are presented above the diagonal. Intraclass correlations between friends on the same variable are bolded along the diagonal. **p* < .05. ***p* < .01.

Table 10

Resting levels of RSA as Predictors of the Total Number of Supportive/Engaged Responses to Problem Statements During the Problem Talk Task (H1)

Responses	*b*	*se*	*p*	95% *CI*
Supportive/Engaged[a]				
Actor Respiration	-0.24	0.70	.73	[-1.60, 1.12]
Partner Respiration	-0.30	0.70	.67	[-1.66, 1.07]
Actor RSA	1.95	2.01	.33	[-1.99, 5.89]
Partner RSA	5.00	2.01	.01	[1.06, 8.94]
Acknowledge				
Actor Respiration	0.05	0.17	.77	[-0.29, 0.39]
Partner Respiration	-0.18	0.17	.30	[-0.52, 0.16]
Actor RSA	0.57	0.49	.24	[-0.40, 1.54]
Partner RSA	0.88	0.49	.08	[-0.09, 1.85]
Add Information				
Actor Respiration	-0.03	0.27	.91	[-0.55, 0.49]
Partner Respiration	-0.37	0.27	.16	[-0.15, 0.89]
Actor RSA	0.11	0.77	.88	[-1.39, 1.62]
Partner RSA	1.70	0.77	.03	[0.20, 3.21]
Advice-Giving (I)				
Actor Respiration	-0.05	0.04	.19	[-0.11, 0.02]
Partner Respiration	0.02	0.04	.63	[-0.05, 0.09]
Actor RSA	-0.07	0.10	.47	[-0.27, 0.12]
Partner RSA	0.18	0.10	.07	[-0.01, 0.38]
Advice-Giving (You)				
Actor Respiration	-0.05	0.08	.51	[-0.21, 0.11]
Partner Respiration	-0.08	0.08	.35	[-0.24, 0.08]
Actor RSA	-0.10	0.23	.67	[-0.56, 0.36]
Partner RSA	0.37	0.23	.12	[-0.09, 0.82]
Opinion/Comment				
Actor Respiration	-0.08	0.11	.47	[-0.29, 0.13]
Partner Respiration	-0.05	0.11	.65	[-0.26, 0.16]
Actor RSA	0.25	0.31	.43	[-0.36, 0.85]
Partner RSA	0.28	0.31	.36	[-0.32, 0.88]
Own Experience (ND)				
Actor Respiration	-0.09	0.20	.66	[-0.47, 0.30]
Partner Respiration	-0.06	0.20	.77	[-0.44, 0.33]
Actor RSA	0.69	0.56	.22	[-0.42, 1.79]
Partner RSA	0.95	0.56	.09	[-0.15, 2.06]

Table 10

Continued

Responses	*b*	*se*	*p*	95% *CI*
Prompt				
Actor Respiration	-0.03	0.02	.09	[-0.06, 0.004]
Partner Respiration	-0.02	0.02	.24	[-0.06, 0.01]
Actor RSA	-0.08	0.05	.10	[-0.18, 0.02]
Partner RSA	-0.11	0.05	.03	[-0.21, -0.01]
Question – Encourage				
Actor Respiration	-0.01	0.05	.81	[-0.10, 0.08]
Partner Respiration	-0.06	0.05	.16	[-0.15, 0.03]
Actor RSA	0.15	0.13	.25	[-0.11, 0.41]
Partner RSA	-0.03	0.13	.81	[-0.29, 0.22]
Question – Information				
Actor Respiration	-0.01	0.07	.85	[-0.15, 0.12]
Partner Respiration	-0.16	0.07	.02	[-0.29, -0.03]
Actor RSA	0.06	0.19	.74	[-0.32, 0.44]
Partner RSA	0.07	0.19	.71	[-0.31, 0.45]
Support/Agree				
Actor Respiration	0.06	0.09	.56	[-0.13, 0.24]
Partner Respiration	-0.08	0.09	.39	[-0.27, 0.10]
Actor RSA	0.37	0.28	.17	[-0.16, 0.91]
Partner RSA	0.70	0.28	.01	[0.16, 1.24]

Notes. [a]Refers to the composite total of all supportive/engaged responses. Actor and partner respiration and RSA were group centered. $N = 192$.

