THE RELATION BETWEEN PARENT AND ADOLESCENT DEPRESSION AND FAMILY INTERACTION PROCESSES: 
THE ROLE OF EMOTION CONTEXT INSENSITIVITY

by

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The Relation Between Parent and Adolescent Depression and Family Interaction Processes: The Role of Emotion Context Insensitivity

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Abstract

The Emotion Context Insensitivity Hypothesis suggests that depressed individuals show diminished emotional reactivity to positive and negative stimuli. This hypothesis served as a basis for understanding how family dynamics relate to depression. Family process and physiological mechanisms of depression were examined across two family interactions. Individuals with high depression were expected to show greater disengagement across the interactions compared to non-depressed individuals. Based on the conceptualization of respiratory sinus arrhythmia (RSA) as a marker of individual differences in emotional flexibility, individuals with low baseline RSA were expected to show greater disengagement. Findings showed that for teens, high depression increased the likelihood of responding to parental anger with their own anger, thus decreasing the interaction quality during conflictual discussions. For parents, high depression symptoms decreased the likelihood of responding to teen positive affect with their own positive affect. High parental baseline RSA increased the quality of the interaction during conflictual discussions.
The Relation Between Parent and Adolescent Depression and Family Interaction Processes: The Role of Emotion Context Insensitivity

Depression is a serious and prevalent disorder in youth, and adolescence constitutes a time of particular risk for the onset of depressive disorders (e.g., Kessler, Avenevoli, & Merikangas, 2001; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993). In a nationally representative community epidemiological survey that included adolescents, lifetime prevalence of major depression in 15- to 18-year-olds was 14%, with an additional 11% reporting minor depression (Kessler & Walters, 1998). Even when diagnostic criteria are not met, subsyndromal depressive symptoms often indicate high levels of distress. For example, when self-report symptom scores rather than diagnoses are used to indicate depressive symptoms, 10-30% of adolescents exceed cutoffs for high levels (e.g., Garrison, Jackson, Marsteller, McKeown, & Addy, 1990; Roberts, Lewinsohn, & Seeley, 1991). Rather than mere adolescent turmoil, elevated self-report scores indicate impaired functioning, and may precede the later development of diagnosable disorders (Hammen & Rudolph, 2003).

In the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), Major Depressive Disorder (MDD) is classified as a mood disorder (American Psychiatric Association, 1994). According to DSM-IV diagnostic criteria, an individual must present with at least 2 weeks of symptoms that indicate deficient positive affect, excessive negative affect, or both. Indeed, research has shown that depressed individuals consistently report low levels of positive affect and high levels of negative affect on questionnaire and interview measures (Clark, Watson, & Mineka, 1994; Jylha & Isometsa, 2006).
With the understanding that dysregulated mood is essential to a diagnosis of depression, there has been increasing interest in recent years in trying to better understand how this mood dysregulation affects an individual’s emotional reactivity. Research literature on this topic can be somewhat problematic, as the terms of emotion and mood are often used interchangeably, and definitions of these terms in the literature can be contradictory (Rottenberg, Gross, & Gotlib, 2005). Thus, it is important to define these terms before exploring how they interact in the context of depression. In line with current literature, emotion is defined as an adaptive reaction, arising when an individual attends and appraises a salient aspect of the environment (Gross, 2008). In contrast, moods are defined as transient episodes of feeling or affect that are only loosely connected with environmental circumstances and are more affected by internal processes (Watson, 2000). Emotions are usually short-lived, and typically coincide with changes in behavior, subjective feelings, and physiology (Keltner & Gross, 1999). Conversely, moods can last for hours or days and exert clear effects on feelings and cognitions (Watson, 2000).

A prominent hypothesis that attempts to clarify the interaction between mood and emotional reactivity in depressed individuals is the Emotion Context-Insensitivity Hypothesis (Rottenberg, Gross, et al., 2005), which suggests that depressed individuals show diminished emotional reactivity to both positive and negative stimuli. This hypothesis draws upon evolutionary explanations for depressive symptoms, which suggest that depressed mood states originally evolved as an internal signal meant to bias an individual against action (Nesse, 2000). In this way, characteristics such as pessimism and lack of motivation may have acted as defensive responses to situations in which
action would be deleterious, such as challenges to dominant figures that would be
dangerous at best and futile at worst (Nesse, 2000). Coming from this framework, it is
clear that a depressed mood state powerfully influences an individual’s response to their
environment. Specifically, a depressed mood state prompts global withdrawal and
disengagement behaviors in response to the environment, and subsequently results in
reduced reactivity to all emotional stimuli regardless of whether the valence of the stimuli
is positive or negative (Rottenberg, Gross, et al., 2005).

Though the emotion-context insensitivity hypothesis is relatively new to the
research literature on depression, findings from studies in which depressed individuals
are exposed to both positive and negative stimuli can be understood within the
framework of this hypothesis. A recent meta-analysis by Bylsma, Morris, & Rottenberg
(2008) on emotional reactivity in major depressive disorder found that individuals who
met clinical criteria for depression show consistent reductions in both positive and
negative emotional responses to mood inductions. All studies included in this meta-
analysis contained a control group of healthy individuals as well as a neutral emotion
condition to allow for the computation of an individual’s positive or negative emotional
response. Additionally, Bylsma and colleagues (2008) found that reductions in emotional
reactivity seen in depressed individuals generalized across behavioral, physiological, and
self-report measures of emotional response.

More specifically, when exposed to either positive or negative emotional stimuli,
clinically depressed individuals show reduced facial expressiveness as measured by facial
muscle activity (Gehricke & Shapiro, 2000; Renneberg, Heyn, Gebhard, & Bachmann,
2005), as well as atypical startle response patterns (Allen, Trinder, & Brennan, 1999;
Dichter, Tomarken, Shelton, & Sutton, 2004; Kaviani et al., 2004), and less overall change in self-reported mood (Rottenberg, Kasch, Gross, & Gotlib, 2002; Rottenberg, Gross, et al., 2005) compared to controls. Additionally, depressed individuals also show less differentiation when compared to healthy controls in the intensity of self-reported sadness in response to negative stimuli that differ in emotional valence (Rottenberg, Gross, et al., 2005). Taken together, these findings reflect a diminished ability in clinically depressed individuals to modulate affect appropriately from one context to another (Mneimne, McDermut, & Powers, 2008).

Recently, researchers have begun to investigate whether similar patterns of muted emotional reactivity are also present in sub-clinically depressed samples. Results show that sub-clinically depressed individuals also exhibit reduced startle response to negative pictures, which occurs when there is a reduction in negative affect, and increased startle response to positive pictures, which occur when there is a reduction in positive affect (Larson, Nitschke, & Davidson, 2007; Mneimne et al., 2008). Though more research on this population is needed, early findings show that a pattern of overall reduction in response to emotional stimuli, similar to what we would expect with the emotion context-insensitivity hypothesis, is also present in sub-clinically depressed samples. These findings highlights the potential relevance of the emotion context-insensitivity hypothesis for understanding a range of depressive severity.

Several emotion theorists argue that emotions have a functional basis and serve as adaptations to problems in the current environment (Keltner & Gross, 2009). Thus, one may hypothesize that reduced emotional reactivity to both positive and negative environmental stimuli posited by the emotion context-insensitivity hypothesis would
result in poor adaptation. Though little research exists to address this hypothesis, early findings suggest that individuals who exhibit high emotion context-insensitivity show poorer psychosocial functioning (Rottenberg, Kasch, et al., 2002). Specifically, it was found that depressed individuals who exhibited the least discrimination between neutral and sad film clips had the poorest psychosocial functioning, as measured by the Global Assessment of Functioning Index (Rottenberg, Kasch, et al., 2002). Additionally, and perhaps more clinically relevant, individuals who showed the lowest reactivity (both in terms of self-report and heart rate) to the amusing film clip were less likely to recover from depression (Rottenberg, Kasch, et al., 2002). These early findings suggest that a better understanding of how the emotion context-insensitivity hypothesis applies to the psychosocial functioning of depressed individuals in their natural environment will be important both in the conceptualization and treatment of this prevalent, serious disorder.

The majority of previous studies on the emotion context-insensitivity hypothesis have focused on the emotional experiences of depressed individuals, and these emotional experiences have been largely artificially simulated in a lab setting. Little is known about how this hypothesis may be relevant in understanding the broader social context in which depressed individuals actually function. One of the most important aspects of the social context, particularly for children and adolescents, is the family environment. Thus, the current study will focus on examining emotional dynamics in families related to depression in parents and adolescents. In this way, the emotion context-insensitivity hypothesis will serve as a theoretical basis for understanding how family dynamics are affected by and related to depression in parents and teens. Both family process and physiological mechanisms of depression will be examined in the framework of emotion
context-insensitivity, in the hopes that a better understanding of these mechanisms from this perspective will provide insight into both the theory and treatment of depression in families.

