

Going Through the Motions?

Development of Parent-Adolescent
Relationships and Psychosocial Problems
during Adolescence

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Going through the motions?

Development of Parent-Adolescent Relationships and
Psychosocial Problems during Adolescence

Met de stroming mee?

De Ontwikkeling van Ouder-Kind Relaties en
Psychosociale Problemen tijdens de Adolescentie
(met een samenvatting in het Nederlands)

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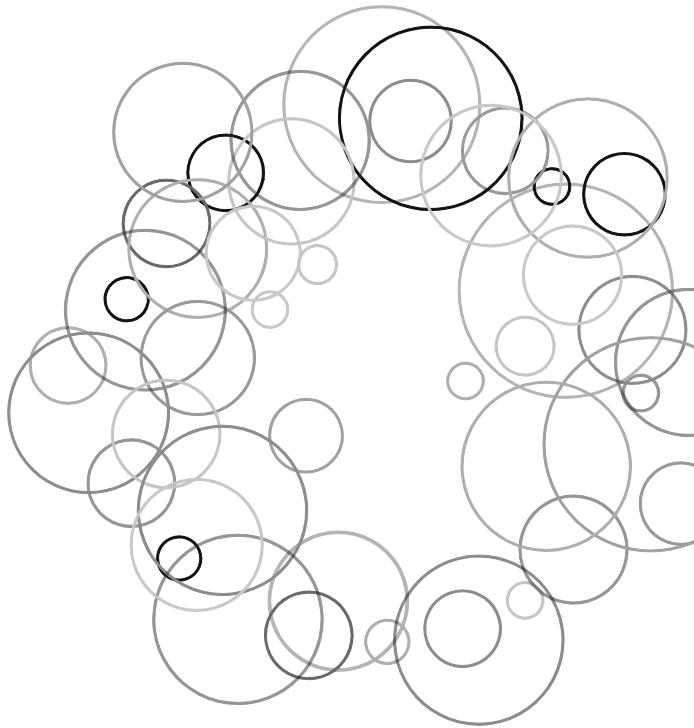
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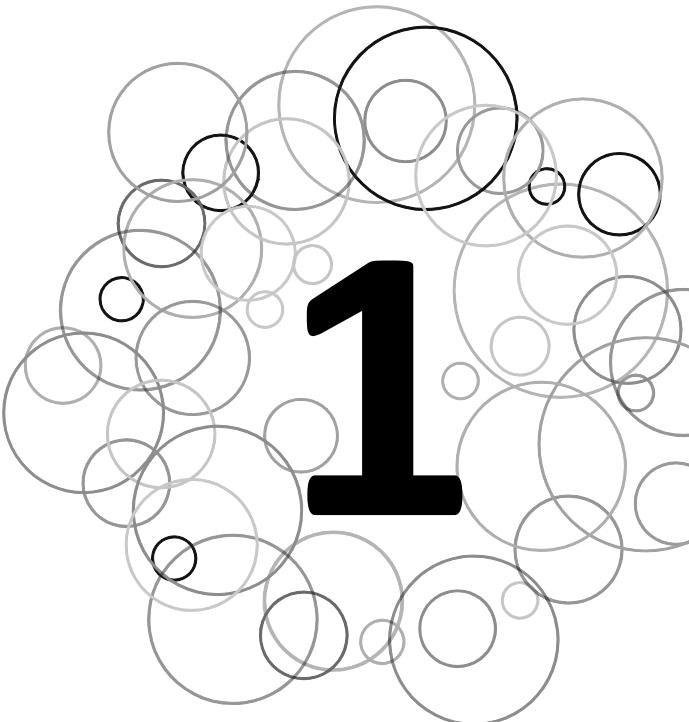


Dedicated to my father, Cor van der Giessen

“Emotional variability is the spice of our life”

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1

General Introduction

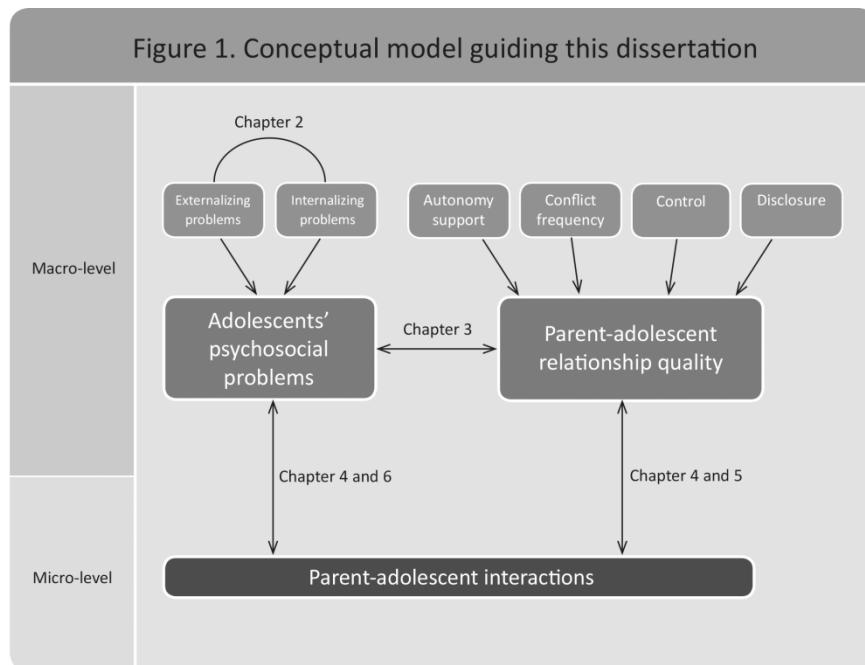
Adolescence is a developmental phase that is marked by profound transformations in parent-adolescent relationships. Across adolescence these relationships change from more hierarchical relationships in early adolescence to more egalitarian relationships by late adolescence (Laursen & Collins, 2009; Smetana, 2011). As adolescents try to assert more autonomy, they begin to re-evaluate the hierarchy of family roles. Discrepant expectancies of parents and adolescents about responsibilities, activities, and autonomy are especially likely to occur, which might generate more episodes of conflict and yield a decline in perceptions of support, warmth, and closeness (Branje, Laursen, & Collins, 2012; Collins & Steinberg, 2006). Although conflicts can be unpleasant, they are considered to be a means of recognizing and resolving discordant expectations regarding autonomy and control. As such, parent-adolescent conflicts are thought to accommodate adolescents' development towards greater autonomy and personal choice, and enable parents and adolescents to establish a more egalitarian relationship (Adams & Laursen, 2007). To conclude, one of the most important challenges during adolescence is to renegotiate and reorganize the parent-adolescent relationship, while maintaining a warm and supportive relationship (Laursen & Collins, 2009).

The quality of parent-adolescent relationships has been argued to be related to key aspects of psychosocial adjustment in adolescence (Bowlby, 1980; Grotevant & Cooper, 1986). Since adolescents are faced with many challenges in relationships with parents, adolescence is especially thought to be a sensitive period for the development of psychosocial problems. Some parent-adolescent dyads may lack adaptive skills and qualities that could be associated with an increased risk for adolescents' psychosocial problems (Laursen & Collins, 2009). In order to prevent adolescents' psychosocial problems, it is important to identify specific risk factors within parent-adolescent relationships that are associated over time with these problems.

The general aim of the current dissertation is to examine longitudinal associations between parent-adolescent relationship quality and adolescents' psychosocial problems over the course of adolescence. To investigate these associations we employ two distinct levels of conceptualization (see Figure 1). First, a macro-level perspective is used to describe rather stable aspects of parent-adolescent relationship quality and adolescents' psychosocial problems across a longer period of time (Van Geert, 2006). Second, a micro-level perspective is used to describe the structure of parent-adolescent interactions (Granic, 2005), or more specifically, the variety or flexibility of emotional patterns displayed by parent-

adolescent dyads during interactions (Hollenstein, 2012). Through bottom-up processes, real-time parent-adolescent interactions are expected to be related to more long-term parent-adolescent relationship quality and adolescents' psychosocial problems (Granic, 2005; Hinde, 1997; Van Geert, 2006).

Altogether, the aim of the current dissertation is three-fold (see Figure 1). The *first aim* is to establish the longitudinal associations between internalizing and externalizing problems during adolescence on a macro-level. The *second aim* is to understand longitudinal associations between parent-adolescent relationship quality and adolescents' psychosocial problem on a macro-level. The *third aim* is to address how the structure of parent-adolescent interactions on a micro-level is related to parent-adolescent relationship quality and adolescents' psychosocial problems on a macro-level.



Psychosocial Problems during Adolescence

Adolescence is an age period in which the occurrence of psychosocial problems changes dramatically; whereas internalizing problems have been found to increase from early adolescence onwards, externalizing problems have been found to

decrease over the course of adolescence (Bongers, Koot, van der Ende, & Verhulst, 2003; Leve, Kim, & Pears, 2005). Although internalizing and externalizing problems are qualitatively different types of problem behaviors, they also have been found to be closely related during adolescence (Wolff & Ollendick, 2006). Several large-scale epidemiological studies among adolescent general populations have consistently shown that co-occurrence is a very common phenomenon, and that it reaches a peak during middle adolescence (Angold, Costello, & Erkanli, 1999). Adolescents showing both internalizing and externalizing problems are at increased risk for later maladjustment (Colman et al., 2009; Fergusson & Woodward, 2002).

Because adolescents' internalizing and externalizing problems appear to be related to each other (Wolff & Ollendick, 2006), it is important to address first the longitudinal associations between these problems. It is examined whether externalizing problems predict subsequent internalizing problems during adolescence (failure model: e.g., Capaldi, 1992; Kosterman et al., 2010), whether internalizing problems predict subsequent externalizing problems during adolescence (acting out model: e.g., Carlson & Cantwell, 1980; Ritakallio et al., 2008), and whether there are bidirectional associations over time between internalizing and externalizing problems during adolescence (e.g., Measelle, Stice, & Hogansen, 2006). Existing studies used childhood or late adolescent samples, employed broadband measures of externalizing and internalizing problems, or did not utilize fully recursive analytic models. Therefore, Chapter 2 specifically addresses on a macro-level bidirectional associations between aggressive behavior and depressive symptoms from early to middle adolescence using fully recursive cross-lagged path models.

Parent-Adolescent Relationship Quality and Adolescents' Psychosocial Problems

Adolescents' psychosocial adjustment takes place in the context of a changing parent-adolescent relationship (Laursen & Collins, 2009). Several theories suggest a link between the quality of parent-adolescent relationships and adolescents' psychosocial problems. For example, attachment theory (Bowlby, 1980) holds that secure, warm, and supportive relationships with parents play an important role in adolescents' adjustment. In a similar vein, the autonomy-relatedness perspective (Grotevant & Cooper, 1986) indicates that for healthy functioning, adolescents' autonomy should be encouraged within a warm and supportive relationship.

Several key features of parent-adolescent relationships have been emphasized to undergo profound transformations during adolescence; autonomy, control, disclosure, and conflict (Collins, Haydon, & Hesemeyer, 2007). A wealth of evidence also shows concurrent and longitudinal associations between these aspects of parent-adolescent relationships and adolescents' psychosocial problems (e.g., Laursen & Collins, 2009; Smetana, 2011). For example, higher levels of perceived parental autonomy support were related to lower levels of adolescents' externalizing and internalizing problems (Manzi, Regalia, Pelucchi, & Fincham, 2012; Soenens, Park, Vansteenkiste, & Mouratidis, 2012). Also, moderate levels of self-reported parental control and higher levels of adolescent disclosure have been related to fewer psychosocial problems during adolescence (Racz & McMahon, 2011). Furthermore, moderate levels of perceived conflict frequency with parents were associated with fewer psychosocial problems of adolescents than either no conflict or frequent conflict (Adams & Laursen, 2007). Empirical support for associations between parent-adolescent relationships and adolescents' psychosocial functioning was not only found with questionnaire data, but also with observational data. It has been consistently found that parent-adolescent interactions characterized by autonomy expressions and affirmations of both parents and adolescents, as well as warmth, some conflict, and moderate parental control were associated with fewer psychosocial problems among adolescents (for an overview see Beveridge & Berg, 2007). Altogether, studies consistently showed that both perceptions and observations of a higher parent-adolescent relationship quality were associated with fewer psychosocial problems of adolescents. In the current dissertation, the constructs autonomy support, conflict frequency, parental control, and adolescent disclosure are used to operationalize parent-adolescent relationship quality.

The Macro-Level: Parent-Adolescent Relationship Quality and Adolescents' Psychosocial Problems

In order to understand the association between parent-adolescent relationship quality and adolescents' psychosocial problems on a macro-level, the current dissertation specifically examines the link between autonomy support and depressive symptoms. It is thought that for healthy psychosocial functioning adolescents need to feel that their opinions, wishes, and needs are supported within parent-adolescent relationships (Grotevant & Cooper, 1986; Ryan & Deci, 2000). A growing body of cross-sectional research consistently showed that adolescents' perceptions of autonomy support from parents were negatively

associated with adolescents' well-being, including depressive symptoms (e.g., Manzi et al., 2012; Soenens et al., 2012; Van Petegem, Beyers, Vansteenkiste, & Soenens, 2012). A predominant focus of these cross-sectional studies has been on the unidirectional relation from perceived parental autonomy support to adolescents' psychosocial problems. Yet, the direction of effects could also go from adolescents' psychosocial problems to perceptions of parental autonomy support. Other aspects of perceived relationship quality, such as attachment quality, have been found to be bidirectionally associated over time with adolescents' psychosocial problems (Branje, Hale, Frijns, & Meeus, 2010; Fanti, Henrich, Brookmeyer, & Kuperminc, 2008). Nevertheless, the question remains whether bidirectional associations exist between perceived parental autonomy support and adolescents' depressive symptoms over the course of adolescence.

Furthermore, it is well-known that friends gradually take up a more central position in the lives of adolescents (Bokhorst, Sumter, & Westenberg, 2009; Smetana, 2011). Possibly, for healthy functioning adolescents also need to feel that their opinions, wishes, and needs are supported within friendships (Ryan & Deci, 2000). Perceptions of friends' autonomy support have been negatively linked to concurrent levels of adolescents' depressive symptoms (Deci, La Guardia, Moller, Scheiner, & Ryan, 2006; Wong & Wiest, 1999). Yet, a cross-sectional study examining differential effects of perceived autonomy support from parents and friends found that during early adolescence only perceptions of parental autonomy support were negatively related to depressive symptoms (Eccles, Early, Fraser, Belansky, & McCarthy, 1997). It is possible that perceived autonomy support from friends becomes more strongly related to adolescents' depressive symptoms from middle adolescence onwards than perceived autonomy support from parents. Taken together, Chapter 3 specifically investigates on a macro-level the bidirectional associations between perceived autonomy support from both parents and friends and adolescents' depressive symptoms from early to late adolescence, thereby investigating a parent-effect, friend-effect and child-effect model.

The Micro-Level: Parent-Adolescent Interactions

In order to understand how the structure of parent-adolescent interactions is related to more long-term indices of parent-adolescent relationship quality and adolescents' psychosocial problems, the current dissertation focuses on the real-time dynamics of emotional patterns during parent-adolescent conflict interactions. Observing emotions during conflict interactions has been found to be

a valid way to examine more complex social interactions (Gottman & Notarius, 2000). Conflict interactions are assumed to capture small changes in emotions and to reflect daily interaction patterns of parent-adolescent dyads (Beveridge & Berg, 2007; Welsh & Shulman, 2008). Micro-analytic coding of such conflict interactions makes it possible to capture real-time patterns of interactional processes between parents and adolescents (Granic, 2005). In the current dissertation, the conflict interactions were coded using a simplified version of the SPecific AFFect (SPAFF) coding system (Gottman, McCoy, Coan, & Collier, 1996; Granic, O'Hara, Pepler, & Lewis, 2007), which identifies emotions expressed during parent-adolescent interactions using four positive affect codes (affection, enthusiasm, humor, interest), five negative affect codes (complaining, sadness, fear, anger, contempt), and a neutral affect code (statements and information exchanges that are non-emotional in content and voice tone).

A dynamic systems approach (Fogel, 1993; Granic, 2005; Thelen & Smith, 1994; Van Geert, 1994) has been employed to examine the emotional structure of parent-adolescent conflict interactions. This approach emphasizes the role of emotional variability of dyads, which reflects the ability of dyads to flexibly switch among a broad range of emotional states from moment-to-moment during conflict interactions (Hollenstein, 2012). Hence, emotional variability of parent-adolescent dyads provides crucial information about the nature of conflict interactions, and it is not noise or error that has to be ignored (Thelen & Smith, 1994).

To reveal and understand emotional variability of parent-adolescent dyads during conflict interactions, the current dissertation employs the “state space grid method” (Hollenstein, 2012), thereby following earlier studies (e.g., Branje, 2008; Granic, Hollenstein, Dishion, & Patterson, 2003; Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011). With this method, the parent’s coded emotions are plotted on the x-axis and the adolescent’s emotions are plotted on the y-axis. As such, each cell on the grid represents a potential emotional state of the parent-adolescent dyad. The dyad’s emotional trajectory is then plotted on a grid in the same order as the emotions proceed in real-time (see Figure 2). Several indices of emotional variability can be derived from a grid, such as the range of dyadic emotional states (dispersion) and the frequency of changes among dyadic emotional states (transitions).

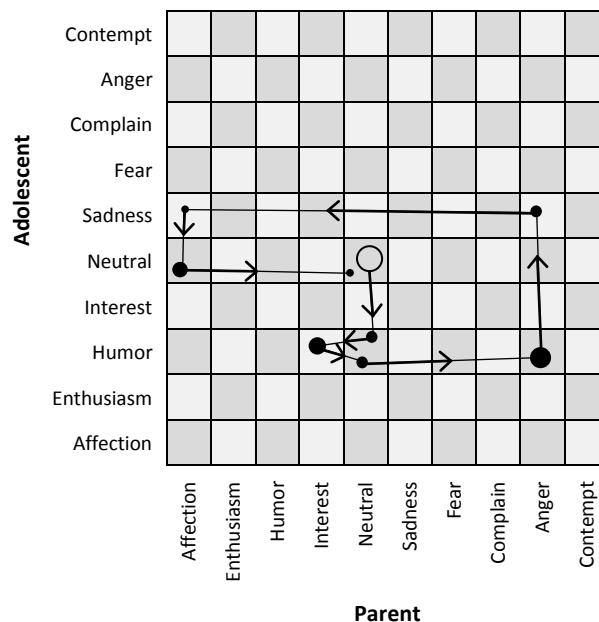


Figure 2. An example of a state space grid depicting a sequence of emotions of a parent-adolescent dyad. Each cell on the grid represents a potential dyadic emotion, and a trajectory is plotted through the successive points on the grid in the same order as the emotions proceed in real time.

During adolescence, temporary higher levels emotional variability of parent-adolescent dyads are considered to be adaptive. From a dynamic systems approach (Fogel, 1993; Granic, 2005; Thelen & Smith, 1994), adolescence can be viewed as a transitional phase for parent-adolescent dyads, during which interaction patterns and relationships are reorganized to represent a more equal balance of power. Conflict interactions, especially in early adolescence, are considered to play an important role in these reorganizations (Laursen & Collins, 2009). More emotional variability during these conflict interactions is considered to be a precondition for adaptation, because it allows parent-adolescent dyads to explore new or alternative interaction patterns if needed and enables parent-adolescent dyads to adaptively realign relationships towards a more equal and horizontal nature (Granic et al., 2003; Lichtwarck-Aschoff, Kunnen, & Van Geert, 2009). Yet, while increased levels of emotional variability of parent-adolescent dyads during conflict interactions are thought to be adaptive, inter-dyadic differences in emotional variability are expected to exist.

Parent-adolescent dyads that show more emotional variability during conflict interactions are expected to adequately handle emotional challenges of conflict interactions, by expressing their thoughts and emotions openly, putting across their point of view clearly, and adjusting discrepant perceptions accordingly. Hence, these dyads are thought to adequately deal with differences in opinions. In contrast, parent-adolescent dyads that show a tendency to get stuck in emotions during conflict interactions, even if these emotions are neutral or positive, might not be able to handle and solve their conflicts (Branje, 2008; Lichtwarck-Aschoff et al., 2009). Higher levels of emotional variability of parent-adolescent dyads during conflict interactions are, therefore, suggested to be related to a better parent-adolescent relationship quality, to a more optimal reorganization of parent-adolescent relationships, and to fewer psychosocial problems of adolescents (Granic, 2005; Lichtwarck-Aschoff et al., 2009). The current dissertation addresses the role of emotional variability in parent-adolescent conflict interactions for parent-adolescent relationship quality and adolescents' psychosocial problems.

Linking the Micro- and Macro-Level: Parent-Adolescent Interactions, Parent-Adolescent Relationship Quality and Adolescents' Psychosocial Problems

In order to understand the merits of emotional variability during parent-adolescent conflict interactions, three chapters in the current dissertation address the longitudinal associations between real-time emotional processes during parent-adolescent conflict interactions (micro-level) and both parent-adolescent relationship quality and adolescents' psychosocial problems (macro-level). First, emotional variability of parent-adolescent dyads is thought to be a key mechanism in the development towards more egalitarian parent-adolescent relationships (Branje, 2008; Granic et al., 2003; Lichtwarck-Aschoff et al., 2009). Up till now, cross-sectional data has shown that adolescent girls who were more emotionally variable perceived moderate levels of conflict with their mother whereas girls who were less emotionally variable perceived either very low or very high levels of conflict (Lichtwarck-Aschoff et al., 2009). Furthermore, it has also been found that higher levels of emotional variability of mother-adolescent dyads were associated with a realignment of levels of perceived dominance, criticism, and open communication in mother-adolescent relationships (Branje, 2008). Nevertheless, empirical evidence about the function of emotional variability in handling relational challenges during adolescence is still limited, and the current dissertation, therefore, extends the current literature by examining how emotional variability of

parent-adolescent dyads (micro-level) is related to parent-adolescent relationship quality (macro-level) over the course of adolescence. More specifically, Chapter 4 addresses associations between the heterogeneity in the development of emotional variability during mother-adolescent conflict interactions and the development of mothers' and adolescents' perceived autonomy support and perceived conflict frequency. Chapter 5 presents the longitudinal associations between emotional variability during mother-adolescent conflict interactions in early adolescence and both maternal control and adolescent disclosure five years later.

Second, the ability to shift in and out of emotions in response to interpersonal demands is also considered to be a hallmark of healthy and adaptive psychosocial functioning (Granic, 2005; Thelen & Smith, 1994). Research has shown that higher levels of emotional variability of parent-child dyads are related with concurrently less internalizing and externalizing behavior and a decrease in externalizing behavior during kindergarten (Hollenstein, Granic, Stoolmiller, & Snyder, 2004), fewer externalizing problems at age five (Lunkenheimer et al., 2011), and more improvement of children's aggressive behavior after treatment (Granic et al., 2007). It is thought that dyads with more emotional variability are able to adequately express, adapt, and regulate their emotions during such interactions (Granic, 2005), which has been found to be related to fewer externalizing and internalizing problems of children and adolescents (Silk, Steinberg, & Morris, 2003). However, longitudinal associations over the course of adolescence between emotional variability of parent-adolescent dyads (micro-level) and psychosocial problems of adolescents (macro-level) still need to be clarified. Therefore, Chapter 4 specifically addresses heterogeneity in the development of emotional variability during mother-adolescent conflict interactions and its associations with the development of adolescents' aggressive behavior. Chapter 6 focuses on the predictive role of emotional variability during mother-adolescent conflict interactions in early adolescence for adolescents' internalizing problems five years later.

Samples: CONAMORE and RADAR

The current dissertation employs data from two longitudinal studies in the Netherlands that focus on the development of adolescents' relationships and behavior problems (see Table 1). In Chapter 3 we use data of the CONflict And

Management Of Relationships project (CONAMORE; Meeus et al., 2004). This project includes 1313 adolescents who were followed during five annual measurement waves in adolescence and during an additional follow-up measurement wave in early adulthood. Participants were recruited from various high schools in Utrecht and surroundings. During the first five annual assessments participants completed a series of questionnaires in their classroom after school hours. The sample consists of an early to middle adolescence cohort ($n = 923$, Mage T1 12.42 years, $SD = .59$ years, 50.7% boys) and a middle to late adolescence cohort ($n = 390$, Mage T1 16.68 years, $SD = .80$, 43.3% boys), thereby covering a total age range from 12 to 16 and from 16 to 20 years. The majority of the participants were Dutch (82.8 %), and the remaining participants (17.2%) identified themselves as part of a non-Western ethnic minority group. Most children (82.9%) lived in intact families. At Wave 1 participants were in junior high and high schools.

In Chapter 2 we use data from the young cohort of the ongoing longitudinal study Research on Adolescent Development and Relationships project (RADAR: Van Lier et al., 2011). The young cohort of the RADAR project consists of 497 adolescents, and their parents, a sibling and their best friend. Participants have been followed during six annual measurement waves and the seventh measurement wave is currently underway. The mean age at the first wave was 13 years ($SD = .05$) and adolescents were in the first grade of junior high school. Most adolescents (85.2 %) lived in intact families.

