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Interpersonal Emotion Dynamics in Adolescence and Emerging Adulthood

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

in

Psychological Sciences

by

Shun Ting Yung

Committee in charge:

Professor Alexandra Main, Chair
Professor Eric Walle
Professor Matthew Zawadzki

2021

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2021

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Abstract of the Dissertation

Interpersonal Emotion Dynamics in Adolescence and Emerging Adulthood

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Doctor of Philosophy, Psychological Sciences

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Emotions occur predominantly in the context of social interactions. Meanwhile, close relationships (e.g., family, friends, romantic partners) play important roles in emotion in social interactions across the lifespan, particularly during adolescence and emerging adulthood. However, most researchers examined emotion without capturing the real-time dynamics and changes over time. Measuring emotion as a trait fails to conceptualize emotionality as situation reactions. There are many ways to examine emotionality through capturing the changes in a day-to-day and moment-to-moment context which can reduce bias. The goal of this dissertation is to examine the interpersonal emotion in social contexts which focused on two developmental periods: adolescence and emerging adulthood. Study I examined emotional interactions in social contexts and how they may affect individuals' psychological distress and health in real-time by using Ecological Momentary Assessment (EMA). Quality of social interactions was found to be related to emotion regulation strategies at the same moment, but social interactions did not predict emotion regulation at the next moment. Findings showed the importance of understanding both social contexts and emotion regulation on momentary levels. Results have strengthened the role of emotion regulation strategies in emotional coping and relationship outcomes. Study II examined emotional synchrony during real-time triadic family interactions. It explored the synchronous emotional states across two triadic interactions (mother, father, and adolescent) and how synchronous emotions were related to both parents' interparental relationship quality and adolescents' psychological health (depressive symptoms and anxiety). Findings showed that families with higher negative synchrony were associated with parents reporting with worse marital satisfaction. Additionally, negative synchrony between mother-father dyads predicted more depressive and anxiety symptoms for adolescents, supporting the impact of parental discord on the child. Findings shed light on how dyadic and triadic emotional synchrony impact on both parents' interparental relationship quality and adolescents' psychological adjustment. Taken together, these studies inform the interwoven nature of social interactions and emotional processes in influencing socio-emotional functioning during adolescence and emerging adulthood. Findings from this dissertation will not only be able to inform research on the interface between social contexts and emotion regulation, but also guide inform interventions aimed at adolescents and families.

Chapter 1: General Introduction

Emotion has traditionally been conceptualized as an intrapersonal phenomenon with a focus on individuals' personal experiences (e.g., feelings) and behaviors (e.g., Cacioppo et al., 1992; Lewis, 2005; Kuppens et al., 2010; Lodewyckx et al., 2011). However, emotions occur predominantly in the context of social interactions (see Butler, 2011; Campos et al., 2011). Close relationships (e.g., family, friends, romantic partners) play important roles in emotion in social interactions across the lifespan, particularly during adolescence and emerging adulthood when individuals begin to interact more and draw greater influence from their peers (e.g., Berndt, 1979, Dishion et al., 2004, Steinberg & Monahan, 2007). In this dissertation, I first introduce the theoretical overview and empirical background on emotion within social interactions. Second, I present my first research study which captured emotional dynamics among emerging adults in real-time by using Ecological Momentary Assessment (EMA). Third, I present my second research study which captured emotional synchrony dynamics within triadic interactions (mothers, fathers, and adolescents) using an observational methodology. Fourth, I discuss general conclusions and contributions to the literature of both of my studies. Future research directions will also be discussed.

Intrapersonal Perspective on Emotion

As a multifaceted construct, theorists have approached emotion from different perspectives. William James (1884) postulated bodily changes in response to perceptual stimuli as emotion. Although the idea was controversial (Barbalet, 1999), it represented the early intrapersonal perspective on emotion, which focused on private feelings as a distinct feature of emotion. Other than feelings, later theorists expanded emotion to encompass physiological responses and expressions. For example, Levenson (1999) proposed that emotions are integral to many physiological systems ranging from facial expression, voice changes, muscular tones, to autonomic nervous system and endocrine activities. Emotion integrates these physiological systems to respond and adapt to external challenges. As Leveson (1999) pointed out, emotion is an essentially short-lived phenomena to respond transient challenges. However, emotion does not only arise from physiological responses to external stimuli. Ekman's work (1984) on universal expressions suggested that, in addition to coordinate internal reactions, emotion can also signal internal states to others and represents an evolved social communication ability. More recent research has featured the temporal nature of emotion's stability and change. This brings attention to the dynamic interactions between emotion's internal processes and the sequences of external social events (Campos et al., 2011).

Interpersonal Perspective on Emotion

Although there is a trait aspect to individual emotional experience (e.g., a person could generally be more prone to negative emotionality), emotion has been acknowledged to have an inherently social function, such as eliciting empathy, cooperation, or conflict (Oatley & Johnson-Laird, 2014). A dynamic-systems approach to emotional change and stability implicated that individual emotional experience is more than a transient self-reflection of emotional traits. Emotional experiences at any given moment in a social interaction could be influenced by or influencing the emotional state of others in that exchange (Butler, 2011; Main et al., 2016). The temporal interpersonal emotion system (TIES; Butler, 2011) is a useful guiding theory to study emotion within

social interactions. Butler (2011) highlighted the importance of examining the interpersonal aspect of emotions in a relationship or an interaction. It is not surprising that emotion has an organizing effect on social interactions and can provide useful information to social partners (Keltner & Kring, 1998). For example, displaying an anger face shows hostility and dominance to receiver. This may be a signal to a receiver that it is not a good time to approach. Gross (1998) suggested that we use emotional cues to infer others' intentions and in turn respond with social behaviors to alter their emotional states. In response to emotional cues, Zaki and Williams (2013) proposed that emotion regulation in social interactions can be targeted to modify emotion of oneself (intrinsic interpersonal regulation) or other people (extrinsic interpersonal regulation) in a response-dependent or response-independent way, with the former representing what one can do to smooth another person's emotional experience in a social interaction, while the latter represents what oneself can do in a social setting to smooth her own emotional experience. Taken together, the interpersonal aspects of emotion have been well supported and developed in the psychological field.

Emotions in Interpersonal Interactions and Psychological Outcomes

Interpersonal interactions in different social contexts may have various impacts on mental health outcomes. Earlier research on the socialization of emotions suggested that emotional interactions with caretakers could influence children's mental health outcomes through their development of emotional expressivity and meta-emotional knowledge (Eisenberg et al., 1998; Katz et al., 1999). Eisenberg and colleagues (2003) found that maternal positive emotion expressivity predicted a) children's self-regulation and social competence in a positive relationship and b) preschool children's lower level of external and internalizing problems. A similar effect was found among adolescents. When mothers frequently react to their adolescents' positive affect with invalidating or dampening responses, those adolescents are more likely to demonstrate more emotionally dysregulated behavior, adopt maladaptive emotion regulation strategies, and have higher levels of depression (Yap et al., 2008).

Beyond family relationships, friends and peers gain increasing importance in adolescence and emerging adulthood. Compared to younger children, older children and adolescents (aged 9 and 13) were more likely to want to change their peer's negative affect when their peers were victimized in a social exclusion paradigm. Furthermore, adolescents were also more likely to engage in cognitive emotions regulation with their peer victims than other age groups (Gummerum & López-Pérez, 2020). This line of research provides evidence that interpersonal emotions regulation can be considered a developmental skill like other regulatory abilities.

Prior work highlights a main gap in the literature. Most researchers examined emotion without capturing the real-time dynamics and changes over time. Measuring emotion as a trait fails to conceptualize emotionality as situation reactions. There are many ways to examine emotionality through capturing the changes in a day-to-day and moment-to-moment context which can also reduce bias. My current studies aim to examine the interpersonal emotion in social contexts which focused on two developmental periods: adolescence and emerging adulthood. I examined emotional interactions in social contexts and how they may affect individuals' psychological distress and health by using dynamic approaches to track emotion over time: (1) ecological momentary assessment (EMA) and (2) observational method by using

behavioral coding of emotion. Findings can help to inform interventions and demonstrate the importance of looking at emotional interactions and how time plays a role in measuring emotionality.

Current Studies

In my first study, I examined the relationship between social contexts and emotion within interactions among college students by using ecological momentary assessment (EMA). First, I examined the relationship between social contexts and emotion regulation at the momentary level by using regression models. Second, I investigated potential carryover effects of social contexts on emotion regulation by conducting lagged models. This study allows me to examine the link between social contexts and emotion regulation during interactions not only their bi-directional relationships, but also the carry over effects. My second study examined how emotional synchrony in a triadic family context were associated with parents' interparental relationship quality and adolescents' mental health. Specifically, both parents and adolescents engaged in two videotaped discussion tasks. Emotions were then coded second-by-second. I then used recurrence quantification analysis (RQA) to examine the synchronous emotions across all dyads/triads and compare dyadic and triadic synchrony across emotion. I tested how dyadic and triadic synchrony were related to parents' interparental relationship and adolescents' psychological health. The observational method and dynamic analyses allowed me to capture the real-time emotion interactions between two parents and their adolescent.

Chapter 2: Emotion Regulation within Social Interactions in Everyday Life among College Students

Introduction

Emotion regulation can be defined as the way individuals attempt to influence which emotions they have, when they have these emotions, and how they experience and express these emotional states (Gross, 1998). Effective emotion regulation entails the ability to adapt emotion regulation strategies for emotional regulation goals and situational demands (Wilms et al., 2020). The way individuals regulate their emotions is variable across time and situations (Kobylińska & Kusev, 2019), and has commonly been used as a predictor to understand how this variability predicts outcomes. Although understudied, it is also important to study emotion regulation strategies as an outcomes to better ascertain the factors that give rise to variability in these strategies. One important factor is the social context that interacts with personal characteristics to define the demands and effectiveness of emotion regulation in different situations (Kobylińska & Kusev, 2019). The current study used ecological momentary assessment (EMA) to examine how pleasantness of social interactions and closeness with the interactive partner predict emotion regulation strategy use in daily life.

Types of Emotion Regulation Strategies

Expressive suppression and cognitive reappraisal are two of the most commonly studied strategies that involve down-regulation of emotion (Gross, 2002). Expressive suppression aims at changing the outward expression of emotional responses while cognitive reappraisal aims at changing the appraised meaning of emotional experiences (Gross, 2014). These two emotion regulation strategies are apt for the present study given (1) both are commonly used in everyday life, and (2) they are closely related to social context (e.g., close relationships) which is central to my study (e.g., Marroquín & Nolen-Hoeksema, 2015; Winterheld, 2016). More generally, they are important variables to explore given research that indicates these strategies are associated with psychopathological symptoms including depression, anxiety, and eating disorders (Aldao et al., 2010).

Changes in Social Contexts and Emotion Regulation

Although only sparsely examined in research, emotion regulation not surprisingly varies according to social contexts (Kobylińska & Kusev, 2019). For example, one study has captured a more long-term and stable social contextual impact given that it examined participants' suppression use two months prior to and ten weeks after the transition to college (Srivastava et al., 2009). Results showed that there was an increase in suppression use while students left their social environment at home and started to explore the new social environment in college. Another study looked at changes in expressive suppression and cognitive reappraisal at the Burning Man Festival which captured a relatively short-term and drastic impact of social context (McRae et al., 2011). Participants reported decreased use of suppression and increased use of reappraisal at the Burning Man festival. Despite the pervasive personal and social impact of emotion regulation, these studies suggested emotion regulation is also influenced by social contexts. Marroquín and Nolen-Hoeksema (2015) suggested a social influence hypothesis of emotion regulation to explain the relationship between social context and emotional outcomes (e.g., depressive mood). In two longitudinal studies, they found that relationship characteristics influenced

individuals' emotion regulation repertoire and use. Furthermore, the study elucidated emotion regulation to be a mediator between social context and psychopathology.