**Physiological Underpinnings of Emotion Context Insensitivity Theory**

A growing body of literature suggests that the study of individual differences in psychophysiological responses to stress is important in understanding a variety of developmental psychopathology symptoms and processes (Cicchetti and Dawson, 2002). Unlike studies relying on self-report measures, physiological studies are able to provide important objective indices of emotional functioning. A substantial body of work places parasympathetic nervous system (PNS) influences on heart rate at the center of an individual’s capacity to regulate emotions (see Beauchaine, 2001, for a review). As a result, much of the relevant research on the emotion context-insensitivity hypothesis has focused on reactivity of the PNS (Bylsma et al., 2008). This focus on the PNS is consistent with Polyvagal Theory (Porges, 1995, 2007), which highlights the role of PNS activity in emotional arousal and regulation. Atypical patterns of activity in the PNS have been linked to both internalizing and externalizing symptoms in adolescents and adults (Beauchaine, 2001).

The PNS is an “autopilot” system that dominates the majority of our daily activity (Hinnant & El-Sheikh, 2009). It is responsible for the “rest and digest” mechanisms in our body, and thus maintains basal heart rate, respiration, and metabolism in the absence of perceived dangers or stressors (Iversen, Iversen, & Saper, 2000). These functions are concerned with the resting of vital organs, as well as the conservation and restoration of bodily energy (Porges, 1995). According to Polyvagal Theory (Porges, 1995, 2007), the
status of the PNS is thought to parallel homeostasis in the body, in that a homeostatic bodily state is characterized by high parasympathetic activity. Conversely, the withdrawal of parasympathetic activity in response to stimuli may indicate stress in the individual. This conceptualization allows us to quantify an individual’s stress level on a physiological level.

Two aspects of PNS functioning that have received considerable attention in the research literature are baseline respiratory sinus arrhythmia (RSA) and changes in RSA in response to emotion- or stress-inducing stimuli. In the framework of the Polyvagal Theory, RSA is conceptualized as an index of the brain’s ability to regulate parasympathetic activity via the vagus nerve (Porges 1995, 2007). The vagus, or tenth cranial nerve is bidirectional, containing both efferent and afferent fibers (Iversen et al., 2000). Efferent fibers originate in the brainstem and innervate the sino-atrial node, which acts as the cardiac pacemaker. As vagal efferent pathways are inhibitory, increased vagal efferent activity causes the heart rate to slow (Porges, 1995, 2007). Subsequently, decreased efferent activity results in heart rate increase.

Vagal efferent pathways responsible for heart rate regulation originate specifically in the nucleus ambiguus, located in the medulla (Saper, 2000). Efferent fibers in this pathway fire rhythmically with an individual’s breathing frequency. This produces a respiratory rhythm in heart rate, which can be indexed by RSA (Porges, 1995). Specifically, RSA is a measure for the degree of ebbing and flowing of the heart rate during the respiratory cycle (Beauchaine, 2001). In this way, the influence by the vagal efferent pathways originating in the nucleus ambiguus on the heart can be monitored by RSA (Porges 1995, 2007).
Research literature has shown that baseline measures of RSA and change in RSA in response to environmental stimuli measure distinct though related aspects of emotionality (Beauchaine, 2001). Generally, resting RSA seems to reflect temperamental reactivity and emotionality in an individual, while change RSA reflects an individual’s attentional focus, emotion regulation, and mood state (Beauchaine, 2001). As previously noted, many studies of the emotion context-insensitivity hypothesis have focused on individual differences in RSA (see Bylsma et al., 2008, for a review), as both this hypothesis and Polyvagal Theory highlight RSA as central to emotion regulation capacity. Trends in this beginning literature seem to be in line with the emotion context-insensitivity hypothesis, in that the inflexibility of affect we see behaviorally in depressed individuals coincides with a physiological inflexibility in the regulation of parasympathetic activity.

High resting RSA has been related to the ability to cope with life stressors in adults (Fabes & Eisenberg, 1997). Similarly, significant RSA decrease in response to challenge has been found to relate to more adaptive emotion regulation in preschoolers and sustained attention in school-aged children (Calkins & Fox, 2002). However, excessive RSA suppression across situations of varying emotional valence has been associated with both internalizing and externalizing disorders (Beauchaine, 2001), as has low resting RSA (Bosch, Riese, Ormel, Verhulst, & Oldehinkel, 2009). The presence of reduced resting RSA levels in both individuals with internalizing and externalizing disorders suggests a link between low basal RSA and emotional inflexibility (Beauchaine, 2001). This link will be important to explore within the framework of emotion context-insensitivity theory.
Studies investigating baseline RSA in depressed individuals show mixed findings. Generally, lower baseline RSA has been found in adolescents and adults with depression compared to healthy controls (Dietrich, et al., 2007; Rottenberg, Clift, Bolden, & Salomon, 2007). Similarly, infants and children of depressed mothers have lower baseline RSA compared to infants and children of healthy mothers (Dawson et al., 2001; Field et al., 1988; Field, Pickens, Fox, Nawrocki, & Gonzalez, 1995; Forbes, Fox, Cohn, Galles, & Kovacs, 2006; Jones et al., 1998). In a recent study, high resting RSA among upper elementary school children was protective against depression symptomatology, but the level of protection varied as a function of maternal melancholia (Shannon, Beauchaine, Brenner, Neuhaus, & Gatzke-Kopp, 2007). Specifically, it was found that the higher the mother’s level of melancholic depression, the less protective high RSA became against depressive symptomatology. However, in a longitudinal study of clinically depressed adults, higher levels of baseline RSA at Time 1 predicted non-recovery from depression at Time 2, even when statistically controlling for initial depression severity, age, and medication use (Rottenberg, Wilhelm, Gross, & Gotlib, 2002). These contradictory results call for continued research in this area.

While there has been tremendous growth in the RSA literature, most studies have focused on RSA in individuals, measured at baseline and during an emotion-provoking stimulus, such as a film clip. This paradigm fails to fully capture a key element of Polyvagal Theory, which suggests that the evolutionary function of the “smart vagus” is to enable the flexible emotional responding often required for social behavior (Porges, 2007). Results of studies using non-social paradigms may not fully inform our understanding of the role of RSA in regulating emotions during social interactions.
Notably, Butler, Wilhelm, and Gross (2006) examined the relation between baseline RSA and emotional expressions during social interactions in college-aged women, and found that higher resting RSA predicted more negative affect and less positive affect when discussing an upsetting film clip with a partner. This finding suggests that higher resting RSA allows for greater emotional flexibility, as appropriate to the task. Change RSA in depressed individuals is a fairly new area in the literature, and most studies examining change RSA have used asocial emotion-provoking stimuli. As the role of baseline RSA is more established in the literature, and has been empirically explored in its relation to social functioning, the current study focuses solely on the role of baseline RSA in family interactions.

Parent-child interactions may provide an ideal setting in which to examine the role of RSA in social interactions, due to the emotional nature of parent-child relationships. Nevertheless, the emotional and social correlates of RSA have not been fully examined in research on families, and research is especially scarce on correlates of RSA in families affected by depression. Of note, Perlman, Camras, & Pelphrey (2008) examined resting RSA in 42 parents of 4-5 year old children, and found that higher parental RSA was related to greater self-reported engagement in effective emotion socialization practices with their children, including emotion coaching practices, and to children’s knowledge of emotional situations. Additional research on the role of RSA in observed parent-child functioning among families affected by depression is clearly needed in order to continue pushing the field forward.

Family Process Mechanisms of Depression
The recognition of depression as a prevalent and serious disorder in adolescent youth has brought with it increased interest in the family influences on depressive symptom expression and maintenance in adolescence. Many family environmental antecedents to the onset of depression in adolescence have been cited in research, including frequent exposure to aversive social exchange between parents and adolescents, negative parental attitudes regarding depression, and adverse family life events such as divorce, family violence, death of a family member, child abuse, and chaotic lifestyles (Weitzman, 2006; Wisdom & Agnor, 2007). Clearly, the onset and maintenance of depression is multi-determined, with genetic, neurobiological and social influences all playing a role. However, a solid conceptualization of how family functioning affects and is affected by depression is especially relevant to developing improved treatment efforts surrounding this disorder.

Built on this framework is the understanding that depressive symptomatology exists in an interpersonal context (Sheeber, Hops, & Davis, 2001). The family environment is often the most salient interpersonal context for adolescents, and removal of oneself from one’s family is often not feasible during this stage of the lifespan (Eshbaugh, 2008). Adding support to the notion that the interpersonal environment of the family is important for understanding adolescent depressive symptoms is the finding that relations with family members appear to be more closely linked to depression than relations with peers (Barrera & Garrison-Jones, 1992; McFarlane, Bellissimo, & Norman, 1994). From this vantage point, increased attention should be directed toward examining various mechanisms by which some forms of aversive interactional family processes may contribute to the development of adolescent depression.
A prominent hypothesis on how aversive family processes result in adolescent depression is that parents may, through positive and negative reinforcement, inadvertently teach their adolescents to behave in a depressed manner (Sheeber et al., 2001). In line with this hypothesis, adolescents have been found to “learn” depressive behaviors from observing and responding to interparental interactions (Davis, Sheeber, Hops, & Tildesley, 2000). Specifically, the expression of facilitative behavior and suppression of aggressive behavior by female adolescents in response to interparental depressive behavior (the adolescent’s father expressing depressive behavior to the adolescent’s mother, or vice versa) was predictive of increases in depressive symptomatology for female adolescents. Conversely, the expression of aggressive behavior by male adolescents in response to interparental depressive behavior was predictive of increases in their depressive symptoms. For both genders, the expression of depressive behaviors in response to interparental depression was significantly related to adolescent depression.