Moreover, in Chapters 4, 5, and 6 we use data from the observation sample of the RADAR project (Van Lier et al., 2011). The observation sample consists of 92 mother-adolescent dyads that were randomly selected from the young cohort of the RADAR project, and these dyads were followed during five annual measurement waves. At the first wave, the mean age of the mothers was 44.87 years ($SD = 4.83$), and the mean age of the adolescents was 13.01 years ($SD = .52$). The sample consists of 54 boys (58.7%) and 38 girls (41.3%) and most adolescents lived in medium or high SES families (92.4%). In addition to filling out the questionnaires, these mother-adolescent dyads were also videotaped at home during a conflict interaction task.

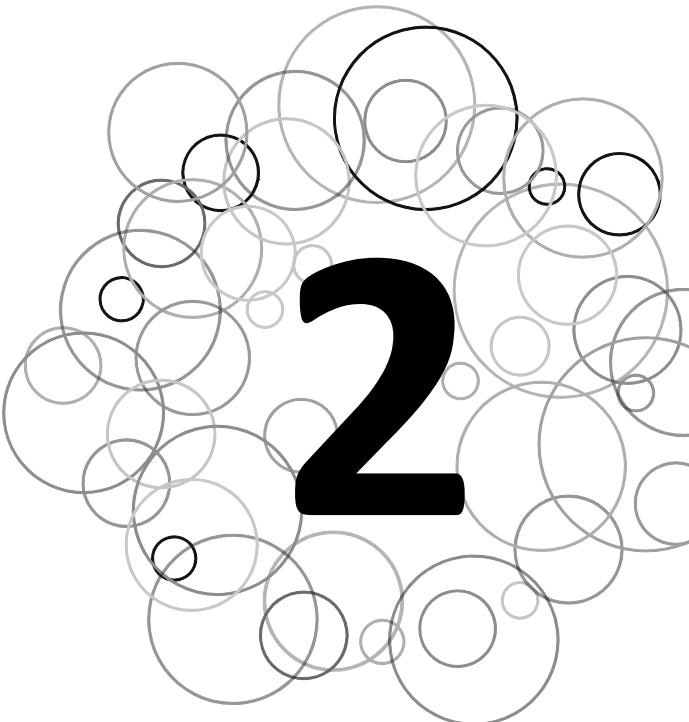
Outline Dissertation

In the following five chapters, five empirical studies are presented on which this dissertation is based (see Table 1 and Figure 1). Chapter 2 presents a multi-

informant study on the bidirectional associations of aggressive behavior and depressive symptoms from early to middle adolescence. Chapter 3 addresses bidirectional associations between perceived autonomy support from parents and friends and adolescents' depressive symptoms from early to late adolescence. Chapter 4 examines heterogeneity in the development of emotional variability during parent-adolescent conflict interactions, and the associations with the development of adolescents' aggressive behavior and parents' and adolescents' perceived autonomy support and conflict frequency. Chapter 5 addresses longitudinal associations between emotional variability during early adolescence and both parental control and adolescent disclosure during late adolescence. Chapter 6 aims to understand whether emotional variability during parent-adolescent conflict interactions in early adolescence predicts parents' and adolescents' internalizing problems five years later. The final Chapter, Chapter 7, provides a summary of the empirical finding as well as a general discussion of these studies. Finally, the reference list, summary (in English and Dutch), acknowledgement, Curriculum Vitae, and publication list are presented as the closing sections of this dissertation.

Table 1. Overview of Level, Sample, and Concepts per Chapter

Chapter	Level	Sample	Concepts
Chapter 2	Macro-level	Main sample RADAR Young ($N = 497$) T1 – T3	Aggressive behavior Depressive symptoms
Chapter 3	Macro-level	CONAMORE ($N = 1313$) T1 – T5	Autonomy support Depressive symptoms
Chapter 4	Micro-level and macro-level	Observation sample RADAR Young ($N = 92$) T1 – T5	Emotional Variability Aggressive behavior Autonomy support Conflict frequency
Chapter 5	Micro-level and macro-level	Observation sample RADAR Young ($N = 92$) T1 and T6	Emotional Variability Adolescent disclosure Maternal control
Chapter 6	Micro-level and macro-level	Observation sample RADAR Young ($N = 92$) T1 and T6	Emotional variability Anxiety symptoms Depressive symptoms Internalizing problems



2

Co-occurrence of Aggressive Behavior and Depressive Symptoms in Early Adolescence: A Multi-Informant Study

Van der Giessen, D., Branje, S., Overbeek, G., Frijns, T., Van Lier, P. A.

C., Koot, H. M., & Meeus, W.

European Review of Applied Psychology

Abstract

Aggressive behavior and depressive symptoms co-occur frequently during adolescence. The failure model argues that the onset of aggressive behavior is more likely to precede the onset of depressive symptoms, whereas the acting out model states that depressed mood predicts subsequent aggressive behavior. However, few longitudinal studies have examined with fully recursive models the temporal ordering of aggressive behavior and depressive symptoms during early adolescence. Therefore, this study examined the bidirectional associations between aggressive behavior and depressive symptoms during early adolescence, using a multi-informant cross-lagged panel model. Gender differences were also investigated. We used data from three waves of questionnaire data that were annually collected among 497 early adolescents (56.9% boys) and their parents, thereby covering an age range from 12 to 15. Adolescents reported on their depressive symptoms and the parents reported on the adolescents' aggressive behavior. Cross-lagged path analyses showed that early adolescents' aggressive behavior predicted subsequent depressive symptoms, but early adolescents' depressive symptoms did not predict aggressive behavior. Findings were similar for boys and girls. Thus, our results provide support for the failure model and suggest that reducing aggressive behavior at the start of adolescence might reduce the risk for subsequent depressive symptoms.

Introduction

Adolescents showing symptoms of depression or aggression are at increased risk for later maladjustment (Colman et al., 2009; Fergusson & Woodward, 2002). Moreover, adolescents with depressive symptoms often report dysfunctions in the regulation of aggressive expressions (Jackson, Kuppens, Sheeber, & Allen, 2011; Kashani, Dahlmeier, Borduin, Soltys, & Reid, 1995). Aggressive behavior and depressive symptoms also co-occur frequently during adolescence, with co-occurrence rates ranging from 8.5% to 83.3% (Angold, Costello, & Erkanli, 1999). Co-occurrence is related to greater impairment in daily functioning, poorer overall adjustment, and more frequent later psychiatric disorders than single symptom occurrence (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003). Moreover, during early adolescence important changes occur in aggressive behavior and depressive symptoms (e.g., Bongers, Koot, van der Ende, & Verhulst, 2003; Leve, Kim, & Pears,

2005). Nevertheless, surprisingly limited attention has been given to the temporal ordering of aggressive behavior and depressive symptoms during early adolescence, while knowledge about this is critical for the development of effective preventive interventions.

Several issues have arisen in the existing longitudinal studies examining the temporal ordering of aggressive behavior and depressive symptoms. These studies used samples with different age ranges (Curran & Bollen, 2001; Van Lier & Koot, 2010), employed different types of reporters (Burt, Obradović, Long, & Masten, 2008; Measelle, Stice, & Hogansen, 2006; Vieno, Kiesner, Pastore, & Santinello, 2008), and used broadband constructs of externalizing and internalizing problems (Masten et al., 2005; Moilanen, Shaw, & Maxwell, 2010). Due to these methodological differences it is difficult to fully delineate the bidirectional association between aggressive and depressive symptomatology and, therefore, an important question remains how aggressive behavior and depressive symptoms are longitudinally associated in early adolescence. Therefore, the current study addresses the limitations of earlier studies by examining the bidirectional associations of aggressive behavior and depressive symptoms over the course of early adolescence, while using a multi-informant cross-lagged panel model.

Longitudinal Associations between Aggressive Behavior and Depressive Symptoms

Several models have been proposed to explain the association between aggressive behavior and depressive symptoms over time. First, the failure model (Capaldi, 1992) holds that aggressive behavior precedes or predicts depressive symptoms. Specifically, aggressive behaviors may result in rejection and a lack of support by important others (i.e., parents), which in turn may lead to pervasive failure experiences in social interactions with these important others. Failure experiences may eventually lead to an increased risk for depressive moods. Second, the acting out model states that depressive symptoms precede or predict aggressive behavior. According to this theory, underlying depressive feelings of children and preadolescents are acted out by displaying aggressive behavior (Carlson & Cantwell, 1980).

Most longitudinal studies suggesting a failure model (Capaldi & Stoolmiller, 1999; Kosterman et al., 2010), an acting out model (Ritakallio et al., 2008), bidirectional associations (Beyers & Loeber, 2003; Measelle et al., 2006), or no cross-lagged associations (Ingoldsby, Kohl, McMahon, & Lengua, 2006; Overbeek et

al., 2006) during adolescence did not use fully recursive cross-lagged path models (Neyer & Asendorpf, 2001). This means, for instance, that studies proposing a failure model, could not rule out the alternative explanation of the acting out model, because they did not include predictive associations from depressive symptoms on aggressive behavior in the same analytical model. Only fully recursive cross-lagged path models can disentangle the direction of effects between aggressive behavior and depressive symptoms, by examining cross-lagged associations from aggressive behavior to depressive symptoms (failure model) and from depressive symptoms to aggressive behavior (acting out model) in one longitudinal path model. These fully recursive models also control for concurrent associations and construct stability, to prevent that predictive associations between aggressive behavior and depressive symptom are spurious and either due to concurrent correlations at any of the waves or to the stability of the constructs across time. The existing longitudinal studies that applied these fully recursive models, often used more broadband measures of externalizing and internalizing problems and results were highly inconsistent.

First, there are several longitudinal studies during the childhood years, using fully recursive models, which provide evidence for a failure model. A recent study that used multi-informant data of teachers and peers showed that children with higher levels of externalizing problems at age 6 were also at risk for developing internalizing problems at age 10, which was partially explained by poor peer relations (Van Lier & Koot, 2010). Furthermore, using a combination of teacher, mother, and observer-reported instruments Moilanen and colleagues (2010) demonstrated with a childhood sample of at-risk boys that externalizing problems were directly associated with internalizing problems during the early school years (age 6-8) and the transition to adolescence (ages 11-12). A recent study with an older sample from ages 8 to 14 found that earlier levels of childhood antisocial behavior were related to later levels of adolescents' depressive symptoms as reported by mothers (Curran & Bollen, 2001). In sum, these aforementioned studies provide longitudinal evidence that aggressive behavior predict depressive symptoms from childhood to early adolescence.

Second, longitudinal studies suggesting an acting out model is less consistent by comparison. One Italian study found with a cross-lagged panel model that self-reported depression at age 12 predicted subsequent perceived antisocial behavior at age 13 (Vieno et al., 2008). There is more evidence based on adolescent reports suggesting that from age 15 to 17 only girls' depressed mood predicted subsequent

delinquency (Wiesner, 2003). Although this last study provided evidence for an acting out model during adolescence, it also provided evidence for a failure model, indicating that depressive symptoms also predicted later levels of aggressive behavior. Therefore, these results underlined the bidirectional associations between depressed mood and aggressive behavior more than just the existence of an acting out model.

Finally, to make the literature even more complex, three other longitudinal studies during adolescence all failed to find cross-lagged associations over time between self-reported delinquency and depressive symptoms (Akse, Hale, Engels, Raaijmakers, & Meeus, 2007; Overbeek, Vollebergh, Meeus, Engels, & Luijpers, 2001), and between self-reported conduct problems and depressive symptoms (Herrenkohl et al., 2010). All three studies used self-reports of adolescents which could lead to spurious relations due to response bias (Vierhaus & Lohaus, 2008). Additionally, two of these studies (Akse et al., 2007; Overbeek et al., 2001) focused on delinquency while most other studies that found lagged associations used a broader category of externalizing problems (e.g., Curran & Bollen, 2001). Nevertheless, two other studies (Burt et al., 2008; Masten et al., 2005) that used the same longitudinal cohort which was followed from age 10 till age 30 and which were assessed with multi-informant measures of internalizing and externalizing problems, also failed to find cross-lagged associations during adolescence. Although externalizing problems were concurrently and positively linked to internalizing problems, no significant longitudinal associations were found from early to late adolescence. Results only suggested that more internalizing problems predicted a relative decline in externalizing problems from late adolescence into emerging adulthood. These findings might suggest that during late adolescence and early adulthood problems in one domain can counteract growth in the other domain.

Additionally, whenever these aforementioned longitudinal studies examined gender differences, the same results were often applicable to both boys and girls. For example, results suggesting a failure model were found for both boys and girls in childhood (Van Lier & Koot, 2010) and during adolescence (Curran & Bollen, 2001). Also, a study that suggested an acting out model did not find differences among early adolescent boys and girls (Vieno et al., 2008), and another study failed to find cross-lagged associations between self-reported delinquency and depressive symptoms for both adolescent boys and girls (Overbeek et al., 2001). In contrast, bidirectional associations between self-reported delinquent behavior and

depressive symptoms were only found for middle adolescent girls (Wiesner, 2003). In sum, most of these empirical studies indicate that the temporal ordering is the same for boys and girls. However, it remains unclear whether the same results will be found when examining gender differences in the bidirectional associations between aggressive behavior and depressive symptoms during early adolescence.

Goals of the Current Study

Altogether, results of the aforementioned longitudinal studies are highly mixed. Some studies suggested a failure model, but most of these studies did not employ fully recursive cross-lagged panel models (e.g., Kosterman et al., 2010), or they used childhood samples (e.g., Van Lier & Koot, 2010). The single study that demonstrated an acting out model from age 12 to 13 used self-reported data of adolescents (Vieno et al., 2008), which could lead to spurious associations due to response bias. Another study, which suggested bidirectional associations from age 13 to 18 between depressed mood and subsequent delinquency, found that the results were only applicable to adolescent girls (Wiesner, 2003). Some studies even did not find significant cross-lagged paths over the course of adolescence (e.g., Akse et al., 2007; Masten et al., 2005). Most importantly, these studies all used different measures of externalizing and internalizing problems, and none of these studies specifically examined the bidirectional link between aggressive behavior and depressive symptoms. So, existing studies examined younger or older samples, used self-reported data, administered measures of more broadband externalizing problems or delinquency, or did not employ fully recursive analytic models.

These limitations underscore the need for additional research on the longitudinal interconnections among aggressive behaviors and depressive symptoms in adolescence using fully recursive models. This is, to the best of our knowledge, the first study examining with a multi-informant cross-lagged panel model the longitudinal associations between aggressive behavior and depressive symptoms during early adolescence. We specifically focus on these associations during early adolescence, because this is an age period in which the occurrence of depressive symptoms and aggressive behavior change dramatically (Bongers et al., 2003). Knowledge about the temporal ordering of these problems during this age period is critical for prevention efforts. We also used multi-informant data to avoid possible confounds of method variance in this study (Vierhaus & Lohaus, 2008); the measure of aggressive behavior was obtained from parental reports whereas the measure of depressive symptoms was based on adolescents self report.

Additionally, this study is among the first to examine gender differences in the temporal ordering of aggressive behavior and depressive symptoms during early adolescence with a multi-informant approach. In line with earlier studies examining bidirectional associations between more broadband externalizing and internalizing problems, we expect that we will not find gender differences in the longitudinal associations between aggressive behavior and depressive symptoms during early adolescence.

Method

Sample

Data were taken from the RADAR (Research on Adolescent Development And Relationships) project, which is an ongoing longitudinal study in the Netherlands that focuses on the development of relationships and behavior problems. For this study, we used the first three annual waves of questionnaire data. The longitudinal sample consists of 497 adolescents (56.9 % boys) and their parents. The mean age at the first wave was 13 years ($SD = .05$) and adolescents were in the first grade of junior high school. Most adolescents (85.2 %) lived in intact families. Adolescents classified as 'at risk' (those having a score at or above the borderline clinical range of the TRF externalizing scale (T-score ≥ 60)) were overrepresented ($n = 206$) in this sample.

In the current study sample attrition was low, namely 6.2 % at T2, 4.6 % at T3, and 10.26 % in from wave 1 to 3. Little's (1988) Missing Completely At Random (MCAR) Test produced a normed χ^2 (χ^2/df) of 1.10. This indicates that it is likely the data were missing at random, and that it is safe to impute missing items (Bollen, 1989). So, respondents with missing values could be included in all model estimations in Mplus using Full Information Maximum Likelihood, resulting in the same sample size for each model (Muthén & Muthén, 2007).

Procedure

To obtain this sample (for more details, see Van Lier et al., 2011), out of all regular primary education schools in the western and central parts of the Netherlands 429 schools were randomly selected and were subsequently approached to participate. We used a two-step inclusion phase (teacher screen followed by parent interviews) to select the 497 families of our study. First, teacher ratings of behavior problems were collected. Because of a specific focus of the RADAR study on delinquency

development, we wanted to oversample adolescents at increased risk for developing externalizing symptoms. High risk was determined by teacher ratings of the externalizing scales of the Teacher's Report Form (Achenbach, 1991; Verhulst, Van der Ende, & Koot, 1997); adolescents who received a T-score ≥ 60 were labeled as 'at risk'. This resulted in including 457 'at risk' adolescents, and 1,087 'control' adolescents who were approached separately in the second selection phase of the study. Second, parents of 1544 adolescents were approached by phone; 463 adolescents were excluded because they did not meet requirements for inclusion in the study (both parents present, and presence of a sibling ≥ 10 years), and 538 actively refused to participate. Non-participation in the RADAR study was not related to the target adolescents' gender ($\chi^2 (1, N = 1544) = 2.75, p = .100, \phi = 0.04$), not related to TRF externalizing behavior scores of 'control' adolescents ($F (1, 1085) = 0.03, p = .880, \eta^2 = 0.00$), and not related to TRF externalizing behavior scores of 'at risk' adolescents ($F (1, 455) = 2.02, p = .160, \eta^2 = 0.01$). Eventually, 497 parents and adolescents provided informed consent of which 206 adolescents were classified as 'at risk' and 291 adolescents were classified as 'control'.

Each year, adolescents, fathers and mothers filled in questionnaires during home visits. In addition to the written instructions trained research assistants provided verbal instructions about the questionnaires. Families received €100 per home-visit. This study was approved by the medical ethics committee of the University Medical Center in Utrecht.

Measures

Depressive symptoms. The Reynolds Adolescent Depression Scale 2nd edition (RADS-2) was used to assess adolescents' depressive symptoms. This is a self-report measure designed as a clinical tool for the identification of depression in adolescents (Reynolds, 2004). Adolescent completed the subscales 'Dysphoric Mood' (8 items; "I feel like crying"), 'Negative Self-Evaluation' (8 items; "I feel I am bad") and 'Somatic Complaints' (7 items; "I am tired"). Items were rated on a four-point scale ranging from 1 (almost never) to 4 (most of the time), and items were averaged to compute a mean score, with higher mean scores indicating higher levels of depressive symptoms. Internal consistency, test-retest reliability, and validity all have been strongly established (Myers & Winters, 2002). The RADS-2 was translated to Dutch using the procedure described by Varni, Seid, and Rode (1999), including forward and backward translation, and pilot testing. In the current

study, Cronbach's alphas of depressive symptoms ranged from .93 to .94 over the three measurement waves.

Aggressive behavior. Aggression was measured using the Aggressive Behavior scale score (20 items) on the Child Behavior CheckList (Achenbach & Edelbrock, 1983). Fathers and mothers rated on a 3-point scale (0 = not true, 1 = somewhat true, 2 = very true or often true) how frequently their adolescents engaged in aggressive behaviors, such as "gets in many fights" and "destroys others' belongings". Items were averaged to compute a mean score for fathers and mothers, with higher mean scores indicating that higher levels of adolescents' aggressive behavior were reported by fathers and mothers. Correlations between mean scores of mothers and fathers all were significant and ranged from .44 to .60 over the three measurement waves. Cronbach's alphas were .90 for mothers, .89 for fathers at all the three measurement waves. For each wave the scale scores of fathers and mothers were collapsed into one parent score by computing their mean. The CBCL was translated and validated for use in the Netherlands (Verhulst, Van der Ende, & Koot, 1996).

Strategy of Analyses

To examine the hypothesized bidirectional relations between adolescents' aggressive behavior and depressive symptoms over time, path analyses with cross-lagged effects were estimated using the software Mplus Version 5 (Muthén & Muthén, 2007). The path model takes into account the stability of aggressive behavior and depressive symptoms over time, and the within-wave correlations between these variables. We used multi-group analyses to explore whether gender differences existed in the associations. In addition, we used Robust Maximum Likelihood Estimation to take into account the non-normal distribution of the aggressive behavior and depressive symptoms data (Enders & Bandalos, 2001).

The first step in the analyses was to examine a fully constrained model that included stability paths and within-wave correlations of aggressive behavior and depressive symptoms (Model 1). Within-wave correlations refer to Wave 1 cross-sectional correlations and to correlated change in Wave 2 and Wave 3. In this fully constrained model we fixed the stability paths between the adjacent waves and the correlated change (Wave 2 and 3) across waves and between boys and girls. In subsequent models we have added hypothesized cross-lagged paths to this model, and we examined whether this improved the goodness-of-fit of the total model. More specifically, Model 2 examined the lagged paths between aggressive behavior

and depressive symptoms, Model 3 examined the lagged associations between depressive symptoms and aggressive behavior, and Model 4 examined the cross-lagged (or bidirectional) associations between the study variables. In addition to the stability paths and within wave correlations the lagged paths from depressive symptoms to aggressive behavior and from aggressive behavior to depressive symptoms were also fixed across waves. With Model 5 it was tested with an unconstrained model whether it was possible to freely vary all paths in the model across waves.

The second step in the analyses was to examine whether the longitudinal associations differed between boys and girls. For the model that fitted the data best, we compared a fully constrained model with an unconstrained model to test whether it was allowed to vary lagged paths from aggressive behavior to depressive symptoms between boys and girls. Because adolescents at increased risk for developing externalizing symptoms were oversampled in the current study, we also tested for the final model whether there were differences between adolescents of the ‘at risk’ group and the control group in the longitudinal associations.

To determine the goodness-of-fit of the models the following global fit measures were used: Chi-Square/degrees of freedom (χ^2/df) ratio, Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). According to Kline (2005), a good fitting model is one in which the χ^2/df ratio is less than 3, the CFI is larger than .95, and the RMSEA is smaller than .08. The model was selected that fitted the data best and that was the most parsimonious model. Model comparisons were conducted using Robust χ^2 difference tests (Satorra & Bentler, 2001). Relatively higher CFI’s and lower RMSEA’s indicated a better model fit.

Results

Descriptives

Repeated measures ANOVA revealed a small but significant decrease in aggressive behavior from wave 1 to wave 3 ($F(2, 443) = 4.26, p = .015, \eta^2 = .02$). The interaction between gender and time was not significant ($F(2, 443) = .19, p = .824$), which means that the change in aggressive behavior did not differ significantly for boys and girls over the three waves. Results also showed that depressive symptoms changed significantly over the waves ($F(2, 458) = 11.71, p < .001, \eta^2 = .05$).

Although effects were small, depressive symptoms decreased from wave 1 to wave 2, but increased from wave 2 to 3. And although the interaction between gender and time was small, girls showed significantly more depressive symptoms over time than boys ($F(2, 458) = 6.67, p = .001, \eta^2 = .03$).

Using the Fisher r-to-z transformation the significance of the difference between Pearson correlation coefficients was calculated. No significant gender differences were found in the Pearson correlations between aggressive behavior and depressive symptoms from Wave 1 to 3. The means, standard deviations, and bivariate correlations for all study variables are presented for the total sample in Table 2.

Table 2. Correlation Coefficients between Early Adolescents' Aggressive Behavior and Depressive Symptoms

	Aggressive Behavior				
	Wave 1	Wave 2	Wave 3	M	SD
Depressive symptoms					
Wave 1	.27**	.25**	.20**	1.63	.49
Wave 2	.22**	.27**	.24**	1.51	.50
Wave 3	.23**	.23**	.28**	1.54	.54
M	.39	.38	.36		
SD	.27	.28	.27		

Note. ** $p < .01$.

Model Comparison

Figure 3 provides the final graphical model of the relations between aggressive behavior and depressive symptoms, and Table 3 shows the model fit indices and the model comparison tests of the different models. We started the analyses with a constrained model, in which all of the estimated parameters were required to be equal across waves and gender. The analyses revealed that the goodness-of-fit improved significantly when lagged paths from aggressive behavior to depressive symptoms were added to the model (See Model 2), but not when lagged paths from depressive symptoms to aggressive behavior were added to the model (See Model 3). When cross-lagged paths were added, this did not result in a significant improvement of the model fit compared to Model 2 (See Model 4).

Table 3. Longitudinal Model Fit Indices and Model Comparison Tests

	Model fit indices					Model comparison tests		
	df	MLr χ^2	χ^2 (df)	CFI	RMSEA	$\Delta\chi SB^2$	Δdf	p
1. Constrained baseline model	11	58.76	5.34	.95	.093			
2. Lagged paths aggressive behavior to depressive symptoms	10	53.23	5.32	.96	.093	2 vs. 1	5.53	1 .019
3. Lagged paths depressive symptoms to aggressive behavior	10	56.10	5.61	.95	.096	3 vs. 1	2.66	1 .164
4. Bidirectional paths depressive symptoms and aggressive behavior	9	50.72	5.64	.96	.097	4 vs. 1 4 vs. 2 4 vs. 3	8.04 2.51 5.38	2 .023 1 .196 1 .021
5. Unconstrained model: vary all model paths across waves	6	44.52	7.42	.96	.114	5 vs. 2	8.71	4 .068

Next, an unconstrained model was examined in which stability paths, concurrent associations, and lagged paths from aggressive behavior to depressive symptoms were allowed to vary across waves (See Model 5). The fit of this unconstrained model was compared to the best fitting constrained model (Model 2). It appeared that freely varying all model paths across waves did not significantly improve the model fit, which indicated that the model was equivalent across waves. The same results were obtained when freely varying stability paths, concurrent associations, lagged paths across waves in separate models. Thus, model comparisons showed that Model 2 was the most parsimonious and offered the best fit in comparison to the other models (χSB^2 (10) = 53.23; CFI = .96; RMSEA = .093).