While emotion regulation strategies were shown to vary across social contexts (e.g., college transition or attending a large festival), it is also possible that individuals' emotion regulation strategies may change during moments of spontaneous social interactions. More specifically, the occurrence and characteristics of social interactions may influence emotion regulation strategy use, which may in turn have a more pervasive effect on the way individuals regulate their emotions the next moment. Intense negative emotions are known to impede effective emotion regulation (Shafir et al., 2016). For example, an extremely unpleasant interaction with a close family member regulated by expressive suppression may have lasting effects that carries into the next moment when another emotion regulation strategy is more desirable. Since Bonanno and colleagues (2004) showed that the flexibility of using or nullifying expressive suppression to be a predictor of long-term psychological adjustment, such an approach could help to explain if there is any carry over effect of social context and its potential impact on emotion regulation over time.

Relationship of Social Contexts and Emotion Regulation Strategies

Drawing upon the social influence hypothesis (Marroquín & Nolen-Hoeksema, 2015), social contexts can directly influence an individual's emotion regulation repertoire and use. Specifically, pleasantness within social interactions and perceived closeness with partner may serve as important predictors of emotion regulation strategy in various domains of studies. Across adult attachment orientations, pleasantness of interactions (i.e., less avoidant or negative response) and perceived closeness with partners were found to be linked to either increased use of more cognitive reappraisal or decreased use of maladaptive emotion regulation strategies (Winterheld, 2016). Similarly in group collaboration, pleasant interactions coupled with group cohesiveness were found to contribute to group member's adaptive emotion regulation strategies (Bakhtiar, 2018). Therefore, the current study focused on perceived pleasantness and closeness to reflect changes in social contexts.

Closeness has important impacts on individual's emotion regulation strategies. Specifically, previous finding showed that perceived closeness of the social partner influences how much expressive suppression individuals use. Individuals who reported less closeness with their partners showed an increased of expressive suppression (Winterheld, 2016). Conversely, frequent emotional and topical disclosure were related to greater intimacy in relationships (Lippert and Prager, 2001; Maier et al., 2013). Importantly, this relationship can be bi-directional, such that difficulty regulating emotions may have a negative impact on the closeness between the individual and partner (Tani et al., 2015).

Pleasantness of interactions is another major domain to understand social environment and its impact on individuals' emotion regulation strategies. Negative experiences from an interaction could intensify an individual's negative emotions and thwart later motivation or attempts at amelioration (Bakhtiar et al., 2018; Mänty et al., 2020). However, to my knowledge, there is no existing research that has directly examined how pleasantness may influence individuals' choices of emotion regulation strategies. Taken together, emerging evidence showed closeness and pleasantness could affect an individual's emotion regulation and adjustment.

Social Contexts and Emotion Regulation among College Students

Transitioning to college marks a challenge to stay connected with hometown relationships while developing new friendships at college (Gentzler et al., 2011). Therefore, it is particularly important to examine emotion regulation patterns during this period characterized by both great changes in social contexts and potentially significant needs for effective emotional adaptation (Christie & Dinham, 1991). Increased use of expressive suppression over cognitive reappraisal was linked to negative mental health outcomes among college students (Campbell-Sills et al., 2006; Mennin et al., 2009; Joormann & Gotlib, 2010; Rude & McCarthy, 2003). For example, among college students, depressed and depression-vulnerable students were found to use more expressive suppression than non-depressed students (Rude & McCarthy, 2003). Reduced use of cognitive reappraisal and increased use of expressive suppression were also related to less cognitive inhibition of negative affect, which is a risk factor for depression (Joormann & Gotlib, 2010). Moreover, a systematic review supported the connection between overutilization of expressive suppression and underutilization of cognitive reappraisal in depression and anxiety disorders (Dryman & Heimberg, 2018). Taken together, prior research showed that examining how contextual factors are related to emotion regulation strategies among college students may provide crucial insights about students' well-being.

Ecological Momentary Assessment

Emotion regulation should be conceptualized as a situational reaction given that we may regulate our emotions differently under varying social situations and contexts (Kobylińska & Kusev, 2019). However, emotion regulation measures have often relied on retrospective self-reports that conceptualize emotion regulation as a relatively stable trait across contexts (e.g., Marroquín & Nolen-Hoeksema, 2015; Winterheld, 2016). While some laboratory-based experimental work has examined state changes emotion regulation strategies simply upon request (e.g., Riem and Karreman, 2019) or through orchestrated social stimuli (e.g., DeWall et al., 2011), these studies are limited in their ecological validity (Campos et al., 2011). Only a few studies examined the impact of social contexts on emotion regulation while capturing emotion regulation as a state outside of the laboratory context (e.g., McRae et al., 2011; Srivastava et al., 2009). These results are promising but are limited to only non-daily drastic social transitions, such as college transitions and the Burning Man Festival. As suggested by a recent paper, ecological momentary assessment (EMA) can possibly capture emotion regulation dynamics during the flow of daily experiences, in real-life settings, and through repeated measurement (Colombo et al., 2020). Given my main interest is to examine how social context is associated with emotion regulation strategies in real-life settings, EMA can potentially investigate moments of the use of expressive suppression and cognitive reappraisal when individuals report engaging in social interactions. This approach can reduce recall bias and offers high ecological validity, because the variables are measured in the participants' living environment repeatedly (van Roekel et al., 2014).

The Present Study

The current study aimed to address how social contexts and emotion regulation strategies are linked among college students at a moment-to-moment level. Participants were asked to report on their social contexts and emotion regulation during these interactions. I examined relationships between social contexts and emotion regulation at

two different time scales: (1) does social context at one moment predict expressive suppression and cognitive appraisal at the same moment (concurrent effects), and (2) does social context at the prior moment predict expressive suppression and cognitive appraisal at the next moment (lagged effects). The lagged models examine if social context has a carryover effect on emotion regulation strategies. Additionally, reverse lagged models were examined to test if expressive suppression and cognitive appraisal may predict how an individual perceives the quality of social interactions in the next moment.

In line with Winterheld (2016)' study, I hypothesized that participants who had a closer relationship with their interactive partners would report using less expressive suppression and more cognitive reappraisal. The relationship between pleasantness, suppression and reappraisal remained exploratory since there was no previous research examined pleasantness and emotion regulation strategies to my knowledge. However, individuals generally prefer to experience positive emotion, so they may use less emotion regulate strategies within a pleasant context (Tamir, 2009). Thus, I hypothesized that participants who had more pleasant interactions would report less use of cognitive reappraisal and less use of suppression. I hypothesized that both pleasantness and closeness would have carryover effects on both expressive suppression and cognitive reappraisal, though the direction of the effect remains exploratory. Furthermore, I hypothesized that both expressive suppression and cognitive reappraisal would have carryover effects on both pleasantness and closeness as well, though the direction of the effect remains exploratory.

Method

Participants

Participants were 71 undergraduate students at a university in Central California. The sample was 77% females, 21% males and 2% other and aged from 18 to 28 years old ($M = 20.6$, $SD = 2.00$). Most participants reported they grew up with a primary caretaker that had a high school degree or less (33.8%). Students were recruited to participate in a study to measure their surroundings, thoughts, and feelings. Participants were included if they were at least 18 years old. See Table 1 for more information about participants.

Procedure

For the baseline session, participants came to a research lab and provided informed consent. Then they completed an online survey via Qualtrics in which they provided demographic information, along with other measures not relevant to the present study. At the end of the baseline session, participants were instructed on how to respond to the EMA prompts measuring pleasantness, closeness, suppression, and reappraisal, among other measures. Participants first downloaded the RealLifeExp app (LifeData Corp., Marion, IN) on their smartphone to complete the EMA questionnaires. Those who did not have a smartphone were given an iPod (Apple, Cupertino, CA) with the app pre-installed to complete the study. Participants completed four EMA surveys each day for two weeks with prompts delivered using a signal-contingent design. Push notifications alerted participants when it was time to complete the EMAs randomly at the following times: between 9-11:30am, 12-2:30pm, 3-5:30pm and 6-8:30pm. Participants had 60 minutes to complete the EMA once the prompt was delivered. Subjects received course credit for participating in the 60-minute baseline session. They were then compensated with a \$25 Amazon gift card after engaging in two weeks of EMA. Students received an

additional \$10 Amazon gift card as a bonus if they completed at least 85% or more of the questionnaires throughout the week.

Measures

Social Interaction. Whether participants had a social interaction since the previous prompt was measured with the question, “Did you have a social interaction since the last prompt? If you had more than one social interaction since the last prompt, please answer the following questions based on your most recent interaction.” The item was coded as 0 (*no*) or 1 (*yes*). If the participant answered “yes,” they were directed to the items that asked about the pleasantness and closeness of the interaction and their use of emotion regulation strategies.

Pleasantness. The pleasantness of the interaction was assessed with the question, “How pleasant was the interaction?” The item was rated on a scale of 0 (*Very Hostile*) to 6 (*Very Pleasant*).

Closeness. Participants’ perceived closeness of the interaction was measured by a set of images (see Appendix). “Using the image below in which you are represented as “Self” and the person you interacted with is represented as “Other”, think about which number best indicates how close you are with that person?” to measure the closeness of the partner with whom they interacted. The item was rated from 1 (*distant/separate*) or 7 (*very close*).

Emotion Regulation. Given my interests in expressive suppression and cognitive reappraisal, I extracted two questions based on prior work measuring emotion regulation strategies with EMA (Visser et al., 2018). I measured emotion regulation (i.e., suppression and reappraisal) by using a similar question with the wording: “In this particular interaction, how much were you trying to hide the emotions you were feeling?” and “In this particular interaction, how much were you actively trying to reframe or think about the situation differently?” The items were rated on a scale of 0 (*not at all*) to 6 (*extremely*). The subscale questions showed moderate internal consistency ($\alpha = 0.73$).

Analytic Plan

Descriptive statistics of pleasantness, closeness, suppression and reappraisal were conducted. Two multi-level models were used to test if social contexts (i.e., pleasantness of an interaction and closeness with the social partner) predicted emotion regulation (i.e., suppression and reappraisal). For the first set of analyses, I examined pleasantness, closeness, expression suppression and cognitive reappraisal at the momentary level. A person-mean centered value for these variables were calculated. First, each person variable’s average value was calculated. Then, this value was subtracted from each of their momentary scores. The momentary score refers to each person’s reported value at each prompt, resulting in a person-mean centered value for each participant. This allowed us to see how a higher pleasantness and closeness score than is typical for that person predicted emotion regulation in those moments. Models controlled for temporal factors, including what day of the study it was for the participant (ranging from 1 to 14), and weekend days (0 = non-weekend day, 1 = weekend day). A random intercept was included to account for the possibility that participants had different levels of initial suppression and reappraisal.

For the second set of analyses, four lagged models were conducted to examine the potential carryover effects of pleasantness and closeness on emotion regulation. This allowed us to see if emotion regulation at time t could be predicted by pleasantness or

closeness at time $t-1$. Temporal factors were controlled, including what day of the study it was for the participant (ranging from 1 to 14), weekend days (0 = non-weekend day, 1 = weekend day), psychological distress on time t , and emotion regulation on time t . A random intercept was included to account for the possibility that participants have different levels of initial suppression and reappraisal.

Finally, a set of reverse models were tested with emotion regulation as predictors and pleasantness/ closeness as the outcome, following all other modeling decisions as reported above.

Results

Descriptive statistics of pleasantness, closeness, suppression and reappraisal are presented in Table 2. For social context, the mean of pleasantness and closeness scores were 4.55 ($SD = 1.33$) and 4.79 ($SD = 2.03$), respectively. For emotion regulation, the mean suppression and reappraisal scores were 1.38 ($SD = 1.71$) and 1.35 ($SD = 1.64$), respectively.