Building on this hypothesis are findings that depressive behaviors in adolescents may be reinforced by their effectiveness in constraining parental aggressive behaviors (Dadds, Sanders, Morrison, & Rebgetz, 1992; Sheeber, Hops, Andrews, Alpert, & David, 1998). Sheeber and colleagues (1998) found that mothers and fathers differentially responded to adolescent depressive behaviors: mothers were more likely to increase facilitative behavior towards the adolescent, while fathers were more likely to decrease their aggressive behaviors. In related research, findings also show that mothers’ depressive behaviors effectively suppress aggressive behavior from their children (Dumas, Gibson, & Albin, 1989; Hops et al., 1987). These findings map on to the
evolutionary assertion that depression behaviors can be adaptive in aversive situations (Nesse, 2000), in that ending an aversive interchange with any family member by exhibiting behaviors of withdrawal and disengagement often negatively reinforces these depressive behaviors. As an aversive home environment is often a chronic stressor for parents and adolescents (Eshbaugh, 2008), chronic exposure to this environment may elicit global withdrawal behaviors and result in reduced reactivity to positive or negative emotional stimuli, as posited by the emotion context-insensitivity hypothesis.

Another line of research that ties the emotion context-insensitivity hypothesis to family processes is focused on exploring rigidity in family interactions. As defined by Hollenstein, Granic, Stoolmiller, and Snyder (2004), rigidity in family interactions is characterized by a diminished behavioral repertoire in the parent-child dyad, limited capacity to switch behaviors in response to environmental changes, and a tendency to get “stuck” in any one particular behavior pattern. Positive relationships have been found between family rigidity and adolescent suicidal thoughts and behaviors (Carris, Sheeber, & Howe 1998) and child internalizing psychopathology (Hollenstein et al., 2004).

Some rigidity in family interaction is normative, as evidenced by a study conducted by Hollenstein and Lewis (2006) that explored normative changes in interpersonal flexibility during positive and negative emotional episodes within parent-adolescent interactions. This study found that all mother-daughter dyads showed less emotional flexibility during the conflict interaction task in comparison to the positive interaction tasks, regardless of the stress level of the dyad.

However, familial rigidity is more pronounced and more problematic in families that are high in conflict and/or stress (Hollenstein & Lewis, 2006; Lichtwarck-Aschoff,
In the same study, Hollenstein and Lewis (2006) also compared familial flexibility between high- and low-stress dyads. High stress dyads were defined as those in which adolescents had experienced 3 or more types of stressful events over the past six months. In addition to showing less flexibility during the conflictual interaction task, high-stress dyads also showed less flexibility during the positive interaction task, and expressed less negative emotion overall. This finding of global inflexibility and suppression of emotional reactivity to both positive and negative environmental stimuli in high stress dyads suggest that increased familial rigidity causes interaction patterns that map on to the emotion context-insensitivity hypothesis.

**Hypotheses**

The goal of this study is to better understand how family dynamics are related to depression in parents and teens. Specifically, we hope to understand how depression affects an individual’s affective response to their partner’s expressed affect during adolescence. Additionally, we will explore whether depression differentially affects an individual’s affective response to their partner during pleasant vs. conflictual family interactions. Finally, we will explore how an individual’s baseline RSA affects the relationship between their level of depression symptoms and their affective response to their partner.

Based on Emotion Context Insensitivity Theory (Rottenberg, Gross, et al., 2005), it is hypothesized that individuals experiencing high levels of depression symptoms will exhibit generalized problems with disengagement. Problems with disengagement would predict that, compared to individuals with low levels of depression, individuals experiencing high levels of depression symptoms would show a weaker relationship
between their own affective expression and their partner’s affect across all observed affect states (distress, anger, and positive affect). This finding would support the notion that depressed individuals show reduced reactivity to all emotional stimuli regardless of whether the valence of the stimuli is positive or negative (Rottenberg, Gross, et al., 2005). In the case of our study, the ‘emotional stimuli’ being presented to participants will be their partner’s affect during the discussion tasks.

Keeping in line with previous findings that high stress dyads show less flexibility and less response to emotional manipulation (Hollenstein & Lewis, 2006), it is also expected that individuals affected by high levels of depression symptoms will show less differentiation of affective dynamics during pleasant vs. conflictual interactions. Thus, individuals affected by depression will show the same weak relationships between their own affective response and their partner’s affect regardless of whether the interaction is designed to elicit positive or negative affect. Individuals not affected by depression are expected to change their affective patterns in response to the task demands. Specifically, for individuals with low levels of depression symptoms, a stronger relationship between their own positive affect and their partner’s positive affect will be seen in the pleasant family interaction, while a stronger relationship between (1) their own anger and their partner’s anger and (2) their own distress and their partner’s distress will be seen in the conflictual family interaction.

A novel aspect of the current study is the ability to examine both external signs of emotionality via behavioral observation and internal signs of physiological arousal via RSA. Integrating both physiological and behavioral data into the analyses should give an even richer understanding of how family dynamics are affected by and related to
depression in parents and teens. Once again, there is a paucity of research on how physiological arousal as measured by RSA unfolds in the context of family interactions, and thus hypotheses on these relationships will be exploratory in nature. In line with Butler and colleagues (2006), we hypothesized that individuals with higher baseline RSA would show greater affective flexibility during parent-child interactions, including greater expression of and responsivity to task-appropriate positive and negative affect during interactions. Further, based on the conceptualization of RSA as a marker of individual differences in negative emotionality and emotional inflexibility (Beauchaine, 2001), it may be hypothesized that individuals demonstrating both low RSA and high depression symptoms will show the most problems with respect to disengagement, in that they will show the weakest relationship between their own and their partner’s affect across all affect types and across all tasks.

Methods

Participants

Participants were 58 parent-adolescent dyads, with all adolescents between the ages of 11 and 17. Families were recruited from the surrounding community via advertisements in local newspapers and online message boards, and through flyers and pamphlets distributed through schools, churches, and community centers. Flyers and pamphlets used for recruiting targeted both low- and high-risk adolescents. The mean age for adolescents was 13.71 years (SD = 1.71 years), and 58.6% were female. One parent was required to complete the study along with the adolescent, and 86.2% of participating parents were mothers. By teen report, 30 teens were European American
(51.7 %), 22 were African American (37.9 %), 3 were Asian-American (5.2%), and 3 were biracial (5.2%). Parents were married or cohabitating in 46.6% of participating families, and 44.8% of participating parents had completed at least a 2-year associates degree. The participating parent was employed at least part-time in 75.9% of all families, and the median family income was between $30,000-$39,000 annually.

**Self Report Measures**

Once families expressed interest in the study, a packet of questionnaires was sent to both the parent and the adolescent to gather further information regarding adolescent and parent depressive symptoms. Specific measures used in these analyses include:

1. **Children’s Depression Inventory (CDI; Kovacs, 1985):** All adolescents completed this questionnaire, a self-report inventory of 27 items coded on a 3-point scale (1: absence of symptoms; 2: moderate symptoms; 3: severe symptoms). A higher total score reflects higher levels of depression. In previous research, the CDI has shown to be a good screening measure for depression in children and adolescents, with acceptable sensitivity and specificity across a number of studies (see Sitarenios & Stein, 2004).

2. **Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977):** All parents completed this questionnaire, a self-report inventory of 20 items coded on a 4-point scale (0: symptom experienced 0-1 day per week; 1: 1-2 days per week; 2: 3-4 days per week; 3: 5-7 days per week). A higher total score reflects higher levels of depression. In previous studies, the CES-D has shown good internal and test-retest reliability, but validity studies suggest that the measure is not specific to depression (Rush, First, & Blacker, 2008). However, the validity
data obtained with the CES-D are comparable to data obtained with the Beck Depression Inventory when it is used as a first-stage screening device (Rush et al., 2008).

**Lab Visit Procedure**

Once both the parent and the adolescent had filled out the questionnaire packets, families were invited in for a lab visit lasting approximately 90 minutes and located on the university campus. At the lab visit, consent forms were reviewed and informed consent was obtained. Adolescents were diagnosed for depression using the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Orvaschel, Puig-Antich, Chambers, Tabrizi, & Johnson, 1982), a semi-structured diagnostic interview. Only the portion of the K-SADS assessing mood disorders was used. The parent and adolescent were interviewed separately, and both interviews focused exclusively on the adolescent’s expression of depressive symptoms. Interviewers reported the peak severity of each symptom both over the adolescent’s lifetime and in the last two weeks. Severity was recorded on a scale from 1 (not at all present) to 3 (severe symptoms). In this way, responses were used to determine whether participants met diagnostic criteria for depression at the lab visit.