Table 11

Resting levels of RSA as Predictors of the Total Number of Unsupportive/Disengaged Responses to Problem Statements During the Problem Talk Task (H1)

Responses	*b*	*se*	*p*	95% *CI*
Unsupportive/Disengaged[a]				
Actor Respiration	0.03	0.06	.62	[-0.09, 0.15]
Partner Respiration	0.02	0.06	.69	[-0.10, 0.14]
Actor RSA	-0.14	0.18	.42	[-0.49, 0.20]
Partner RSA	-0.03	0.18	.87	[-0.38, 0.32]
Change Subject				
Actor Respiration	0.06	0.04	.10	[-0.01, 0.13]
Partner Respiration	-0.06	0.04	.07	[-0.14, 0.004]
Actor RSA	-0.01	0.10	.94	[-0.21, 0.19]
Partner RSA	-0.09	0.10	.37	[-0.30, 0.11]
Minimize				
Actor Respiration	0.01	0.02	.52	[-0.02, 0.05]
Partner Respiration	-0.01	0.02	.51	[-0.05, 0.02]
Actor RSA	0.02	0.05	.71	[-0.08, 0.12]
Partner RSA	-0.05	0.05	.35	[-0.15, 0.05]
Nonsupport/Disagree				
Actor Respiration	0.03	0.03	.43	[-0.04, 0.09]
Partner Respiration	0.002	0.03	.96	[-0.06, 0.06]
Actor RSA	0.03	0.09	.71	[-0.14, 0.21]
Partner RSA	-0.01	0.09	.90	[-0.19, 0.17]
Own Experience (Distracting)				
Actor Respiration	-0.02	0.09	.56	[-0.10, 0.05]
Partner Respiration	0.02	0.09	.53	[-0.05, 0.10]
Actor RSA	-0.22	0.11	.05	[-0.43, -0.01]
Partner RSA	-0.02	0.11	.86	[-0.23, 0.20]
Silence				
Actor Respiration	0.02	0.01	.24	[-0.01, 0.04]
Partner Respiration	0.01	0.01	.44	[-0.02, 0.04]
Actor RSA	0.02	0.04	.56	[-0.06, 0.10]
Partner RSA	0.05	0.04	.22	[-0.03, 0.13]

Notes. [a]Refers to the composite total of all unsupportive/disengaged responses. Actor and partner respiration and RSA were group centered. *N* = 192.

Table 12

Supportive/Engaged Responses to Problem Statements as Predictors of RSA Reactivity During the Problem Talk Task (H2)

Response	*b*	*se*	*p*	95% *CI*
Supportive/Engaged[a]				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.58	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.03	0.01	<.001	[0.01, 0.04]
Partner Response $_{T-1}$	0.01	0.01	.28	[-0.01, 0.02]
Acknowledge				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.06	0.02	.009	[0.01, 0.10]
Partner Response $_{T-1}$	0.03	0.02	.11	[-0.01, 0.07]
Add Information				
Actor Resting RSA[b]	0.001	0.01	.91	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.27	[-0.002, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.02	0.01	.13	[-0.01, 0.05]
Partner Response $_{T-1}$	0.03	0.01	.04	[0.002, 0.06]
Advice-Giving (I)				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.02	0.05	.74	[-0.09, 0.11]
Partner Response $_{T-1}$	-0.02	0.05	.70	[-0.12, 0.08]
Advice-Giving (You)				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.03, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.56	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.05	0.03	.08	[-0.01, 0.11]
Partner Response $_{T-1}$	-0.02	0.03	.48	[-0.08, 0.04]