Moment-Level Models

Multilevel modeling testing the relationship between person-mean centered social context (i.e., pleasantness, closeness) and emotion regulation (i.e., suppression, reappraisal) are presented in Table 3. Results showed that participants who experienced an elevated level of pleasantness in the moment compared to their mean level of pleasantness had a lower level of suppression and reappraisal in those moments. Additionally, participants who experienced an elevated level of closeness in the moment compared to their mean level of closeness had a lower level of suppression and reappraisal in those moments.

Moment-Level Lag Models

I tested whether time t emotion regulation (i.e., suppression, reappraisal) was predicted by time $t-1$ social context (see Table 4 and 5). Results showed that both pleasantness and closeness do not have carryover effect on suppression and reappraisal ($ps > .15$).

Moment-Level Reverse Lagged Models

The reverse lagged models examined whether time t social context (i.e., pleasantness, closeness) predicted by time $t-1$ emotion regulation (i.e., suppression, reappraisal). Time t pleasantness ($\beta = .09, p = .004$) and closeness ($\beta = .09, p = .040$) were found to be predicted by time $t-1$ reappraisal in a positive direction (Table 6 and 7).

Discussion

The purpose of this study was to examine if variability in social contexts (i.e., pleasantness, closeness) in the moment predicted variation in the use of emotion regulation strategies (i.e., expressive suppression, cognitive appraisal). Descriptive statistics showed both expressive suppression and cognitive reappraisal had a low mean score but relatively high standard deviation. This showed that even though participants reported low frequency of regulating their emotions, those emotion regulation events were with high variability and intensity.

At the moment-to-moment level, results showed that experiencing more pleasantness predicted both lower expressive suppression and cognitive appraisal. Consistent with my hypotheses, more pleasant interactions predicted less expression suppression. In pleasant interactions, this may have resulted in participants experiencing more positive emotion (Bernstein et al., 2018). Importantly, this would be a situation

where their positive emotion was matching with the valence of the situation, which is a situation in which suppression is less likely to occur (Kalokerinos et al., 2017). Consistent with my hypotheses, more pleasant interactions predicted less cognitive reappraisal. A previous study showed individuals can reappraise to downregulate positive emotional experiences (Kalokerinos et al., 2015). While results showed that expressive suppression downregulated positive emotional expression, only reappraisal can downregulate the actual positive experience. Therefore, this may support our participants that they prefer not defaulting to downregulate pleasant interactions unless positive emotional experience is inappropriate.

Furthermore, results showed that experiencing more (versus less) closeness predicted both lower expressive suppression and cognitive appraisal at the moment-to-moment level. Consistent with my hypotheses, participants decreased use of expressive suppression when they interacted with a closer partner. In line with previous studies, it is possible that individuals were more willing to openly express their emotions when they were interacting with a more trusted and helpful intimate partner (Reis & Shaver, 1988). Thus, participants may suppress less in social interactions with a closer partner. Inconsistent with my hypotheses, participants were found to decrease use of cognitive reappraisal when they interacted with a closer partner. This is inconsistent with previous research that participants interacted with closer and more securely attached partner reported greater use of reappraisal (Winterheld, 2016). It is plausible that when participants interact with a closer partner, they do not have to downregulate any positive emotions they experience (Kalokerinos et al., 2015). Thus, they reappraise less in an interaction with high closeness. Overall, when interactions were characterized as high pleasantness or closeness, participants may feel more accepted and expressive so that they do not have to suppress or reappraise their emotions to modify their emotional experience.

In the lagged model, I tested whether time t emotion regulation was predicted by time $t-1$ social context. Results showed that moment-to-moment emotion regulation (i.e., suppression, reappraisal) was associated with moment-to-moment social contexts (pleasantness, closeness). However, pleasantness and closeness did not have carryover effects on suppression and reappraisal. In other words, social context from one moment did not predict emotion regulation strategy use in the following moment. Unlike long-term life changes, such as college transitions (Srivastava et al., 2009), current result suggested that pleasantness and closeness are unlikely to have long-term effects on emotional distress or regulation.

In the reverse lagged model, I tested whether time t social context was predicted by time t emotion regulation. The reverse lagged model revealed cognitive reappraisal at one moment was found to predict less pleasantness and closeness at the same moment, but more pleasantness and closeness at the following moment. Cognitive reappraisal has been found to consume cognitive capacity (Lee and Xue, 2018). As individuals engage in reappraisal, it may become challenging to maintain a stable and close interaction with their partners at the same time. Therefore, it is possible that participants may prefer to be alone when they were reappraising a negative event. However, they may open up and perceive social interactions with more pleasantness and closeness after their negative thoughts were resolved. Thus, a carryover effect of reappraisal on pleasantness and closeness was found. Taken together, the lagged models suggested that emotion

regulation strategies at one moment predict perceived pleasantness and closeness of social interactions at the next moment, but not the other way around. This is similar to the findings of previous studies that reported reappraisal as the emotion regulation strategy most associated with positive affect and positive relationship outcomes (Moskowitz et al., 2009; Rusu et al., 2019). For example, reappraisal was found to be related to positive dyadic coping in couples, which in turn increased both partners' relationship satisfaction. Building from previous study, my study found that reappraisal is not only associated to positive outcomes, but also has a positive carryover effect on social interactions.

Limitations and Future Directions

The current study is an important first step in understanding the impact of social contexts in emotion regulation among college students in everyday life. However, some limitations warrant mentioning. First, the current study only included undergraduate students from one institution which may limit generalizability of the findings. Specifically, participants are students living in a more rural area of Central California. Options for entertainment, social activities, and transportation are subjected to more constraints than many urban areas or suburbs; thus, the effects of this social context could be affected. Second, most of the participants were females given the overrepresentation of Psychology majors in the study. As Goubet and Chryssikou (2019) reported, women tended to report using more emotion regulation strategies with higher flexibility comparing to men. Given that gender has not been a factor in emotion regulation research. Future studies could include more male students and examine gender differences in social context and emotion regulation. Third, future studies could incorporate more variables to capture complexities of social contexts with different aspects. For example, my study did not capture the social interactions' content, length, gestures etc. All these interactions' features may affect how individuals regulate their emotions.

Conclusion and Implications

This study holds implications for understanding social context and emotion regulation in the everyday lives of college students. By extending previous research, I used the EMA approach which allowed us to investigate participants' responses close in time to when they just had interactions and regulated their emotions. Quality of social interactions was found to be related to emotion regulation strategies at the same moment, but social interactions did not predict emotion regulation at the next moment. Interestingly, I found that emotion regulation strategies predict more pleasantness and closeness in social interactions at the next moment. My findings showed the importance of understanding both social contexts and emotion regulation on momentary levels. My results have strengthened the role of emotion regulation strategies in emotional coping and relationship outcomes. It will be critical to further uncover the factors that maintain this reciprocal relationship, as it is closely related to well-being. Overall, college campuses should consider promoting positive social interactions (e.g., pleasantness and closeness relationships) as an important resource for improving student wellbeing. Results supported that social interaction is related to emotion regulation strategies at the same moment. Students who had social interactions on campus would impact the way they regulate their emotions. College students who have higher levels of pleasantness and closeness within their social interactions tend to suppress and reappraise less. This is important given that emotion regulation, especially lower suppression, has been found to

be closely associated with both well-being and relationships (Gross & John, 2003). While cognitive reappraisal is generally considered as adaptive, increased reappraisal may lead to unforeseen health consequences, such as increased cortisol reactivity (Denson et al., 2014; Johnson et al., 2019). Student life officers and healthcare practitioners should be aware of the impact of social contexts in order to promote emotional and physical health in college.

Chapter 3: Emotion in a Triad Context

Introduction

The results of Chapter 2 suggests that social contexts are one of the important factors that contribute to emotion. Although the emotional aspects of social interactions were examined by using real-time self-reports, the study from Chapter 2 did not capture the real-time emotion dynamics during interpersonal interactions. To this end, the study presented in the current chapter examined synchronous emotional states among family members and how each concurrently synchronous pattern is related to parents' interparental relationship quality and adolescents' psychological health.

Parental Responses to Their Children's and Adolescents' Emotions

Within interpersonal interactions, parental responsiveness has been shown to be important for adolescents' social and emotional development. One way in which parents influence adolescents' psychological health is through the way they respond to their adolescents' emotions. Adolescents who receive less parental support (e.g., validation) in response to their emotions are more likely to experience depressive symptoms (Lougheed et al., 2015). Parent-child coregulation of emotion in dyadic interactions is also related to externalizing behaviors outside of family context (Lunkenheimer et al., 2011).

Additionally, adolescents whose parents express rejection, criticisms, or punishment in response to their emotions are more likely to have depressive symptoms (Allen et al., 2012; Johnco & Rapee, 2018). Families who tend to exchange negative emotions (i.e., one person's negative emotion is preceded by the other person expressing a negative emotion) are more likely to have adolescents who experience higher levels of stress and who fail to manage and resolve conflicts during family problem-solving discussions (Robin, 1979). Conversely, children who received supportive responses from parents for their emotional experiences tend to have greater life satisfaction, more positive emotional experience, and less distress as young adults (Ramakrishnan et al., 2019). For example, higher levels of parental autonomy support are associated with more positive feelings of social competence (Soenens & Vansteenkiste 2005).

Interparental Relationship Quality and Children's/Adolescents' Psychological Health

As suggested by Robin's research (1979), the broader emotion climate inside a family could manifest to have an impact on the child. For instance, problems within parents' relationship can implicate the child's social emotional development as parental conflicts start to bring negative emotional experiences to the child in family interactions (Cummings, 1987). Research in marital conflicts have supported this view. Marital functioning in families is strongly related to children's depressive symptoms and their social and emotional development, including internalizing and externalizing problems (Cummings & Davies, 1994; Cummings et al., 2005). However, the mechanism for parental discordance spilling over to influence the child remains unclear. One study did report that in families in which parents are described as showing a high level of displeasure, coldness, anger, disagreement, and competition with each other, children are more likely to score highly in externalizing aggressive behaviors, internalizing behaviors, and have lower academic achievement during kindergarten and first grade (Cowan & Cowan, 2003). This study remains limited by the participant's age group and retrospective reports; there lacks clear evidence that dyadic interactions dynamics can

influence the third person, the adolescent, in a triadic family system. Specifically, the current study sets to explore if emotional dynamics between dyads (mother-adolescent, father-adolescent, and mother-father) and the triad as a whole can indicate problems for the interparental relationship as well as for adolescents' mental health.

The Importance of Examining Triadic Family Emotion Dynamics

The majority of studies on parent–adolescent interactions have solely focused on the dyads (parent-adolescent). For example, Granic and his colleagues (2003) used a dynamic system approach (i.e., state space grids) to examine longitudinal changes in family interactions' structure during early adolescence. Results showed that early adolescence is a period to have increased flexibility in behaviors during parent-child interactions. Analyzing the dynamic process of individuals' emotional synchrony or asynchrony from moment to moment can contribute to a more robust and detailed understanding of emotional wellbeing and relationship quality among members of a core family. Main and her colleagues (2016) focused not only on concurrently shared emotional states but also on time-lagged synchrony of parents' and adolescents' emotions relative to one another. By using recurrence quantification analysis (RQA) and growth curve analysis, results showed that lower levels of concurrent synchrony of negative emotions are associated with higher discussion satisfaction. All these findings highlight the important contributions of moment-to-moment dynamics in parent–adolescent interactions. However, this paper only focused on the interactions between one parent and their adolescent. Examining interactions in a triadic context can better present emotional experiences within a family.