Subsequently, for the best fitting model (Model 2) we tested with multi-group analyses whether the lagged paths between aggressive behavior and depressive symptoms could be constrained to be equal for boys and girls. Chi-square difference tests showed that varying lagged paths across gender did not significantly improve the model fit, ($\Delta\chi SB^2$ (1, N=497) = .88, p = .347). As expected, this indicates that there were no gender differences in the longitudinal associations between aggressive behavior and depressive symptoms. Additionally, these

associations did not differ for adolescents in the 'at risk' group and the control group ($\Delta\chi^2_{SB2} (1, N=497) = .12, p = .731$).

Model Results

Altogether, the results revealed (see Figure 3) lagged paths from aggressive behavior to depressive symptoms. Hence, more aggressive behavior of adolescents significantly predicted more subsequent depressive symptoms. These lagged paths were significant even after controlling for initial levels of all variables and for their cross-time stability. However, no significant lagged paths from depressive symptoms to aggressive behavior were found. The pattern of findings appeared to be the same over time for adolescent boys and girls and for adolescents in the 'at risk' group and the control group. The results also showed significant within-wave correlations between adolescents' aggressive behavior and their depressive symptoms. Higher levels of aggressive behavior were related to more depressive symptoms of adolescents (i.e. T1 correlation), and a relative increase in aggressive behavior was associated with a relative increase in depressive symptoms of adolescents (i.e. correlated change at T2 and T3). The model also showed considerable stability of behavior problems, especially of aggressive behavior.

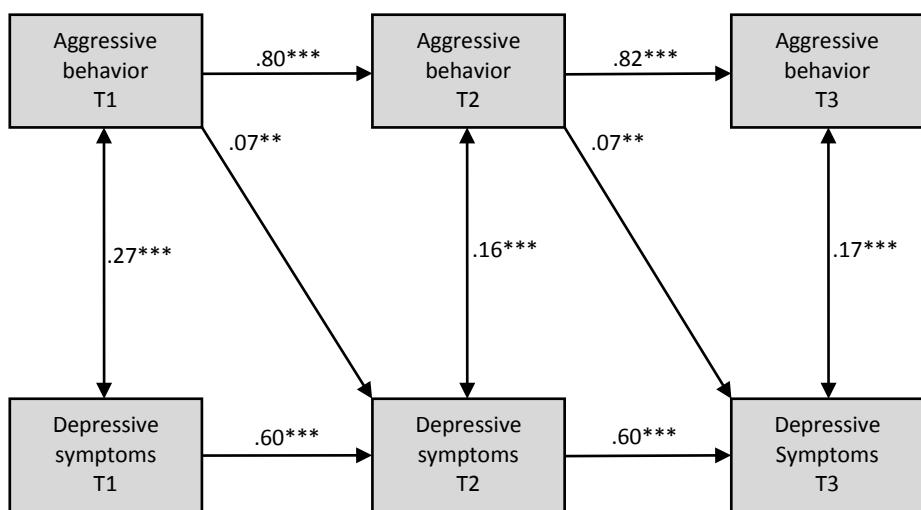


Figure 3. Longitudinal Associations between Early Adolescents' Aggressive Behavior and Depressive Symptoms for the Total Sample

Discussion

The current longitudinal study examined the bidirectional associations of aggressive behavior and depressive symptoms during early adolescence and whether gender moderated these associations. The longitudinal design allowed us to examine the expectations of two contrasting perspectives about the temporal ordering of depressive symptoms and aggressive behavior: The failure model (Capaldi, 1992), which suggests that aggressive behavior precede or predict depressive symptoms, and the acting out model (Carlson & Cantwell, 1980), which states that depressive symptoms precede or predict aggressive behaviors.

Our multi-informant cross-lagged panel analyses revealed that as expected aggressive behavior and depressive symptoms were concurrently and longitudinally linked during early adolescence. Consistent with the failure model, it appeared that early adolescents' aggressive behavior predicted subsequent higher levels of depressive symptoms. However, this study does not provide support for an acting out model, because we did not find significant longitudinal associations from depressive symptoms to aggressive behavior. The observed associations were operating similarly across female and male adolescents in this sample.

Longitudinal Associations between Aggressive Behavior and Depressive Symptoms

Our results, thus, provide support for the failure model (Capaldi, 1992) because during early adolescence higher levels of aggressive behavior predicted subsequent higher levels of depressive symptoms. Our results are in line with earlier longitudinal studies that suggested a failure model in childhood (Van Lier & Koot, 2010), adolescence (Curran & Bollen, 2001), and with broadband constructs of externalizing problems (Moilanen et al., 2010). This study also showed positive concurrent associations, indicating that adolescents who show more aggressive behavior also perceived more depressive symptoms (Wolff & Ollendick, 2006). Furthermore, construct stability (i.e., auto correlations for aggressive behavior and depressive symptoms) was moderate to strong, which underscores the importance of early identification and prevention efforts prior to adolescence. Often (cross-) lagged effects are statistically difficult to find when concurrent associations are moderate and when construct stability is high (Neyer & Asendorpf, 2001). However, even when controlling for these associations in our fully recursive cross-lagged model, we found small but significant lagged effects. Therefore, confidence

can be placed in the present findings that aggressive behavior predicts subsequent depressive symptoms during early adolescence.

The current literature suggests several possible explanations why aggressive behavior predicts subsequent depressive symptoms during adolescence. The link has been explained by developmental cascades between competence and behavior problems (Capaldi, 1992; Masten & Cicchetti, 2010). It is thought that aggressive behavior leads to multiple failures experienced by adolescents, such as academic skill deficits and rejection by the family and by peers, which in turn may lead to depressed mood. Several studies found evidence for developmental cascades from externalizing problems to diminished social competence to internalizing problems from early childhood to late childhood (Van Lier & Koot, 2010) and from childhood to young adulthood (Masten et al., 2005). Additionally, cascade paths were also found from externalizing problems at age 6 to low academic competence at age 8 to internalizing problems at age 10 (Moilanen et al., 2010). Although these studies underline that social and academic failures can potentially explain the association from aggressive behavior to depressive symptoms, our small lagged effects do not suggest such developmental cascading effects. It is much more likely that the link between aggressive behavior and depressive symptoms can be explained by common risk factors (Keiley et al., 2003). For example, a common genetic liability has been found to explain 45% of the observed covariation between antisocial behavior and depressed mood (O'Connor, McGuire, Reiss, Hetherington, & Plomin, 1998). Also, parents of adolescents with both depressive symptoms and conduct problems showed the lowest levels of warmth and the highest level of hostility during interactions (Ge, Best, Conger, & Simons, 1996). Finally, research also suggested that aggressive and depressive children both demonstrate social cognitive distortions (Quiggle, Garber, Panak, & Dodge, 1992; Rudolph & Clark, 2001). Although we were not able to examine these risk factors, results of the current study may be explained by the presence of risk factors common to both aggressive and depressive symptomatology during adolescence. Therefore, we believe that more research is needed that specifically addresses the role of these common risk factors in the longitudinal association between aggressive behavior and depressive symptoms during adolescence.

Furthermore, the pattern of longitudinal associations found in this study was the same for adolescent boys and girls. This is line with several studies who did not find gender differences in the temporal ordering of more broadband externalizing and internalizing problems (e.g., Van Lier & Koot, 2010; Vieno et al., 2008). As

expected, the present study thus suggests that during early adolescence aggressive behavior predicts depressive symptoms in similar ways for boys and girls. For prevention and intervention it is thus important that both boys and girls are targeted. The next step is to explore gender differences with regard to explanatory mechanisms.

Our results did not support the acting out model that proposes that depressive symptoms precede aggressive behavior (Carlson & Cantwell, 1980). This could be due to several reasons. For example, Patterson, Reid, and Dishion (1992) proposed a transactional association over time between depressive and aggressive symptomatology. Aggressive behaviors during childhood and early adolescence are likely to produce academic skill deficits, rejection by the family and peers, and low self-esteem which is associated with depressive symptoms over time. In turn, rejection by the family and peers is an important prelude to deviant peer group membership, which is related to more aggressive behaviors, because deviant peers are thought to support aggressive behaviors. Studies, indeed, have reported transactional associations between depressive symptoms and externalizing problems. More specifically, there is evidence for a robust effect from depressed mood on delinquency trajectories from middle to late adolescence (Beyers & Loeber, 2003). Additionally, conduct problems at age 27 are found to predict depression at age 30 (Herrenkohl et al., 2010). Thus, it could be possible that this study was not able to capture lagged effects from depressive symptoms to subsequent aggressive behavior due to our focus on early adolescence or our focus on aggressive behavior only.

Finally, the few longitudinal studies that found evidence for lagged paths from depressive symptoms to aggressive behavior during adolescence (Vieno et al., 2008; Wiesner, 2003) all used adolescent reports of depressive and aggressive symptoms. This could potentially have biased their results, because of shared method variance (Vierhaus & Lohaus, 2008). The current study used a multi-informant approach and therefore more confidence can be placed in the robustness of the results.

Strengths, Limitations and Future Directions

In sum, our results offer a significant contribution to the co-occurrence literature, because there is a clear paucity of longitudinal studies that examine both the temporal ordering of aggressive behavior and depressive symptoms and gender differences in this association over the course of early adolescence. A key strength

of the present study is that we used a multi-informant cross-lagged panel model to disentangle longitudinal associations between aggressive behavior and depressive symptoms, and our large dataset permitted us to do meaningful analyses of gender differences. Depressive symptoms have been found to be best judged by self-report, because internalizing behaviors may only in part be observable to parents (Vierhaus & Lohaus, 2008). Symptoms of aggressive behavior are for parents much easier to observe and more disruptive to family functioning, and therefore externalizing problems are more likely to attract attention from the parents than internalizing problems. The CBCL has, therefore, often been used to assess aggressive behavior (Achenbach, McConaughy, & Howell, 1987). And although, our multi-informant approach reduces biases due to shared method variance, it can still be considered a limitation that we did not use multiple informants for each construct. It would be interesting to examine whether including data from multiple reporters for both aggressive behavior and depressive symptoms would yield the same conclusions.

Several limitations of this study should also be noted and addressed in future research. Firstly, the current results are limited to early adolescence. Although our results are in line with several earlier studies that suggested a failure model in childhood (Van Lier & Koot, 2010) and adolescence (Curran & Bollen, 2001), our small effects of aggressive behavior to depressive symptoms could be due to the age of our sample. Despite the increase in depressive symptoms during adolescence (Bongers et al., 2003), aggressive behavior usually peaks during childhood (Leve et al., 2005), and it is possible that our study started too late to capture stronger associations between aggressive behavior and depressive symptoms. As mentioned before, our focus on early adolescence and aggressive behavior could also explain why we did not find support for an acting out model. It is possible that depressive symptoms are able to predict subsequent aggressive behavior during early childhood (Carlson & Cantwell, 1980), from middle adolescence onwards (Beyers & Loeber, 2003), or when using more broadband constructs of externalizing problems (Herrenkohl et al., 2010). Altogether, more research is needed that examines the temporal ordering between aggressive behavior and depressive symptoms from early childhood to late adolescence with cross-lagged panel models. Once patterns and timing of co-occurrence between aggressive behavior and depressive symptoms are clearly identified and replicated during these other age periods, the processes by which they occur can be more specifically examined.

Secondly, because some symptoms of depression overlap with symptoms of aggression, namely irritability and agitation, co-occurrence could be an artifact of overlapping symptomatology of aggression and depression questionnaires (Wolff & Ollendick, 2006). However, empirical evidence demonstrated that eliminating these overlapping symptoms from both aggression and depression questionnaires did not result in lower levels of co-occurrence between aggression and depression, showing that the co-occurrence was not due to overlapping symptoms. (Biederman, Faraone, Mick, & Lelon, 1995). It is therefore unlikely that the longitudinal link between depressive symptoms and aggressive behavior can be explained by symptom overlap of the Aggressive Behavior Scale of the CBCL and the Reynolds Adolescent Depression Scale.

Thirdly, although adolescents at increased risk for developing externalizing symptoms were oversampled in the current study, we did not find differences in temporal ordering of aggressive behavior and depressive symptoms between the 'at risk' group and the control group. Extending the current study to clinical populations could increase our understanding of the co-occurrence between aggression and depression (Burke, Loeber, Lahey, & Rathouz, 2005; Harrington, Fudge, Rutter, Pickles, & Hill, 1991; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002). Even though some co-occurrence studies based on community samples used clinical cut-off points to define a particular criterion level above which respondents showed a significant risk for a psychiatric diagnostic disorder (Ge et al., 1996; Overbeek et al., 2006), the present study did not use such cut-off points. This study used the full range of information about behavior problems available in the data. We also investigated subclinical levels of aggressive behavior, because even low levels of aggressive behaviors, such as lying and fighting, are perceived as socially undesirable (Tremblay, 2000). Our results indeed underline the importance of also investigating subclinical levels, because low levels of aggressive behavior were still predictive of subsequent depressive symptoms.

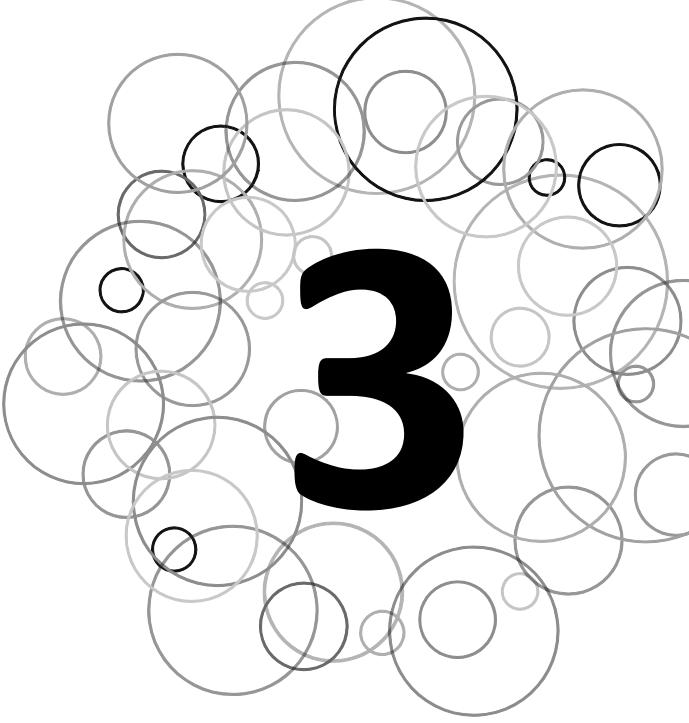
Finally, the current data were gathered from a relatively ethnic homogeneous sample of adolescents, which limits the external validity of the findings. Future research could contribute to the present literature by employing other samples in terms of cultural background.

Conclusion and Implications

The present study showed that early adolescents' aggressive behavior predicted their subsequent depressive symptoms. Consistent with a failure model, male and

female adolescents' interpersonal problems seem associated with later depressive symptoms. The fully recursive and longitudinal nature of this study provides assurance that the temporal effect and model results are tenable.

This study underlines the importance of considering cross-domain effects for prevention and intervention. Reducing aggressive behavior before or at the start of adolescence might reduce the risk for subsequent depressive symptoms. And although early adolescent boys may show higher levels of aggressive behavior than girls, our results underline the importance that aggressive girls should also be targeted for prevention and intervention. Moreover, because of the high stability of both aggressive behaviors and depressive symptoms, prevention and intervention should take place as soon as possible.



3

**Perceived Autonomy Support from
Parents and Best Friends:
Longitudinal Associations with
Adolescents' Depressive Symptoms**

Van der Giessen, D., Branje, S., & Meeus, W.

Social Development

Abstract

According to Self-Determination Theory (SDT), experiencing autonomy support in close relationships is thought to promote adolescents' well-being. Perceptions of autonomy support from parents and from best friends have been associated with lower levels of adolescents' depressive symptoms. This longitudinal study examines the relative contribution of perceived autonomy support from parents and best friends in relation to adolescents' depressive symptoms and changes in these associations from early to late adolescence. Age and gender differences were also investigated. Questionnaires about mother, father, and a best friend were filled out by 923 early adolescents and 390 middle adolescents during five consecutive years, thereby covering an age range from 12 to 20. Multi-group cross-lagged path analysis revealed concurrent and longitudinal negative associations between perceived parental autonomy support and adolescents' depressive symptoms. No concurrent and longitudinal associations were found between perceived best friends' autonomy support and adolescents' depressive symptoms. Results were similar for early and middle adolescent boys and girls. Prevention and treatment programs should focus on the bidirectional interplay during adolescence between perceptions of parental autonomy support and adolescents' depressive symptoms.

Introduction

It is well recognized that the emergence of more autonomous functioning is a crucial developmental process for adolescents (Smetana, 2011; Wray-Lake, Crouter, McHale, 2010). According to Self-Determination Theory (SDT, Ryan & Deci, 2000), experiencing autonomy support from the social environment is thought to promote adolescents' well-being and to prevent the development of adolescents' depressive symptoms. Thus, for healthy affective functioning adolescents need to feel that their opinions, wishes, and needs are supported within close relationships (Grotevant & Cooper, 1986).

The two relational contexts most important for adolescents are relationships with parents and friends (Smetana, 2011). Perceiving autonomy support from parents (Manzi, Regalia, Pelucchi, & Fincham, 2012) as well as from best friends (Deci, La Guardia, Moller, Scheiner, & Ryan, 2006) has been associated concurrently with lower levels of adolescents' depressive symptoms. Although parents are thought to remain important for adolescents, best friends gradually take a more

central position in the lives of adolescents (De Goede, Branje, Delsing, & Meeus, 2009; Way & Greene, 2006). Best friends may become more important providers of autonomy support over the course of adolescence. These changes may affect the relative contribution of perceptions of autonomy from parents and best friends to adolescents' depressive symptoms from early to late adolescence. Therefore, this longitudinal study examined bidirectional associations between parents' and best friends' perceived autonomy support and depressive symptoms and changes in these associations from early to late adolescence.

Perceptions of Autonomy Support in Close Relationships and Depressive Symptoms

According to SDT, the need for autonomy implies that adolescents have a natural desire to experience a sense of personal choice, volition, and psychological freedom (Ryan & Deci, 2000). Autonomy supportive relationships are thought to encourage such self-determined functioning in adolescents, and autonomy support is considered to be critical to adolescents' well-being, including depressive symptoms (Grolnick, Ryan, & Deci, 1991). Adolescents who feel pressured to think, behave, or feel in a particular way, are assumed to show higher levels of depressive symptoms (Soenens & Vansteenkiste, 2010). In line with SDT, the autonomy-relatedness perspective also assumes that for healthy affective functioning of adolescents, relationship partners should support adolescents' autonomy while maintaining a warm and supportive relationship (Allen et al., 2006; Feeney, 2007; Grotevant & Cooper, 1986). Thus, adolescents' need for autonomy support refers to the central issue of feelings of encouragement of the self in the context of interpersonal interaction, and it is therefore argued to be vitally important to investigate adolescents' perceptions of autonomy support in close relationships (Ryan & Deci, 2000).

A growing body of cross-sectional research consistently showed that perceptions of autonomy support from parents were negatively associated with adolescents' depressive symptoms (La Guardia, Ryan, Couchman, & Deci, 2000; Soenens, Park, Vansteenkiste, & Mouratidis, 2012). For example, higher levels of perceived parental promotion of volitional functioning were related to fewer depressive symptoms during middle (Soenens et al., 2012) and late adolescence (Soenens, Vansteenkiste, & Sierens, 2009). Also, early and middle adolescents who reported a low frequency of depressive feelings perceived more autonomy support from parents than adolescents who reported a high frequency of depressive

feelings (Wong & Wiest, 1999). Late adolescents who perceived more satisfaction regarding their need for autonomy from parents reported lower levels of depressive symptoms (La Guardia et al., 2000). Moreover, the negative association between perceptions of autonomy support and depressive symptoms has been found repeatedly across cultures during middle and late adolescence (Chirkov & Ryan, 2001; Manzi et al., 2012; Sheldon, Abad, & Omoile, 2009). One longitudinal study also showed that early adolescents who perceived an autonomy-enhancing family climate reported more adaptive coping over time (Seiffge-Krenke & Pakalniskiene, 2011).

Besides empirical support for a direct link between perceived parental autonomy support and adolescents' depressive symptoms, there are also studies that provided evidence for an indirect association. When adolescents perceived more autonomy support from parents, they reported higher levels of personal choice or volition, and consequently showed lower levels depressive symptoms during middle and late adolescence (Soenens et al., 2007). Additionally, autonomy-supportive parenting during middle and late adolescence was found to predict more adaptive emotion regulation, and this has been associated with fewer depressive symptoms during adolescence (Roth & Assor, 2012; Roth, Assor, Niemiec, Ryan, & Deci, 2009; Silk, Steinberg, & Morris, 2003). Altogether, these aforementioned cross-sectional studies supported the notion that greater perceived autonomy support from parents was associated with fewer depressive symptoms during adolescence. Longitudinal research is needed that examines whether higher levels of perceived parental autonomy support also predict lower levels of adolescents' depressive symptoms over time.

Research on perceptions of autonomy support from best friends and depressive symptoms is more limited. One cross-sectional study (Deci et al., 2006) that examined associations between autonomy support from best friends and well-being (e.g., fewer depressive symptoms) during late adolescence showed that higher levels of perceived autonomy support from best friends were associated with higher levels of well-being. Furthermore, early and middle adolescents who reported a low frequency of depressive feelings perceived more autonomy support from friends than adolescents who reported a high frequency of depressive feelings (Wong & Wiest, 1999). Finally, heterogeneity in the development of perceived autonomy support and closeness in best friendships was associated with the development of adolescents' depressive symptoms (Selfhout, Branje, & Meeus, 2009). More specifically, girls who experienced from early to late adolescence low

levels of both autonomy support and closeness with best friends, showed an increase in depressive symptoms over time. Yet, girls who experienced high levels of both autonomy support and closeness with best friends throughout adolescence showed low levels of depressive symptoms over time. Overall, these three studies indicated that experiencing low levels of autonomy support in (best) friendships was related cross-sectionally to more depressive symptoms and related longitudinally to the development of depressive symptoms. Nevertheless, longitudinal predictive effects from adolescents' perceptions of best friends' autonomy support to subsequent adolescents' depressive symptoms still need to be examined.

Relative Contribution of Perceptions of Autonomy Support from Parents and Best Friends to Depressive Symptoms

Although several studies showed that perceptions of autonomy support from both parents and best friends were negatively associated with adolescents' depressive symptoms (Deci et al., 2006; Soenens et al., 2012), only a few studies examined the relative contribution of parents' and best friends' autonomy support to adolescents' depressive symptoms. A cross-sectional study examining the relative contribution of perceived autonomy support from parents, siblings, friends, and school found that during early adolescence only perceptions of parental autonomy support were negatively related to depressive symptoms (Eccles, Early, Fraser, Belansky, & McCarthy, 1997). In contrast, one observational study on the relative contribution over time of autonomy and relatedness in interactions with parents and best friends showed that difficulties with establishing autonomy and relatedness during interactions with both parents and best friends each explained small, but unique, amounts of variance in future depressive symptoms of early adolescents (Allen et al., 2006). Thus, the two studies that examined parents' and best friends' autonomy support in tandem used different measures of autonomy support (i.e., perceptions and observations), and yielded different results. More research is needed that examines the relative contribution of perceived parents' and best friends' autonomy support to adolescents' depressive symptoms across adolescence.

Both theory (Bowlby, 1980; Laursen & Bukowski, 1997) and empirical evidence (Hodges, Finnegan, & Perry, 1999) suggest that relationships of parents and friends are closely related. There is an overlap between adolescents' perceptions of relationships with parents and friends. For example, when adolescents perceived

their parents as more supportive, they also perceived their friends as more supportive (Stice, Ragan, & Randall, 2004; Young, Berenson, Cohen, & Garcia, 2005). Nevertheless, it has also been found that although parents remained important during adolescence, friends became increasingly important during this age period (Bokhorst, Sumter, & Westenberg, 2009; De Goede et al., 2009). Whereas support and closeness decreased in relationships with parents, closeness, support, and intimacy increased in friendships (Collins & Steinberg, 2006; Smetana, 2011). It could be possible that perceived autonomy support from best friends becomes more strongly related to depressive symptoms over the course of adolescence than perceived autonomy support from parents. Hence, the current study specifically examined whether age moderates the longitudinal associations between perceived autonomy support from parents and best friends and adolescents' depressive symptoms.