During all remaining lab tasks, the adolescent and their parent were seated in comfortable chairs alone in the observation room while physiological recordings were monitored from the adjacent room. Specifically, disposable Ag/AgCl electrodes were attached to the chest in a modified lead II configuration to measure heart rate, and a stretchable respiratory effort transducer band was secured around the participant’s chest to measure respiration rate.
Participants first took part in a two-minute paced breathing task. Parents and adolescents were seated in front of separate computer monitors linked for simultaneous presentation of stimuli, but oriented so parents and adolescents could not see one another easily. During this task, participants were instructed to breathe in and out along with the presentation of the words “Breathe In” and “Breathe Out” on a computer screen. This encouraged participants to take slow, deep breaths, as they would normally do when they are feeling relaxed. This task was designed to induce a respiratory rate of 9 cycles per minute, following recommendations by Wilhelm, Grossman, and Coyle (2004). Physiological activity recorded on this task served as the baseline of physiological response for each participant.

Participants were then asked to complete two 5-minute discussions on family-related matters. Families were asked to: 1) discuss a family conflict between parents and teens that had occurred in the last month, and how it was resolved/could be resolved, and 2) discuss a plan for a positive event that the family could do together in the next week. These general prompts allowed parent-adolescent dyads to focus on a topic of salient importance to them within the task parameters. These tasks were adapted from Dishion & Kavanagh (2003), and are meant to pull for distinct emotional reactions. Specifically, the first task is designed to pull for negative affect reactions, while the second task is designed to elicit positive affect. Tasks were presented in a consistent order across families, given our interest in examining the role of task switches on parents’ and teens’ affective expression. Discussion tasks were digitally recorded using small, remotely-operated wall-mounted digital cameras. Following a debriefing, each dyad received $50 for participation.
Psychophysiological Measures

Heart rate and respiration data were collected simultaneously from the parent and adolescent using a Biopac MP150 system, with data recorded onto a Dell Optiplex 745 computer. Amplifiers were set for a gain of 1000 and signals were sampled at 200 Hz. Biopac ECG100 electrocardiogram amplifiers were used to collect electrocardiogram (ECG) data. ECG data were reduced off-line in Acknowledge 4.0 using low (35 Hz) and high (1 Hz) pass filters. Heart rate (HR) was derived from the interbeat intervals (IBI) using an automated algorithm, and measured as time in milliseconds between sequential R-waves of the ECG. The respiratory band was attached to a Biopac RSP100C amplifier. Raw signals from the respiratory band were transformed via band pass filter, with a low frequency cut-off fixed at 0.05 and a high-frequency cut-off fixed at 1. Following these reductions, RSA was computed using a time-domain, peak-valley procedure employing inspiratory and expiratory periods as windows for determining the range of cardiac-interval fluctuations associated with the respiratory cycle (for a complete description of this procedure, see Grossman, van Beek, & Wientjes, 1990). Physiological and observational recordings were synchronized using Noldus Observer XT 7.0. All physiological parameters were inspected for artifacts, and artifacts were corrected using automated correction routines (and manual correction when possible, for remaining artifacts).

Observational Measures

Observational codes were recorded with Noldus Observer XT 7.0. Trained observers coded each participant independently in real-time, yielding two synchronized streams of data. The Simple Affect Coding System (SACS; Jabson, Venkatraman, &
Dishion, 2003) was used to assess the objective display of affect in real-time during interactions. Each code was based on a combination of facial expressions, gestures, posture, voice tone, volume, and speech rate that captured a gestalt of the affective tone of each moment of behavior. Affect displayed by each participant during the interaction tasks was coded into one of five affective categories: positive affect (happiness and surprise attributes), validation (communicating engagement attributes), anger/disgust (anger and disgust attributes), distress (sadness, fear, and withdrawal attributes), and neutral (non-emotional or non-codeable attributes). Coders would first watch the discussion tasks once through to get a sense of each participant’s neutral affect. Coders would then assign an affect code to each participant at the start of the task, and note each change in affect state throughout the task. In this way, an affect state was assigned to each second of the discussion tasks for each participant. All codes were mutually exclusive (i.e., an individual could be in only one affect state at a time).

For hypothesis testing analyses, positive affect and validation codes were collapsed into an overall positive affect variable. Real-time coding yields times of onset and offset for displayed affect, which were used to calculate the time spent in each affective state for each participant. These time sums were calculated for each one-minute epoch, yielding 5 epochs per participant per task. These 5 epochs were then averaged, yielding one number representing the average amount of affect displayed per minute per participant for each task.

Observers were trained to a minimum criterion of 70% agreement and a kappa of 0.60 using an event-unit based comparison with a 2-second tolerance window and 80% event overlap, and a criterion of a 0.80 kappa using a time-unit based comparison with a
2-second tolerance window, with reliability calculated using GSEQ 5.0 (Bakeman, Quera & Gnisci, 2009). Both reliability methods were employed because a time-unit kappa may provide a somewhat liberal reliability estimate, while event-based kappas may be somewhat conservative (Bakeman et al., 2009). Weekly training meetings were held to minimize observer drift. Twenty percent of all family visits were coded by all coders and the coding supervisor. For the event-unit method, average coder agreement was 74% (kappa = 0.64), and for the time-unit method, average agreement was 93% (kappa = 0.81).

**Analysis Plan**

Linear mixed models were implemented in SPSS 17.0, with the family process indices (the durations of various affect states for parents and adolescents in the various tasks) as dependent variables. To analyze results from a repeated-measures study like the current experiment, researchers have traditionally used multivariate analysis of variance (MANOVA) or repeated-measures ANOVAs (Jennings, 1987). Within a repeated-measures design, it is often the case that measurements made in sequence on the same subjects are correlated with each other (Bagiella, Slan, & Heitjan, 2000). As a result, analysis methods must take into account this correlation (Bagiella et al., 2000). In recent years, researchers have increasingly used mixed models to analyze repeated-measures data. These models have several advantages over traditional methods, as reviewed by Bagiella and colleagues (2000). First, because one fits mixed models by maximum likelihood, cases with missing observations can be included, thus leading to more reliable conclusions. Conversely, repeated-measures ANOVAs and MANOVAs estimate parameters by a moment-matching method that requires deletion of any case with missing
data. Second, mixed models attempt to estimate both the mean and the variance, and can thus lead to more efficient estimates and more powerful statistical tests. Third, mixed models only estimate the essential number of parameters as defined by the researcher, and consequently make better use of the available degrees of freedom. Finally, mixed models are more flexible, allowing one to model the dependence of outcomes on both fixed and time-varying predictors.

Separate linear mixed models were run for each affect code (overall positive affect, anger/disgust, and distress). Additionally, separate linear mixed models were implemented for adolescent and parent affect codes so as to simplify the analyses. Specifically, analyses predicted the average display of affect in seconds per minute across the five minutes. In the teen-focused analyses, teen depression symptoms as measured by the CDI, teen baseline RSA, and parental display of the same affect were used as predictors (i.e., in analyses predicting teen positive affect, parent positive affect was used as a predictor). We included teen depression symptoms as measured by the CDI rather than diagnostic status as measured by the K-SADS for multiple reasons. First, when reviewing the data collected from interviews, adolescents who received a clinical diagnosis of depression also scored above the clinical cut-off of 16 on the CDI. The only exception was an adolescent who scored very low on the CDI but was clinically elevated from the interview; however, this adolescent had a previous diagnosis of Bipolar Disorder. Second, the interview data was only categorical, as the symptom severity data was not clearly marked by the researchers on a number of participant interviews. Using the CDI allowed us to analyze depressive symptoms on a continuum, which is especially
important given that subsyndromal depression can also lead to impaired functioning (Hammen & Rudolph, 2003).

In the parent-focused analyses, parent depression symptoms as measured by the CESD, parent baseline RSA, and teen display of the same affect were used as predictors. In this way, the participant’s own display of affect was predicted by their own depressive symptoms and physiological arousal, as well as their partner’s affective display. All variables in these analyses were centered in order to yield interpretable betas, as well as to decrease potential collinearity effects for any interaction terms. All preliminary mixed model analyses included a fixed effect for task and utilized a first-order autoregressive covariance matrix, which allowed for correlated residuals across adjacent time-points. Models that showed any significant interaction effects for task warranted follow-up analyses, in which separate linear mixed models were implemented for each task. Significant interactions found in the follow-up analyses were further probed using a Multiple Linear Regression two-way interaction tool developed by Preacher, Curran, & Bauer (2006). For each significant interaction, the region of significance, simple intercepts, and simple slopes calculated at the boundaries of this region were computed (see Preacher et al., 2006).

**Results**

**Descriptive Analyses**

Descriptive statistics for parental and adolescent depression symptoms, baseline RSA, and observed affect during discussion tasks are shown in Table 1. On the CDI, eleven adolescents scored above the clinical cutoff of 17 (Sitarenios & Stein, 2004). As
measured by the CESD, 20 parents scored above the clinical cutoff of 16 (Rush et al., 2000).