Existing studies on triadic family interactions have highlighted the role of family emotional dynamics in the development of children and adolescents' psychopathology. A study used state space grids to explore the affects during parent-adolescent problem-solving interactions among mothers, fathers and their adolescents with depression or without depression (Hollenstein et al., 2016). Comparing to health adolescents, family with depressed adolescents were found to express a wider range affect. They also spend more time and return to discrepant affect quickly. Another study revealed more specific, anger-related interactions patterns in families of depressed adolescents (Bodner et al., 2018). Families of depressed adolescents expressed more anger in triadic interactions, and parents' anger responses and adolescents' dysphoric affect followed each other more often compared to other families. While marital relationship quality was known to have an effect on child mental health outcomes, to my knowledge, no existing studies have examined the relationship between triadic family interaction and marital relationship quality.

Adolescents' gender should also be considered in examining their emotional experiences within a family context since previous research has found that adults of different gender are affected by family stressors differently (Sonnenberg et al., 2013). From an early age, gender differences in emotion expression are evident among children, and parents responded to these expressions differently according to the child's gender (Chaplin et al., 2005). Gender differences in emotion expression also continue to develop and change as children grow from toddler to middle childhood to adolescence (Chaplin & Aldao, 2013). As the effects of age and gender in children's emotion expression starts to emerge in literature (e.g., Chaplin, 2015; Chaplin et al., 2017, Sanchis-Sanchis et al., 2020), the dynamics and consequences of parental response in relation to children's

gender remain largely unexplored. Thus, adolescents' gender should also be considered in examining their emotional experiences within a family context.

The Present Study

The main goal of the current study was to explore the synchronous emotional states across two triadic interactions (mother, father, and adolescent) and how synchronous emotions were related to (a) parents' interparental relationship quality and (b) adolescents' psychological health (depressive symptoms and anxiety). First, using recurrence quantification analysis (RQA), I explored the dyadic and triadic synchrony (i.e., recurrence) pattern across three emotional states (i.e., negative, positive emotion and validation/interest) in two interaction tasks.

Similar to many previous studies, the current study focused on negative and positive emotions to capture two broad emotions categories. Additionally, while validation and interest are also included in positive emotion, they can be separated out as a pair of emotional state (Main et al., 2016). Validation and interest do not only present a positive emotional state, but they also have a social function especially in conflict discussion. Given that no studies have compared the dyadic and triadic synchrony across emotional states, I did not have any specific predictions how emotion synchrony across emotions might differ across different dyads within the triad. Second, I explored whether dyadic and triadic synchrony were related to adolescents' depressive and anxiety symptoms. I hypothesized that higher dyadic and triadic negative synchrony would be associated with more adolescents' depressive and anxiety symptoms. Third, I explored a) whether there are differences as a function of adolescents' gender in dyadic and triadic synchrony, and b) whether adolescents' gender moderates associations between synchrony and outcomes. Relationship remains exploratory.

Method

Participants

Participants in the present study participated in the fifth wave of the Schoolchildren and their Families (SAF) study; a longitudinal investigation of the effects of individual, marital, and family functioning on children's psychological health across elementary and middle school (Cowan et al., 2005). Two hundred two-parent families from 28 cities and towns within a 40-mile radius from the University of California, Berkeley were recruited when the children were beginning kindergarten. Families were recruited into the study through public services radio announcements and flyers distributed to preschools and daycare centers in the San Francisco Bay Area. Parents were contacted by phone to determine their willingness to participate in this study. Fifty-two families participated in the final wave, which took place when adolescents were in 9th grade; 50% were female. For the racial/ethnic distribution of large sample participating families was 84% European American, 6.9% Asian, 6.6% African American and 2.5% Latinx. The average age of mothers was 36.18 years ($SD = 5.75$), and the average age of fathers was 37.07 years ($SD = 5.75$). Total family income ranged from \$22,000 to \$240,000 with a median of \$73,000.

Procedure

A target adolescent, mothers and fathers participated in a laboratory visit at the University of California, Berkeley that consisted of several questionnaires and videotaped interactions. The present study focused on two observed interactions – the family circle task and a conflict discussion. In the family circle task, family members worked together

to draw a picture of how close each family was to one another and discussed the drawing. In this task, mothers, fathers, and adolescents were instructed to select which image best represented their family – these were labeled cohesive, separate, triangulated, or detouring. Larger circles represented the parents, and the smaller circle represented the target adolescent. Spaces between circles indicated the distance between family members (Kerig, 1995). The present study focused on portion of the task in which family members were asked to discuss which circle graphic reflected their own family system the best and to explain discuss each other’s viewpoints as a family. In the conflict discussion, family members independently identified a topic they frequently argued about in the past and subsequently discussed this topic for 10 minutes without a researcher present. Adolescents and parents sat side-by-side and both discussions were videotaped.

Measures

Adolescents’ and Parents’ Emotions. The 16-code version of the Specific Affect Coding System (SPAFF version 4.0; Coan & Gottman, 2007) using Mangold INTERACT (version 14) was used to code adolescent, mother, and father emotions second-by-second during the interaction tasks. The SPAFF is divided into positive, negative, and neutral codes with specific emotions within each dimension. Codes were assigned in a mutually exclusive and exhaustive manner, meaning that only one code was applied at each time point. Mothers, fathers, and adolescents were coded separately, resulting in three synchronized streams of emotions. SPAFF codes were collapsed into the following categories: negative (e.g., contempt, criticism), positive (e.g., affection, humor) and validation/interest (Main et al., 2016; see Appedix for a complete list of SPAFF codes). Validation and interest were collapsed under the same category since they are conceptually similar and are expected to have similar temporal coordination. Validation was coded when participants validated their partners’ behaviors or verbal content. Interest was coded when participants showed curiosity to their partners (see Coan & Gottman, 2007). As with all SPAFF codes, both validation and interest can be taken verbally (e.g., statements of understanding for validation, being curious about partner’s point of view) and non-verbally (e.g., head nodding for validation and raising eyebrow showing interest).

In order to establish interrater reliability, the lead author trained two undergraduate research assistants to reach 80% agreement prior to the start of coding. To minimize coder drift, weekly meetings were held for coders to discuss any discrepancies. Due to the categorical nature of the data, Cohen’s kappa was used to calculate interrater reliability. A minimum of 75% agreement across codes was required for the data to be included in final analyses (see Coan & Gottman, 2007); videos were recoded until this criterion was met. The average kappa across all codes was 0.89 for mothers, 0.86 for fathers, and 0.90 for adolescents (range = 0.70 to 1.00).

Marital Satisfaction. Interparental relationship quality was assessed with the Short Marital Adjustment test (Locke & Wallace, 1959), a measure of marital satisfaction. This test consists of 15 items with eight different subscales. All subscales were collapsed as the Short Marital Adjustment test has high internal consistency (Locke & Wallace, 1959). This test also discriminates between couples with marital problems and without marital problems (O’Leary & Turkewitz, 1978). Mothers and fathers completed the questionnaire separately. Sample items included, “State the approximate extent of agreement or disagreement between you and your mate on handling family

finances”, and “State the approximate extent of agreement or disagreement between you and your mate on sex relations.” Responses were based on a Likert scale from 0 (*always disagree*) to 5 (*always agree*). The reliability of the scale in the present study was good ($\alpha = 0.75$ and $\alpha = 0.77$ for mothers and fathers, respectively).

Adolescent Depressive Symptoms. The Children’s Depression Inventory (CDI; Kovacs, 1985) was used to assess the presence and severity of depressive symptoms in adolescents. This scale consists of 27 items capturing several different aspects of depressive symptoms, including hedonic capacity, depressed mood, and mood swings. All item scores were combined into a total depression score (range = 0 to 54), with higher scores indicating higher levels of depressive symptoms. Reliability of the scale was acceptable in the present study ($\alpha = .63$).

Adolescent Anxiety. The Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) was used to measure adolescents’ anxiety. The BSI consists of nine symptoms sub-scales in total: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. The subscale of anxiety was used. Each item was rated on a 5-point scale ranging from 1 (*not at all*) to 5 (*extremely*). Sample items include, “During the past 7 days, how much were you distressed by nervousness or shakiness inside?”, “During the past 7 days, how much were you feeling tense or keyed up?” Reliability for this scale was good for the present study ($\alpha = .77$).

Analytic Strategy

Recurrence Quantification Analysis (RQA). Recurrence quantification analysis (RQA) was used to analyze emotion dynamics between mothers, fathers and adolescents during both the family circle task and conflict discussion. After collapsing emotion into three categories: negativity (e.g., contempt, criticism), positivity (e.g., affection, humor) and validation/interest, the time series of these categories were extracted. Categorical RQA was used since the emotion displayed during both interaction tasks were coded as either present or absent from moment-to-moment. Emotions time series for mothers, fathers, and adolescents were in 1 second units. By using RQA, I calculated the rates at which adolescents and parents revisited particular emotion states. This provided the information of synchrony measures for positive, negative and validation/interest separately. After calculating the synchrony measures for each emotion categories, they were added to the RQA model which calculated the extent to which emotions were revisited across family members of the triad interaction. By running RQA, three sets of analyses were generated.

First, the global recurrence was calculated which each emotion categories were matched in general across the entire interaction. By calculating the global recurrence for each emotion separately, percentage of recurrence was obtained. The percentage of recurrence reflects the general matching with an emotion across pairs of the triadic interaction. For example, a 5% mother-adolescent recurrence rate refers to within all possible recurrence, mother and adolescent match each other’s negative emotions 5% of the time across the interaction. Second, the joint recurrence was included between participants in the analyses given that the global recurrence only includes dyadic participants pairs but not the triadic itself (cf. Marwan et al., 2007). Joint recurrence is calculated by taking the recurrence across two dyads and composing the triad. Hence, the joint recurrence reflects the triad recurrence which how all three family members are

recurring emotionally in each category as a unit. Note that the joint recurrent rate would be lower than the dyadic recurrence rate. This is based on a dual constraint that it is required that each dyadic pair only count recurrence if both pairs match emotionally. This would automatically drop the recurrence rate in all analyses.

Analyses. Before testing the research questions, frequencies, distributions, and correlations for all variables were examined. I conducted paired samples t-tests to examine whether there were differences in emotion synchrony across negative, positive, and validation/interest categories across dyads (i.e., adolescent-mother, adolescent-father, and mother-father) within triads across the two discussion tasks. I then conducted correlations to examine associations between emotion synchrony across dyads and triads with interparental relationship quality and adolescent depressive symptoms and anxiety. Finally, I conducted hierarchical multiple regressions to test unique associations of dyadic and triadic emotion synchrony and outcomes.

Results

Preliminary Analyses

Descriptive statistics (minimums, maximums and means) of the frequency of mothers', fathers' and adolescents' emotions across the two discussion tasks are presented in Table 8.

Correlations between synchrony, marital satisfaction, depressive and anxiety symptoms are presented in Table 10. In the family circle task, greater negative mother-father synchrony and triadic synchrony were related to lower mother and father marital satisfaction. No significant correlations were found between negative synchrony and marital satisfaction in the conflict discussion. In the family circle task, greater negative mother-father synchrony and triadic synchrony were significantly related to more adolescents' depressive and anxiety symptoms. Greater negative mother-adolescent and father-adolescent synchrony were found to be related to fewer adolescents' anxiety symptoms in the conflict discussion. No significant correlation between positive emotion, adolescents' depressive and anxiety symptoms, and parents' marital satisfaction were found in either interaction task. Similarly, no significant correlations between validation/interest and marital satisfaction were found in the conflict discussion. However, in the family circle task, mother-adolescent validation/interest synchrony was negatively correlated with mothers' marital satisfaction.