Table 12

Continued

Response	*b*	*se*	*p*	95% *CI*
Opinion/Comment				
Actor Resting RSA[b]	0.001	0.01	.91	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.52	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.28	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	-0.01	0.02	.81	[-0.05, 0.04]
Partner Response $_{T-1}$	-0.03	0.02	.22	[-0.08, 0.02]
Own Experience (ND)[c]				
Actor Resting RSA[b]	0.002	0.01	.91	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.59	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.04	0.02	.006	[0.01, 0.07]
Partner Response $_{T-1}$	-0.01	0.02	.41	[-0.04, 0.02]
Prompt				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	-0.01	0.09	.93	[-0.19, 0.17]
Partner Response $_{T-1}$	-0.05	0.09	.62	[-0.23, 0.14]
Question – Encourage				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.56	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.07	0.05	.14	[-0.02, 0.16]
Partner Response $_{T-1}$	0.04	0.03	.22	[-0.02, 0.10]
Question – Information				
Actor Resting RSA[b]	0.001	0.01	.91	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.57	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.28	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.07	0.03	.04	[0.002, 0.13]
Partner Response $_{T-1}$	0.04	0.03	.20	[-0.02, 0.11]

Table 12

Continued

Response	*b*	*se*	*p*	95% *CI*
Support/Agree				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.05	0.03	.11	[-0.01, 0.11]
Partner Response $_{T-1}$	-0.01	0.03	.66	[-0.07, 0.05]

Notes. [a]Refers to the composite total of all supportive/engaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. [c]ND = non-distracting. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting RSA in the following 30-second segment. *N* = 196.

Table 13

Unsupportive/Disengaged Responses to Problem Statements as Predictors of RSA Reactivity During the Problem Talk Task (H2)

Response	*b*	*se*	*p*	95% *CI*
Unsupportive/Disengaged				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.54	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.01	0.03	.68	[0.04, 0.07]
Partner Response $_{T-1}$	-0.03	0.03	.34	[-0.08, 0.03]
Change Subject				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.01	0.05	.88	[-0.10, 0.12]
Partner Response $_{T-1}$	0.02	0.05	.68	[-0.09, 0.13]
Minimize				
Actor Resting RSA[b]	0.002	0.01	.91	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.52	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.28	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	-0.10	0.10	.30	[-0.29, 0.09]
Partner Response $_{T-1}$	-0.21	0.10	.03	[-0.40, -0.02]
Non-support/Disagree				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.54	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	-0.04	0.04	.29	[-0.11, 0.03]
Partner Response $_{T-1}$	-0.03	0.04	.47	[-0.09, 0.05]
Own Experiences (Distracting)				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.54	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Actor Response$_{T-1}$	0.07	0.05	.22	[-0.04, 0.17]
Partner Response $_{T-1}$	-0.03	0.05	.64	[-0.13, 0.08]

Table 13

Continued

Response	*b*	*se*	*p*	95% *CI*
Silence				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Actor Response$_{T-1}$	0.40	0.12	.001	[0.17, 0.62]
Partner Response $_{T-1}$	0.19	0.12	.09	[-0.04, 0.42]

Notes. [a]Refers to the composite total of all unsupportive/disengaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting RSA in the following 30-second segment. *N* = 196.

Table 14

RSA as a Predictor of Supportive/Engaged Responses to Problem Statements During the Problem Talk Task (H3)