Direction of Effects Between Perceptions of Autonomy Support and Depressive Symptoms

Most research so far, examined associations between perceived autonomy support and depressive symptoms in a cross-sectional and unidirectional way. This means that most studies investigated whether perceived autonomy support from parents or best friends predicted concurrent levels of depressive symptoms in adolescents (e.g., Deci et al., 2006; Soenens et al., 2012). These unidirectional effects have been interpreted often as evidence for a parent effect model or a friend effect model. However, the direction of effects could also go from adolescents' depressive symptoms to parents' and best friends' autonomy support, reflecting a child effect model. Adolescents with depressive symptoms tend to view themselves and others negatively, which makes adolescents less likely to recognize, utilize and benefit from support from others, and more likely to perceive rejection from others (Hale, VanderValk, Akse, & Meeus, 2008). Thus, adolescents' depressive symptoms could potentially change their perceptions of autonomy support. Also, according to Coyne's interpersonal theory of depression (Coyne, 1976), these negative beliefs of adolescents with depressive symptoms may also elicit more rejecting responses and less adequate reactions to support from others, and such support erosion may result in lower perceived autonomy support by adolescents. To disentangle the direction of effects over time between perceived autonomy support and depressive symptoms, we employed longitudinal cross-lagged path models (Neyer & Asendorpf, 2001), thereby controlling for concurrent associations and stability of

both perceived autonomy support from parents and best friends and depressive symptoms when estimating bidirectional effects over time between these variables.

Research Aims and Hypotheses

In sum, the major aim of this longitudinal study was to investigate bidirectional associations between perceived autonomy support from parents and best friends and adolescents' depressive symptoms from early to late adolescence. Based on earlier cross-sectional studies (Deci et al., 2006; Soenens et al., 2012), we expected that perceived autonomy support in both close relationships is negatively associated over time with adolescents' depressive symptoms. We also studied differences in the strength of these associations from early to late adolescence. Because best friends have been found to become more important over the course of adolescence (De Goede et al., 2009), it was expected that during early adolescence perceived parental autonomy support would be most strongly related to depressive symptoms, and that during middle adolescence, best friends' autonomy support would become more strongly related to depressive symptoms. Additionally, within SDT (Ryan & Deci, 2000) autonomy support is thought to be equally beneficial for boys and girls throughout life. Therefore, we examined gender differences in the longitudinal associations between perceived autonomy support and depressive symptoms. We expected to find negative associations between perceptions of parents' and best friends' autonomy support and adolescents' depressive symptoms for both boys and girls during adolescence.

Method

Participants

The sample of this study consisted of 1313 adolescents from the early to middle adolescence cohort ($n = 923$) and the middle to late adolescence cohort ($n = 390$) who participated in the longitudinal project on CONflict And Management Of RElationship (CONAMORE, Meeus et al., 2004). Questionnaires were filled out by the adolescents in five waves with a one-year interval. Adolescents reported about their father, mother, and a self-nominated best friend. Adolescents answered the questionnaires about their biological, adoptive, or step-parent; most adolescents reported about their biological mother (98.0%) and biological father (95.5%). Of the 1313 adolescents, 48.5% were boys and 51.5% were girls. The mean age at the first

wave was 12.42 years ($SD = .59$) for the early adolescence cohort, and was 16.68 years ($SD = .80$) for the middle adolescence cohort. Because both age groups were assessed during five measurement waves, a total age range from 12 to 16 and from 16 to 20 years was available. The majority of the participants were Dutch (82.80 %), and the remaining participants (17.20%) identified themselves as part of a non-Western ethnic minority group. Most adolescents (82.90%) lived in intact families at Wave 1. Participants were in junior high and high schools at Wave 1. The early and middle adolescence cohort were comparable regarding living situation ($\chi^2 (1) = 10.43, p = .110$), and ethnicity ($\chi^2 (1) = 7.66, p = .110$). The distribution of gender across age groups appeared to be different, $\chi^2 (1) = 5.96, p = .015, \varphi = .07$. There were more adolescent boys who were 16 years and younger, and there were more adolescent girls who were 16 years and older. Finally, adolescents from non-intact families and intact families were comparable at Wave 1 regarding levels of perceived autonomy support from parents ($F (1, 1310) = .50, p = .481$) and best friends ($F (1, 1310) = .67, p = .413$). Yet, at Wave 1 adolescents from non-intact families reported higher levels of depressive symptoms than adolescents from intact families ($F (1, 1310) = 7.29, p < .001, \eta^2 = .01$).

Sample attrition was 1.20% across Wave 1 to Wave 5. Little's (1988) Missing Completely At Random (MCAR) Test produced a normed χ^2 (χ^2/df) of 1.55. This indicated that it was likely the data were missing at random, and that it was safe to impute missing items (Bollen, 1989). Missing items were therefore estimated in Mplus using Full Information Maximum Likelihood (Satorra & Bentler, 2001).

Procedure

Participants were recruited from various high schools in Utrecht and surroundings. A recruitment letter was given to parents and students explaining the goals of the project. The possibility of not participating was also explained in this letter. Both adolescents and their parents were required to provide informed consent. More than 99% of the approached adolescents decided to participate. During annual assessments, participants completed a series of questionnaires on relationships and psychosocial problems in their classrooms after school hours. All measures were administered in a fixed order during all five measurement waves. Adolescents first completed questionnaires about their relationship (with mothers, fathers, and friends), and after that adolescents filled out questionnaires about their psychosocial problems. The present study focused on autonomy symptoms and depressive symptoms, and the measures are presented below in the order they

were administered. Interviewers who visited the schools provided verbal instructions about the questionnaires. Written instructions were also offered. Confidentiality of responses was guaranteed. Each wave adolescents received € 10 as a reward for their participation.

Measures

Perceived autonomy support. The balanced relatedness scale (Shulman, Laursen, Kalman, & Karpovsky, 1997) was used to measure adolescents' perceived autonomy support in relationships with their mother, father, and best friend. This scale assessed the extent to which adolescents felt that their mother, father, and best friend accepted their opinions, wishes and needs. The questionnaire consisted of seven items that were answered on a four-point scale (i.e., 1 = absolutely disagree to 4 = absolutely agree). Adolescents judged to what extent the seven items characterized their relationship with their mother, father, and best friend respectively. For example, the adolescent had to answer the following statements: 'My mother/father/best friend respects my decisions', and 'My mother/father/best friend considers my opinion'. For each wave the seven items were averaged to compute mean composite scale scores for perceived autonomy support. Previous research supported construct validity, convergent validity, and test-retest reliability of the instrument for parent-adolescent relationships and friendships (e.g., Selfhout et al., 2009; Shulman et al., 1997; Van der Giessen, Branje, Frijns, & Meeus, 2013). In this study, Cronbach's alphas of autonomy support ranged from .84 to .90 for mothers, from .88 to .91 for fathers, and from .90 to .91 for the best friend over the five measurement waves.

Mean scores for reports on mothers ranged from 3.22 to 3.32 across waves and for reports on fathers means ranged from 3.18 to 3.24 over across waves. At each wave, mothers' mean scores were significantly higher than fathers' mean scores ($p < .001$). Also, mean scores on mothers and fathers were strongly correlated over the five waves, ranging from .57 to .67 ($p < .001$). To avoid problems of collinearity, for each wave the scale scores on mothers and fathers were collapsed into one parent score by computing their mean. When adolescents' reports on either fathers or mothers were missing (3.88% at Wave 1, 3.06% at Wave 2, 3.39% at Wave 3, 3.39% at Wave 4, and 4.59% at Wave 5), the mean score reflected the score for just one parent.

Depressive symptoms. Adolescents' depressive symptoms were assessed with the Children's Depression Inventory (Kovacs, 1992). The CDI is a widely used self-report

measure for depression in non-clinical samples of children and adolescents, and it has demonstrated good validity and reliability over time (Craighead, Smucker, Craighead, & Ilardi, 1998; Timbremont & Braet, 2002). Cronbach's alphas in this study ranged from .89 to .93 over the five measurement waves. Twenty-seven multiple-choice items assessed the severity of depressive symptoms during the previous two weeks. Example items included: 'I feel lonely all the time', 'I hate myself', and 'I do not have any friends'. For each item, adolescents were presented with three statements representing varying levels of symptomatology. Adolescents were asked to choose the statement that best described them. Items were rated on a three-point scale indicating symptom severity (i.e., 1 = no presence of symptom, and 3 = highest severity possible). For analytic purposes, items were averaged to compute a mean score, with higher mean scores indicating greater reports of depressive symptomatology (Kline, 2005). Nonetheless, it should be noted that when items were recoded (i.e., 0 = no presence of symptom and 2 = the highest severity possible) and then summed into a total depression score, these total scores were between 0 and 54 and the means were between 4.59 and 5.01 ($SD = 5.83$ to 7.38) over the five measurement waves in the present sample. Finally, it appeared that the mean scores of depressive symptoms were censored at one (i.e., a large proportion of adolescents had a mean of one on the measure) and positively skewed. To make the distribution more normal, this measure was log transformed (Tabachnick & Fidell, 2007).

Table 4. Means, Standard Deviations and Correlation Coefficients between Perceived Parents' and Best Friends' Autonomy Support and Adolescents' Depressive Symptoms

	Autonomy support parents					Autonomy support best friends					Depressive symptoms				
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Autonomy support parents															
Wave 1	-														
Wave 2	.49**	-													
Wave 3	.38**	.53**	-												
Wave 4	.38**	.50**	.56**	-											
Wave 5	.31**	.47**	.48**	.60*	-										
Autonomy support best friends															
Wave 1	.36**	.29**	.25**	.23**	.20**	-									
Wave 2	.27**	.48**	.34**	.32**	.28**	.35**	-								
Wave 3	.19**	.33**	.52**	.33**	.31**	.33**	.42**	-							
Wave 4	.27**	.31**	.37**	.52**	.39**	.28**	.38**	.40**	-						
Wave 5	.19**	.32**	.34**	.40**	.54**	.26**	.35**	.39**	.46**	-					

Table 4. Continued.

	Autonomy support parents					Autonomy support best friends					Depressive symptoms				
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Depressive symptoms															
Wave 1	-.20**	-.19**	-.14**	-.20**	-.17**	-.11**	-.03	.04	-.08**	-.10**	-.	-.	-.	-.	-.
Wave 2	-.20**	-.23**	-.18**	-.23**	-.23**	-.03	-.10**	-.09**	-.09**	-.08**	.50**	-.	-.	-.	-.
Wave 3	-.16**	-.16**	-.21**	-.18**	-.20**	-.03	-.01	-.10**	-.07*	-.08**	.41**	.55**	-.	-.	-.
Wave 4	-.13**	-.15**	-.16**	-.27**	-.27**	-.06*	-.06*	-.01	-.02	-.08**	.36**	.44**	.55**	-.	-.
Wave 5	-.11**	-.16**	-.13**	-.20**	-.20**	-.02	-.02	-.05	-.07*	-.13**	.34**	.46**	.53**	.62**	-.
<i>M</i>	3.21	3.25	3.23	3.24	3.29	3.17	3.18	3.17	3.22	3.26	1.18	1.18	1.19	1.17	
<i>SD</i>	.42	.44	.45	.46	.45	.52	.48	.50	.48	.45	.27	.25	.24	.23	.22

Note. Means and standard deviations reported here are not transformed. * $p < .05$. ** $p < .01$.

Results

Descriptive statistics

The means, standard deviations, and bivariate correlations for all study variables are presented in Table 4. Parental autonomy support was consistently associated with adolescents' depressive symptoms both within and across waves. Adolescents who perceived more autonomy support from parents, reported lower levels of depressive symptoms. Perceived best friends' autonomy support was not consistently associated with adolescents' depressive symptoms both within and across waves (i.e., only 13 out of 20 relations were significant). Using the Fisher r -to- z transformation the significance of the difference between significant Pearson correlation coefficients was calculated. Significant correlations between perceived best friends' autonomy support and adolescents' depressive symptoms also were significantly smaller ($p < .001$) than significant correlations between perceived parental autonomy support and adolescents' depressive symptoms. Furthermore, parental autonomy support was significantly associated with best friends' autonomy support, indicating that adolescents who perceived their parents as more supportive of autonomy, also perceived their best friend as more supportive of autonomy.

Model Comparisons: Longitudinal Associations Between Perceptions of Autonomy Support and Depressive Symptoms

To examine the hypothesized temporal relations between adolescents' perceptions of autonomy support from parents and best friends with depressive symptoms over time, path analyses with cross-lagged effects were conducted using the software Mplus Version 6 (Muthén & Muthén, 2010). We used multi-group analyses to examine whether the path coefficients differed between boys and girls, and between the two cohorts. Model comparisons were conducted using MLR χ^2 difference tests ($\Delta\chi^2$). Model comparison tests and model fit indices of the different models are presented in Table 5.

Table 5. Longitudinal Model Fit Indices and Model Comparison Tests

	Model fit indices						Model comparison test			
	df	MLr χ^2	χ^2 (df)	AIC	CFI	RMSEA	90% CI	RSMEA	$\Delta\chi^2$	Δd
Model 1. Baseline model	244	379.80	1.56	-5553	.97	.046	[.040, .053]			
Model 2. Cross-lagged paths and within-wave correlations autonomy support parents and depressive symptoms	200	219.40	1.10	-5626	1.00	.019	[.005, .028]		2 vs. 1	160.40*** 44
Model 3. Cross-lagged paths and within-wave correlations autonomy support best friends and depressive symptoms	200	339.45	1.70	-5498	.97	.051	[.041, .054]		3 vs. 1	40.35 44
Model 4. Models 2 and 3 combined	156	170.16	1.09	-5596	1.00	.018	[.000, .031]		4 vs. 1	209.64*** 88
Model 5. Fixation of cross-lagged paths and within-wave correlations within age and gender groups	236	270.29	1.15	-5639	.99	.023	[.000, .034]		4 vs. 2	49.24 44
Model 6. Fixation of cross-lagged paths and within-wave correlations across age groups	244	279.05	1.14	-5642	.99	.023	[.000, .034]		4 vs. 3	169.29*** 44
Model 7. Fixation of cross-lagged paths and within-wave correlations across gender	244	283.25	1.16	-5638	.99	.024	[.000, .031]		5 vs. 2	50.89 74
Model 8. Fixation of cross-lagged paths and within-wave correlations across age and gender groups	248	288.14	1.16	-5640	.99	.025	[.000, .031]		6 vs. 5	8.76 14

Note. First, for reasons of presentation we added/constrained within-wave correlations and cross-lagged paths at the same time, but it should be noted that results were the same when adding/constraining both type of paths separately. Second, we constrained unstandardized parameter estimates in our models; mean levels were still allowed to vary across age and gender groups. * $p < .05$. ** $p < .01$. *** $p < .001$.

The first step in the analyses was to examine whether within-wave and cross-lagged associations between parents' autonomy support and depressive symptoms and best friends' autonomy support and depressive symptoms could be added to the model. A four-group model that included stability paths of autonomy support and depressive symptoms, as well as within-wave correlations and cross-lagged effects between autonomy support of parents and best friends represented the baseline model (Model 1). Within-wave correlations refer to Wave 1 cross-sectional correlations and to correlated change in Wave 2 to Wave 5. Next, Model 2 examined the within-wave and cross-lagged associations between parental autonomy support and depressive symptoms, Model 3 examined the within-wave and cross-lagged associations between best friends' autonomy support and depressive symptoms, and Model 4 investigated the combined within-wave and cross-lagged associations of autonomy support of both parents and best friends and depressive symptoms. Results revealed that the goodness-of-fit improved significantly when relations between perceived parental autonomy support and adolescents' depressive symptoms were added to the baseline model, but not when relations between perceived best friends' autonomy support and adolescents' depressive symptoms were added to this model (see Table 5). Therefore, Model 2 was used in further analyses.

The second step in the analyses was to examine whether it was possible to constrain within-wave correlations and cross-lagged paths across waves and across age and gender groups. It should be noted that we only constrained unstandardized parameter estimates in our models; mean levels were still allowed to vary across age and gender groups. First, we tested with Model 5 whether it was possible to fix across waves the within-wave correlations (i.e., correlated change) between autonomy support and depressive symptoms, cross-lagged paths from autonomy support to depressive symptoms, and cross-lagged paths from depressive symptoms to autonomy support. We wanted to know if these paths were of the same strength across waves, while allowing these paths to vary between age and gender groups. Model comparisons showed that within-wave correlations and cross-lagged paths could be constrained across waves (see Table 5). Next, we examined whether it was also possible to fix the different paths (i.e., within-wave correlations and cross-lagged paths) to be equal across the age groups (Model 6), across the gender groups (Model 7), and across both age and gender groups (Model 8) without significantly impairing the model fit. Model comparisons showed that cross-lagged paths and within-wave correlations could also be

constrained across age and gender groups (see Table 5). Therefore, Model 8 was the final model and offered an excellent fit, χ^2 (248) = 288.14; CFI = .99; RMSEA = .025.

The cross-lagged path coefficients from perceived parental autonomy support to adolescents' depressive symptoms (parent effect model) and from adolescents' depressive symptoms to perceived parental autonomy support (child effect model) in the final model appeared to be different in strength, and therefore we additionally tested, using again the MLR χ^2 difference test ($\Delta\chi^2$), whether these cross-lagged paths were also statistically different. It appeared that a model which constrained these cross-lagged paths within and across gender and age groups significantly worsened the model fit (χ^2 (249) = 324.54; CFI = .98; RMSEA = .034), indicating that the child effect and the parent effect significantly differed in strength from each other. Therefore, we can conclude that the child effect was significantly stronger than the parent effect.

Finally, it should be noted that the mean score of perceived autonomy support from parents sometimes represented just the score for one parent. Therefore, we checked whether results were the same for mothers and fathers. As such, we ran all analyses separately for perceived autonomy support from mothers and perceived autonomy support from fathers. It appeared results of these analyses were similar to the abovementioned findings. Therefore, we retained the construct of perceived parents' autonomy support in our analyses.

Table 6. Standardized Estimates of the Final Model

Standardized Paths	Early adolescent girls	Middle adolescent girls		Early adolescent boys		Middle adolescent boys	
		Middle adolescent girls		adolescent boys		adolescent boys	
Stability paths							
Parents	.32***	—	.53***	.26**	—	.52***	—
Best friends	.16**	—	.32***	.25**	—	.33***	.18*
Depressive symptoms	.38***	—	.61***	.42***	—	.68***	.32***
T1 Correlations							
T1 parents ↔ depressive symptoms		-27***		-22***		-22***	-20***
T1 parents ↔ best friends		.39***		.33***		.40***	.40***
Correlated change							
Parents ↔ depressive symptoms	-.07***	—	-.06***	-.08***	—	-.07***	-.07***
Parents ↔ best friends	.26***	—	.39***	.12*	—	.25***	.26***
Cross-lagged effects							
Parents → depressive symptoms		-.04***		-.05***		-.04***	-.04***
Depressive symptoms → parents		-.08***		-.07***		-.09***	-.09***
Parents → best friends		.12*		.04		.24**	.11
Best friends → parents		-.17***		-.02		.19*	.06

Note. Variables named parents and best friends refer to the perceived autonomy support of these relationship partners. In this table ranges of parameter estimates across the five waves are presented. The first author can be contacted for standardized and unstandardized regression coefficients of all paths in the final model. See also Figure 1 for a simplified graphical presentation of the cross-lagged model. * $p < .05$. ** $p < .01$. *** $p < .001$.

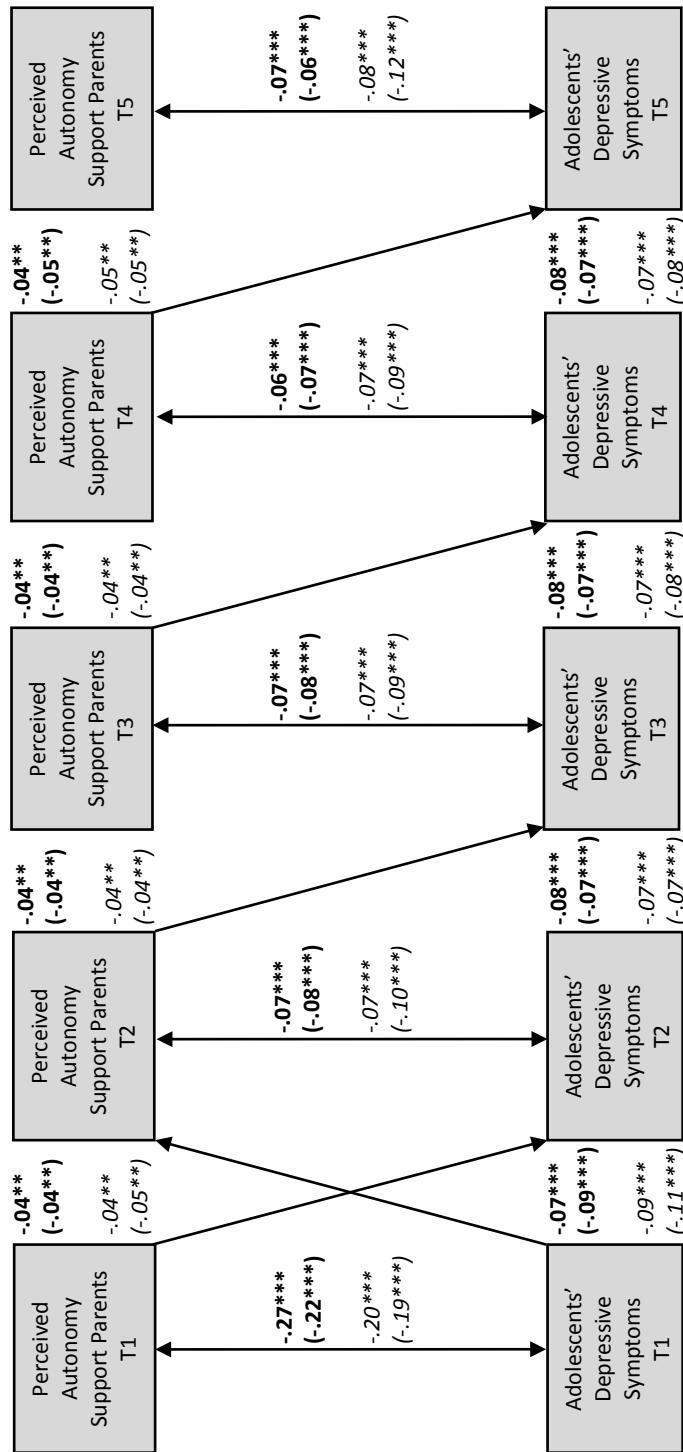


Figure 4. Longitudinal associations between perceived parental autonomy support and adolescents' depressive symptoms.

Note. The standardized estimates are shown separately for each group. Bold = girls; italic = boys. The middle adolescent group is presented between brackets. To simplify the figure, stability paths and associations between perceived parents' autonomy support and perceived best friends' autonomy support were not included here. See Table 6 for ranges of standardized estimates of all paths of this cross-lagged model. The first author can be contacted for standardized and unstandardized regression coefficients of all paths in the final model. * $p < .05$. ** $p < .01$. *** $p < .001$.

Model Results: Longitudinal Associations Between Perceptions of Autonomy Support and Depressive Symptoms

Figure 4 presents the standardized estimates for the final model of the relations between perceived parental autonomy support and adolescents' depressive symptoms. Table 6 displays the standardized parameter estimates of the final model. It should be noted that although standardized estimates are reported for all four groups (i.e., younger boys, younger girls, older boys, and older girls) cross-lagged paths and within-wave correlations did not significantly differ in strength between these groups; the model comparisons, described above, showed that these paths could be constrained within and across age and gender groups. Results showed that within-wave correlations between perceived parental autonomy support and adolescents' depressive symptoms were small to moderate. In line with our expectations, lower levels of parental autonomy support were significantly related to more depressive symptoms of adolescents (i.e., T1 correlation), and a relative increase in autonomy support from parents was significantly associated with a relative decrease in depressive symptoms of adolescents (i.e., correlated changes). Perceived autonomy support from parents and best friends, and adolescents' depressive symptoms were moderately stable over time.

Most importantly, our results revealed a significant bidirectional relationship between perceived parental autonomy support and adolescents' depressive symptoms over time, offering support for both the parent effect model and the child effect model. Even after controlling for the cross-time stability and the within-wave correlations of all variables, the cross-lagged paths from perceived parental autonomy support to adolescents' depressive symptoms and from adolescents' depressive symptoms to perceived parental autonomy support were both significant. Hence, more depressive symptoms of adolescents significantly predicted less autonomy support from parents over time, and more autonomy support from parents significantly predicted fewer depressive symptoms of adolescents. Finally, the child effect appeared to be significantly stronger than the parent effect.

Discussion

The main aims of this longitudinal study were to examine the bidirectional associations between depressive symptoms and perceived autonomy support from parents and best friends over time, and to investigate whether these associations

differed for early and middle adolescent boys and girls. Overall, the results showed that perceived parental autonomy support and adolescents' depressive symptoms were concurrently and longitudinally associated during adolescence. Findings also revealed bidirectional associations over time, although paths from depressive symptoms to parental autonomy support (child effect) tended to be stronger than paths from parental autonomy support to adolescents' depressive symptoms (parent effect). In contrast, no concurrent and longitudinal associations were found between perceived autonomy support from best friends and adolescents' depressive symptoms. These findings were similar for early and late adolescent boys and girls.