Paired sample t-tests were conducted to examine the difference between the family circle task and conflict discussion across different emotions. Results are presented in Table 11. All synchronies were significantly different across two tasks in negative emotion. In negative emotion, conflict discussion had higher synchrony than the family circle task in all pairs. Mother-adolescent synchrony was also significantly different across two interaction tasks in validation/interest. Result showed that conflict discussion had higher validation/ interest mother-adolescent synchrony comparing to the family circle task.

Research Question 1: Are there Dyadic and Triadic Differences Across Synchrony of Different Emotions?

The first research question was to examine whether there were differences across dyadic synchrony across negative, positive, and validation/interest emotional states. Paired samples t-tests were conducted to compare synchrony in emotions across all dyad pairs (adolescent-mother, adolescent-father, and mother-father) across different emotions

(negative, positive, and validation/interest). First, I examined differences in dyadic synchrony of negative emotion. Results showed that father-adolescent pairs had significantly greater negative synchrony compared with mother-father negative synchrony ($t(50)=2.11, p=.040$) in the conflict discussion task (see Table 9 for means and standard deviations of all pairs' synchrony). There were no other significant differences between dyads in the synchrony of negative emotion in the conflict discussion, and there were no significant differences in the family circle task. Second, I examined differences in dyadic synchrony of positive emotion. In the conflict discussion, both mother-adolescent and mother-father positive synchrony were significantly higher than father-adolescent synchrony ($t(50)=2.41, p=.020$ and $t(50)=-2.66, p=.010$ respectively). Conversely, mother-adolescent positive synchrony was significantly higher than mother-father positive synchrony in the family circle task, $t(50)=2.93, p=.005$. Third, I examined differences in dyadic synchrony of validation/ interest. All dyadic synchrony variables were significantly different from one another in both the conflict discussion and family circle task. In the conflict discussion, mother-adolescent dyads had greater synchrony of validation/interest synchrony than father-adolescent dyads, $t(50)=4.71, p=.000$. Moreover, mother-father dyads showed higher synchrony compared to both mother-adolescent synchrony, $t(50)=-2.08, p=.043$ and father-adolescent synchrony $t(50)=-4.53, p=.000$. In the family circle task, I found very similar pattern as in the conflict discussion. Mother-adolescent dyads had greater synchrony of validation/interest synchrony than father-adolescent dyads, $t(50)=2.09, p=.042$. Additionally, mother-father dyads had greater synchrony of validation/interest compared to both mother-adolescent dyads $t(50)=-4.05, p=.000$ and father-adolescent dyads, $t(50)=-4.60, p=.000$.

Research Question 2: Are Dyadic and Triadic Synchrony Uniquely Associated with Adolescent Mental Health?

The second research question was to test whether dyadic and triadic synchrony across different emotions were associated with adolescents' depressive symptoms and anxiety. Hierarchical multiple regression analyses were conducted to test this research question. Analyses were conducted separately within each emotion category for each dependent variable across the two discussion tasks, resulting in a total of 12 hierarchical multiple regression analyses. The first step of the models included the main effects of gender. The second step added the main effects of each dyadic pair synchrony. Result showed that higher father-adolescent synchrony of negative emotion in the family circle task (but not the conflict discussion) was associated with fewer adolescent depressive symptoms in the family circle task (see Table 12). Higher mother-father synchrony of negative emotion in the family circle task (not in the conflict discussion) was associated with more adolescent depressive and anxiety symptoms. For positive emotion synchrony, higher mother-father synchrony of positive emotion in the conflict discussion (but not the family circle task) was associated with greater adolescents' depressive symptoms. There were no significant unique associations between dyadic or triadic synchrony of validation/ interest and adolescent mental health.

Research Question 3: Are Associations between Dyadic and Triadic Synchrony and Adolescent Mental Health Moderated by Adolescent Gender?

The third research question was to examine whether dyadic and triadic synchrony across different emotions were associated with adolescents' depressive and anxiety symptoms differently as a function of adolescent gender. Following up from my research

question 2, the third step added the triadic synchrony (see Table 12). The last step added the interaction term of gender and synchrony. Interaction terms were created by centering the synchrony variable around their mean and multiplying them together.

Results revealed that mother-father negative emotion synchrony in the family circle task was uniquely positively associated with greater adolescent depressive and anxiety symptoms, controlling for adolescent-mother, adolescent-father, and triadic negative synchrony (see Table 12). In the family circle task, interactions between gender and synchrony were not able to be conducted given collinearity issues. Interestingly, mother-father positive emotion synchrony in the conflict discussion was also positively associated with adolescent depressive, but not anxiety, symptoms. There were no other unique associations between dyadic or triadic emotion synchrony and adolescent mental health across the tasks. However, there were some interactions between emotion synchrony and adolescent gender predicting adolescent mental health. Specifically, there was a significant interaction between mother-father negative emotion synchrony in the conflict discussion and adolescent depressive (but not anxiety) symptoms. Probing of the interaction revealed that male adolescents reported higher depressive symptoms when there was higher mother-father negative emotion synchrony compared with when there was lower mother-father negative emotion synchrony; there were no differences in female adolescents' depressive symptoms as a function of mother-father negative emotion synchrony (see Figure 1). There were also unique significant interactions between mother-adolescent and father-adolescent positive emotion synchrony and adolescent depressive (but not anxiety) symptoms. Specifically, female adolescents reported higher depressive symptoms when mother-adolescent positive emotion synchrony was higher relative to when mother-adolescent positive emotion synchrony was lower; there were no differences for male adolescents as a function of adolescent-mother positive emotion synchrony (see Figure 2). Conversely, female adolescents reported lower depressive symptoms when father-adolescent positive emotion synchrony was higher compared with when synchrony was lower; for male adolescents, the opposite effect was seen (see Figure 3).

Discussion

The current study explored dyadic and triadic emotion dynamics in two interactions tasks among mothers, fathers, and adolescents. In dyadic dynamics, a trend emerges that father-adolescent tended to have higher negative synchrony and lower positive synchrony when compared to other pairs. Father-adolescent also showed less validation/interest when compared to father-mother or mother-adolescent dyads.

For outcomes, as expected, families with higher negative synchrony were associated with parents reporting with worse marital satisfaction. While higher negative synchrony of father-adolescent dyads predicted fewer depressive symptoms for adolescents, negative synchrony between mother-father dyads predicted more depressive and anxiety symptoms for adolescents, supporting the impact of parental discord on the child. Worse parental marital satisfaction was also predicted by higher father-adolescent positive synchrony, whereas better marital satisfaction was predicted by higher mother-adolescent positive synchrony. Gender differences were also found and discussed.

Differences in Dyadic Emotion Synchrony

Negative Emotion

I found that father-adolescent negative synchrony was significantly higher than the mother-father negative synchrony in the conflict discussion task (but not the family circle task). This is consistent with previous studies that have found the father-child relationship to be generally more emotionally challenging. Fathers tended to be more likely to challenge adolescent to regulate his/her emotions autonomously by providing less explicit structure (Van Lissa et al., 2019). In this same study, compared to mothers, fathers also tended to give more comments, indirect suggestions, and requests for actions in conflict or problem-solving discussions. In problem-solving discussions, fathers were more likely to express higher levels of anxiety and tension (Capaldi et al., 1994; Grotevant & Cooper, 1985). All these studies may explain why father-adolescent was found to have higher negative synchrony particularly in the conflict discussion task. No significant differences were found across all dyads' synchrony of negative emotion in the family circle task. This is not surprising given to the nature of the family circle task which did not induce as much negativity as the conflict discussion.

Positive Emotion

Results showed that both mother-adolescent and mother-father positive synchrony were significantly higher than father-adolescent synchrony in the conflict discussion (but not the family circle task). Previous research found mothers tend to express more positive emotions than fathers in a family context (Cassidy et al., 1992). The present study extended this identified difference to a dyadic context within families. Mothers' tendency to initiate positive behaviors within interactions can partially explain the result (Fletcher et al., 1996). Previous studies alluded a picture that mothers tended to respond to all positive, neutral and negative behaviors with positivity which suggested that mothers were more likely to behave with a manner of "be nice and forgive". However, current research suggested mothers are not only expressing more positive emotion, they are also better at matching positive emotions with other family members which hinted a stronger ability to empathize others' positivity.

Additionally, previous study found that comparing to mothers, fathers were less likely to respond, maintain or amplify depressed adolescents' positive affect (Katz et al., 2014). Findings may suggest that this responding pattern did not only apply on depressed adolescents, but also on the general youth population. In the family circle task, mother-adolescent positive synchrony was significantly higher than mother-father synchrony, suggesting that mothers may tend to share more positive emotion with their adolescents than with their partners. One of the plausible reasons can be caused by the reciprocal relationship of positive emotion between mothers and adolescents. Mothers who were found to be more expressive in positive emotions towards child, the child in turn was more positively expressive with mother as well, and vice versa (Cassidy et al., 1992). This may explain why mother-adolescent had a higher positive synchrony. Testing the direction of emotional expression between mothers, fathers and adolescents could be a future direction.

Validation/ Interest

All dyads were significantly different from one another in their synchrony of validation/interest in both the conflict discussion and the family circle task. Specifically, mother-adolescent dyads had higher validation/interest synchrony than did father-adolescent dyads. This is consistent with previous studies that mothers showed more support (conceptually similar to validation/interest) than did fathers during adolescences

(De Goede et al., 2009). Moreover, mother-father dyads showed higher validation/interest synchrony compared to both mother-adolescent synchrony and father-adolescent synchrony. This is consistent with a previous study with mother-adolescent dyads that revealed a time-lagged synchrony or turn-taking pattern of validation/interest during conflict discussions (Main et al., 2016). My findings build on Main et al. (2016)'s result that mothers and fathers may show validation/interest concurrently towards their adolescent which form a parenting alliance. Then, adolescents may take turns to show validation/interest towards parents. However, note that my analysis did not reveal the direction of this dynamic. It is also possible that mothers and fathers were showing validation/interest towards each other. Future studies that specifically explore the triadic dynamics of validation and interest in terms of direction and topics involved would yield valuable insights for clinical practice.

Associations between Dyadic and Triadic Emotion Synchrony and Adolescent Mental Health

Negative Emotion

Results showed that higher negative father-adolescent synchrony was associated with fewer adolescent depressive symptoms. Though unexpected, some studies did find parents tended to respond to depressed adolescents with more positive emotions and less negative emotions and aggression, perhaps as a way of facilitating the child's emotion regulation (Schwartz et al., 2012). In addition, higher negative mother-father synchrony was associated with more adolescent depressive and anxiety symptoms. This result is consistent with survey-based research examining the relationship between family emotional climate and youth wellbeing. Family negative emotion expressiveness was found to be related to more children's depressive and anxiety symptoms (Stocker et al., 2007; Luebke and Bell, 2014). Unlike the survey-based research, which is often subjected to bias in reporting, this study strengthened the evidence through real-time observational methodology. The emotional security theory has long investigated interparental discord, with a special emphasis on interparental conflicts, as a contributor to children's mental health problems (Cummings & Davies, 1994). Current result has extended this relationship.

Positive Emotion

For positive emotion, higher positive mother-father synchrony predicted more adolescents' depressive symptoms. This result can be explained by parents may tended to respond to adolescent's display of dysphoria with positive emotions (Schwartz et al., 2012).

Validation/ Interest

No significant prediction associations between validation/interest and the outcome variables. This can be due to the low frequency of the validation/interest codes.

The Role of Adolescent Gender

I explored dyadic and triadic synchrony and its association with adolescents' depressive and anxiety symptoms moderating by adolescents' gender. Results showed that compared to daughters, sons with higher mother-father negative synchrony in the conflict discussion had more depressive symptoms. Overall, this is consistent with previous findings that parental conflict contributes to children's mental health problems (Essex et al., 2003; Smith et al., 2019; Simpson, 2020). Furthermore, the gender difference is consistent with some findings with adults' samples. Compared to females,

males were found to be more susceptible to household stressors (Sonnenberg et al., 2013). These emotion dynamics may reflect broader family dynamics within the household.