Response	*b*	*se*	*p*	95% *CI*
Supportive/Engaged[a]				
Actor Resting RSA[b]	0.003	0.03	.94	[-0.06, 0.07]
Actor Respiration $_{T-1}$	0.001	0.01	.83	[-0.01, 0.01]
Actor Respiration	-0.01	0.01	.09	[-0.02, 0.002]
Actor Response$_{T-1}$	-0.02	0.01	.10	[-0.05, 0.004]
Actor RSA $_{T-1}$	0.02	0.02	.35	[-0.03, 0.07]
Partner RSA $_{T-1}$	-0.01	0.02	.82	[-0.05, 0.04]
Acknowledge				
Actor Resting RSA[b]	-0.0001	0.01	.99	[-0.02, 0.02]
Actor Respiration $_{T-1}$	-0.002	0.002	.21	[-0.01, 0.001]
Actor Respiration	0.01	0.002	.004	[0.002, 0.01]
Actor Response$_{T-1}$	-0.10	0.01	<.001	[-0.12, -0.07]
Actor RSA $_{T-1}$	0.01	0.01	.55	[-0.01, 0.02]
Partner RSA $_{T-1}$	0.01	0.01	.16	[-0.004, 0.03]
Add Information				
Actor Resting RSA[b]	0.001	0.01	.94	[-0.02, 0.02]
Actor Respiration $_{T-1}$	-0.001	0.003	.80	[-0.01, 0.01]
Actor Respiration	-0.003	0.003	.25	[-0.01, 0.002]
Actor Response$_{T-1}$	0.30	0.01	<.001	[0.28, 0.33]
Actor RSA $_{T-1}$	0.03	0.01	.007	[0.01, 0.06]
Partner RSA $_{T-1}$	-0.02	0.01	.19	[-0.04, 0.01]
Advice-Giving (I)				
Actor Resting RSA[b]	0.000	0.002	.99	[-0.01, 0.01]
Actor Respiration $_{T-1}$	-0.0001	0.001	.93	[-0.01, 0.001]
Actor Respiration	0.001	0.001	.32	[-0.002, 0.002]
Actor Response$_{T-1}$	-0.001	0.01	.97	[-0.03, 0.03]
Actor RSA $_{T-1}$	0.01	0.003	.02	[0.001, 0.01]
Partner RSA $_{T-1}$	0.01	0.003	.17	[-0.002, 0.01]
Advice-Giving (You)				
Actor Resting RSA[b]	0.0002	0.01	.97	[-0.01, 0.01]
Actor Respiration $_{T-1}$	-0.002	0.001	.19	[-0.004, 0.001]
Actor Respiration	-0.003	0.001	.05	[-0.01, 0.000]
Actor Response$_{T-1}$	0.12	0.01	<.001	[0.10, 0.15]
Actor RSA $_{T-1}$	0.01	0.01	.08	[-0.001, 0.02]
Partner RSA $_{T-1}$	0.01	0.01	.38	[-0.01, 0.02]

Table 14

Continued

Response	*b*	*se*	*p*	95% *CI*
Opinion/Comment				
Actor Resting RSA[b]	0.0001	0.01	.99	[-0.01, 0.01]
Actor Respiration $_{T-1}$	0.003	0.002	.05	[0.0001, 0.01]
Actor Respiration	-0.001	0.002	.38	[-0.004, 0.002]
Actor Response$_{T-1}$	-0.03	0.01	.06	[-0.05, 0.001]
Actor RSA $_{T-1}$	0.01	0.01	.17	[-0.004, 0.02]
Partner RSA $_{T-1}$	0.01	0.01	.04	[0.001, 0.03]
Own Experience (ND)[c]				
Actor Resting RSA[b]	0.001	0.01	.94	[-0.02, 0.02]
Actor Respiration $_{T-1}$	0.0004	0.003	.87	[-0.01, 0.01]
Actor Respiration	-0.004	0.003	.09	[-0.01, 0.001]
Actor Response$_{T-1}$	0.07	0.01	<.001	[0.05, 0.10]
Actor RSA $_{T-1}$	-0.01	0.01	.53	[-0.03, 0.02]
Partner RSA $_{T-1}$	0.01	0.01	.48	[-0.02, 0.03]
Prompt				
Actor Resting RSA[b]	0.0001	0.002	.96	[-0.003, 0.003]
Actor Respiration $_{T-1}$	0.001	0.0004	.16	[-0.0002, 0.001]
Actor Respiration	-0.0001	0.0004	.80	[-0.001, 0.001]
Actor Response$_{T-1}$	0.01	0.01	.67	[-0.02, 0.03]
Actor RSA $_{T-1}$	0.003	0.002	.09	[-0.0004, 0.01]
Partner RSA $_{T-1}$	0.003	0.002	.10	[-0.001, 0.01]
Question – Encourage				
Actor Resting RSA[b]	0.001	0.003	.87	[-0.01, 0.01]
Actor Respiration $_{T-1}$	-0.001	0.001	.51	[-0.002, 0.001]
Actor Respiration	-0.001	0.001	.44	[-0.002, 0.001]
Actor Response$_{T-1}$	-0.01	0.01	.43	[-0.04, 0.02]
Actor RSA $_{T-1}$	0.01	0.004	.09	[-0.001, 0.01]
Partner RSA $_{T-1}$	0.001	0.004	.85	[-0.01, 0.01]
Question – Information				
Actor Resting RSA[b]	0.001	0.004	.90	[-0.01, 0.01]
Actor Respiration $_{T-1}$	0.002	0.001	.08	[-0.0002, 0.004]
Actor Respiration	-0.0004	0.001	.73	[-0.003, 0.002]
Actor Response$_{T-1}$	0.06	0.01	<.001	[0.03, 0.08]
Actor RSA $_{T-1}$	0.004	0.01	.43	[-0.01, 0.01]
Partner RSA $_{T-1}$	0.01	0.01	.02	[0.002, 0.02]