Perceptions of Autonomy Support from Parents and Depressive Symptoms

In line with assumptions of SDT (Ryan & Deci, 2000) and with earlier cross-sectional studies (Soenens et al., 2012), this study provided longitudinal evidence for a parent effect model; adolescents who perceived lower levels of support for their wishes, opinions and needs from their parents, reported higher levels of depressive symptoms over time. Within SDT (Ryan & Deci, 2000), it is thought that adolescents have a basic inclination to act in a self-determined fashion, and parents who nurture this self-determination promote well-being. When adolescents feel that parents do not support their thoughts, feelings, and choices, they are at increased risk for later depressive symptoms. Although more longitudinal research should examine the mediating role of self-determined functioning, our results suggested that the extent to which parents were perceived as promoting autonomy was associated with future levels of adolescents' depressive symptoms.

In addition, a child effect was found, which also tended to be stronger than the parent effect. Adolescents who reported more depressive symptoms perceived lower levels of autonomy support from parents over time. This could be explained by the negative beliefs or support erosion that depressive adolescents are thought (Coyne, 1976) and found (Hale et al., 2008) to experience. Depressed adolescents are characterized by negative cognitive beliefs; they tend to view themselves and others negatively. These negative beliefs make them less likely to recognize, utilize and benefit from support from others, and they are more likely to expect and receive rejection from others. Thus, these negative feelings exhibited by adolescents with depressive symptoms are thought to foster subsequent feelings and experiences of not being accepted, valued and supported by their parents. Interventions should therefore, especially, focus on how negative beliefs of

adolescents with depressive symptoms affect their perceptions of parental autonomy support.

As expected, concurrent and longitudinal associations between perceived parental autonomy support and depressive symptoms were found for both boys and girls and from early to late adolescence. Thus, our results provided longitudinal support for the proposition of SDT (Ryan & Deci, 2000) that autonomy support is positively associated with adolescents' well-being across age and gender. It is also in line with earlier studies that showed positive concurrent associations between perceived parental autonomy support and well-being during early, middle, and late adolescence (La Guardia et al., 2000; Soenens et al., 2012; Wong & Wiest, 1999), and a study that found that perceived parental autonomy support is related to adaptive adolescent coping of both adolescent boys and girls (Seiffge-Krenke & Pakalniskiene, 2011). Altogether, the current study emphasized the mutual interplay between perceptions of parental autonomy support and depressive symptoms for both boys and girls throughout adolescence.

Perceptions of Autonomy Support from Best Friends and Depressive Symptoms

In line with an earlier cross-sectional study (Eccles et al., 1997), yet in contrast with assumptions of SDT (Ryan & Deci, 2000) and earlier studies (Allen et al., 2006; Deci et al., 2006), this study showed no concurrent and longitudinal associations between perceived autonomy support from best friends and adolescents' depressive symptoms, taking into account the amount of perceived parental autonomy support. These findings indicate that perceptions of best friends' autonomy support did not become more strongly related to depressive symptoms over the course of adolescence. Also, a lack of associations between perceived best friends' autonomy support and adolescents' depressive symptoms was apparent, despite the fact that positive associations between perceived parental autonomy support and perceived best friends' autonomy support were quite strong. Finally, in line with our cross-lagged path analyses, correlations between perceived best friends' autonomy support and adolescents' depressive symptoms were quite inconsistent and weak. Together, results showed that perceptions of autonomy support and depressive symptoms are related in parent-adolescent relationships rather than in friendships.

The absence of a friend effect, therefore, might suggest that perceptions of autonomy support are especially important in parent-adolescent relationships. Because of the unequal power balance in the parent-adolescent relationship, this

relationship is considered to be most important for adolescents to gain and experience autonomy (Smetana, 2011). In contrast, friendships are usually characterized by reciprocity and mutuality (Collins & Steinberg, 2006). Although we did not examine reciprocity of best friendships, it might explain why promoting autonomy is more self-evident in best friendships than in parent-adolescent relationships. Other aspects of adolescents' best friendships may perhaps be more strongly related to adolescents' healthy functioning. For example, intimacy, closeness, and negative feedback seeking in friendships have been found to be related to adolescents' depressive symptoms (Bokhorst et al., 2009; Borelli & Prinstein, 2006; Burk & Laursen, 2005). It is, thus, possible that experiencing relatedness in best friendships is more closely related to well-being than experiencing autonomy support (Ryan & Deci, 2000). Future studies should therefore compare the associations between these different characteristics in best friendships and adolescents' depressive symptoms.

Additionally, parental autonomy support might be related to depressive symptoms, because it is more consistent than best friends' autonomy support. Perceptions of parents' autonomy support showed greater temporal stability than perceptions of best friends' autonomy support. Moreover, studies showed that during adolescence there was a considerable level of fluidity, change, and instability in (best) friendships (Cantin & Boivin, 2004; Chan & Poulin, 2007). In the current study, adolescents were allowed to report about a different best friend each year, and only 10.80% of the adolescents reported about the same best friend each year. It has been argued that friendships only have a positive impact on adolescents' adjustment when they are high in both quality and stability (Poulin & Chan, 2010). Thus, the relative instability of best friendships during adolescence could potentially explain the absence of the associations between perceived best friends' autonomy and adolescents' depressive symptoms; future studies should address the moderation of stability of best friendships when examining associations between perceived autonomy support from friends and depressive symptoms.

Finally, the absence of associations between perceived best friends' autonomy support and adolescents' depressive symptoms may also be explained by co-rumination with best friends. Co-rumination and autonomy support are similar in that they both involve a focus on mutual encouragement of personal thoughts and feelings (Rose, 2002). Although perceptions of co-rumination in best friendships were found to be related to higher levels of depressive symptoms of adolescents

(Rose, Carlson, & Waller, 2007), perceptions of autonomy support in best friendships were found to be related to lower depressive symptoms of adolescents (Deci et al., 2006). In the current study, perceptions of autonomy support from best friends may have partly reflected perceptions of co-rumination with best friends, resulting in an absence of associations between best friends' autonomy support and depressive symptoms. Future studies therefore should examine in best friendships the unique contributions of perceived autonomy support and co-rumination for adolescent's depressive symptoms.

Limitations and Future Directions

Several limitations of this study should be noted and addressed in future research. Despite the advantages of an accelerated longitudinal design, which enabled examining for the first time the longitudinal effects between perceived autonomy support and depressive symptoms, this study was nevertheless limited in that two groups of participants were assessed annually for five years. Future work would benefit when one group of adolescents is followed from early until late adolescence. Furthermore, the current study relied solely on adolescents' perceptions. We examined perceptions of autonomy support because within SDT (Ryan & Deci, 2000) it is argued that the degree to which adolescents feel encouraged to express opinions, wishes, and needs in close relationships is related to well-being. Also, depressive symptoms are best judged by self-report, because internalizing problems may only in part be observable by parents (Vierhaus & Lohaus, 2008). Moreover, it has been found that the perception of the relationship affects depressive feelings more than the actual state of the relationship (Brendgen, Wanner, Morin, & Vitaro, 2005). The fact that different patterns of effects were found for perceived autonomy support from parents and best friends suggests that the results do not merely reflect a response bias. Still, the current findings will be enhanced when future research assesses autonomy support with a combination of measurement approaches, such as multi-informant questionnaires and behavioral observations.

This study included a community-based sample of adolescents who were not diagnosed with depression. Extending the current study to clinical populations could increase our understanding of how perceived autonomy support relates to depression. For the development of prevention and intervention it is also important to know whether adolescents with depressive symptoms are different

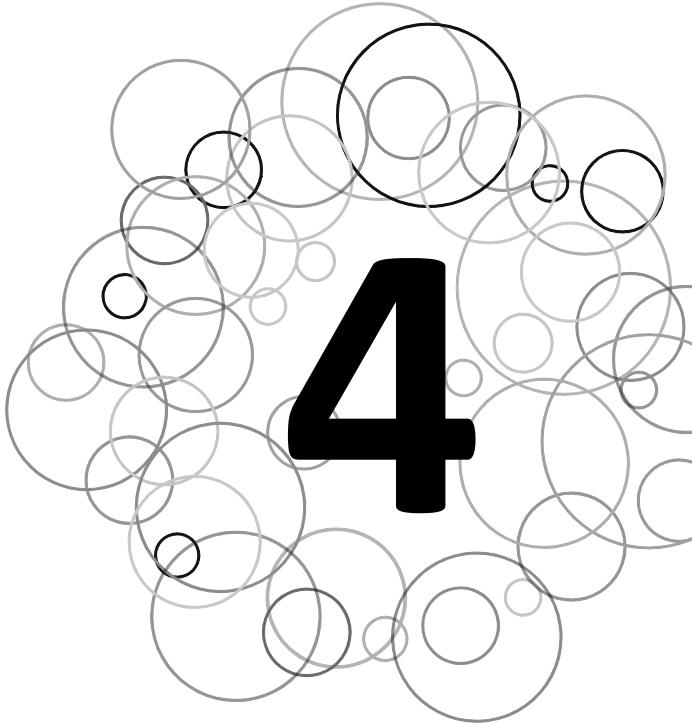
from those who are clinically depressed with regard to perceptions of autonomy support.

Furthermore, perceptions of parental autonomy support are theoretically and empirically related to anxiety symptoms in adolescence (McLeod, Wood, & Weisz, 2007). Since, anxiety symptoms co-occur frequently with depressive symptoms (Angold, Costello, & Erkanli, 1999), it is important that future research addresses the relative contribution of perceived parents' and best friends' autonomy support for both depressive symptoms and anxiety symptoms in the same analytical model.

Finally, the current data were gathered from a relatively homogeneous sample of adolescents, which limits the generalizability of the findings. Although associations between perceptions of parental autonomy support and depressive symptoms have been found for adolescents with diverse cultural backgrounds (Manzi et al., 2012), future research needs to examine the relative contribution of parents' and best friends' autonomy support on adolescents' depressive symptoms across cultures.

Conclusion

Altogether, consistent with assumptions of SDT (Ryan & Deci, 2000), the current study showed concurrent and longitudinal associations between perceived parental autonomy support and adolescents' depressive symptoms during adolescence. In this study a total age range from 12 to 20 years was available, and we were therefore able to extend current knowledge about associations between perceptions of parental autonomy support and adolescents' depressive symptoms over the course of adolescence. The longitudinal nature of our data also enabled us to infer temporal relations among these study variables. Our results revealed that different associations between adolescents' depressive symptoms and autonomy support from parents versus best friends existed; only perceived parental autonomy support was bidirectionally associated with the existence and development of early and middle adolescent boys' and girls' depressive symptoms. Thus, the extent to which parents were perceived as supporting autonomy appeared to be more closely related to adolescents' depressive symptoms than the extent to which best friends were perceived to support autonomy. Prevention and treatment programs should focus on the mutual interplay between adolescents' depressive symptoms and perceptions of parental autonomy support.



4

Dyadic Variability in Mother-Adolescent Interactions: Developmental Trajectories and Associations with Psychosocial Functioning

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Abstract

Dyadic variability is considered to be a key mechanism in the development of mother-adolescent relationships, and low levels of dyadic flexibility are thought to be associated with behavior and relationship problems. The present observational study examined heterogeneity in the development of dyadic variability in mother-adolescent interactions and associations with psychosocial functioning. Dyadic variability refers to the range of emotional states during interactions of mother-adolescent dyads. During five annual home visits, 92 mother-adolescent dyads (M age T1 = 13; 65.2% boys) were videotaped while discussing a conflict, and they completed several questionnaires on adolescents' aggressive behavior and adolescents' and mothers' perceived relationship quality. Two types of dyads were distinguished: low variability dyads (52%) and high decreasing variability dyads (48%). Over time, high decreasing variability dyads were characterized by a broader emotional repertoire than low variability dyads. Moreover, these two dyad types had distinct developmental patterns of psychosocial adjustment. Over time, high decreasing variability dyads showed lower levels of adolescents' aggressive behavior, and higher levels of perceived relationship quality than low variability dyads. These findings suggest that over time more dyadic variability is associated with less adjustment problems and a more constructive development of the mother-adolescent relationship. Adaptive interactions seem to be characterized by a wider range of emotional states and mothers should guide adolescents during interactions to express both positive and negative affect. Observing the dyadic variability during mother-adolescent interactions can help clinicians to distinguish adaptive from maladaptive mother-adolescent dyads.

Introduction

The developmental phase of adolescence is marked by changes in the mother-adolescent relationship. From early to middle adolescence, the number of conflicts among mothers and adolescents increases, and maternal support and power decreases (De Goede, Branje, & Meeus, 2009). These changes are thought to accommodate adolescents' development towards greater autonomy and personal choice, and enable mothers and adolescents to establish a more egalitarian relationship (Laursen & Collins, 2009; Smetana, 2011). Changes in the content of mother-adolescent relationships may be accompanied by changes in structural

aspects of the mother-adolescent relationships. An important structural aspect of relationships is the variability of dyadic interaction patterns, which refers to the range of emotional states of dyads during mother-adolescent interactions (Hollenstein & Lewis, 2006; Lichtwarck-Aschoff, Kunnen, & van Geert, 2009). According to a dynamic systems approach, dyadic variability is considered to be an important factor in relationship changes, because this variability allows dyads to reorganize interaction patterns (Fogel, 1993; Thelen & Smith, 1994). High levels of dyadic variability may enable mother-adolescent dyads to adapt to relationship challenges and opportunities that arise during adolescence (Granic, Hollenstein, Dishion, & Patterson, 2003), and low levels of dyadic variability in mother-child interactions have been associated with both adjustment and relational problems (Granic, O'Hara, Pepler, & Lewis, 2007; Lichtwarck-Aschoff et al., 2009). The major aim of the current observational study is to examine whether heterogeneity in the development of dyadic variability during mother-adolescent interactions is related to the development of adolescents' aggressive behavior, and adolescents' and mothers' perceived relationship quality.

Dyadic Variability During Adolescence

During the developmental period of adolescence, the mother-adolescent system reorganizes. Adolescents begin to re-evaluate the hierarchy of family roles and they try to assert more autonomy. This growing need for adolescent autonomy may give rise to discrepant expectancies of adolescents and mothers, which can result in more episodes of conflict. Mothers supporting adolescents' autonomy during conflict interactions enable the mother-adolescent system to realign beliefs and goals, to reduce conflict, and eventually to establish a more egalitarian relationship (Laursen & Collins, 2009). So, adolescence can be viewed as a transitional phase for the mother-adolescent system.

According to a dynamic systems approach (Thelen & Smith, 1994), development is characterized by major structural shifts during which interaction patterns of mother-adolescent dyads are reorganized into new forms. Higher levels of dyadic variability are thought to typify periods of change and reorganization (Fogel, 1993). As conflicts are assumed to contribute to the development of autonomy and independence (Laursen & Collins, 2009; Pinquart & Silbereisen, 2002), higher levels of dyadic variability during these conflicts may be related to a more optimal reorganization of mother-adolescent interaction patterns (Granic et al., 2003). Mother-adolescent dyads that are able to express both positive and

negative emotions during conflicts may be able to put across their point of view clearly and to adjust their perceptions accordingly, which enables them to develop more egalitarian interaction patterns. However, dyads that have a tendency to express a small range of emotions, even if these emotions are neutral or positive, might be characterized by a lack of sensitivity to interpersonal and contextual demands. Dyads that get stuck in negative emotional states during conflicts may not be able to solve the conflict and maintain a close relationship. Also, dyads that remain continuously in a mutual positive or neutral emotional state during conflict interactions might not be adapting well to the emotional demands of such a context. So, it is thought that the expression of a wide range of both positive and negative emotions during conflict interactions is related positively to relational reorganizations during adolescence (Granic, 2005). Dyadic variability is therefore thought to be a key mechanism in the development towards more egalitarian mother-adolescent relationships (Branje, 2008; Lichtwarck-Aschoff et al., 2009).

From a dynamic systems viewpoint, dyadic variability is thought to characterize transitional periods and it is therefore expected to be higher during adolescence when mother-adolescent relationships need to be reorganized. One study examined changes in the structure of mother-son interactions from preadolescence to middle adolescence, and indeed found an average peak in dyadic variability in mother-son dyads at age 13 to 14 (Granic et al., 2003). As dyadic variability during mother-adolescent interactions may change over the course of adolescence, it seems important to examine associations of development of dyadic variability with adjustment and relational changes during adolescence.

Dyadic Variability, Adjustment, and Relationship Quality

Dyadic variability is found to be related to psychosocial functioning, and it is thought that dyadic emotion regulation potentially can explain this link (Granic et al., 2007; Lichtwarck-Aschoff et al., 2009). Through interactions with parents, adolescents learn to express and to regulate their emotions (Gross, 2007; Izard, 2009). Dyads with low levels of variability have been labeled as “rigid”, and these dyads are thought to have difficulties with emotion regulation during interactions (Granic et al., 2007). In addition to an indirect association between lower levels of emotion regulation and higher levels of externalizing problems (De Rubeis & Granic, 2012; Silk, Steinberg, & Morris, 2003), there is also evidence for a direct association between levels of dyadic variability and aggressive behavior in childhood. Less dyadic variability at age three contributed to more externalizing

problems at age five (Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011), rigid mother-child interactions were associated with externalizing behavior problems in high risk children in kindergarten (Hollenstein, Granic, Stoolmiller, & Snyder, 2004), and more rigid mother-child dyads failed to show an improvement in children's aggressive behavior after treatment (Granic et al., 2007). Altogether, less dyadic variability during childhood is related to higher levels of children's aggressive behavior. There is no evidence yet for this link during adolescence, and therefore the current study will examine the longitudinal associations between dyadic variability and aggressive behavior over the course of adolescence.

Much less is understood about the link between dyadic variability and perceived relationship quality. Cross-sectional data showed that adolescent girls who were more emotionally variable perceived moderate levels of conflict with their mother whereas girls who were less emotionally variable perceived either very low or very high levels of conflict (Lichtwarck-Aschoff et al., 2009). Adolescents who were more rigid in emotional states across conflicts also had conflicts about a greater number of topics. These adolescents were stuck in a small emotional repertoire in different conflict discussions. So, these results suggest that experiencing a wider range of emotions is adaptive because it is associated with moderate levels of conflicts during early adolescence. Conflicts are thought to trigger relational reorganizations; and they generally are seen as healthy and adaptive patterns of interactions during adolescence (Laursen & Collins, 2009). However, it is not known whether and how developmental changes in dyadic variability over the course of adolescence are related to developmental changes in adolescents' and mothers' perceived relationship quality. The current study will therefore examine these associations.

Research Aims and Hypotheses

The major aim of the present observational study is to examine the associations between heterogeneity in the development of dyadic variability during mother-adolescent interactions and the development of adolescents' aggressive behavior, and adolescents' and mothers' perceived relationship quality. To be able to target mother-adolescent dyads at greatest risk for adjustment and relationship problems, it is necessary to examine developmental pathways of dyadic variability. Therefore, we adopt a person-centered approach to first identify distinct dyadic variability trajectories, which can vary in terms of both the level of variability and its rate of growth or decline over time (Nagin, 2005). Next, we will examine the

longitudinal link between dyadic variability trajectories and aggressive behavior, perceived autonomy support and perceived conflict frequency. We expect that adolescents from mother-adolescent dyads with higher levels of variability over time will report lower levels of aggressive behavior over time than adolescents from mother-adolescent dyads with lower levels of variability over time (e.g., Lunkenheimer et al., 2011). Also, we expect that higher levels of dyadic variability over time are related to self-reported changes over time in the mother-adolescent relationship, such as more autonomy support and moderate levels of conflict (e.g., Lichtwarck-Aschoff et al., 2009). To examine these research questions, we employ five consecutive annual waves of data from both observations and questionnaires of mother-adolescent dyads.

Method

Sample

This study uses data from the RADAR (Research on Adolescent Development And Relationships) project, an ongoing longitudinal study in the Netherlands that focuses on the development of relationships and problem behavior in adolescence. To date, six annual waves of data-collection have been completed among 497 adolescents and their parents. The present study used a subsample of 92 mothers and adolescents who were videotaped during five annual home visits. At the first wave, the mean age of the mothers was 44.87 years ($SD=4.83$), and the mean age of the adolescents was 13.01 years ($SD=.52$). The sample consisted of 54 boys (58.7%) and 38 girls (41.3%). At the first wave, adolescents were in the first grade of junior high. Most adolescents lived in medium or high SES families (92.4%).

Attrition in the observation sample was relatively low, namely 15.22% from wave 1 to 5. T-test and chi-square analyses revealed no differences in age, gender, and family SES between participants that participated on all five waves and participants that dropped out of the study. Little's (1988) Missing Completely At Random (MCAR) Test produced a normed χ^2 (χ^2/df) of 1.04 which indicates a good fit between sample scores with and without imputation (Bollen, 1989). Missing values were therefore estimated in Mplus using Full Information Maximum Likelihood (Enders & Bandalos, 2001). We used Robust Maximum Likelihood Estimation to take into account the non-normal distribution of some of the data (Satorra & Bentler, 2001).

Procedure

The participants were recruited from several randomly selected Dutch schools in the province of Utrecht, and the cities of Amsterdam, Rotterdam, The Hague, and Almere. Teacher screening and parent interviews were used to select the 497 families in the RADAR sample. The participants received written information describing the research project. At the first wave 102 mother-adolescent dyads were randomly selected from the total RADAR-sample to also participate in the annual videotaped interactions tasks. Ninety-two dyads were willing to participate and provided written informed consent. The present study used this subsample of mother-adolescent dyads.

Each year, mothers and adolescents were videotaped at home during conflict interaction tasks. Mothers and adolescents also filled out several questionnaires during the home visits. In addition to the written instructions, trained research assistants provided verbal instructions about the questionnaires. Families received €100 per home-visit. This study was approved by the medical ethics committee of the University Medical Center in Utrecht.

Conflict Interaction Task

Mothers and adolescents were asked to choose an issue that they discussed most often during the last month. We provided the Interpersonal Conflict Questionnaire (Laursen, 1995), which lists topics of frequent family conflicts (e.g., chores, school problems, curfews), as an aid to selecting topics. Mothers and adolescents spent 10 minutes attempting to resolve the conflict issues, and their discussion was videotaped ($M = 7.88$ minutes; $SD = 1.9$).

Each conflict interaction task was coded using a simplified version of the SPecific AFFect coding system (SPAFF: Gottman, McCoy, Coan, & Collier, 1996). This modified SPAFF version has been applied successfully to parent-child interactions (e.g., Hollenstein et al., 2004). SPAFF identifies the affects expressed during parent-child interactions through a combination of verbal content, voice tone, facial expression, and physical cues. Coders categorized the affects displayed using four positive codes (affection, enthusiasm, humor, interest), five negative codes (complaining, sadness, fear, anger, contempt), and a neutral code (refers to statements and information exchange that are non-emotional in content and voice tone). The 10 mutually exclusive affect codes were recorded continuously in real time for mothers and adolescents independently. Observational codes were recorded using The Observer XT 9.0 (Noldus Information Technology, 2009).

Coders were trained intensively over a 3-month period to achieve a minimum inter-observer criterion of 75% agreement and .65 kappa. To maintain these criterions, weekly discussion meetings were conducted. Twenty percent of the videotaped interactions were independently coded by two coders to provide estimates of reliability. Coders were unaware which sessions were used to assess observer agreement. The average inter-observer agreement over five waves was .71 kappa.

Measures

Dyadic variability measures. The data of the conflict interactions of each dyad at each wave were plotted on state space grids in GridWare 1.15a (Lamey, Hollenstein, Lewis, & Granic, 2004). This program plots the real-time emotions (SPAFF codes) during the conflict interactions of mother-adolescent dyads on state space grids. A grid represents all possible emotional combinations of a mother-adolescent dyad. The mother's coded emotions are plotted on the x-axis and the adolescent's emotions are plotted on the y-axis. Each cell on the grid represents a potential emotional state of the dyad. A trajectory is plotted through the successive dyadic points on the grid in the same order as the emotions proceed in real time. Thus, a grid represents a sequence of dyadic emotional states. The state space grids for the present study consisted of 100 cells, because to each dyad member 10 possible emotions or SPAFF codes were available during the conflict discussions.

Three state space grid measures of dyadic variability were derived from GridWare 1.15a (Lamey et al., 2004) for each dyad at each wave. First, the *total number of unique cells* (TUC) refers to the total number of unique emotional states the dyad occupied during the interaction (Granic et al., 2003). A high TUC score indicates that the dyad behaved more flexibly during the interaction, because they occupied more cells on the grid. When dyads have a low TUC value they remain in the same emotional states for long periods of time, and therefore show less flexible interaction patterns.

Second, *dispersion* assesses the spread of emotional states of the dyad across cells. More specifically, it refers to the sum of the squared proportional duration across all cells adjusted for the total number of cells in the grid. Dispersion values were inverted to create a dispersion range from 0 to 1 (Granic et al., 2007). Dyads with dispersion values close to 0 show behavior in few cells, and dyads with dispersion values close to 1 show emotions in many cells. This means that dyads with high dispersion levels show more variability in their emotions. The formula that was used by GridWare to calculate dispersion is: $1 - [(n \sum (di/D)^2) - 1] / [n - 1]$.