As a preliminary step, correlations were run between family interaction process indices, depression symptoms, baseline RSA levels, and family demographics (results are shown in Table 2). Specifically, we examined whether teen age, parent and teen gender, and ethnicity were significantly correlated with any of the predictor or outcome variables measured. In these analyses, ethnicity was a two-category variable based on the teen’s self-reported ethnicity: (1) European American and (2) ethnic minority status (all other ethnic groups reported). Both parent gender and teen gender were significantly negatively correlated with teen baseline RSA, which showed that both being a teen male and participating with a male parent were correlated with lowered teen baseline RSA. Further, teen ethnicity was significantly positively correlated to both parent distress and teen anger expressed during the family activity discussion. This correlation showed that having ethnic minority status was correlated with increased parental distress and decreased teen anger during the family activity discussion. As parent gender, teen gender, and ethnicity were all significantly correlated with various family interaction process indices and predictor variables, they were included as covariates in all analyses.

Preliminary paired samples t-tests examined whether levels of distress, anger, and affect differed across tasks for both parents and teens. Results were significant for both parent expressed anger ($t(53) = 4.56, p < 0.05$) and teen expressed anger ($t(52) = 4.46, p < 0.05$), indicating that both parents and teens expressed more anger in the conflict task versus the fun discussion. Results were also significant for both parent expressed positive affect ($t(54) = -5.05, p < 0.05$) and teen expressed positive affect ($t(53) = -3.88, p$
< 0.05), indicating that both parents and teens expressed more positive affect in the fun discussion versus the conflict task. Results were significant for teen expressed distress \((t(52) = 2.71, p < 0.05)\), indicating that teens expressed more distress in the conflict task versus the fun discussion. However, parent expressed distress did not differ significantly across tasks \((t(53) = 0.96, p = 0.34)\). Overall, results generally supported the task manipulation on observed parental and teen affect.

**Linear Mixed Model Analyses for Teen Affect**

**Distress.** Results for the preliminary analyses examining teen distress, in which a fixed effect for task was included, are shown in Table 3. No significant main effects were found, though task showed an effect on teen distress at trend-level \((p = .059)\). No significant interaction effects were found, and thus further separate analyses by task were not warranted.

**Anger.** Results for the preliminary analyses examining teen anger, in which a fixed effect for task was included, are shown in Table 4. Results indicated a significant main effect for ethnicity, indicating that teens with an ethnic minority status showed less anger than teens classified as European American across both tasks. There was also a significant main effect for teen depression symptoms, which indicated that adolescents with high levels of depression symptoms showed more anger across both tasks than teens with low levels of depression symptoms. Further, there was a significant main effect for parent anger: across both tasks, the higher the parent’s level of expressed anger, the higher the teen’s anger. A significant interaction effect for parent anger and teen depression was also found. This interaction was not probed further because subsequent analyses showed that this effect is only significant during the family conflict task. Given
these later analyses, it was unnecessary to unpack the interaction in this initial analysis. No other significant interaction effects were found, though one interaction term was at trend level: task by teen depression (p = .054). Given this trend-level finding, further analysis was warranted.

Follow-up analyses, in which separate linear mixed models were run for each task, are shown in Table 5. In both tasks, there was a significant positive main effect of parent anger on teen anger: the higher the parent’s level of expressed anger, the higher the teen’s anger. This was the only significant finding for the family activity discussion. However, the family conflict discussion analysis produced two more main effects. Specifically, teen boys showed significantly more anger than teen girls, and teens with ethnic minority status showed significantly less anger than European American teens in the conflictual family discussion task.

Additionally, there was a significant interaction effect for teen depression and parent anger on teen anger during the family conflict discussion, as seen in the preliminary analyses. Of note, this interaction was not significant during the family activity discussion, emphasizing the importance of follow-up analysis where appropriate. Further investigation of this significant interaction effect showed that as teen depression symptoms increased, the relationship between teen anger and parent anger became more strongly positive (see Figure 1). However, the simple slope of teen anger regressed on parent anger was only significant at two of the three chosen values for teen depression: the mean and one standard deviation above the mean. Of more interest are the values of teen depression for which the simple slope was statistically significant. The region of significance on teen depression ranges from -37.65 to -6.60, indicating that any given
simple slope outside this range is statistically significant. Given that the values for centered teen depression range from -8.84 to 25.16, this indicates that the effect of parent anger on teen anger is not significant for those teens with very low depression symptoms, but is significant for teens with mean to high levels of depression.

**Positive affect.** Results for the preliminary analyses examining teen positive affect, in which a fixed effect for task was included, are shown in Table 6. Results showed a significant main effect of task, which indicated that teens expressed significantly more positive affect in the family activity discussion compared to the family conflict discussion. There was also a significant main effect of parent positive affect: across both tasks, the higher the parent’s level of expressed positive affect, the higher the teen’s positive affect. No significant interaction effects were found, and thus further separate analyses by task were not warranted.

**Linear Mixed Model Analyses for Parent Affect**

**Distress.** Results for the preliminary analyses examining parental distress, in which a fixed effect for task was included, are shown in Table 7. No significant main effects were found, though teen distress showed a positive effect on parent distress at trend-level (p = .056). Results indicated a significant three-way interaction effect of task by parent baseline RSA by teen distress, thus warranting follow-up analyses. Separate linear mixed models were then run for each task, as shown in Table 8.

Results indicated that the effect of the relationship between parent baseline RSA and teen distress on parent distress differed across tasks. In the family conflict task, there was a significant interaction effect of parent RSA and teen distress on parent distress. Further investigation of this significant interaction effect showed that as parent baseline
RSA increases, the relationship between parent distress and teen distress became more strongly positive (see Figure 2). However, the simple slope of parent distress regressed on teen distress was only significant at one of the three chosen values for parent RSA: one standard deviation above the mean. Of more interest are the values of parent RSA for which the simple slope was statistically significant. The region of significance on parent RSA ranges from -177.35 to 12.37, indicating that any given simple slope outside this range is statistically significant. Given that the values for centered baseline RSA range from -124.54 to +243.21, this indicates that the effect of teen distress on parent distress is not significant for those parents with low to mean baseline RSA, but is significant for parents with high RSA. Conversely, in the family activity task, the interaction between parent RSA and teen affect was not significant. However, a significant main effect of teen distress on parent distress was found: the higher the teen’s level of expressed distress, the higher the parent’s distress.

**Anger.** Results for the preliminary analyses examining parental anger, in which a fixed effect for task was included, are shown in Table 9. Results indicated a significant main effect of task, in that parents expressed significantly more anger in the conflict discussion compared to the family activity discussion. There was also a significant main effect of teen anger: across both tasks, the higher the teen’s level of expressed anger, the higher the parent’s anger. No significant interaction effects were found, though three interaction terms were at trend level: task by teen anger (p = .065), parent baseline RSA by teen anger (p = .065), and task by CESD by parent baseline RSA (p = .061). Given these trend-level findings, further analysis was warranted.
Follow-up analyses, in which separate linear mixed models were run for each task, are shown in Table 10. In both tasks, there was a significant positive main effect of teen anger on parent anger: the higher the teen’s level of expressed anger, the higher the parent’s anger. This was the only significant finding for the family activity discussion. However, in the family conflict discussion, results indicated a significant interaction effect of teen anger and parent baseline RSA on parental expression of anger. Further investigation of this significant interaction effect showed that as parent baseline RSA decreases, the relationship between parent anger and teen anger became weaker and less positive (see Figure 3). However, the simple slope of parent anger regressed on teen anger is only significant at two of the three chosen values for parent RSA: the mean and one standard deviation below the mean.

Of more interest are the values of parent RSA for which the simple slope was statistically significant. The region of significance on parent RSA ranged from 32.93 to 236.11, indicating that any given simple slope outside this range is statistically significant. Given that the values for centered baseline RSA ranged from -124.54 to +243.21, this indicates that the effect of teen anger on parent anger was not significant for those parents with high baseline RSA, but was significant for parents with low to mean RSA. The given range of significance may also suggest that the effect of teen anger on parent anger was significant for parents with very high baseline RSA, and in this case the simple slope would posit that the relationship between parent and teen anger was significantly negative for parents with very high baseline RSA. However, as our sample only included one parent above the upper range of significance, results regarding very high RSA should be interpreted with caution.
Additionally, results indicated a significant interaction between parent baseline RSA and parent depression on parent expressed anger. Further investigation of this significant interaction effect showed that none of the simple slopes for the chosen RSA values (one standard deviation below the mean, the mean, and one standard deviation above the mean) were significant (see Figure 4). Again, of more interest are the values of parent RSA for which the simple slope was statistically significant. The region of significance on parent RSA ranged from -126.09 to 194.71, indicating that any given simple slope outside this range is statistically significant. Given that the values for centered baseline RSA ranged from -124.54 to +243.21, this indicates that the effect of parent depression on parent anger was only significant for those parents with very high baseline RSA. Specifically, for parents with very high RSA, the relationship between parent depression and parent anger was positive. However, as our sample only included one parent above the upper range of significance, results regarding very high RSA should be interpreted with caution.