Table 14

Continued

Response	*b*	*se*	*p*	95% *CI*
Support/Agree				
Actor Resting RSA[b]	0.004	0.001	.94	[-0.01, 0.01]
Actor Respiration $_{T-1}$	0.001	0.001	.34	[-0.001, 0.004]
Actor Respiration	-0.001	0.001	.30	[-0.004, 0.001]
Actor Response$_{T-1}$	-0.12	0.01	<.001	[-0.15, -0.10]
Actor RSA $_{T-1}$	0.01	0.01	.07	[-0.001, 0.02]
Partner RSA $_{T-1}$	-0.01	0.01	.31	[-0.02, 0.01]

Notes. [a]Refers to the composite total of all supportive/engaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. [c]ND = non-distracting. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting responses in the following 30-second segment. *N* = 196.

Table 15

Unsupportive/Disengaged Responses to Problem Statements as Predictors of RSA Reactivity During the Problem Talk Task (H3)

Response	*b*	*se*	*p*	95% *CI*
Unsupportive/Disengaged				
Actor Resting RSA[b]	0.0004	0.004	.92	[-0.01, 0.01]
Actor Respiration $_{T-1}$	-0.0004	0.001	.79	[-0.003, 0.002]
Actor Respiration	0.001	0.001	.61	[-0.002, 0.003]
Actor Response$_{T-1}$	0.17	0.01	<.001	[0.14, 0.19]
Actor RSA $_{T-1}$	0.01	0.01	.06	[-0.001, 0.02]
Partner RSA $_{T-1}$	0.01	0.01	.17	[-0.004, 0.02]
Change Subject				
Actor Resting RSA[b]	0.0001	0.002	.98	[-0.004, 0.004]
Actor Respiration $_{T-1}$	-0.002	0.001	.01	[-0.003, -0.001]
Actor Respiration	0.0002	0.001	.78	[-0.001, 0.002]
Actor Response$_{T-1}$	0.02	0.01	.24	[-0.01, 0.04]
Actor RSA $_{T-1}$	0.001	0.003	.75	[-0.01, 0.01]
Partner RSA $_{T-1}$	0.0002	0.003	.95	[-0.01, 0.01]
Minimize				
Actor Resting RSA[b]	0.0000	0.001	.99	[-0.003, 0.003]
Actor Respiration $_{T-1}$	-0.001	0.0004	.11	[-0.001, 0.0001]
Actor Respiration	-0.0002	0.0004	.63	[-0.001, 0.001]
Actor Response$_{T-1}$	-0.02	0.01	.09	[-0.05, 0.003]
Actor RSA $_{T-1}$	0.001	0.002	.46	[-0.002, 0.01]
Partner RSA $_{T-1}$	0.0004	0.002	.83	[-0.003, 0.004]
Non-support/Disagree				
Actor Resting RSA[b]	-0.0003	0.003	.91	[-0.01, 0.01]
Actor Respiration $_{T-1}$	-0.001	0.001	.61	[-0.003, 0.001]
Actor Respiration	0.001	0.001	.21	[-0.001, 0.003]
Actor Response$_{T-1}$	0.38	0.01	<.001	[0.36, 0.41]
Actor RSA $_{T-1}$	0.01	0.004	.24	[-0.003, 0.01]
Partner RSA $_{T-1}$	0.003	0.004	.46	[-0.01, 0.01]
Own Experiences (Distracting)				
Actor Resting RSA[b]	0.0002	0.002	.95	[-0.01, 0.01]
Actor Respiration $_{T-1}$	0.001	0.001	.24	[-0.001, 0.002]
Actor Respiration	-0.001	0.001	.43	[-0.002, 0.001]
Actor Response$_{T-1}$	0.09	0.01	<.001	[0.06, 0.11]
Actor RSA $_{T-1}$	0.001	0.003	.71	[-0.005, 0.01]
Partner RSA $_{T-1}$	0.004	0.003	.19	[-0.002, 0.01]