D refers to the total duration of the interaction, d_i is the duration in cell i on the grid, and n indicates the total number of possible cells on the grid. The TUC and Dispersion measures have been shown to exhibit good reliability and moderate predictive validity (Granic et al., 2007; Hollenstein et al., 2004). The present study also showed moderate stability of these measures over time. For TUC, correlations ranged from .41 to .56 ($p < .01$), and for Dispersion correlations ranged from .34 to .46 ($p < .01$).

Third, *duration entropy* measures the organization and predictability of interaction patterns, and it specifically refers to the level of dyadic transitions between different emotional states. Duration entropy was calculated in GridWare with the formula: $\Sigma(P_i * \ln(1/P_i))$. P_i refers to the probability of a single time-unit occurring in a state, which is calculated by dividing the duration of an emotional state by the total duration of the interaction. High entropy reflects high levels of dyadic variability; there is a high level of dyadic transitions between different emotions on the grid. These dyads thus visit cells on the grid for shorter periods of time resulting in less organized and less predictable dyadic emotions. When dyads display low duration entropy this indicates more dyadic rigidity; cells on the grid are visited for longer periods of time which makes dyadic emotions more organized and predictable. The moderate to high correlations ($r = .32$ to $r = .60$, $p < .01$) between waves in the present study indicated stability of the duration entropy measure.

Questionnaire measures. The physical aggression subscale of Morales and Crick's (1998) revised self-report measure of aggression and victimization (see Linder, Crick, & Collins, 2002) also assessed adolescents' *aggressive behavior*. Adolescents rated six items on a 7-point Likert scale, ranging from "not at all" to "very true". Example items are: "I try to get my own way by physically intimidating others" and "When someone has angered or provoked me in some way, I have reacted by hitting that person". Higher scores indicate higher levels of aggressive behavior. The Cronbach's alphas at the different measurement waves were good; they ranged from .88 to .89.

The balanced relatedness scale (Shulman, Laursen, Kalman, & Karpovsky, 1997) was used to measure the *perceived autonomy support* of mothers and adolescents. This scale assessed the extent to which mothers felt that they accepted the opinions, wishes, and needs of the adolescent, and the extent to which adolescents felt that their mother accepted their opinions, wishes, and needs. The questionnaire consisted of seven items that were answered on a four-point scale

(i.e., 1 = absolutely disagree to 4 = absolutely agree). Mothers and adolescents independently judged to what extent the seven items characterized their relationships. For example, mothers had to answer the following statements: “I respect my child’s decisions” and “I consider my child’s opinions”. Adolescents had to answer statements such as: “My mother respects my decisions”, and “My mother considers my opinion”. For each wave the seven items were averaged to compute separate mean composite scores for mothers and adolescents. Previous research supported the validity and reliability of the instrument (Shulman et al., 1997). In this study, Cronbach’s alphas of perceived autonomy support over the five measurement waves ranged from .82 to .89 for mothers and from .83 to .91 for adolescents.

Perceived conflict frequency between mothers and adolescents was measured using the Interpersonal Conflict Questionnaire (Laursen, 1995). Both mothers and adolescents independently rated whether they had an argument or fight with each other over the past seven days. They rated 10 issues on a 5-point Likert scale, ranging from never to often. Examples of items are “responsibilities”, “personal freedom”, “relationships”, “homework”, and “annoying behavior”. We averaged the 10 items to compute separate conflict frequency mean scores for adolescents and mothers. Cronbach’s alphas over the five measurement waves ranged from .86 to .92 for mothers, and from .85 to .88 for adolescents.

Strategy of Analyses

To examine whether there are distinct developmental trajectories of dyadic variability from age 13 to 17, we conducted Multivariate Latent Class Growth Analyses (MLCGAs). To be able to conduct these MLCGAs, we first determined whether changes over time in the dyadic variability measures were linear or quadratic by performing Univariate Latent Growth Models (LGMs) for the three measures of variability separately. We conducted MLCGAs in Mplus 6.1 (Muthén & Muthén, 2010). MLCGA summarizes longitudinal data by modeling individual-level variability in developmental trajectories through a small number of classes that are defined by unique sizes and shapes (Nagin, 2005). This means that we modeled the development of dyadic variability from age 13 to 17, and examined whether certain types of mother-adolescent dyads tend to have distinctive developmental trajectories of dyadic variability over the five waves. We performed MLCGAs on the three variability measures TUC, duration entropy, and dispersion simultaneously, because these three indicators represent dyadic variability, or the range of dyadic

emotional states, in a slightly different way. Correlations between TUC and dispersion ranged from .65 to .74 ($p < .01$) across waves, correlations between TUC and duration entropy ranged from .78 to .82 ($p < .01$) across waves, and correlations between dispersion and duration entropy ranged from .95 to .97 ($p < .01$) across waves.

Several criteria were used to determine the number of classes or trajectories in the MLCGAs. First, when comparing models the Sample Size Adjusted Bayesian Information Criterion (SSA-BIC) should be lowest for the most optimal model. Second, we used the Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT; Lo, Mendell, & Rubin, 2001) to determine whether a model with k classes is significantly better than a model with $k-1$ classes. Third, we utilized entropy as an index of classification accuracy. (Please note that entropy in the MLCGA is different from the variability measure duration entropy). Entropy values range from .0 to 1.0, with values of .75 and higher indicating accurate classifications. Finally, the theoretical meaningfulness and interpretability should be satisfactory. If an additional trajectory was found to be a slight variation of a trajectory already found in a lower class solution, we chose the most parsimonious model. Also, every group had to cover at least 5% of the sample for meaningful interpretation and further analysis (Muthén & Muthén, 2000; Nagin, 2005). Furthermore, to validate that more dyadic variability referred to a broader emotional repertoire of both positive and negative affect and was not restricted to a specific affect, we performed LGMs for positive and negative affect separately.

To examine whether the dyadic variability trajectories showed distinct initial levels and change rates of aggressive behavior, perceived autonomy support, and perceived conflict frequency between ages 13 and 17, we performed multigroup LGMs controlling for gender. The dyadic variability trajectory membership was thereby entered as a grouping (or moderating) variable in these analyses. We ran the models for adolescents' aggressive behavior, adolescents' and mothers' perceived autonomy support, and adolescents' and mothers' perceived conflict frequency separately. Firstly, we determined with LGMs what shape of growth applied best to each model. We examined this for the dyadic variability trajectories separately. Secondly, we compared unconstrained with constrained models to test whether intercept and slope values could be constrained to be equal for the different dyadic variability trajectories.

To determine the goodness-of-fit of the LGMs, we used the following global fit measures: Chi-Square/ degrees of freedom (χ^2/df) ratio, Comparative Fit Index

(CFI), and the Root Mean Square Error of Approximation (RMSEA). According to Kline (2005), a good fitting model is one in which the χ^2/df ratio is less than 3, the CFI is larger than .90, and the RSMEA is smaller than .10. We conducted model comparisons using Robust χ^2 difference tests (Satorra & Bentler, 2001). When examining the growth shape of a model we selected the model that significantly improved the model fit, and when examining parameter constraints, we selected the model that did not significantly impair the model fit. Additionally, relatively higher CFI's and lower RMSEA's indicated a better model fit.

Results

Development of Dyadic Variability During Adolescence

It appeared from the LGMs that linear models fitted best for all three variability measures TUC ($\Delta\chi^2_{SB2}$ (1, N = 92) = 1.74, $p = .187$), duration entropy ($\Delta\chi^2_{SB2}$ (1, N = 92) = 2.37, $p = .124$), and dispersion ($\Delta\chi^2_{SB2}$ (1, N = 92) = 0.40, $p = .556$). Consequently, we specified linear slopes in the MLCGAs. MLCGAs with one through four classes were estimated. The multivariate two-class model seemed to fit the data best, because for this model the SSA-BIC was lowest (1535.57), the LMR-LRT was significant (285.72, $p < .01$), and entropy was acceptable (.89). Also, adding a third and a fourth class to the model did not provide unique information (i.e., trajectories were found to be a variation of one of the trajectories in the 2-class solution), and it resulted in trajectories of less than 5% of the sample. Due to the relatively small sample size it was not possible to use multigroup MLCGAs to examine gender differences. However, the distribution of gender of the two dyadic variability classes showed a comparable distribution to that of the total sample.

Table 7 provides estimates of mean intercepts and mean linear slopes. The two variability classes were meaningfully different on these growth parameters. The first class (Low variability dyads, $n = 48$) was composed of dyads who displayed lower levels of dyadic variability on all three measures and they remained stable in dyadic variability from age 13 to 17. The second class (High decreasing variability dyads, $n = 44$) showed higher levels of dyadic variability over time than the first class, and a downward trend in the three dyadic variability measures from age 13 to 17. Figure 5 provides a graphical presentation of the mean trends for the two dyadic variability trajectories per variability measure.

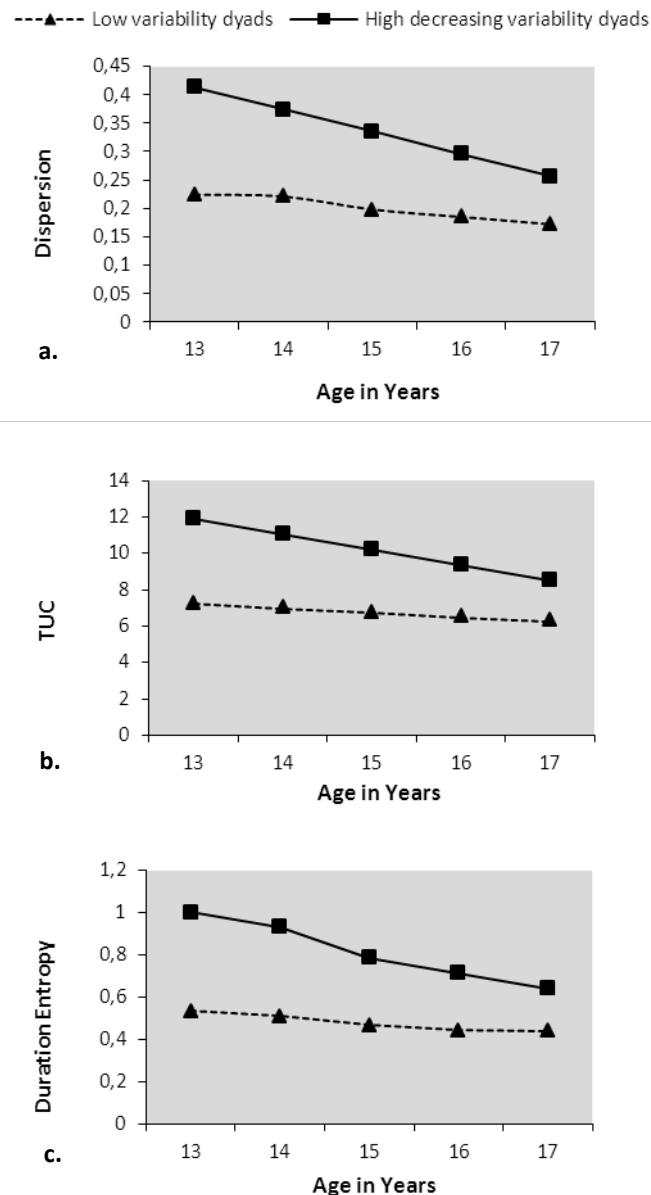


Figure 5. A graphical presentation of the mean trends of the two dyadic variability classes for dispersion (a), total number of unique cells (TUC) (b), and duration entropy (c).

Table 7. Intercepts and Linear Slopes for the Two Class Solution

	Low Variability Dyads		High Decreasing Variability Dyads	
	B	95% CI	B	95% CI
Intercepts				
TUC	7.25***	[6.23, 8.23]	11.89***	[10.96, 12.83]
Dispersion	.25***	[0.19, 0.26]	.41***	[0.37, 0.45]
Duration entropy	.53***	[0.46, 0.61]	1.00***	[0.92, 1.09]
Linear slopes				
TUC	-0.25	[-0.51, 0.02]	-0.85***	[-1.24, -0.45]
Dispersion	-.01*	[-0.02, 0.00]	-.04***	[-0.05, -0.03]
Duration entropy	-.02*	[-0.04, -0.01]	-.07***	[-0.10, -0.05]

Note. TUC = total unique number of cells, CI = confidence intervals * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Additionally, LGMs fitted the data well for both positive ($\chi^2(20) = 12.395$, CFI = 1.00, RSMEA = .00 (90% CI = .000 -.092)) and negative affect ($\chi^2(20) = 14.331$, CFI = 1.00, RSMEA = .00 (90% CI = .000 -.081)). The results indicated in line with the definition of variability, that high decreasing variability dyads initially showed more negative and positive affect (mean intercept negative affect = .20; $SE = .01$, $p < .001$; mean intercept positive affect = .10; $SE = .01$, $p < .001$) than low variability dyads (mean intercept negative affect = .07; $SE = .01$, $p < .001$; mean intercept positive affect = .06; $SE = .01$, $p < .001$). Furthermore, between age 13 and 17, high decreasing variability dyads significantly decreased in negative affect (mean slope = -.03; $SE = .01$, $p < .001$), but low variability dyads showed stable and low levels of negative affect (mean slope = -.01; $SE = .00$, $p = .316$). Thus, the initial differences between the two types of dyads in the level of negative affect became smaller during adolescence. Finally, as high decreasing variability dyads (mean slope = -.01; $SE = .01$, $p = .017$) and low variability dyads (mean slope = -.01; $SE = .01$, $p < .016$) showed a similar significant decrease in the level of positive affect between age 13 and 17, the high decreasing variability dyads showed consistently more positive affect between age 13 and 17 than the low variability dyads.

Development of Dyadic Variability, Adjustment, and Relationship Quality

Our main aim was to examine differences between low variability dyads and high decreasing variability dyads in the development of adolescents' aggressive behavior, adolescents' and mothers' perceived conflict frequency, and adolescents' and mothers' perceived autonomy support. We controlled for gender in the

analyses. Fit statistics of the final models are presented in Table 8 and regression coefficients in Table 9. Figure 6 provides a graphical presentation of the mean trends for the two dyadic variability trajectories of aggressive behavior, perceived autonomy support, and perceived conflict frequency from age 13 to 17.

Table 8. Fit Statistics of Univariate Multigroup LGMs for Aggressive Behavior, Perceived Autonomy Support, and Perceived Conflict Frequency

	MLr χ^2	df	χ^2/df	CFI	RMSEA	90% CI RMSEA
Aggressive behavior	18.00	21		1.00	.000	[.000, .104]
Mothers' perceived autonomy support	31.41	27		.98	.060	[.000, .135]
Adolescents' perceived autonomy support	25.17	21		.92	.066	[.000, .147]
Mothers' perceived conflict frequency	18.74	28		1.00	.000	[.000, .048]
Adolescents' perceived conflict frequency	43.59	27		.99	.029	[.000, .126]

Note. MLr χ^2 = Robust Maximum Likelihood estimation of Chi-Square, df = degrees of freedom, CFI = Comparative Fit Index, RMSEA= Root Mean Square Error of Approximation, CI = Confidence Interval

Aggressive behavior. Fit statistics indicated that the shape of growth differed for the two types of dyadic variability dyads: for aggressive behavior a quadratic model fitted the low variability dyads best and a linear model fitted the high decreasing variability dyads best. Next, intercept values could be constrained to be equal between dyadic variability dyads ($\Delta\chi^2_{SB2}$ (1, N = 92) = 0.06, p = .809). This indicated that adolescents of low variability and high decreasing variability dyads had similar initial levels of aggressive behavior. For the adolescents of low variability dyads there was a significant decrease in aggressive behavior from age 13 to 15, followed by a significant increase in aggressive behavior from age 15 to 17. In contrast, adolescents of high decreasing variability dyads showed stable levels of aggressive behavior from age 13 and 17 (see Table 9 and Figure 6).

Perceived autonomy support. For mothers' perceived autonomy support, a linear model fitted the data best for both low variability and high decreasing variability dyads (see Table 8). Intercept values could be constrained to be equal between dyadic variability dyads ($\Delta\chi^2_{SB2}$ (1, N = 92) = 2.78, p = .096). However, the linear

slope could not be constrained to be equal between dyadic variability dyads ($\Delta\chi^2_{SB2}$ (1, N = 92) = 7.24, $p = .007$). These results indicated that mothers of low variability and high decreasing variability dyads perceived similar initial levels of autonomy support, but differences in developmental pathways of autonomy support. Mothers of low variability dyads perceived stable levels of autonomy support over time, and they showed lower levels of autonomy support towards middle adolescence than mothers of high decreasing variability dyads. Mothers of high decreasing variability dyads perceived a significant increase in autonomy support over time (see Table 9 and Figure 6).

For adolescents' perceived autonomy support, fit statistics indicated that the shape of growth differed for the two types of dyadic variability dyads: a quadratic model fitted the low variability dyads best and a linear model fitted the high decreasing variability dyads best (see Table 2). Intercept values could be constrained to be equal between dyadic variability dyads ($\Delta\chi^2_{SB2}$ (1, N = 92) = 0.47, $p = .493$). This indicated that adolescents of low variability and high decreasing variability dyads perceived similar initial levels of autonomy support, but differences in developmental paths of autonomy support. For adolescents of low variability dyads there was a significant decrease in perceived autonomy support from age 13 to 15, followed by a significant increase in perceived autonomy support from age 15 to 17. In contrast, adolescents of high decreasing variability dyads showed stable levels of perceived autonomy support over time, and they showed higher levels of autonomy support between age 14 and 16 than adolescents of low variability dyads (see Table 9 and Figure 6).

Perceived conflict frequency. For mothers' and adolescents' perceived conflict frequency, a linear model fitted the data best for both low variability dyads and high decreasing variability dyads (see Table 8). Intercept values could be constrained to be equal between dyadic variability dyads for mothers' perceived conflict frequency ($\Delta\chi^2_{SB2}$ (1, N = 92) = 0.39, $p = .534$), and adolescents' perceived conflict frequency ($\Delta\chi^2_{SB2}$ (1, N = 92) = 1.15, $p = .285$). This indicated that mothers and adolescents of low variability and high decreasing variability dyads perceived similar initial levels of conflict frequency at age 13 of adolescents (see Table 9 and Figure 6).

Slope values mothers' perceived conflict frequency could be constrained to be equal between dyadic variability dyads ($\Delta\chi^2_{SB2}$ (1, N = 92) = 0.24, $p = .627$). The results indicated that mothers of low variability and high decreasing variability dyads perceived similar developmental paths of conflict frequency over time.

Mothers of both types of dyads did not significantly change in their levels of perceived conflict frequency over time (see Table 9 and Figure 6). It was not possible to constrain the slope values between dyadic variability dyads for adolescents' perceived conflict frequency ($\Delta\chi^2_{SB2} (1, N = 92) = 4.17, p = .041$). The results also suggested that there were differences in the developmental paths of adolescents' perceived conflict frequency. Adolescents of low variability dyads perceived stable levels of conflict frequency over time, and towards middle adolescence they perceived higher levels of conflict frequency than adolescents of high decreasing variability dyads. Adolescents in this latter type of dyads perceived a significant decrease in adolescents' conflict frequency over time (see Table 9 and Figure 6).

Table 9. Growth Factors of Univariate Multigroup LGMs of Aggressive Behavior, Perceived Autonomy Support and Perceived Conflict Frequency

	Intercept			Linear slope			Quadratic slope		
	M	σ^2	95% CI / M	M	σ^2	95% CI / M	M	σ^2	95% CI / M
Low variability dyads									
Aggressive behavior	1.64***	.68*	[1.45, 1.83]	-0.19**	.20	[-0.36, -0.01]	0.05**	.01	[0.01, 0.09]
Mothers' perceived autonomy support	3.30***	.06**	[3.21, 3.37]	0.01	.00	[-0.02, 0.03]			
Adolescents' perceived autonomy support	3.29***	.08	[3.22, 3.38]	-0.18**	.07	[-0.28, -0.05]	0.04*	.01	[0.01, 0.07]
Mothers' perceived conflict frequency	2.22***	.16**	[2.13, 2.37]	0.01	.01	[-0.04, 0.03]			
Adolescents' perceived conflict frequency	2.18***	.21**	[2.05, 2.31]	-0.04	.02*	[-0.09, 0.02]			
High decreasing variability dyads									
Aggressive behavior	1.64***	.56*	[1.45, 1.83]	-0.03	.02	[-0.09, 0.03]			
Mothers' perceived autonomy support	3.30***	.04**	[3.23, 3.36]	0.05***	.00	[0.02, 0.07]			
Adolescents' perceived autonomy support	3.29***	.12***	[3.21, 3.36]	-0.02	.01	[-0.05, 0.02]			
Mothers' perceived conflict frequency	2.22***	.38***	[2.13, 2.37]	0.01	.02	[-0.04, 0.03]			
Adolescents' perceived conflict frequency	2.18***	.16	[2.05, 2.31]	-0.08**	.00	[-0.14, -0.03]			

Note. Quadratic slopes are only presented for the models where a quadratic trend was present. M = mean, σ^2 = variance, CI = confidence interval.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$.

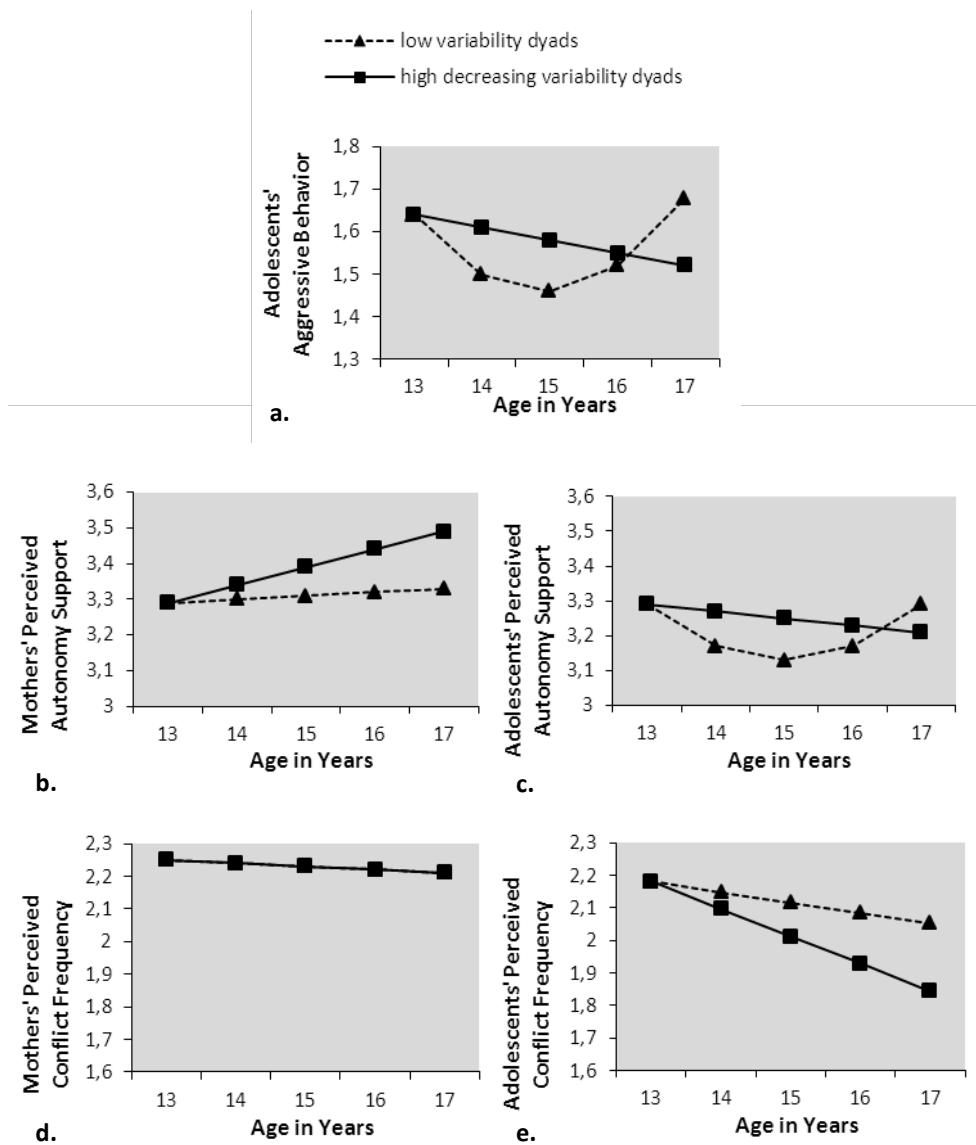


Figure 6. Development of aggressive behavior (a), perceived autonomy support (b, c) and perceived conflict frequency (d, e) for low variability dyads and high decreasing variability dyads

Discussion

The main goal of this observational study was to examine whether heterogeneity in the development of dyadic variability during mother-adolescent interactions was related to the development of adolescents' adjustment and adolescents' and mothers' relationship quality. Adolescence is a developmental phase that is characterized by changes toward more egalitarian mother-adolescent relationships (De Goede et al., 2009; Pinquart & Silbereisen, 2002). Conflict interactions are expected to trigger these relational reorganizations (Laursen & Collins, 2009). Higher levels of dyadic variability during conflict interactions are thought to characterize periods of change and reorganization, and to be related to a more optimal reorganization of the mother-adolescent relationship (Granic, 2005). Low levels of dyadic variability are suggested to be related to lower relationship quality and higher levels of adolescents' adjustment problems (Hollenstein et al., 2004; Lichtwarck-Aschoff et al., 2009). Therefore, we investigated whether changes in the structural organization of real-time interaction patterns during adolescence are related to developmental changes in the content of these relationships. The current study is one of the first examining heterogeneity in the development of dyadic variability and its associations with the development of psychosocial functioning over the course of adolescence.