Additionally, I found that compared to daughters, sons with higher father-adolescent positive synchrony also had more anxiety symptoms in the conflict discussion. Conversely, daughters with higher mother-adolescent positive synchrony had more anxiety symptoms in the conflict discussion. Given that both findings were found in the conflict discussion which may be explained with the nature of the task itself. These findings can be explained by parent-adolescent dyads expressing humor to disguise or regulate emotions during a potentially negative or volatile topic. These interaction patterns could be problematic since a mutually acknowledged negative topic (e.g., when families discussing their conflicts) itself can be a source of stress and anxiety for adolescents. Moreover, humor has been identified as a distraction-based emotion regulation strategy (Wu et al., 2021). Even though his strategy can effectively regulate individuals' emotions, this emotion regulation strategy can be an indicator of avoidance. It can turn into a distraction-based emotion regulation strategy which is maladaptive and at risk of anxiety disorders (Wolgast & Lundh, 2017; Kashdan et al., 2006; Berman et al., 2010).

Limitations and Future Directions

The current study is an important first step in understanding how synchronous shared emotional states within a triadic interaction are related to adolescents' mental health and interparental relationship quality. However, some limitations warrant mentioning.

First, though the sample included multiple family members, the sample size was somewhat small and could have been underpowered to detect some smaller effects. Only 52 families participated at the final point in this study. In order to have a higher power, a larger sample size is needed.

Second, a more diverse sample can allow us to examine how cultural factors may play a role in the relationship between synchronous shared emotional states, adolescents' mental health and parents' interparental relationship quality. It is not surprising that culture and emotion are closely related (Markus & Kitayama, 1991). For example, in order to maintain group harmony, Asian Americans tend to value emotional suppression more than veridical emotional expression (Gross & John, 1998; Tsai et al., 2002). Parents and adolescents with different cultural backgrounds may affect the way how they express their emotion during interactions, in turn to impact their mental health. Future research should look into how cultural factors influence the shared emotional states of parents and adolescent and the implications of such dynamics for adolescents' psychological health.

Third, this current study has only focused on the final time point which is a cross-sectional design. Because all variables were measured at the same time, I cannot draw any conclusions about the casual relationship of family members' concurrently shared emotional states, adolescents' mental health and parents' interparental relationship quality. It would be informative if future research is conducted with a longitudinal design to examine the causal relationship between these variables.

Conclusions and Implications

My study adds to our understanding of how family's concurrently shared emotional states, adolescents' psychological health and parents' interparental relationship

quality are closely related. Even though there is a link between interparental relationship quality and adolescents' psychological health, not many studies have examined family's concurrently shared emotional states during real-time interactions, and how such dynamics are associated with adolescent psychological health, including risk in depression and anxiety and parents' marital satisfaction. The observational methodology sheds light on everyday family dynamics that contribute to both adolescents' risk in depression and anxiety and parents' interparental relationship quality.

Most of the research on parent-adolescent relationships solely focused on one single parent. However, family dynamics may be different when the entire family is present (McHale & Fivaz-Depeursinge, 2010). This current study can be used to develop inform intervention of the importance of examining the entire family system which includes both parents and adolescent into account. Specifically, it is important for researchers to conduct observational research which videotape both parents' and adolescents' behaviors and views in order to capture the entire family dynamic. Interventions focused on reducing psychological distress in adolescents should focus more on their emotion responses during family interactions to promote positive mental health.

Chapter 4: General Conclusions

Interpersonal emotion dynamics play a prominent role in adolescents' and emerging adults' adjustment. Taken together, the findings from this dissertation will provide further insight into how social interactions (i.e., interaction social contexts and emotional synchrony) impact adolescents' socio-emotional development. Different aspects of social interaction contexts, such as pleasantness, closeness, triadic, were discussed. Further, these findings highlight how these associations may unfold over time, such as, real-time parents-child interactions and momentary changes in social environments.

Chapter 2, study I, examined how social context plays a role in emotion regulation strategy on a moment-to-moment level among college students. Emotion regulation strategies, expressive suppression and cognitive reappraisal, were conceptualized as situation reactions by using ecological momentary assessment (EMA). Participants reported that social interactions and emotion regulation strategy four times a day for 14 consecutive days. Findings from the multilevel models indicated that the pleasantness of social interactions and closeness with the interacted partner are related to both individuals' expressive suppression and cognitive reappraisal at the same moment. The lagged model showed that both pleasantness and closeness do not have any carryover effect on expressive suppression and cognitive reappraisal in the next moment. However, there was a significant carryover effect of cognitive reappraisal on both pleasantness and closeness on the next moment. Findings suggested variability in social contexts in the moment is associated to variation in the emotion regulation strategies use. To extend from previous research, this study used the EMA approach which highlighted the importance of examining participants' responses close in time to when they just had interactions and regulated their emotions. Findings from this study highlighted the importance of understanding both social contexts and emotion regulation on a momentary level.

Chapter 3, study II, examined emotional synchrony during real-time triadic family interactions. I explored the synchronous emotional states across two triadic interactions (mother, father, and adolescent) and how synchronous emotions were related to both parents' interparental relationship quality and adolescents' psychological health (depressive symptoms and anxiety). By using recurrence quantification analysis (RQA), findings indicated that father-adolescent tended to have higher negative synchrony and lower positive synchrony when compared to other pairs. Father-adolescent also showed less validation/interest when compared to father-mother or mother-adolescent dyads. Other than dyadic pairs, results showed that families with higher negative synchrony were associated with parents reporting with worse marital satisfaction. Additionally, negative synchrony between mother-father dyads predicted more depressive and anxiety symptoms for adolescents, supporting the impact of parental discord on the child. This study shed light on how dyadic and triadic emotional synchrony impact on both parents' interparental relationship quality and adolescents' psychological adjustment. This chapter can be used to develop inform intervention of the importance of examining the entire family system which includes both parents and adolescent into account.

Emotion has long been understood as a fluctuating response to situational factors. In contrast, emotion regulation has been predominantly characterized as an individual

trait that often reliably modifies emotional experiences (e.g., Marroquín & Nolen-Hoeksema, 2015; Winterheld, 2016). Recently, there have been increasing calls to re-examine the fluidity of emotion regulation in social contexts (e.g., Colombo et al., 2020). In the current work, I focused on the interpersonal aspects of emotion dynamics. Study I examined emotion regulation as a dynamic response to social interactions, suggesting social contexts to be associated emotion regulation capacities. Study II examined the role of family emotional synchrony on interparental relationship quality and adolescents' emotional wellbeing, suggesting patterns of interpersonal emotion dynamics (e.g., high vs. low synchrony over negative emotions) has impacts on long-term social contexts and emotionality. Together, my studies revealed that emotionality is far from being a static intrapersonal trait even among non-clinical populations.

From a methodological perspective, past research has relied on infrequent self-reports across a long time span which provided very little details about the underlying temporal nature of interpersonal emotion dynamics. Study I demonstrated the need to examine the effects of interpersonal interactions by collecting data repeatedly daily. Results revealed emotion regulation could change along with the quality of social interaction from one to the next moment. Study II highlighted the need to examine real-time interaction patterns in understanding interpersonal emotion dynamics and psychological wellbeing. Results indicated that the patterns of emotional synchrony can emerge in relatively short periods of triadic family interactions, providing a potential direction to understand how emotional dynamics within single moments can aggregate to relationship problems and psychological distress over time.

Collectively, these studies inform the interwoven nature of social interactions and emotional processes in influencing socio-emotional functioning during adolescence and emerging adulthood. This dissertation used novel methodologies to build on a previous literature which has been increasingly recognizing emotionality as a function of social interactions. By capturing real-time data in social interactions, these studies had contributed to understand emotional processes in a state level, and investigation of emotional climate, parental relationship quality, and adolescents' emotional well-being. This dissertation supported the view that emotionality is both organizing and influenced by social interactions (e.g., Butler, 2011; Main et al., 2016). Findings from this dissertation will not only be able to inform research on the interface between social contexts and emotion regulation, but also guide inform interventions aimed at adolescents and families.

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Table 1
Study 1 Participant Demographics

Variables	Descriptive information
	<i>M</i> (<i>SD</i>) [<i>range</i>]
Age	20.6 (2.00) [18.0-28.0]
	<i>n</i> (%)
Gender	
Male	15 (21.1%)
Female	55 (77.5%)
Other	1 (1.4%)
Race	
Black/ African American	1 (1.4%)
Native American (North or South America)	4 (5.6%)
Asian	11 (15.5%)
Native Hawaiian or Pacific Islander	0 (0.0%)
White	37 (52.1%)
More than one	8 (11.3%)
Academia classification	
1st year/ Freshman=1	12 (16.9%)
2nd year/ Sophomore=2	14 (19.7%)
3rd year/ Junior=3	23 (32.4%)
4th year/ Senior=4	22 (31.0%)
5th year or more/ Super Senior=5	0 (0%)
Parental education	
High school or less	24 (33.9%)
High school graduate	17 (23.9%)
Some college	5 (7.0%)
Associate's/vocational degree	5 (7.0%)
Bachelor's degree	9 (12.7%)
Master's degree	4 (5.6%)
Other	6 (8.5%)
MD/ PHD/ JD	1 (1.4%)
Total N	71

Table 2

Descriptive Statistics of Pleasantness, Closeness, Suppression, Reappraisal

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
<i>Social Contexts</i>				
Pleasantness	4.55	1.33	0.0	6.0
Closeness	4.79	2.03	1.0	7.0
<i>Emotion Regulation</i>				
Suppression	1.38	1.71	0.0	6.0
Reappraisal	1.35	1.64	0.0	6.0

Notes: *M* = mean, *SD* = standard deviation, *Min* = Minimum, *Max* = Maximum

Table 3
Multiple Regression Predicting Suppression and Reappraisal from Pleasantness and Closeness at the Person-Mean Centered Level

	Dependent Variable		Dependent Variable	
	Suppression	Reappraisal	Suppression	Reappraisal
<i>Fixed Effects</i>				
Intercept	4.34*** (.17)	4.31*** (.17)	1.28*** (.22)	1.14*** (.21)
Study Day	-.01 (.01)	-.01 (.01)	.00 (.01)	.01 (.01)
Weekend Day	.09 (.06)	.10 (.07)	.02 (.08)	.08 (.07)
Minutes Elapsed	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)
Pleasantness	-.23*** (.02)	-.20*** (.02)	--	--
Closeness	--	--	-.12*** (.02)	-.10*** (.02)
<i>Random Effects</i>				
Intercept	.34*** (.07)	.33*** (.07)	.91*** (.19)	.91*** (.18)
Residual	1.33*** (.05)	1.38*** (.05)	1.96*** (.07)	1.69*** (.06)
<i>Model Effects</i>				
Pseudo R^2	0.05	0.03	0.01	0.01

Note: Coefficients and standard error (SE, in parentheses), *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 4

Lag Model Predicting Suppression and Reappraisal from Pleasantness

	Suppression (Time t)	Reappraisal (Time t)
<i>Fixed Effects</i>		
Intercept	2.18 (2.14)	2.74 (2.26)
Study Day	-.00 (.01)	-.01 (.01)
Weekend Day	2.81 (7.23)	-.57 (7.64)
Pleasantness (Time t)	-.34*** (.04)	-.26*** (.03)
Pleasantness (Time $t-1$)	.02 (.04)	.04 (.03)
Emotion Regulation (Time $t-1$)	.14*** (.03)	.15*** (.03)
<i>Random Effects</i>		
Intercept	.89*** (.20)	1.09*** (.23)
Residual	1.76*** (.08)	1.47*** (.07)
<i>Model Effects</i>		
Pseudo R^2	0.11	0.05

Note: Coefficients and standard error (SE, in parentheses), *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 5
Lag Model Predicting Suppression and Reappraisal from Closeness

	Suppression (Time <i>t</i>)	Reappraisal (Time <i>t</i>)
<i>Fixed Effects</i>		
Intercept	1.37 (2.27)	2.34 (2.34)
Study Day	-.00 (.01)	-.00 (.01)
Weekend Day	2.36 (7.67)	-1.33 (7.90)
Closeness (Time <i>t</i>)	-.13*** (.03)	-.11*** (.02)
Closeness (Time <i>t</i> -1)	-.00 (.03)	.04 (.03)
Emotion Regulation (Time <i>t</i> -1)	.13*** (.03)	.15*** (.03)
<i>Random Effects</i>		
Intercept	1.02 *** (.23)	1.17*** (.25)
Residual	1.86*** (.09)	1.52*** (.07)
<i>Model Effects</i>		
Pseudo <i>R</i> ²	0.04	0.01

Note: Coefficients and standard error (SE, in parentheses), ****p* < .001, ***p* < .01, **p* < .05.