Table 15

Continued

Response	*b*	*se*	*p*	95% *CI*
Silence				
Actor Resting RSA[b]	0.0004	0.001	.68	[-0.002, 0.002]
Actor Respiration $_{T-1}$	-0.0001	0.0003	.74	[-0.001, 0.001]
Actor Respiration	0.0002	0.0003	.45	[-0.0004, 0.001]
Actor Response$_{T-1}$	0.01	0.01	.60	[-0.02, 0.03]
Actor RSA $_{T-1}$	0.003	0.001	.02	[0.001, 0.01]
Partner RSA $_{T-1}$	0.003	0.001	.02	[0.001, 0.01]

Notes. [a]Refers to the composite total of all unsupportive/disengaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting responses in the following 30-second segment. *N* = 196.

Table 16

RSA Coregulation Between Friends During the Problem Talk Task (H4)

Predictor	*b*	*se*	*p*	95% *CI*
Actor Resting RSA[a]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.49	[-0.008, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.65	[-0.03, 0.02]

Notes. [a]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled “T-1” were lagged so that variables from the previous 30-second segment were predicting responses in the following 30-second segment. $N = 200$.

Table 17

Supportive/Engaged Responses to Problem Statements as a Moderator of RSA Co-Regulation (Partner RSA_{T-1}) During the Problem Talk Task (H5)

Response	*b*	*Se*	*p*	95% *CI*
Supportive/Engaged[a]				
Actor Resting RSA[b]	0.002	0.01	.87	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.33	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.19, -0.14]
Partner RSA $_{T-1}$	-0.01	0.01	.53	[-0.03, 0.02]
Actor Response$_{T-1}$	0.03	0.01	<.001	[0.01, 0.04]
Partner Response $_{T-1}$	0.01	0.01	.29	[-0.01, 0.02]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.003	0.01	.61	[-0.01, 0.02]
Acknowledge				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.46	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.32	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.61	[-0.03, 0.02]
Actor Response$_{T-1}$	0.06	0.02	.01	[0.01, 0.10]
Partner Response $_{T-1}$	0.03	0.02	.12	[-0.01, 0.08]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.003	0.03	.90	[-0.05, 0.05]
Add Information				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.58	[-0.03, 0.02]
Actor Response$_{T-1}$	0.02	0.01	.13	[-0.01, 0.05]
Partner Response $_{T-1}$	0.03	0.01	.03	[0.003, 0.06]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.02	0.02	.40	[-0.05, 0.02]
Advice-Giving (I)				
Actor Resting RSA[b]	0.002	0.01	.86	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.49	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.65	[-0.03, 0.02]
Actor Response$_{T-1}$	0.02	0.05	.73	[-0.08, 0.12]
Partner Response $_{T-1}$	0.04	0.07	.58	[-0.09, 0.16]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.09	0.07	.19	[-0.05, 0.23]