Development of Dyadic Variability During Adolescence

By using a person-centered approach (Nagin, 2005), this study found two types of mother-adolescent dyads that followed different developmental trajectories of dyadic variability: *low variability dyads* (52% of our sample) and *high decreasing variability dyads* (48% of our sample). Low variability dyads were characterized by stable and lower levels of dyadic variability during adolescence, indicating that these dyads maintained a limited emotional repertoire during conflict interactions throughout adolescence. High decreasing variability dyads were characterized by higher initial levels of dyadic variability, and decreasing levels of dyadic variability as adolescents grew older. Consistent with the definition of variability, these high decreasing variability dyads showed more positive and negative affect over time than low variability dyads. So, the high variability dyads seem to navigate adolescence with a broader emotional repertoire during conflict interactions.

From a dynamic systems standpoint (Fogel, 1993; Thelen & Smith, 1994), the broad range of emotional states of high decreasing variability dyads during early

adolescence seems to suggest that these dyads are in the middle of reorganizing their interaction patterns. It is assumed that when dyads are able to express negative affect during interactions, but at the same time are able to display positive affect to each other, they may be better able to explore alternative interaction patterns and to renegotiate their relationship (Granic, 2005; Izard, 2009). Furthermore, both theory (Granic, Dishion, & Hollenstein, 2006) and empirical evidence (Granic et al., 2003) suggest that as mother-adolescent dyads pass through the transitional period of adolescence, interaction patterns become less variable. In our study, high decreasing variability dyads indeed showed a decrease in dyadic variability over the course of adolescence. In contrast, the small emotional repertoire of low decreasing variability dyads throughout adolescence is thought to indicate that these dyads did not go through a period of reorganization of interaction patterns (Granic, 2005), which is further confirmed by the lack of change in perceived conflict frequency and the stable or even decreasing level of perceived autonomy support of these dyads. Future research needs to examine whether differential developmental patterns of dyadic variability also are related to differential changes in interaction patterns of dyads during adolescence. In short, the distinct developmental patterns of dyadic variability were associated differently with the development of psychosocial functioning from age 13 to 17.

Development of Dyadic Variability, Adjustment, and Relationship Quality

As expected, high decreasing variability dyads were characterized by a more optimal developmental profile of psychosocial functioning than low variability dyads. In line with our expectations, adolescents from low variability dyads showed increases in aggressive behavior over time, which extends previous results using younger age groups (Lunkenheimer et al., 2011). Although there are initial similarities in levels of aggressive behavior between low and high decreasing variability dyads, both dyads seem to navigate the transitional phase of adolescence with different levels of aggressive behavior. Although adolescents from low variability first reported decreases in aggressive behavior, towards middle adolescence they reported increases in aggressive behavior and eventually showed higher levels of aggressive behavior than adolescents from high decreasing variability dyads. It is thought that adolescents from dyads that do not have enough opportunity to learn to express, share, and regulate different types of emotions (Granic et al., 2007; Hollenstein et al., 2004) show higher levels of aggressive behavior (De Rubeis & Granic, 2012; Silk et al., 2003). Our results suggest that the

limited ability to express emotions during conflict discussions is associated temporarily with inhibited aggression but eventually to increased levels of aggression. The stable levels of aggressive behavior reported by adolescents from high decreasing variability dyads might indicate that they have learned to adequately use, share, and regulate different emotions over the course of adolescence (Silk et al., 2003). So, over the course of adolescence, the range of emotional states of mother-adolescent dyads seems associated with the levels of aggressive behavior.

Furthermore, high decreasing variability dyads reported a better relationship quality than low variability dyads. Although there were no initial differences between both dyads, mothers and adolescents from high decreasing variability dyads started to show higher levels of autonomy support over time and adolescents from these dyads also reported lower levels of conflict over time. During adolescence, mothers and adolescents need to realign their autonomy perceptions and expectancies and for this it is important that mothers support the autonomy of adolescents (Laursen & Collins, 2009). Our results suggest that high decreasing variability dyads seem to adjust to the growing autonomy needs of adolescents more adequately over the course of adolescence than low variability dyads, because they perceive more autonomy support over time than low variability dyads. Furthermore, the decrease in conflict frequency reported by adolescents from high decreasing variability dyads also may indicate that these dyads develop more egalitarian relationships over the course of adolescence. When power is more equally divided in the mother-adolescent relationship, conflicts are not so much needed anymore to convey discrepant perceptions (De Goede et al., 2009; Laursen & Collins, 2009). In contrast, adolescents from low variability dyads reported stable and higher levels of conflict throughout adolescence, which in the long term is suggested to have a detrimental effect on the relationship and on psychosocial adjustment (Smetana, 2011). Finally, it must be noted that mothers from high decreasing and low variability dyads did not differ with regard to their levels over time of perceived conflict frequency. This could be due to the fact that mothers often struggle with relinquishing power to adolescents and therefore experience interactions as more conflictual than adolescents do (Zimmer-Gembeck & Collins, 2006). Overall, our results seem to suggest that mother-adolescent dyads with a broader emotional repertoire during interactions are characterized by changes over time towards a more egalitarian mother-adolescent relationship.

Limitations and Future Directions

Several limitations of this study should be noted and addressed in future research. It must be noted that both types of dyads may have experienced a peak in dyadic variability during pre or early adolescence (Granic et al., 2003), but our study started too late to be able to observe such a pattern. Given our promising results, it is important to examine heterogeneity of dyadic variability from childhood to late adolescence. Although our study is also unique in showing that distinct developmental pathways of dyadic variability were associated with differential development of adolescent psychosocial functioning, our findings do not shed light on the developmental order between dyadic variability and psychosocial functioning. Future research should examine whether increases in mother-adolescent variability predict adaptive psychosocial functioning, or whether adaptive psychosocial functioning predicts the level of dyadic flexibility.

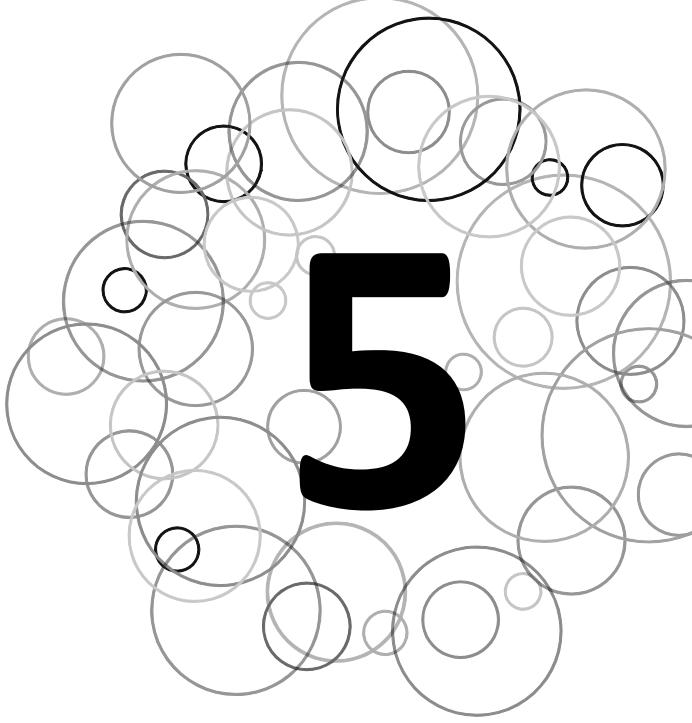
Furthermore, it is important to note that earlier research has employed different definitions of variability. It has been defined as the range of the emotional repertoire of a system (Lichtwarck-Aschoff et al., 2009), the number of changes in emotional states or the flexibility of a system (Granic et al., 2003), mean durations of emotional states or rigidity of a system (Hollenstein et al., 2004), and the predictability of system characteristics (Dishion, Nelson, Winter, & Bullock, 2004). Although all these definitions refer to different structural aspects of a system, definitions have been used interchangeable. Even more so, some studies use a composite measure including multiple structural aspects of a system. To avoid confusion, the current study used only one definition of variability, namely the range of the emotional repertoire, because the nature and quality of emotions expressed during mother-adolescent interactions changes substantively over the course of adolescence (Eisenberg et al., 2009). Future research should also examine the development of other structural aspects of mother-adolescent interactions and its longitudinal associations with psychosocial functioning during adolescence.

Additionally, because gender differences have been found in levels of aggressive behavior and perceived relationship quality (Bongers, Koot, van der Ende, & Verhulst, 2003; De Goede et al., 2009), we controlled for gender in our analyses. Our results showed that gender was not a significant predictor of intercept and slope differences in our analyses, and therefore it is unlikely that gender plays a role in the relationship between dyadic variability and psychosocial functioning. Finally, because the current study used a conflict discussion task to examine the structural organization of interactions over time, it seems prudent to

investigate whether the same developmental profiles of dyadic variability are evident across diverse interaction contexts. Moreover, future studies should examine whether our findings can be generalized to other racial, ethnic, and socioeconomic populations.

Conclusion

The present study offers new and unique insights into the heterogeneity in the development of dyadic variability and its associations with the development of psychosocial functioning over the course of adolescence. First, a person centered approach enabled us to identify two distinct developmental trajectories of dyadic variability during adolescence. Second, because we employed five consecutive annual waves of data from both observations and questionnaires of 92 mother-adolescent dyads, we were able to focus on both the structure and content of relationships, which provided a broader view on the longitudinal associations between dyadic variability and psychosocial functioning during adolescence. Taken together, these results paint a picture of high decreasing variability dyads that are characterized by a broader emotional repertoire, stable and lower levels of adolescents' aggressive behavior, and an increase in perceived relationship quality. In contrast, low variability dyads are typified by a smaller emotional repertoire, an increase in adolescents' aggressive behavior, and lower levels of perceived relationship quality over time. Observing dyadic variability in the emotional climate during interactions can help clinicians to distinguish adaptive from maladaptive mother-adolescent dyads. Our results also may help families understand how to adapt interaction patterns to developmental changes that take place during adolescence. For example, mothers often think that they have to suppress adolescents' negative emotional states, and encourage adolescents' positive emotional states. However, the current research suggests that adaptive interactions are marked by a wide range of emotional states and mothers should therefore guide adolescents during interactions in learning to express both positive and negative affect.



5

Emotional Variability during Mother- Adolescent Conflict Interactions: Longitudinal Links to Adolescent Disclosure and Maternal Control

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Abstract

The aim of this study was to examine relations of emotional variability during mother-adolescent conflict interactions in early adolescence with adolescent disclosure and maternal control in early and late adolescence. Data were used from 92 mother-adolescent dyads (M age T1 = 13.05; 65.20% boys) who were videotaped at T1 while discussing a conflict. Emotional variability was derived from these conflict interactions. Mothers also completed questionnaires at the start of the study (T1) and five years later (T6) on adolescent disclosure and maternal control. Path analysis showed that more emotional variability during conflict interactions in early adolescence was associated with higher levels of *adolescent disclosure* in early adolescence and with relative decreases in *maternal control* from early to late adolescence. More emotional variability of mother-adolescent dyads serves an important function in adaptively dealing with relational challenges that arise during adolescence.

Introduction

As adolescents get older, they increasingly consider pieces of information about their daily life and activities as private and personal, while their mothers might consider that some of these issues fall under their jurisdiction (Petronio, 2002; Smetana & Asquith, 1994). Mother-adolescent dyads need to find an optimal balance between adolescents' autonomy and privacy on the one hand and maternal control and access to information on the other hand. Otherwise stated, mother-adolescent interactions should provide a context that fosters adolescents' disclosure of information, without too much interference with adolescents' increasing need to become more autonomous (e.g., Branje, Laursen, & Collins, 2012; Smetana, 2011). From early to late adolescence, adolescents' openness and disclosure to their mothers' increases and maternal control decreases (Keijsers, Frijns, Branje, & Meeus, 2009; Keijsers & Poulin, in press). Thus, mother-adolescent relationships ultimately become more horizontal in nature towards the end of adolescence.

Conflict interactions in early adolescence are thought to play an important role in reorganizing mother-adolescent relationships towards more adolescent disclosure and less maternal control (Adams & Laursen, 2007; Branje et al., 2012). In addition to the type of emotions expressed during these mother-adolescent

conflict interactions, emotional variability during conflict interactions might be instrumental to enhance adolescent disclosure and maternal control. Emotional variability reflects the ability of mother-adolescent dyads to flexibly switch between dyadic emotional states from moment-to-moment during conflict interactions (Granic, 2005; Hollenstein, 2012; Thelen & Smith, 1994). It is thought that more emotional variability in early adolescence allows dyads to reorganize interaction patterns if needed and, thus, enables mother-adolescent dyads to adapt to relational challenges that arise during adolescence (Lichtwarck-Aschoff, Kunnen, & Van Geert, 2009; Van der Giessen, Branje, Frijns, & Meeus, 2013). However, there is still a lack of empirical knowledge about the function of emotional variability during conflict interactions in early adolescence in handling relational challenges, such as adolescent disclosure and maternal control, over the course of adolescence. Therefore, the aim of this study is to examine the links of observed emotional variability during mother-adolescent conflict interactions in early adolescence with mothers' perceptions of adolescent disclosure and maternal control in early and late adolescence.

The Function of Emotional Variability in Conflict Interactions

Conflict interactions of mothers and adolescents often center on discrepant expectancies about authority, autonomy, and responsibilities. Therefore, mother-adolescent dyads need to find a way of communicating that allows for disagreement, negative emotions, and autonomy to occur while enhancing disclosure, relatedness, and problem solving (Bosma et al., 1996; Laursen & Collins, 2009). From a dynamic systems approach (Fogel, 1993; Thelen & Smith, 1994), more emotional variability during conflict interactions in early adolescence is thought to allow dyads to reorganize interaction patterns. That is, mother-adolescent dyads that show relatively high levels of emotional variability during conflict interactions are expected to adequately express their thoughts and emotions, to put across their point of view clearly, and to adjust discrepant perceptions accordingly. These dyads are expected to adequately deal with differences in opinions. In contrast, mother-adolescent dyads that show a tendency to get stuck in emotions during conflict interactions, even if they get stuck in neutral or positive emotions, might not be able to solve their conflicts, because these dyads may not provide a supportive and secure context to discuss different point of views and discordant emotions (Branje, 2008; Van der Giessen et al., 2013). Empirical evidence showed that more emotional variability in early

adolescence was associated with indicators of adaptive relationship reorganization. Higher levels of emotional variability were associated with moderate levels of perceived conflict frequency (Lichtwarck-Aschoff et al., 2009), with a realignment of levels of perceived dominance, criticism, and open communications in mother-adolescent relationships (Branje, 2008), and with a decrease in perceived conflict frequency and an increase in perceived autonomy support over time (Van der Giessen et al., 2013). Taken together, both theory and research suggest that more emotional variability during mother-adolescent conflict interactions is helpful in dealing with various relational challenges that arise during adolescence, and serves an important function in adaptively realigning relationships towards a more equal and horizontal nature.

Emotional variability in mother-adolescent conflict interactions are, therefore, expected to play a role in dealing with challenges that arise with respect to maternal control and adolescent disclosure. Being able to express your thoughts, feelings, and emotions during conflicts is considered to be related to mutual understanding and more open communication patterns (e.g., Adams & Laursen, 2007; Butler, 2011), which may facilitate adolescent disclosure and might reduce maternal control. Regarding adolescent disclosure, one of the main reasons why adolescents refrain from disclosure is their concern about mothers' potentially negative responses about the content of their disclosure (Darling, Cumsille, Caldwell, & Dowdy, 2006; Marshall, Tilton-Weaver, & Bosdet, 2005; Tilton-Weaver et al., 2010). This implies that adolescents feel safer to disclose to their mothers in a context where their emotions, both positive and negative, are likely to be accepted. More emotional variability during conflict interactions might be indicative of such a safe and supportive context characterized by more open communication, because more emotionally variable mothers and adolescents are thought to be able to freely express different types of emotions. More emotional variability in early adolescence might therefore be related to more adolescent disclosure both concurrently and over time.

Mother-adolescent conflict is also considered be a means of recognizing and resolving discordant expectations regarding autonomy and control, thereby providing an important context for negotiating maternal authority towards adolescents (Hawk, Hale, Raaijmakers, & Meeus, 2008; Petronio, 2002; Smetana, 2011). When mother-adolescent dyads express different emotions more flexibly and easily during conflict interactions, these dyads might talk about discordant expectations more thoroughly as they are searching for new patterns of behaviors

that match maturing autonomy needs of adolescents. In this way, more emotional variability during conflict interactions in early adolescence may represent an important part of the process by which mothers and adolescents adequately realign autonomy expectations with one another (Lichtwarck-Aschoff, Kunnen, & Van Geert, 2010). Mothers in more emotionally variable dyads might, therefore, be expected to relax control over adolescents over time, thereby gradually allowing adolescents to make decisions without informing them first. Ultimately, in the longer run it is, thus, possible that more emotional variability during conflict interactions in early adolescence is related to changes towards a more horizontal nature of the relationship, with less authority and control of mothers over their adolescents.

Research Aims and Hypotheses

Emotional variability of mother-adolescent dyads during conflict interactions is, thus, thought and found to be a key mechanism in dealing with relational challenges and in the development towards more egalitarian mother-adolescent relationships (Fogel, 1993; Lichtwarck-Aschoff et al., 2009; Thelen & Smith, 1994). Although conflict interactions in early adolescence are considered to play an important role in dealing with relational reorganizations towards more adolescent disclosure and less maternal control (Adams & Laursen, 2007; Branje et al., 2012), the specific role of emotional variability during these conflicts for adolescent disclosure and maternal control has not been investigated yet. Therefore, the major aim of the current study is to examine concurrent and longitudinal associations between observed emotional variability during mother-adolescent conflict interactions in early adolescence and mothers' perceptions of adolescent disclosure and maternal control in early and late adolescence. We expect that higher levels of emotional variability during mother-adolescent conflict interactions in early adolescence are related to higher levels of adolescent disclosure and lower levels of maternal control in early adolescence, and to relative increases in adolescent disclosure and relative decreases in maternal control from early to late adolescence. Although the current study was mainly interested in examining the unique role of emotional variability of mother-adolescent dyads for adolescent disclosure and maternal control, earlier studies have shown that the type of emotional responses expressed was related to adolescent disclosure and maternal control (Marshall et al., 2005; Tilton-Weaver et al., 2010). Therefore, we controlled

for the emotional valence (e.g., types of emotions expressed) of the conflict interactions.

Method

Sample and Procedure

Participants were 92 mother-adolescent dyads who were a subsample of the young cohort from the larger longitudinal research project called “RADAR Young” (Research on Adolescent Development And Relationships Young). This is an ongoing longitudinal study in the Netherlands that focuses on the development of relationships and problem behavior in adolescence. For the current study, observation data of mother-adolescent conflict interactions were used from the first (T1) measurement wave, and questionnaire data of mothers were used from the first (T1) and sixth (T6) measurement wave with a 5-year interval. At the first wave, the mean age of the mothers was 44.87 years ($SD = 4.83$), and the mean age of the adolescents was 13.01 years ($SD = 0.52$). The sample consisted of 54 boys (58.7%) and 38 girls (41.3%). At the first wave, adolescents were in the first grade of junior high. Most adolescents lived in medium or high SES families (92.4%). Attrition in the observation sample was 18.48% from T1 to T6. Chi-square and T -test analyses revealed no differences in gender, family SES, age, and outcome variables between participants who participated at T1 and T6 and participants that dropped out of the study.

Participants were recruited from several randomly selected Dutch schools in the province of Utrecht, and the cities of Amsterdam, Rotterdam, The Hague, and Almere. Teacher screening and parent interviews were used to select the families in the main RADAR sample ($N = 497$). The participants received written information describing the research project. At the first wave 102 mother-adolescent dyads were randomly selected from the main RADAR-sample to participate in the annual videotaped interactions tasks. Ninety-two dyads were willing to participate and provided written informed consent. Families received €100 per home-visit. This study was approved by the medical ethics committee of the University Medical Center in Utrecht.

Conflict Interaction Task

Mothers and adolescents were asked to choose an issue that they discussed most often during the last month. We provided the Interpersonal Conflict Questionnaire

(Laursen, 1995), which lists topics of frequent family conflicts (e.g., chores, school problems, curfews), as an aid to selecting topics. Mothers and adolescents had to resolve the conflict issue within 10 minutes ($M = 7.59$ minutes; $SD = 2.00$ minutes), and their discussion was videotaped. Each conflict interaction task was coded using a simplified version of the SPAFF coding system (SPAFF; Gottman, McCoy, Coan, & Collier, 1996), which has been applied successfully to parent-child interactions (Hollenstein, Granic, Stoolmiller, & Snyder, 2004). Coders categorized the affects displayed using four positive codes (affection, enthusiasm, humor, interest), five negative codes (complaining, sadness, fear, anger, contempt), and a neutral code (refers to statements and information exchanges that are non-emotional in content and voice tone). The 10 mutually exclusive affect codes were recorded continuously in real time for mothers and adolescents independently, using The Observer XT 9.0 (Noldus Information Technology, 2009). Coders were trained intensively over a 3-month period to achieve a minimum inter-observer criterion of 75% agreement and .65 kappa (M inter-observer agreement $T1 = .73$ kappa). To maintain these criteria, weekly discussion meetings were conducted. Twenty percent of the videotaped interactions were independently coded by two coders to provide estimates of reliability. Coders were unaware which sessions were used to assess observer agreement.

Measures

Emotional variability. To capture the emotional variability of mother-adolescent dyads, the data of each conflict interaction were plotted on state space grids in GridWare 1.15a (Lamey, Hollenstein, Lewis, & Granic, 2004). This program plots the real-time emotions (SPAFF codes) during the conflict interactions on state space grids (see Figure 7). A grid represents all possible emotional combinations of a dyad, and each cell on the grid represents a potential emotional state of the dyad. The mother's coded emotions are plotted on the x-axis and the adolescent's emotions are plotted on the y-axis. A trajectory is plotted through the successive dyadic points on the grid in the same order as the emotions proceed in real time. Thus, a grid represents a sequence of dyadic emotional states. The state space grids for the present study consisted of 100 cells, because for each dyad member 10 possible emotions or SPAFF codes were available during the conflict discussions.

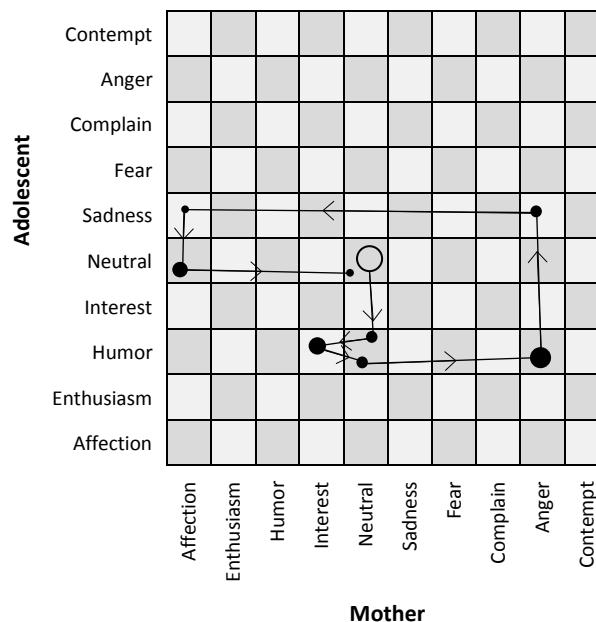


Figure 7. An example of a state space grid depicting a sequence of emotions of a mother-adolescent dyad. Each cell on the grid represents a potential dyadic emotion, and a trajectory is plotted through the successive points on the grid in the same order as the emotions proceed in real time.

Two distinct measures of dyadic emotional variability, which have been shown to exhibit good reliability and predictive validity (Granic, O'Hara, Pepler, & Lewis, 2007; Hollenstein et al., 2004), were derived from GridWare for each mother-adolescent dyad at the first wave. First, to tap emotional flexibility, *transitions* per minute assessed the number of dyadic changes or movements per minute between cells on the state space grid, and it was corrected for differences in total duration of the conflict discussions. Higher values indicated more frequent changes per minute between dyadic emotional states ($M = 5.17$, $SD = 2.59$). Second, to tap the emotional repertoire, *dispersion* assesses the spread of dyadic emotional states. Dispersion ranges from 0 to 1, with values close to one indicating that behavior was equally distributed across cells and values of zero indicating that behavior was in only one cell ($M = .34$, $SD = .17$). For each mother-adolescent dyad an emotional variability construct was created, resulting in a measure of general dyadic *emotional variability* (Hollenstein et al., 2004). Each emotional variability construct

combined the Z-scores of transitions and dispersion by computing their mean, thereby reflecting these two different aspects of emotional variability of dyads, namely emotional flexibility and the emotional repertoire. Higher scores indicated higher levels of emotional variability of dyads, that is, these dyads showed the ability to flexibly switch between a broad range of positive and negative emotions.