Table 6
Lag Model Predicting Pleasantness from Suppression and Reappraisal

	Pleasantness (Time <i>t</i>)	Pleasantness (Time <i>t</i>)
<i>Fixed Effects</i>		
Intercept	5.67 (1.43)	6.05** (1.56)
Study Day	.00 (.01)	-.00 (.01)
Weekend Day	-2.71 (4.86)	-4.16 (5.30)
Suppression (Time <i>t</i>)	-.24*** (.03)	--
Suppression (Time <i>t</i> -1)	.05 (.03)	--
Reappraisal (Time <i>t</i>)	--	-.21*** (.03)
Reappraisal (Time <i>t</i> -1)	--	.09** (.03)
Pleasantness (Time <i>t</i> -1)	.11** (.03)	.12** (.03)
<i>Random Effects</i>		
Intercept	.32 *** (.08)	.42*** (.10)
Residual	1.25*** (.06)	1.27*** (.06)
<i>Model Effects</i>		
Pseudo R^2	0.90	0.25

Note: Coefficients and standard error (SE, in parentheses), *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 7
Lag Model Predicting Closeness from Suppression and Reappraisal

	Closeness (Time <i>t</i>)	Closeness (Time <i>t</i>)
<i>Fixed Effects</i>		
Intercept	9.37*** (2.63)	9.66*** (2.71)
Study Moment	.01 (.01)	.01 (.01)
Weekend Moment	-15.00 (4.86)	-15.97 (9.20)
Suppression (Time <i>t</i>)	-.17*** (.04)	--
Suppression (Time <i>t</i> -1)	.07 (.04)	--
Reappraisal (Time <i>t</i>)	--	-.19*** (.04)
Reappraisal (Time <i>t</i> -1)	--	.09* (.04)
Closeness (Time <i>t</i> -1)	.25*** (.03)	.25*** (.03)
<i>Random Effects</i>		
Intercept	1.38*** (.32)	1.50*** (.34)
Residual	2.55*** (.12)	2.55*** (.12)
<i>Model Effects</i>		
Pseudo <i>R</i> ²	0.32	0.11

Note: Coefficients and standard error (SE, in parentheses), ****p* < .001, ***p* < .01, **p* < .05.

Table 8

Descriptive Statistics of Mothers', Fathers' and Adolescents' Emotions, Interparental Relationship Quality, and Psychological Health.

	Mothers			Fathers			Adolescents		
	<i>M</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>Min</i>	<i>Max</i>
Family Circle Task									
Positive	15.86	3.00	56.00	18.37	0.00	65.00	18.25	1.00	58.00
Negative	10.75	0.00	34.00	9.88	0.00	30.00	13.63	0.00	37.00
Validation/Interest	43.41	5.00	89.00	35.57	8.00	77.00	46.80	15.00	102.00
Conflict Discussion									
Positive	7.86	0.00	25.00	0.84	0.00	11.00	9.24	0.00	25.00
Negative	3.39	0.00	30.00	3.98	0.00	20.00	6.18	0.00	37.00
Validation/Interest	17.27	2.00	56.00	9.24	2.00	24.00	12.37	0.00	17.00

Notes: *M* = Mean, *SD* = Standard Deviation. Values of emotions are durations in seconds, * $p < .05$, ** $p < .01$.

Table 9

Descriptive Statistics of Emotion Synchrony Across Emotion Categories

	Conflict Discussion				Family Circle task			
	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Negative								
Mother-Adolescent	2.82	3.11	0	15.10	.22	.96	0	6.48
Father-Adolescent	3.47	3.50	0	14.30	.22	1.47	0	10.50
Mother-Father	2.43	2.87	0	17.82	.07	.39	0	2.79
Triadic	.19	.27	0	1.18	.03	.21	0	1.51
Positive								
Mother-Adolescent	.71	1.22	0	6.40	.76	1.26	0	6.41
Father-Adolescent	.44	.63	0	2.69	.44	.75	0	4.69
Mother-Father	.59	.69	0	2.90	.42	.90	0	6.14
Triadic	.17	.28	0	1.23	.20	.45	0	2.96
Validation/ Interest								
Mother-Adolescent	.46	.41	0	1.98	.23	.34	0	1.80
Father-Adolescent	.25	.26	0	1.14	.17	.29	0	1.36
Mother-Father	.68	.75	0	3.75	.79	1.11	.07	6.37
Triadic	.04	.05	0	.18	.03	.08	0	.44

Notes: *M* = mean, *SD* = standard deviation, *Min* = Minimum, *Max* = Maximum. Values of emotions are the percentage of recurrence (i.e., synchrony) which reflects the general matching for each emotion categories across pairs of the triadic interaction.

Table 10

Correlations Between Dyadic/Triadic Synchrony, Marital Satisfaction, Depressive and Anxiety Symptoms

	Marital Satisfaction (F)	Marital Satisfaction (M)	Depression (A)	Anxiety (A)
Negative				
Mother-Adolescent	.07/-.13	-.12/-.12	-.06/-.12	-.35*/-.11
Father-Adolescent	-.09/-.07	-.26/.03	-.11/.03	-.41**/.04
Mother-Father	-.21/.42**	-.28/.42**	-.12/.51**	-.26/.42**
Triadic	-.14/.34*	-.20/.36*	-.11/.41**	-.21/.36*
Positive				
Mother-Adolescent	.22/-.01	.14/-.05	.10/-.08	.22/-.07
Father-Adolescent	.12/.03	.03/.04	.19/.05	.16/.00
Mother-Father	-.17/.28	-.14/.25	.15/.28	-.13/.28
Triadic	-.11/.09	-.05/.05	.11/.02	-.03/.07
Validation/ Interest				
Mother-Adolescent	.13/-.25	.11/-.12	-.04/.01	.17/-.17
Father-Adolescent	-.19/-.39**	-.17/-.14	-.12/.06	-.13/-.07
Mother-Father	-.10/-.21	-.16/-.24	.06/-.08	-.05/-.12
Triadic	.14/-.20	-.15/-.21	-.18/-.15	-.13/-.19

Notes: F=fathers, M=mothers, A=adolescents; left of diagonal=conflict discussion, right of diagonal=family circle task, ** $p < .01$, * $p < .05$.

Table 11
Paired Sample T-Tests Comparing Task Differences Across Emotions

	Mean	SD	S.E. Mean		Paired <i>t</i> Test	
			<i>t</i> value	<i>df</i>	Sig (Two-Tailed)	
Negative						
Mother-Adolescent	2.60	3.36	0.47	5.52	50	.00
Father-Adolescent	3.25	3.98	0.56	5.84	50	.00
Mother-Father	2.35	2.86	0.40	5.89	50	.00
Triadic	.16	0.36	0.05	3.22	50	.00
Positive						
Mother-Adolescent	-.06	1.65	.23	-.24	50	.81
Father-Adolescent	.00	.85	.12	.03	50	.98
Mother-Father	.17	1.05	.15	1.14	50	.26
Triadic	-.03	.48	.07	-.46	50	.65
Validation/ Interest						
Mother-Adolescent	.23	0.51	.07	3.23	50	.00
Father-Adolescent	.08	0.36	0.05	1.51	50	.14
Mother-Father	-.11	1.28	.18	-.62	50	.54
Triadic	0.01	.10	.01	.52	50	.60

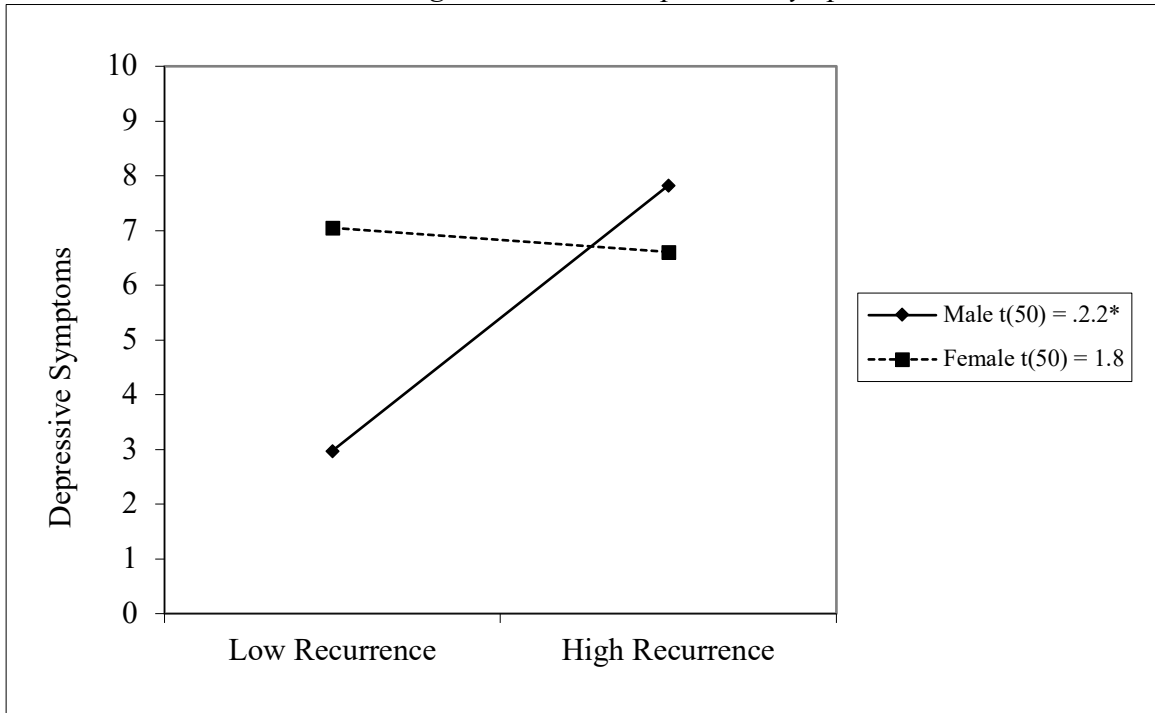
Notes: SD=standard deviation, Values of emotions are the percentage of recurrence (i.e., synchrony) which reflects the general matching for each emotion categories across pairs of the triadic interaction.