Table 17

Continued

Response	*b*	*se*	*p*	95% *CI*
Advice-Giving (You)				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.52	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.33	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.16]
Partner RSA $_{T-1}$	-0.01	0.01	.61	[-0.03, 0.02]
Actor Response$_{T-1}$	0.05	0.03	.08	[-0.01, 0.11]
Partner Response $_{T-1}$	-0.02	0.03	.45	[-0.08, 0.04]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.02	0.04	.59	[-0.09, 0.05]
Opinion/Comment				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.49	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.21, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.68	[-0.03, 0.02]
Actor Response$_{T-1}$	-0.01	0.02	.82	[-0.05, 0.04]
Partner Response $_{T-1}$	-0.03	0.02	.24	[-0.08, 0.02]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.002	0.03	.94	[-0.05, 0.06]
Own Experience (ND)[c]				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.57	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.32	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.56	[-0.03, 0.02]
Actor Response$_{T-1}$	0.04	0.02	.006	[0.01, 0.07]
Partner Response $_{T-1}$	-0.01	0.02	.44	[-0.04, 0.02]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.01	0.02	.42	[-0.02, 0.04]
Prompt				
Actor Resting RSA[b]	0.002	0.01	.87	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.51	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.32	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.64	[-0.03, 0.02]
Actor Response$_{T-1}$	-0.03	0.09	.77	[-0.21, 0.16]
Partner Response $_{T-1}$	-0.04	0.09	.69	[-0.22, 0.15]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.21	0.12	.08	[-0.45, 0.03]

Table 17

Continued

Response	*b*	*se*	*p*	95% *CI*
Question – Encourage				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.51	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.30	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.07	0.01	.63	[-0.03, 0.02]
Actor Response$_{T-1}$	0.07	0.05	.14	[-0.02, 0.16]
Partner Response $_{T-1}$	0.02	0.05	.69	[-0.07, 0.11]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.07	0.05	.19	[-0.18, 0.04]
Question – Information				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.53	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.61	[-0.03, 0.02]
Actor Response$_{T-1}$	0.07	0.03	.05	[0.001, 0.13]
Partner Response $_{T-1}$	0.05	0.03	.16	[-0.02, 0.11]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.02	0.04	.62	[-0.10, 0.06]
Support/Agree				
Actor Resting RSA[b]	0.002	0.01	.87	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.51	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.35	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.64	[-0.03, 0.02]
Actor Response$_{T-1}$	0.05	0.03	.09	[-0.01, 0.11]
Partner Response $_{T-1}$	-0.03	0.03	.40	[-0.09, 0.03]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.12	0.04	.001	[0.05, 0.19]

Notes. [a]Refers to the composite total of all supportive/engaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. [c]ND = non-distracting. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting RSA in the following 30-second segment. *N* = 196.

Table 18

Unsupportive/Disengaged Responses to Problem Statements as a Moderator of RSA Co-Regulation (Partner RSA$_{T-1}$) During the Problem Talk Task (H5)

Response	*b*	*se*	*p*	95% *CI*
Unsupportive/Disengaged				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.49	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.32	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.69	[-0.03, 0.02]
Actor Response$_{T-1}$	0.01	0.03	.68	[-0.04, 0.07]
Partner Response $_{T-1}$	-0.04	0.03	.22	[-0.11, 0.03]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.03	0.04	.43	[-0.05, 0.12]
Change Subject				
Actor Resting RSA[b]	0.002	0.01	.90	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.65	[-0.03, 0.02]
Actor Response$_{T-1}$	0.01	0.05	.87	[-0.10, 0.12]
Partner Response $_{T-1}$	0.03	0.05	.63	[-0.08, 0.13]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.07	0.07	.33	[-0.20, 0.07]
Minimize				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.48	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.29	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.70	[-0.03, 0.02]
Actor Response$_{T-1}$	-0.10	0.10	.31	[-0.29, 0.09]
Partner Response $_{T-1}$	-0.27	0.12	.02	[-0.50, -0.04]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.16	0.19	.40	[-0.21, 0.53]
Non-support/Disagree				
Actor Resting RSA[b]	0.002	0.01	.89	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.32	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.64	[-0.03, 0.02]
Actor Response$_{T-1}$	-0.04	0.04	.29	[-0.11, 0.03]
Partner Response $_{T-1}$	-0.04	0.05	.50	[-0.13, 0.06]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.01	0.07	.86	[-0.12, 0.14]