**Positive affect.** Results for the preliminary analyses examining parental positive affect, in which a fixed effect for task was included, are shown in Table 11. Results indicated a significant main effect of task, in that parents expressed significantly more positive affect in the family activity discussion compared to the family conflict discussion. There was also a significant main effect of teen positive affect: across both tasks, the higher the teen’s level of expressed positive affect, the higher the parent’s positive affect. Further, there was a significant interaction effect of parent depression and teen positive affect on parent positive affect. Further investigation of this significant interaction effect showed that as parent depression symptoms increased, the relationship
between parent distress and teen distress became weaker and less positive (see Figure 5). However, the simple slope of parent distress regressed on teen distress was only significant at two of the three chosen values for parent depression: the mean and one standard deviation below the mean. Of more interest are the values of parent depression for which the simple slope was statistically significant. The region of significance on parent depression ranges from 3.57 to 67.61, indicating that any given simple slope outside this range is statistically significant. Given that the values for centered parent depression range from -12.67 to 30.33, this indicates that the effect of teen positive affect on parent positive affect is not significant for those parents with high depression symptoms, but is significant for parents with low to mean levels of depression. As there were no significant interaction effects for task, further separate analyses by task were not warranted.

**Discussion**

The broad goal of this study was to better understand how family dynamics are related to depression in parents and teens, with respect to how depression affects an individual’s affective response to their partner’s expressed affect during adolescence. Specifically, we sought to explore whether depression differentially affects an individual’s affective response to their partner during pleasant vs. conflictual family interactions. Further, we explored how an individual’s baseline RSA affects the relationship between their level of depression symptoms and their affective response to their partner.
In general, it appears that the task manipulation succeeded in pulling for conflictual versus enjoyable family discussions for both parents and teens, in that both parents and teens showed significantly more positive affect and significantly less anger in the fun family activity discussion versus the conflict task. Additionally, teens showed significantly more distress in the conflict task versus the fun family activity discussion. Preliminary paired sample t-test findings initially suggested that the task manipulation was not successful in regards to parent expressed distress. However, subsequent mixed model analyses for parent expressed distress showed that findings differed significantly across discussion tasks (as further outlined below), suggesting that task manipulation was partially successful for expressed distress.

In general, it appeared that partner affect was a significant predictor of both parent and teen affect across both discussion tasks. For both parents and teens, the level of expressed anger by their partner significantly and positively predicted their own expressed anger in both discussions. Similarly, the level of expressed positive affect by their partner significantly and positively predicted both parents’ and teens’ positive affect across both tasks. The findings for distressed affect were less clear. For parents, teen distress was only significantly predictive of their own distress during the fun family activity discussion. For teens, parental distress was not significantly predictive of their own distress. These findings may be best interpreted in the framework of understanding emotion through approach and avoidance motivation (Carver & Harmon-Jones, 2009). This line of research associates behavioral tendencies to approach and avoid with emotional states. Specifically, recent physiological and self-report studies have linked anger and joy emotion states to approach-related motivations and behaviors, while fear
and sadness have been linked to avoidance-related motivations and behaviors (Carver & Harmon-Jones, 2009). Given this framework, it makes sense that expressed distress did not pull for the same reciprocity as did expressed anger or positive affect in the current study. Our findings support the assertion that specific emotions are linked to approach and avoidance behavior, as expressed positive affect and anger were both consistently and significantly related to partner expressed affect, while expressed distress was not. Overall, these findings show that observed affects in parents and teens are strongly influenced by one another, regardless of whether the interaction is pulling for distinctly positive or negative emotions.

**Teen Affect: Depression and Baseline RSA Findings**

We sought to examine the role of both teen depression symptoms and baseline RSA in moderating the responsivity of teens to their parent’s affect. Across tasks, no significant main effects or interaction effects were found for teen baseline RSA. This nonsignificant finding runs counter to Polyvagal theory, which posits that the evolutionary function of the “smart vagus” is to enable the flexible emotional responding often required for social behavior (Porges, 2007). However, this study only incorporated baseline RSA in the analyses, and did not investigate the effects of change RSA. Recent literature findings suggest that in order to get a clear picture of the influence of RSA on psychosocial functioning in youth, it may be important to consider baseline RSA in conjunction with change RSA in response to social stimuli (Hinnant & El-Sheikh, 2009). In a recent study, changes in teen RSA were significantly related to teens’ ability to regulate affect by social engagement with a parent (Willemen, Goossens, Koot, & Schuengel, 2008). It is also important to note that most studies investigating the effects
of RSA have used exclusively adult samples, and thus it may be that the role of baseline RSA functions differently in adolescent populations.

However, teen depression symptoms were found to significantly impact teens’ responsivity to their parents’ anger during the family conflict discussion. Specifically, at higher levels of teen depression symptoms, the relationship between teen anger and parent anger became more strongly positive. Further, the regions of significance for this effect indicated that the effect of parent anger on teen anger was only significant for teens with mean to high levels of depression. This region of significance suggests that both subsyndromal and clinical levels of teen depression symptoms have a deleterious effect on the expression of teen anger during conflictual parent-child interactions.

This finding appears counter to Emotion Context Insensitivity Theory (Rottenberg, Gross, et al., 2005), in that this theory would predict teens suffering from depression to be less responsive to emotional stimuli – in this case, parent anger. However, one potential issue with past research on emotion context insensitivity is that the lack of reactivity found in the studies may be artifactual. That is, depressed individuals may be preoccupied with their own internal distress, and may find the film clips to be less relevant or engaging than their real-life concerns. However, real discussion about actual issues in the family may be quite engaging. Perhaps the nature of the conflict task used in the current study is that it does not allow for teens to avoid emotional stimuli. Thinking along these lines, what we may be seeing is that when negative emotional stimuli are unavoidable, depressed teens have a very difficult time not responding to the negative stimuli with their own negative affect. Thus, perhaps we are seeing the reason why individuals with depression avoid emotional stimuli – because
when they are not able to avoid, the negative emotions they experience are overwhelming. Further, this finding may support the hypothesis that high levels of depression symptoms would decrease the flexibility of parent-child interactions (as found in Hollenstein & Lewis, 2006), though not in the way we originally expected. Our finding that teens high in depression symptoms showed stronger responsivity to parental anger with their own anger may suggest that depressed teens have less flexibility in their response to partner anger than nondepressed teens.

**Parent Affect: Depression and Baseline RSA Findings**

We sought to examine the role of both parental depression symptoms and baseline RSA in moderating the responsivity of parents to their teen’s affect. Across tasks, no significant main effects of parental baseline RSA on parental expressed affect were found. However, parental baseline RSA was found to significantly and differentially influence the responsivity of parents to their teen’s expressed anger and distress during the family conflict discussion. At higher levels of parent baseline RSA, the relationship between parent distress and teen distress became more strongly positive, while the relationship between parent anger and teen anger became weaker and less positive. Further, the regions of significance of these effects showed that the effect of teen distress on parent distress was only significant for parents with high RSA, while the effect of teen anger on parent anger was only significant for parents with low to mean RSA. Thus, high parental RSA predicted strong responsivity to teen distress, but a weak response to teen anger. Low and mean levels of parental RSA predicted the opposite: strong responsivity to teen anger and a weak response to teen distress.
These findings may be conceptually in line with Polyvagal Theory, which suggests that the role of RSA is to enable the flexible emotional responding often required for social behavior (Porges, 2007). These findings are also commensurate with studies that have shown higher baseline RSA to predict adaptive social and emotional functioning (e.g., Thayer & Lane, 2000). Research literature has shown that elevated levels of conflictual, critical, and angry familial interactions make both parents and teens more vulnerable to depression (Sheeber et al., 2001). In this light, being able to inhibit one’s own anger in response to partner anger may help to decrease overall anger in the interaction, and thus promote more adaptive functioning within the family. Less research literature exists on the nature of expressed distress in familial interactions. However, results regarding expressed distress may be conceptually in line with the results of Butler and colleagues (2006). During potentially difficult discussions (i.e., of conflict in the current study, or of upsetting film clips in Butler and colleagues’ (2006) study), it may be adaptive for people to mutually express distress and concern in order to solve problems. Thus, in the current study, flexible and adaptive behavior for a parent engaged in conflictual conversation with their teen would likely involve inhibiting the display of anger in response to their teen’s anger and increasing the display of distress in response to their teen’s distress. In this light, higher baseline RSA was related to greater success in modifying negative emotions in order to meet the task demands.

Across tasks, no significant main effects of parental depression on parental expressed affect were found. However, parental depression was found to significantly influence the responsivity of parents to their teen’s expressed positive affect across both discussion tasks. Specifically, as parent depression symptoms increased, the relationship
between parent positive affect and teen positive affect became weaker and less positive. Further, the regions of significance of these effects showed that the significant positive effect of teen positive affect on parent positive affect was only significant for parents with low to mean levels of depression. Thus, high levels of parental depression symptoms were related to a weaker response to their teen’s positive affect.