Table 12
Hierarchical Multiple Regressions Predicting Depressive and Anxiety Symptoms from Emotion Synchrony and Adolescent Gender

Variable	Depressive symptoms		Anxiety symptoms	
	β	ΔR^2	β	ΔR^2
Negative				
Step 1		-.20/-.02		-.02/-.02
Gender (Male=0; Female=1)	.06/.06		.01/.01	
Step 2		-.00/.43		-.05/.20
Mother-Adolescent	-.04/-.56		-.02/-1.6	
Father-Adolescent	-.27/-2.10*		-.17/-.11	
Mother-Father	.02/3.14**		-.02/2.09**	
Step 3		-.02/.42		-.06/.18
Triadic	-.13/-5.03		-.14/.48	
Step 4		.06/.46		-.14/.19
Gender X Mother-Adolescent	1.01/ ^a		.24/ ^a	
Gender X Father-Adolescent	-.07/ ^a		.21/ ^a	
Gender X Mother-Father	-.99*/ ^a		-.45/ ^a	
Gender X Triadic	-.14/ ^a		.08/ ^a	
Positive				
Step 1		-.02/-.02		-.02/-.02
Gender (Male=0; Female=1)	.06/.06		.01/.01	
Step 2		.12/.01		-.01/-.08
Mother-Adolescent	-.10/.24		-.19/.16	
Father-Adolescent	-.58/-.26		-.25/.11	
Mother-Father	.65**/.35		.44/-.20	
Step 3		.11/-.01		-.01/-.10
Triadic	0.40/.24		.45/.33	
Step 4		.16/-.00		.10/-.07
Gender X Mother-Adolescent	0.28/1.20		-1.73/1.06	
Gender X Father-Adolescent	-1.75*/-1.15		-1.07/-1.48	
Gender X Mother-Father	.91*/1.24		.09/1.39	
Gender X Triadic	.68/-.54		1.44/-.66	
Validation/interest				
Step 1		-.02/-.02		-.02/-.02
Gender (Male=0; Female=1)	.06/.06		.01/.01	
Step 2		-.05/-.03		-.05/-.04
Mother-Adolescent	-.03/-.07		-.07/-.11	
Father-Adolescent	-.20/-.24		-.06/-.10	
Mother-Father	.15/.11		-.13/-.06	
Step 3		-.08/-.02		-.06/-.06
Triadic	.12/.49		.23/.07	
Step 4		-.05/-.07		-.11/-.16
Gender X Mother-Adolescent	.05/-.76		.28/.12	
Gender X Father-Adolescent	-1.78/.42		-.48/.08	
Gender X Mother-Father	.54/.14		.67/-.16	
Gender X Triadic	.96/-.30		-.21/-.02	

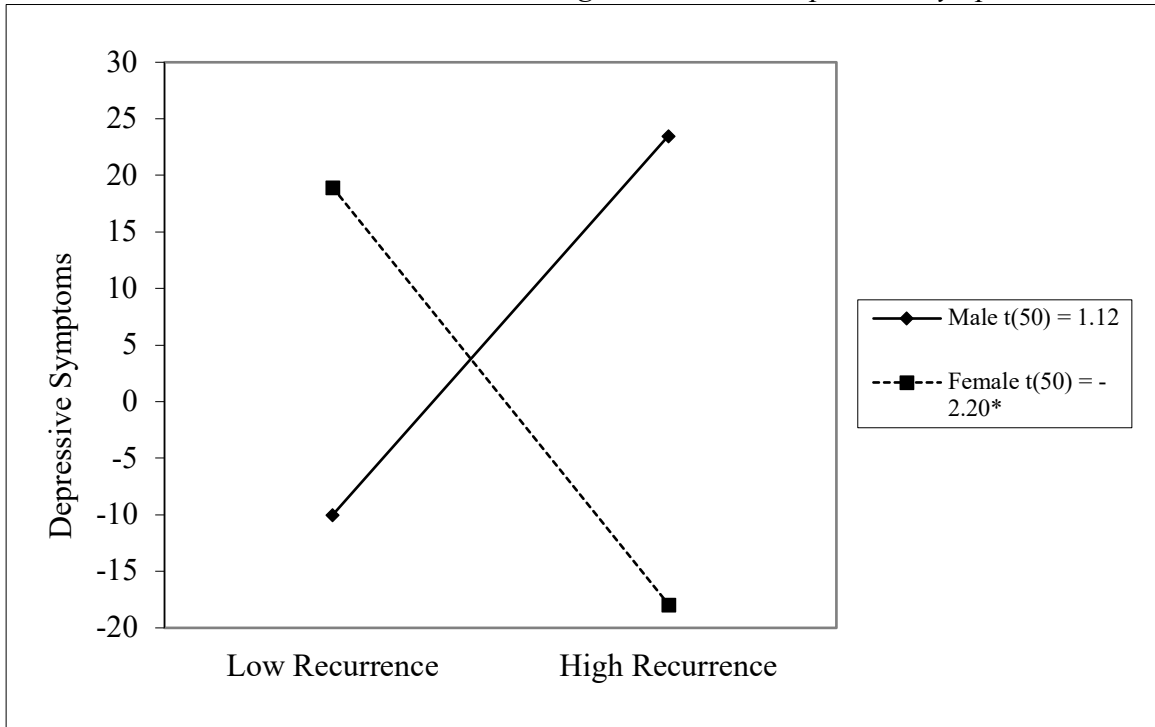
Notes: left of diagonal=conflict discussion, right of diagonal=family circle task, ^a indicates model with collinearity issue, ** $p < .01$, * $p < .05$.

Figure 1
Interaction Between Mother-Father Negative Synchrony During the Conflict Discussion and Adolescent Gender Predicting Adolescents' Depressive Symptoms



Notes: * $p < .001$.

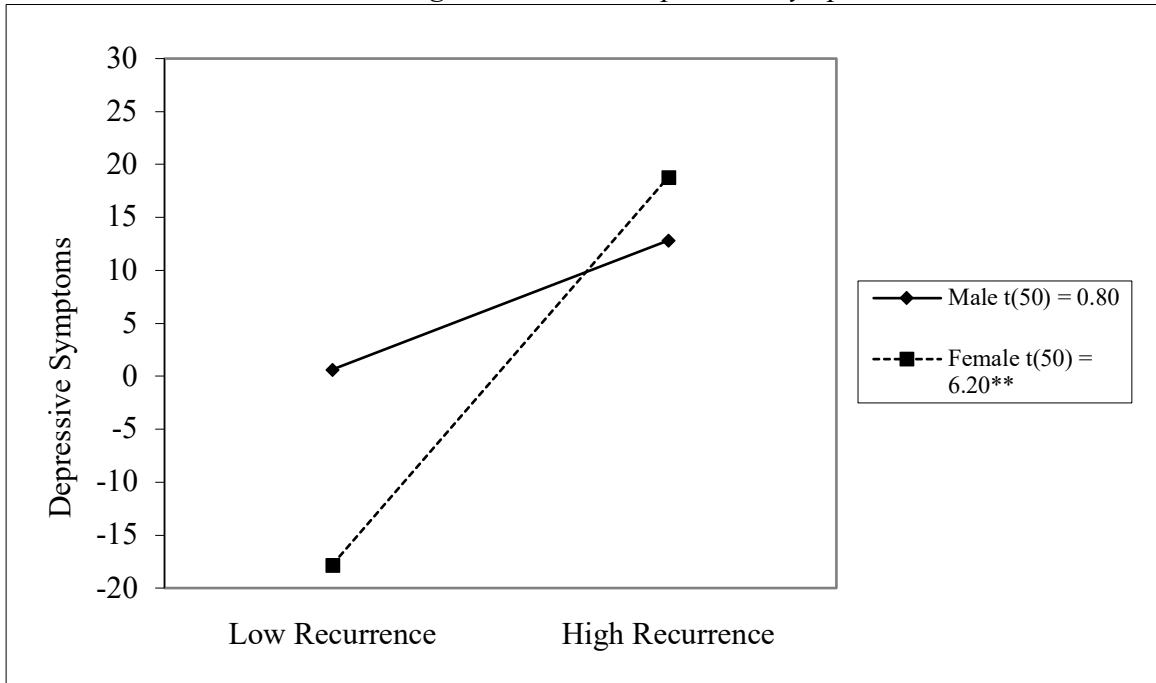
Figure 2
Interaction Between Father-Adolescent Positive Synchrony During the Conflict Discussion and Adolescent Gender Predicting Adolescents' Depressive Symptoms



Notes: $*p < .001$.

Figure 3

Interaction Between Mother-Father Positive Synchrony During the Conflict Discussion and Adolescent Gender Predicting Adolescents' Depressive Symptoms



Notes: * $p < .001$.

Appendix
Specific Affect Coding System (SPAFF) Coding Categories

Emotion	Function	Indicators
<i>Negative Emotion</i>		
Contempt	Belittle, hurt, humiliate	<ul style="list-style-type: none"> • Sarcasm • Insults • Mockery • Hostile humor • Eye rolls • Exaggerated voice tone
Belligerence	Provocation	<ul style="list-style-type: none"> • Taunting questions • Dares/challenges • Unshared humor • Raised inflection • Jaw thrust
Criticism	Point out defective character/personality	<ul style="list-style-type: none"> • Blaming • List of complaints • Negative mind reading • “You always”/”you never” • Betrayal statements
Stonewalling	Refusal to listen or respond	<ul style="list-style-type: none"> • Away behavior • Monitoring gaze • Rigid face and body • Clenched jaw
Defensiveness	Deflect responsibility or blame	<ul style="list-style-type: none"> • Yes-but statements • Minimization • Aggressive assertions • Cross-complaining • Excuses • Folded arms • High-pitched/raised voice
Domineering	Control and impose compliance	<ul style="list-style-type: none"> • Invalidation • Low balling • Glowering • Lecturing/patronizing • Incessant speech • Threats/ultimatums • “Horns” – head/body forward • Deliberately slow speech
Anger	Perceived violation of autonomy, respect, and boundaries	<ul style="list-style-type: none"> • Frustration • Angry questions • Angry “I” statements • Commands • Sharp exhalations • Tight jaw/neck muscles • Sudden voice change
Sadness	Loss, resignation, helplessness, pessimism, or hopelessness	<ul style="list-style-type: none"> • Sighing

		<ul style="list-style-type: none"> • Resignation • Hurt feelings • Pouting/sulking • Crying • Slouching • Low energy • Drooped head/shoulders • Trembling lips/chin
Whining	Victim stance via emotional protest	<ul style="list-style-type: none"> • High-pitched voice • Nasal tone
Disgust	Revulsion	<ul style="list-style-type: none"> • Involuntary reaction • Moral objection • Nausea
Tension	Fear, worry, nervous anticipation, dread	<ul style="list-style-type: none"> • Speech disturbances • Nervous laughter • Fidgeting • Nervous gestures • Shallow breathing • Lip biting
<i>Positive Emotion</i>		
Affection	Facilitate closeness and bonding	<ul style="list-style-type: none"> • Reminiscing • Compliments • Caring statements • Common cause • Slow, quiet speech
Humor	Shared amusement	<ul style="list-style-type: none"> • Good-natured teasing • Imitation/exaggeration • Wit/silliness • Laughter • High energy
Enthusiasm	Passion, interest, eagerness, joy	<ul style="list-style-type: none"> • Anticipation • Positive excitement/surprise • Expansiveness • High intensity • Big smiles • Exclamations
Neutral	Relaxed exchange of information	<ul style="list-style-type: none"> • No indicators of affect • Unclear moments
<i>Validation/ Interest</i>		
Interest	Information and/or elaboration seeking	<ul style="list-style-type: none"> • Positive nonverbal attention • Clarification questions • Open-ended questions
Validation	Openness, understanding, respect, or acceptance	<ul style="list-style-type: none"> • Back channels • Paraphrasing • Sentence finishing • Direct expressions of understanding • Apologizing

Item measuring closeness. Participants were represented as "Self" and the person they interacted with was represented as "Other". Using the image below, participants were asked to choose which number best indicates how close they were with that person