Table 18

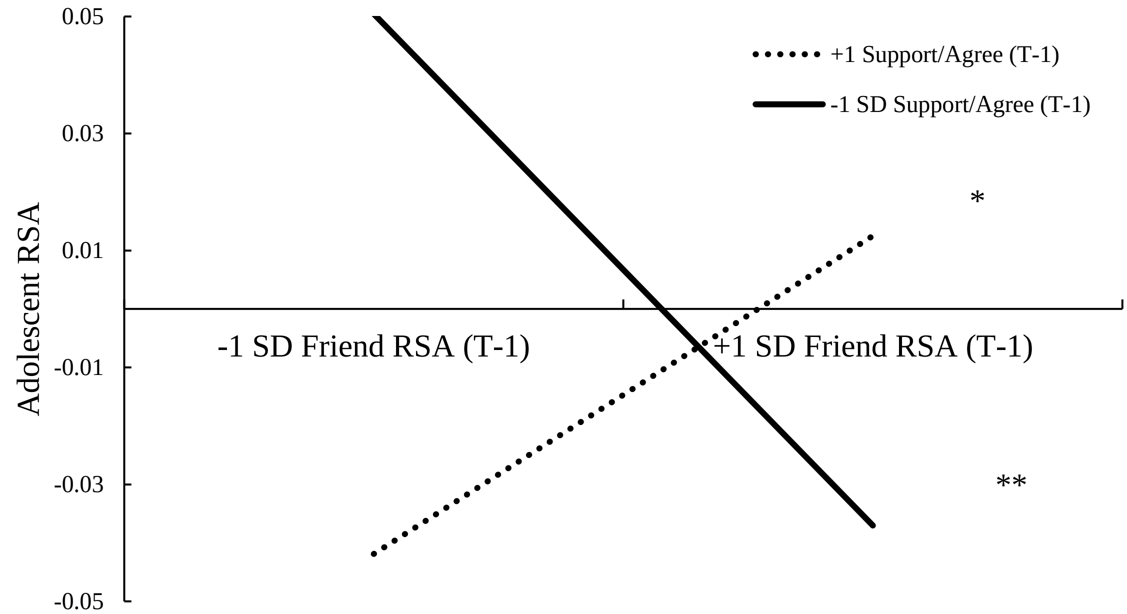
Continued

Response	*b*	*se*	*p*	95% *CI*
Own Experiences (Distracting)				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.50	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.31	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.18	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.68	[-0.03, 0.02]
Actor Response$_{T-1}$	0.07	0.05	.21	[-0.04, 0.17]
Partner Response $_{T-1}$	-0.05	0.06	.41	[-0.17, 0.07]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	0.06	0.07	.37	[-0.07, 0.19]
Silence				
Actor Resting RSA[b]	0.002	0.01	.88	[-0.02, 0.03]
Actor Respiration $_{T-1}$	-0.002	0.003	.47	[-0.01, 0.004]
Actor Respiration	0.003	0.003	.33	[-0.003, 0.01]
Actor RSA $_{T-1}$	-0.17	0.01	<.001	[-0.20, -0.15]
Partner RSA $_{T-1}$	-0.01	0.01	.66	[-0.03, 0.02]
Actor Response$_{T-1}$	0.39	0.12	.001	[0.17, 0.62]
Partner Response $_{T-1}$	0.21	0.13	.10	[-0.04, 0.47]
Partner RSA $_{T-1}$ x Partner Response $_{T-1}$	-0.05	0.15	.72	[-0.33, 0.23]

Notes. [a]Refers to the composite total of all unsupportive/disengaged responses. [b]Resting RSA refers to the measure taken before the problem talk task in which friends sat quietly side-by-side for three minutes. Resting RSA was group centered. All other variables were within-person centered. Predictors labeled "T-1" were lagged so that variables from the previous 30-second segment were predicting RSA in the following 30-second segment. *N* = 196.

Figure 5

Interaction Between Support/Agree Responses and the Coregulation Effect (The Effect of Friends' RSA on Adolescents' Subsequent RSA Reactivity)



Notes. All variables are within-person centered. $**p < .01$; $*p < .05$.

VITA

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