This finding is conceptually in line with Emotion Context Insensitivity Theory (Rottenberg, Gross, et al., 2005), in that parents suffering from high levels of depression symptoms were less responsive to emotional stimuli – in this case, positive affect expressed by their teen. However, as described earlier, significant findings for teen depression ran counter to this prominent theory. One reason for the disparate findings across parents and teens may be that the vast majority of research studies based on Emotion Context Insensitivity Theory have used exclusively adult samples and nonsocial paradigms (Bylsma et al., 2008). It may be that emotion context insensitivity theory does not apply as cleanly to a depressed adolescent population. Further, it may be that this theory is not an appropriate model for how depressed individuals respond to social stimuli.

We also sought to understand any potential interaction effects concerning the roles of baseline RSA and depression in moderating the responsivity of an individual to their partner’s affect. We hypothesized that those individuals showing both low baseline RSA and high levels of depression symptoms would show the weakest responsivity to their partner’s affect. Across both parents and teens, no significant interaction effects of this nature were found. This hypothesis was exploratory in nature, and it may be that our sample was not large enough to produce a significant interaction effect of this
complexity. Future studies should continue to explore the relationships between RSA, depression, and affective responsivity, to further understand the implications of Polyvagal theory and Emotion Context Insensitivity theory as they apply to family interactions.

**Limitations and Future Directions**

Several limitations to the current study are worth noting. First, this study focused on RSA, which has been related to emotional and social flexibility and emotion regulation in a number of studies. However, as previously mentioned, this study only incorporated measures of baseline RSA given that results for baseline RSA have been more consistent in the literature. Although less consistent, some studies have also found that changes in RSA in response to emotion-inducing stimuli may also be important in understanding emotional processes. Change RSA in depressed individuals is a fairly new area in the literature. However, early findings suggest that depressed individuals exhibit less RSA fluctuation across reactivity tasks compared to healthy controls (Rottenberg et al., 2007). Similarly, children of chronically depressed mothers exhibited more pronounced decreases across in RSA across positive, negative, and neutral film clips compared to controls, as well as less net change in RSA across all tasks (Ashman, Dawson, & Panagiotides, 2008). Additionally, in a longitudinal study of depressed individuals, those who exhibited a greater change RSA from baseline in response to a sad film clip were more likely to recover from depression than those who showed minimal change RSA (Rottenberg, Salomon, Gross, & Gotlib, 2005). Although change RSA was not incorporated in the current analyses, change RSA data was collected, and will be examined in future work. In addition, RSA is only one physiological index out of many that may be relevant to family functioning. Future studies could incorporate sympathetic
nervous system measures, HPA indices, and central nervous system measures in order to broaden our understanding of the connection between physiology and family science.

Second, we included teen depression symptoms as measured by the CDI rather than diagnostic status as measured by the K-SADS. This decision was made due to the fact that the interview data was only categorical, as the symptom severity data was not clearly marked by the researchers on a number of participant interviews and therefore not usable. The CDI allowed us to analyze depressive symptoms on a continuum, which is especially important given that subsyndromal depression can also lead to impaired functioning (Hammen & Rudolph, 2003). However, given that diagnostic data was not used, it may not be appropriate to generalize our findings to a clinical sample. Further, only one fifth of teens in the study were above the clinical cutoff for depression symptoms. Future studies should examine the influence of depression on family functioning in clinically-recruited rather than community-recruited families. By focusing on families seeking treatment, we may be better able to understand the patterns of family functioning that could be addressed through intervention. Similarly, working with a clinically-recruited sample would further our findings on the role of RSA in this population.

Third, linear mixed models were used to understand the relationship between parent and teen affect during family interactions. These analyses collapsed all affect expressed across the five minutes of the discussion task into one overall affect score, and thus did not directly explore how responsive individuals were to their partner’s affect during the task. Additionally, these analyses only predicted expressed affect from the partner’s identical affect state (e.g., teen expressed anger was predicted from parent
expressed anger, without taking into account the potential effects of parent distress or parent positive affect on teen anger). It may be important to explore how parent-child interactions unfold on a shorter time-scale (i.e. second-by-second), and to flesh out more fully the interrelations of various affective states during family interaction, in order to capture the nature of affective reciprocity within families and how that reciprocity affects and is affected by depression. As such, additional research employing alternative analytic methods, such as state-space analyses (e.g. Hollenstein & Lewis, 2006) is warranted.

Despite limitations, the current results underscore the importance of a nuanced understanding of affective responsivity in family interactions. This study showed that parent and teen affective responses are highly interrelated. For teens, it appeared that high levels of depression symptoms increased the likelihood of teens responding to parental anger with their own anger, and thus decreasing the quality and flexibility of the interaction during conflictual family discussions. For parents, it appeared that high levels of depression symptoms decreased the quality of the interaction when the conversation topic is more positive, in that parents were less responsive to their teen’s positive affect. Conversely, high baseline RSA seemed to help increase the quality and flexibility of the interaction during conflictual family discussions.

Increasing family flexibility may be an important target for intervention, though no studies to date have investigated this aspect of family functioning in the treatment of adolescents with internalizing symptomatology. In a recent study on the treatment effects of an intervention targeting families with aggressive children, findings show that children who benefitted most from treatment showed increased flexibility in parent-child
interactions from pre- to post-treatment (Granic, O’Hara, Pepler, & Lewis, 2007).
Specifically, dyads including these most-improved children showed increases in the
number of times the dyad changed emotional states and the breadth of the dyad’s
behavioral repertoire, as well as decreases in the amount of time “stuck” in any one state
during problem-solving interactions. This recent intervention research combined with
previous and current findings on rigidity in families that suffer from depression suggest
that emotional flexibility in parent-child relationships may be necessary for a healthy,
adaptive environment. We hope the current study fosters future research on the role of
depression and physiological processes in promoting adaptive emotional functioning in
families.
Appendix

SIMPLE AFFECT CODING SYSTEM (SACS)
Child and Family Center, University of Oregon, 2003
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The Simple Affect Coding System (SACS) is a several category coding system intended to capture the objective display of affect as relationship interactions. The SACS is inspired by several affect coding systems employed over the years. Specifically, the work of Paul Ekman and John Gottman has inspired this simple, yet dynamic attempt at operationalizing the often-subjective material of emotional display. The central tenet of the SACS is to ignore verbal content and to rather, base all coding on the affect displayed by the participants in an interaction. The cues that are used for reliable code selection will based on a gestalt of constructs including vocal quality, facial cues, and body posture and/or orientation. Each code is outlined in the pages that follow.

SACS Crib Sheet

All codes in the SACS are scored based on affect demonstrated, not verbal content. The gestalt of cues used to score the emotions that are observed will include vocal tone, facial affect, and body posture and/or orientation. Again, verbal content will be ignored.

p - Positive Affect
- Laughter
- Joy
- Smiling
- General Positive Affect
- Enjoyment
- Shock
- Anticipation
- Playfulness
- Joking

v - Validation
- Physical Orientation Towards Speaker
- Voice Tone Neutral or Up
- Eye Contact
- Head Nods

a - Anger/Disgust
- Raised Voice
- Irritation/Annoyance
- Constrained Anger
- Frustration
- Furrowed Brow

- Sickened
- Fed-Up
- Repulsed
- Rejection
- Aversion
- Contempt
- Eye Rolls
- Mocking

d - Distress
- Passivity
- Resignation
- Crying
- Slow Sighing
- Remorse
- Depressed
- Fear
- Nervous Laughter
- Speech Disturbances*
- Fidgeting*
- Postures of Withdrawal*
- Fear Face/Postures of Fear
- Whining
*These attributes are especially common – when one of these is present, make sure an additional distress attribute is present before giving a distress code.

**n - Neutral**
- Resting Affect
- Un-codeable Affect
**p - Positive Affect**

The positive affect code is comprised of happiness and surprise attributes. This code is characterized by a general appearance of a positive emotional state. This is an active code, as opposed to one’s resting emotional state. Look for smiles, happy eyes, raised cheeks, lips apart or together and turned up.

**Attributes:**

**Caring** – This attribute is characterized by a positive, warm, loving expression during interaction. Look for a dreamy, happy face. This may also appear as warm flirtation or love with a small smile.

**Laughter/Smiling** – This attribute includes the clear and often audible laughter than can erupt during an interaction. The cheeks are raised and the lips may or may not be parted in a smile. This is the sit of someone who is truly happy, *not to be confused with nervous laughter (the distinction on tough-to-decipher laughter: eye contact = positive, no eye contact = distress).*

**Enjoyment** – Often when participants are experiencing enjoyment they demonstrate happiness, smiles, and amusement.

**General Positive Affect**

**Shock** – *careful, if they are “shocked” by a bad grade it might be better to code as anger.*

**Unexpected News** – *careful, see above.*

**Surprise**

**Playfulness/Joking** – *This code is appropriate for when participants are telling a joke or being silly/playful to lighten the mood. However, in instances when a participant is telling a joke at the expense of the other participant, this should be considered mocking and coded as anger.*

**v - Validation**

Validation is intended to capture the affective essence of the participant that is actively communicating that they are listening, tracking and engaged in what the speaker is saying. This is a very active code and is not to be confused with neutral.

**Attributes**
**Back-Channels** – These indicate the individual is listening to the speaker in an affirmative fashion by using paralinguistic cues such as head nods and other physical and vocal assenting behaviors. It must be very clear that the participant is oriented towards the speaker for back-channels to be coded validation. Be cautious of meaningless head nods *(see below for further clarification):*

- *Head nods that are answering a question are NOT coded as validation* (i.e., “Did you turn that paperwork in?” [responds with head nod] – this is not an appropriate v code).
- *Head nods in response to such phrases as “Okay?” and “You know?” ARE coded as validation, as these are figures of speech that ask for validation.*

**Physical Orientation** – This attribute includes eye contact and being actively positioned towards the speaker.

**Requirements:** There is a communication on the part of the listener that the speaker makes sense, that the listener is tracking what the speaker is saying in an active manner. The voice tone will be either neutral or up. Eye contact is important.

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**a – Anger/Disgust**

In the SACS, anger and disgust are combined as one code. Lowered brows and a slight hint of tension in the jaw and clenched teeth characterize anger. The vocal quality is raised beyond the limits of a normal tone. The angry person may sound fed up, like they’ve ‘had it up to here’. Words may be biting or abrupt with one word or syllable more strongly stressed. The disgusted person is repulsed and completely disgusted by something the other participant has said or done.

**Attributes:**

**Raised Voice** – This is an open anger, often with a loud voice tone, while in the midst of confronting, scolding, or accusing the participant. The speaker may sound irrational or show evidence of being upset with involuntary twitches or jerks.

**Irritation/Annoyance** – The speaker is frustrated and will employ changes in the rhythm of speech and the way certain words are stressed.

**Constrained Anger** – Attempts made to control being angry. An example of this is the lowering of the voice and speaking in an even, staccato rhythm, as if to communicate to the partner that the speaker is at the end of his/her rope.

**Physical Cues of Anger** – Voice is raised or lowered beyond the limits of a normal tone, there may be involuntary jerks or twitches, a tight jaw and/or clenched teeth. The brows are drawn together and lowered, the upper eyelids may be lowered and lips are pressed or tight.

**Physical Cues of Disgust** – The disgust face is usually easy to recognize. It is characterized by the wrinkling of the nose and the drawing up of the upper lip.
extreme displays the cheeks may raise and the eyelids narrowed. The mouth may be open or closed.

**Contempt** – Contempt will include, but is not limited to, mockery of the present participant, eye rolls, and lip smacking/teeth sucking.

**Requirements:** In order to code anger, a **change in tone** must be present (this can be any of the tones listed above: raised voice, irritation/annoyance, or constrained anger). In addition, there must be either (a) a **facial cue for anger** (i.e., furrowed brow, tight jaw, clenched teeth, etc.) or (b) a **body cue for anger** (i.e., sharp hand gestures, moving forward in their seat from neutral). Exceptions to these requirements include:

- Certain facial/body/tone changes can be coded as anger in the absence of another cue for anger. These include: eye rolls, disgust faces, mocking of the present participant, and yelling to the point of blowing out our speakers.
- If a participant meets the requirements for anger (marked change in tone and either (a) facial or (b) body cue), and then stops talking but does not lose their facial or body cues that got them into the anger code, leave the participant in anger until they also lose their facial or body cue.

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**d – Distress**

The distress code is marked by a decrease in energy and a passive, resigned countenance. It can be expressed in a very subdued, quiescent state or in a plaintive, poignant way. This code is generally displayed with a low volume of the voice and a slowness of speech. It may resemble fear, sound like whining or appear as sadness.

**Resigned/Passive** – Sometimes there is an evenness in the tempo (a kind of monotony) with lowered amplitude. The participant may behave as if resigned or hopeless. They may appear unable to cope with the other participant’s behavior. They lack energy, may feel sorry for themselves, feel a minor loss, or miss something or someone. Sometimes this is characterized by long pauses between phrases or words – as if it takes an extra effort to speak.

**Poignant/Crying** – Code all crying as sadness if the context suggests grief, remorse, regret, rejection or hopelessness. Sometimes this also looks like someone trying *not* to cry.

**Feels Hurt** – The participant shows grief, remorse or desolation. There may be a quavering voice tone that is abnormally high/low in pitch. The may be a sense of depression/hopelessness.

**Whining** – The participant sounds very nasal/sing-songy; may resemble “nails on a chalkboard”.
**Slow Sighing** – Slow sighing (as opposed to quick exhalations of air) are coded distress. Look for a deep intake of breath and slow shoulders droop as they let the air go. The may appear tired.

**Fear** – Fear can result from the feeling of anxiety, feeling worried or uncomfortable. The expression of fear may include raised eyebrows that are drawn together. The general appearance may be tense, as if the person cannot sit still.

**Fidgeting** – Excessive/repeated plucking at clothing/hands. Rubbing areas of the face, lip biting.

**Fear Face** – The mouth may or may not be open but the lips are stretched back. The upper eyelids are raised giving the eyes the appearance of bulging. The eyebrows may also be raised and/or drawn towards the center of the forehead.

**Speech Disturbances** – The speaker is obviously having a difficult time expressing what it is they want to say. This may include several incomplete statements or unfinished thoughts within one speaking turn. Stuttering or repetitive utterances of “uh” or “uhm” may also be indicative to fear. *However, if the participant’s first language is clearly not English, do not count Speech Disturbances as distress.*

**Postures of Withdrawal** – The participant is back in their seat and looking away from the other present participant.

**Requirements:** In order to code distress, two distress cues must be present (i.e., postures of withdrawal and slow sighing, speech disturbances and fidgeting, etc.). The exception to this rule is crying: code crying as distress regardless of whether another distress cue is present.

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**Neutral**

Neutral is sometimes thought of as the dividing line between negative and positive codes. It is recognized as being non-emotional in content and voice tone. The voice has an even, relaxed quality, without marked stress on individual syllables and within a comfortable pitch range. When observing something that cannot be defined by the SACS or it is too subtle to recognize immediately, then code neutral. **Become familiar with the participant’s resting face. S/he may naturally have turned down lips, or other permanent features that may appear to be emotional expressions.**

**Attributes:**

**Statements/Information Exchange** – Matter of fact, non-emotional content.

**Non-Codable Interactions** – Any affective behavior that is not defined by the SACS or does not adequately fit into the described categories.
Table 1. *Descriptive statistics*

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* Parent depression symptoms as measured by CESD; Teen depression symptoms as measured by CDI.
Table 2. Correlations for family process indices, depression, baseline RSA, and family demographics.

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Table 3: *Linear mixed model predicting teen distress with fixed effect for task.*

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Table 4: Linear mixed model predicting teen anger with fixed effect for task.

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*a. This parameter is set to 0 because it is redundant.*
Table 5: Linear mixed models predicting teen anger, separated by task.

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Table 6: Linear mixed model predicting teen positive affect with fixed effect for task.

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a. This parameter is set to 0 because it is redundant.
Table 7: Linear mixed model predicting parent distress with fixed effect for task.

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a. This parameter is set to 0 because it is redundant.
Table 8: *Linear mixed models predicting parent distress, separated by task*

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Table 9: *Linear mixed model predicting parent anger with fixed effect for task.*

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\[a. \text{This parameter is set to 0 because it is redundant.}\]
Table 10: *Linear mixed models predicting parent anger, separated by task.*

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Table 11: *Linear mixed model predicting parent positive affect with fixed effect for task.*

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<tr>
<td>(Task = 1) x Parent RSA x Teen Positive Affect</td>
<td>-3.1E-4</td>
<td>.00</td>
<td>.84</td>
</tr>
<tr>
<td>(Task = 2) x Parent RSA x Teen Positive Affect</td>
<td>0</td>
<td>0</td>
<td></td>
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<tr>
<td>CESD x Parent RSA x Teen Positive Affect</td>
<td>-7.8E-7</td>
<td>1.5E-4</td>
<td>.99</td>
</tr>
</tbody>
</table>

a. This parameter is set to 0 because it is redundant.
Figure 1. Mean plot illustrating the interaction of teen depression and parent anger on teen anger during the family conflict discussion.
Figure 2. Mean plot illustrating the interaction of teen distress and parent baseline RSA on parent distress during the family conflict discussion.
Figure 3. Mean plot illustrating the interaction of teen anger and parent baseline RSA on parent anger during the family conflict discussion.
Figure 4. Mean plot illustrating the interaction of parent depression and parent baseline RSA on parent anger during the family conflict discussion.
Figure 5. Mean plot illustrating the interaction of parent depression and teen positive affect on parent positive affect across both discussion tasks.
References