Emotional affect ratio. To capture the overall emotional valence of the dyadic conflict interactions, we calculated for each mother-adolescent dyad the *emotional affect ratio*. Affect ratios have been found to be good predictors of well-being and adjustment in adolescence and adulthood (Fredrickson & Losada, 2005; Silk et al., 2011). First, we derived from GridWare the total duration in seconds of dyadic positive affect (SPAFF codes affection, enthusiasm, humor, and interest) and dyadic negative affect (SPAFF codes complain, sadness, fear, complain, anger, and contempt) of mother-adolescent dyads. The duration of positive affect and the duration of negative affect of dyads was each corrected for differences in total duration of the interaction ((duration affect / duration total interaction) *100). Second, these corrected measures of dyadic positive and negative affect were used to calculate a dyadic affect ratio. This ratio represents the proportion of positive versus negative affect of a dyad during their interaction (negative affect / (positive affect + negative affect)). Higher scores indicated that dyads showed more negative affect than positive affect during conflict interactions.

Disclosure and control. To tap mothers' perceptions of adolescent disclosure and maternal control we used two scales developed by (Stattin & Kerr, 2000) which have demonstrated adequate validity and reliability in previous studies (see for a review of studies (Racz & McMahon, 2011). All questions were scored by mothers, using a 5-point Likert scale, ranging from 1 = never to 5 = often. First, the *adolescent disclosure* scale measured with 6 items mothers' perceptions of adolescents' voluntary and spontaneous revelations about friends, activities, and whereabouts. An example item is 'Does your child spontaneously tell things to you about his/her friends?' (α s .71 at T1 and .83 at T6). Second, the *maternal control* scale measured with 5 items the way in which mothers perceive themselves as controlling their adolescent child's activities and friendships. An example of an item is 'Does your child need your permission before he or she can go out during the weeknights?' (α s .82 at T1 and .87 at T6).

Results

To examine whether emotional variability was concurrently and longitudinally associated with adolescent disclosure and maternal control, we performed a path analysis in Mplus 6 (Muthén & Muthén, 2010). The model consisted of observed emotional variability at T1, perceptions of adolescent disclosure at T1, and perceptions of maternal control at T1. Also, we included perceptions of adolescent disclosure and maternal control at T6. Finally, we included the observed emotional affect ratio at T1 in the analysis, to control for the emotional valence of conflict interactions. We used Full Information Maximum Likelihood estimation, because the variables were normally distributed (maximum skewness values -1.10) and the Little's MCAR test (Little, 1988) produced a normed and nonsignificant χ^2 (χ^2/df) of 1.17, which indicated a good fit between sample scores with and without imputation (Bollen, 1989).

Table 10. Zero-order Correlations Between Emotional Variability, the Emotional Affect Ratio, Adolescent Disclosure, and Maternal Control

	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.
1. Emotional variability T1	0.00	0.96	-					
2. Emotional affect ratio T1	56.31	24.66	.33**	-				
3. Adolescent disclosure T1	4.33	0.50	.26*	.25*	-			
4. Maternal control T1	4.51	0.84	-.06	-.02	.15	-		
5. Adolescent disclosure T6	3.97	0.70	.33**	.13	.60**	.11	-	
6. Maternal control T6	2.79	1.10	-.44**	-.15	-.07	.22*	-.12	-

Note. The emotional variability construct combined the Z-scores of transitions per minute and dispersion, and therefore the mean score represented here is zero. For the raw mean score of transitions per minute and dispersion, the reader is referred to the description of these measures in the method section on page 98. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Descriptive Statistics

Table 10 provides descriptive statistics and correlations of all study variables. The means in Table 10 revealed that levels of adolescent disclosure and in particular maternal control, decreased over time. Repeated measures ANOVA also showed significant decreases in adolescent disclosure from T1 to T6 ($F(1, 80) = 32.66, p < .001, \eta^2 = .29$) and especially in maternal control from T1 to T6 ($F(1, 79) = 112.29, p < .001, \eta^2 = .64$). In addition, the mean of the emotional affect ratio indicated that mother-adolescent dyads showed relative more negative than positive affect during the conflict interactions. The correlations in Table 10 showed, first of all, that more emotional variability was significantly related to relatively more negative than positive affect (emotional affect ratio) during interactions. This indicates that, in line with the definition of emotional variability, more emotionally variable dyads revealed a broad range of both positive and negative emotions. Furthermore, more emotional variability at T1 was significantly associated with more *adolescent disclosure* at T1 and T6, and with lower *maternal control* at T6; when mother-adolescent dyads flexibly switched among a broad range of emotions during conflict interactions, mothers reported more disclosure of adolescents regarding leisure activities at T1, and more disclosure and weaker maternal control five years later. The emotional affect ratio at T1 was also positively related to adolescent disclosure at T1, reflecting that when mother-adolescent dyads showed relatively more negative than positive affect during conflict interactions at T1, mothers reported more disclosure of adolescents at T1. Finally, there were no concurrent and longitudinal associations of maternal control with adolescent disclosure and the emotional affect ratio.

Model Results: Emotional Variability, Adolescent Disclosure, and Maternal Control

Figure 8 provides the standardized estimates of the model examining concurrent and longitudinal associations between observed emotional variability, and perceptions of adolescent disclosure and maternal control, while controlling for the observed emotional affect ratio. The model provided an excellent overall fit to the data: $\chi^2(2) = .27, p = .87$; CFI = 1.00; RMSEA = .00, range .00 - .10.

Regarding *adolescent disclosure*, emotional variability at T1 was positively associated with adolescent disclosure at T1, suggesting that when mother-adolescent dyads showed more emotional variability during conflict interactions at T1, mothers perceived higher levels of adolescent disclosure at T1. However,

emotional variability at T1 did not predict relative changes in adolescent disclosure from T1 to T6. This indicated that emotional variability of mother-adolescent dyads at T1 was not associated with adolescent disclosure at T6, when controlling for its association with adolescent disclosure at T1. In line with this, adolescent disclosure showed considerable stability over 5 years.

Regarding *maternal control*, we did not find a negative link between emotional variability and maternal control at T1. However, emotional variability at T1 predicted a relative decrease in maternal control from T1 to T6. When mother-adolescent dyads showed more emotional variability at T1, mothers reported a decrease in their control over the period from T1 to T6. The longitudinal association of emotional variability with maternal control was of considerable strength, also considering that we controlled for previous levels of maternal control, adolescent disclosure, and the emotional affect ratio.¹

Some of the control variables also revealed significant associations with adolescent disclosure and maternal control worth mentioning. In early adolescence emotional variability was positively associated with the emotional affect ratio; more emotionally variable dyads showed relatively more negative than positive affect during the conflict interactions. Also, the emotional affect ratio at T1 was positively related to adolescent disclosure at T1, indicating that when mother-adolescent dyads showed more negative than positive affect during conflict interactions at T1, mothers perceived more disclosure of adolescents at T1. Yet, the emotional affect ratio at T1 was not related to maternal control at T1. In contrast to adolescent disclosure the stability of maternal control from T1 to T6 was rather low. Finally, maternal control and adolescent disclosure were not concurrently associated at T1 and T6.

¹ We checked whether results were the same when controlling for the duration of positive affect and negative affect separately (instead of controlling for the emotional affect ratio). Similar results were obtained. More emotional variability of dyads was significantly related to more negative affect and more positive affect during the conflict interactions in early adolescence, indicating that more emotionally variable dyads indeed flexibly switch among both positive and negative emotions. Thus, in order to reduce the number of variables in our analysis we decided to include the emotional affect ratio in the model.

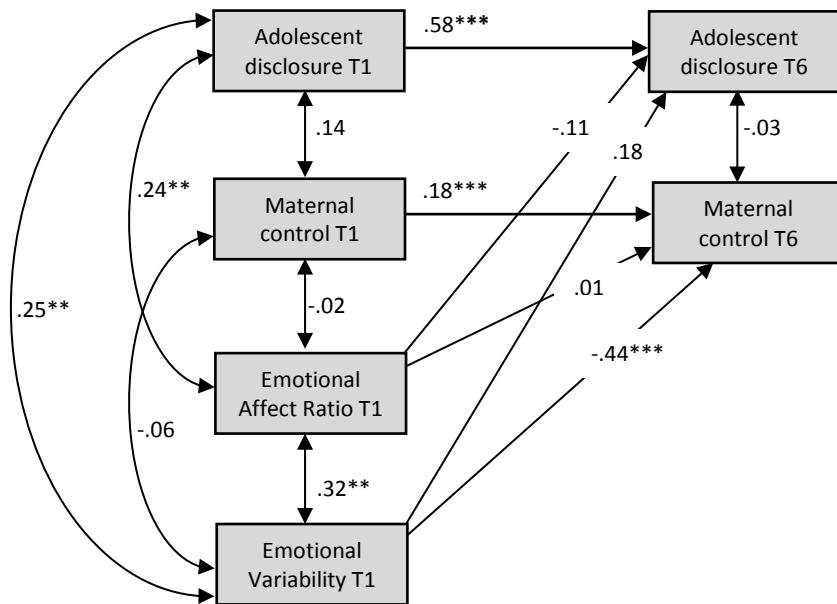


Figure 8. Standardized Parameter Estimates for the Concurrent and Longitudinal Associations between Emotional Variability, Adolescent Disclosure, and Maternal Control, while Controlling for the Emotional Affect Ratio

Note. ** = $p < .01$, *** = $p < .001$.

Discussion

The aim of this study was to examine associations between emotional variability of mother-adolescent dyads observed during conflict interactions in early adolescence and mothers' perceptions of adolescent disclosure and maternal control in early and late adolescence. Results supported our hypothesis from a dynamic systems perspective (e.g., Fogel, 1993) that more emotional variability in mother-adolescent conflict interactions is helpful in adaptively dealing with relational challenges that arise during adolescence. More emotional variability in early adolescence was associated with (a) higher levels of adolescent disclosure in early adolescence, and (b) relative decreases in levels of maternal control from early to late adolescence.

As expected, emotional variability in conflict interactions and *adolescent disclosure* were positively associated in early adolescence. That is, when mother-

adolescent dyads were more able to flexibly switch among a broad range of positive and negative emotions during conflict interactions, mothers perceived adolescents to generally disclose more information about their friends, activities, and whereabouts to them. This result supports the idea that more emotional variability during conflict interactions is a potential indicator of more open communication and a context which is accepting of both positive and negative emotions. More open communication and mutual understanding is important for adequately handling conflict interactions during adolescence (Adams & Laursen, 2007; Butler, 2011; Petronio, Jones, & Morr, 2004). Adolescent disclosure seems to be facilitated when mother-adolescent dyads more openly and flexibly express emotions towards each other during conflict interactions.

This finding puts some nuances to earlier studies which have shown that more conflicts between mothers and adolescents, and more negative emotional responses of mothers were related to fewer disclosures of adolescents (e.g., Marshall et al., 2005; Tilton-Weaver et al., 2010). Yet, when mother-adolescent dyads are able to flexibly express all of their emotions, both positive and negative, within conflict interactions, this could be indicative of a safe and supportive interaction context, and adolescents might therefore also feel free to discuss everyday issues with their mothers indicating higher levels of disclosure. In fact, our results also showed that when dyads were observed to let out relatively more negative than positive emotions during conflict interactions, adolescents were also perceived by mothers to open up about their leisure time. Earlier studies examining inter-individual differences in adolescent disclosure predominantly focused on adolescents' general perceptions of negative or positive responses of mothers (e.g., Tilton-Weaver et al., 2010). Yet, the current study elicited real-time emotions of mother-adolescent dyads during conflicts. As such, relatively more negative than positive emotions during these conflicts might not be perceived by adolescents as potentially conflictual or negative, and therefore these adolescents perhaps do not feel discouraged to disclose information to their mothers. Taken together, during early adolescence conflict interactions should be an interaction context in which mother-adolescent dyads can safely and easily express both positive and negative emotions, and such conflict interactions might facilitate adolescents' disclosure of information to mothers.

In contrast with our expectations and the considerable correlation coefficient, results revealed that emotional variability in early adolescence did not predict adolescent disclosure in late adolescence, when controlling for disclosure in early

adolescence. This result might be explained by the considerable stability of adolescent disclosure from early to late adolescence, which suggests that more emotional variability of mother-adolescent dyads is related to stable levels of adolescent disclosure, and may therefore reflect relatively stable open communication patterns of dyads.

Furthermore, although as expected more emotional variability in early adolescence predicted relative decreases of *maternal control* from early to late adolescence, emotional variability was, in contrast with our expectations, not concurrently associated with maternal control in early adolescence. These findings suggest that more emotional variability during conflict interactions enables mothers to gradually relax control over time and may actually push the relationship towards a more horizontal distribution of power by the end of adolescence. A great deal of studies, as well as the current study, has shown that mothers tend to relax control from middle adolescence onwards (e.g., Bosma et al., 1996; Keijsers & Poulin, in press). Relatively higher levels of maternal control is considered to be normative in early adolescence (Eccles et al., 1991; Smetana, 2011), which might explain the non-significant relation between emotional variability and maternal control in early adolescence. Yet, in order to support adolescents' increasing need for autonomy, mothers need to increasingly allow adolescents to make decisions without informing their mothers first (Branje et al., 2012; Steinberg & Silverberg, 1986). Mothers, however, can vary in their willingness or ability to let go of their control over adolescents. As such, more emotional variability might characterize mother-adolescent dyads who exchange discordant thoughts, expectations, and arguments during conflict interactions, which might result in adequately negotiating adolescents' autonomy, and in mothers exerting less control by late adolescents. Taken together, our findings suggest that relative decreases in maternal control from early to late adolescence is facilitated through flexibly expressing a broad range of positive and negative emotions during conflict interactions in early adolescence.

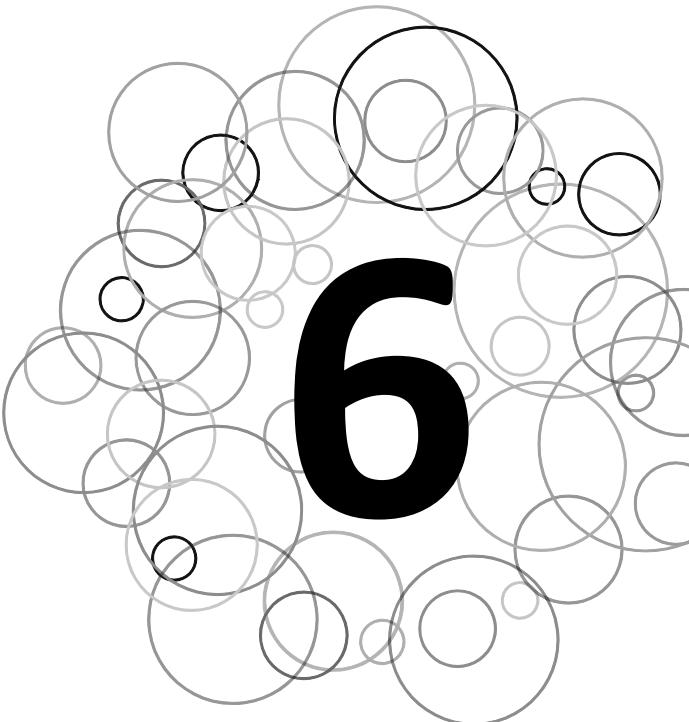
Strengths, Limitations, and Future Directions

Although the current study has a number of important strengths, such as the longitudinal and multi-method design, several limitations should also be noted and addressed in future research. First, the current study investigated emotional variability during conflict interactions, because conflict interactions are considered to play an important role in reorganization mother-adolescent relationships during

adolescence (Adams & Laursen, 2007). Yet, mother-adolescent dyads also face different and increasingly complex interpersonal contexts, and emotional demands are distinct across these contexts (Collins & Steinberg, 2006). Future research could, therefore, address whether emotional variability in other interaction contexts is also a marker of more adolescent disclosure and predictive of less maternal control. Second, the current data were gathered from a relatively homogeneous sample of Caucasian mothers and adolescents from relatively high SES families, which limits the generalizability of the findings beyond the current sample. To contribute to the present literature future studies should examining emotional variability among more diverse samples. Third, the data used in the current study did not allow us to examine the developmental order between emotional variability and both adolescent disclosure and maternal control, and we were, thus, not able to infer the directional order of these associations. Future research could investigate whether emotional variability predicts subsequent levels of adolescent disclosure and maternal control, or whether adolescent disclosure and maternal control predict subsequent levels of emotional variability.

Conclusion

Notwithstanding these limitations, the present study advances our understanding of the role of emotional variability in mother-adolescent interactions in early adolescence for adolescent disclosure and maternal control over the course of adolescence. This study clearly demonstrates that more emotional variability during conflict interactions in early adolescence is associated with higher levels of adolescent disclosure in early adolescence as well as with relative decreases of maternal control from early to late adolescence. More emotional variability of mother-adolescent dyads during conflict interactions might reflect more open communication patterns of these dyads, which may allow adolescents to disclose information about leisure time activities and which may enable mothers to gradually relax control over time. To conclude, through flexibly expressing a broad range of positive and negative emotions during conflict interactions in early adolescence, mother-adolescent dyads seem to be better able to cope with the developmental demands of adolescence.



6

Emotional Variability in Mother- Adolescent Interactions and Internalizing Problems of Mothers and Adolescents: Dyadic and Individual Processes

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Abstract

Emotional variability during mother-adolescent conflict interactions is considered to be important for healthy socio-emotional functioning of mothers and adolescents. An important question remains whether we should approach emotional variability from a dyadic or individual stance. The current observational study examined whether emotional variability of *dyads*, emotional variability of *mothers*, and emotional variability of *adolescents* during conflict interactions in early adolescence predicted mothers' and adolescents' internalizing problems five years later. The current study used data from 92 mother-adolescent dyads (*Mage T₁* = 13.05; 65.20% boys) who were videotaped at T₁ while discussing a conflict. They also completed questionnaires at the start of the study (T₁) and five years later (T₆) on mothers' internalizing problems, and adolescents' anxiety and depressive symptoms. Hierarchical regression analyses showed that less emotional variability of dyads and emotional variability of mothers at T₁ predicted relative increases in mothers' internalizing problems, adolescents' depressive symptoms, and adolescents' anxiety symptoms from T₁ to T₆. The results were not moderated by the emotional valence (e.g., types of emotions expressed) of conflict interactions. When dyads and mothers were less able to flexibly switch among a broad range of positive and negative emotions during conflict interactions in early adolescence this predicted relative increases in mothers' and adolescents' internalizing problems from early to late adolescence. Results also suggested that emotional variability should be approached from a dyadic stance. Taken together, findings highlighted the importance of considering limited emotional variability in the development and treatment of internalizing problems of mothers and adolescents.

Introduction

During adolescence, mother-adolescent relationships tend to become more egalitarian, and this realignment is thought to coincide with conflict interactions (Laursen & Collins, 2009). The expression of emotions is an integral part of these conflict interactions (Jones, 2001). Whether conflict interactions are functional and are related to healthy socio-emotional functioning depends to a certain extent on how emotions are expressed and handled (Adams & Laursen, 2007; Branje, Laursen, & Collins, 2012; Kashdan & Rottenberg, 2010). In addition to the type of

emotions expressed during mother-adolescent conflict interactions, emotional variability during mother-adolescent conflict interactions is thought to be associated with socio-emotional functioning of both interaction partners (Fogel, 1993; Granic, 2005). *Emotional variability* reflects the ability to flexibly switch between different emotional states from moment-to-moment during interactions (Hollenstein, 2012). Mothers and adolescents who are able to flexibly switch among a broad range of positive and negative emotions during conflicts may adequately deal with the emotional challenges of conflicts by putting across their point of view clearly and to adjust discrepant perceptions accordingly. In contrast, mothers and adolescents who show a tendency to remain in very few emotions, even if these states are neutral or positive, might not be adapting well to the emotional challenges of conflict interactions (Granic, Hollenstein, Dishion, & Patterson, 2003; Lichtwarck-Aschoff, Kunnen, & Van Geert, 2009; Van der Giessen, Branje, Frijns, & Meeus, 2013). More emotionally rigid mother-adolescent dyads might have difficulties expressing, adapting, and regulating their emotions during such interactions (Granic, 2005). Altogether, being able to flexibly switch among a broad range of positive and negative emotions during mother-adolescent conflict interactions is thought to be a hallmark of healthy socio-emotional functioning of both mothers and adolescents.

Recent research (Hollenstein, Granic, Stoolmiller, & Snyder, 2004; Van der Giessen et al., 2013) has shown that lower levels of emotional variability during conflict interactions are associated with higher levels of externalizing problems of children and adolescents. While emotional functioning of mother-adolescent dyads also has been shown to represent a critical dimension of a high risk profile for internalizing problems (e.g., McMakin et al., 2011), most earlier studies did not specifically investigate longitudinal associations between emotional variability during conflict interactions and internalizing problems over the course of adolescence. Internalizing problems often involve difficulties in expressing emotions as well as inhibited emotional responses (Zahn-Waxler, Klimes-Dougan, & Slattery, 2000), and lower levels of emotional variability in conflict interactions may provide a context in which mother-adolescent dyads have little opportunity to learn to openly express different types of emotions and to regulate emotional turmoil (Granic, 2005; Van der Giessen et al., 2013). Thus, problems of mother-adolescent dyads to flexibly express and manage their emotional responses during conflict interactions in early adolescence may be a risk factor for subsequent internalizing problems. The current observational study, therefore, aimed to

extend prior research by examining whether emotional variability during conflict interactions in early adolescence predicted internalizing problems of both mothers and adolescents five years later.

Emotional Variability at a Dyadic Level and Socio-Emotional Functioning

Emotional variability in mother-adolescent interactions has been examined often at a dyadic level, thereby focusing on the movement of mother-adolescent dyads from one dyadic emotional state to another over the course of an interaction (Hollenstein & Lewis, 2006). From a dynamic systems viewpoint (Granic, 2005; Thelen & Smith, 1994), dyads can be regarded as a system that consists of unique interconnected properties that affect each other over the course of time. During social interactions, both partners are continuously active and engaged in the communication, and each partner's emotions are continuously regulated by actions of the other partner. Individuals also dynamically alter their emotions with respect to the ongoing and anticipated emotions of their partners (Fogel, 1993). Emotional expressions during conflict interactions reflect what goes on between dyad members and these emotions, thus, appear to be embedded within a relational context (Campos, Walle, Dahl, & Main, 2011; Hinde, 1997). Therefore, emotions during conflicts are irreducible to each individual's emotions within the dyad, and vital information about the dyadic system is missing when examining only the individuals' emotions and neglecting the other dyads member's emotions (Granic & Patterson, 2006). Thus, when examining emotional variability during mother-adolescent conflict interactions the dyad should be the unit of analysis.

Research has shown that lower levels of emotional variability at a dyadic level (i.e., small emotional repertoire, few switches between emotional states, and high mean durations of emotional states) during parent-child interactions were related to higher levels of concurrent and future socio-emotional problems of children and adolescents. For example, less emotional variability of parent-child dyads during interactions was associated with concurrent internalizing and externalizing behavior and growth in externalizing behavior during kindergarten (Hollenstein et al., 2004), more externalizing problems at age five (Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011), less improvement of children's aggressive behavior after treatment (Granic, O'Hara, Pepler, & Lewis, 2007), and an increase in adolescents' aggressive behavior over time (Van der Giessen et al., 2013). Altogether, less emotional variability of parent-child dyads in conflict interactions has been related to unhealthy socio-emotional functioning, especially externalizing

problems, during childhood and adolescence. However, the predictive role of emotional variability of dyads for subsequent internalizing problems of adolescents has received less attention.

Emotional Variability at an Individual Level and Socio-Emotional Functioning

Despite the apparent role, according to theory (Granic, 2005) and research (Hollenstein et al., 2004; Van der Giessen et al., 2013), of emotional variability at a dyadic level for socio-emotional functioning it is possible that emotional variability of each individual within a dyad is the key factor in predicting adolescents' socio-emotional functioning. In contrast to the propositions of a dynamic systems approach (Granic & Patterson, 2006), higher levels of emotional variability could reflect more variability in emotions of just one dyad member, instead of more emotional variability of both dyad members together. On the one hand, adolescents could pull mother-adolescent dyads into more emotional variability during conflict interactions. Compared to mothers, adolescents experience greater extremes of emotion, with a bigger range between higher and lower moods than mothers, and adolescents' mood states tend to be less persistent and quicker to dissipate than those of mothers (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996; Larson, Moneta, Richards, & Wilson, 2002). These frequent changes in emotional states are considered to be more normative during adolescence and to be related to healthy socio-emotional functioning (Collins & Steinberg, 2006). On the other hand, mothers could also pull dyads into more emotional variability during conflict interactions. Mothers who freely display a wide range of emotions teach adolescents a variety of emotions and teach them to appropriately express, adapt, and regulate these emotions, and this is thought to be important for adolescents' healthy affective functioning (Morris, Silk, Steinberg, Myers, & Robinson, 2007). Thus, emotional variability at an individual level is distinct from emotional variability at a dyadic level, and could be more important in the prediction of socio-emotional functioning of adolescents.

Despite the importance of also investigating the predictive effects of emotional variability of each individual within a dyad on adolescents' socio-emotional functioning, there is no research yet examining the associations between individuals' emotional variability during mother-adolescent conflict interactions and adolescents' internalizing problems. Nevertheless, there are studies that have shown concurrent and longitudinal links between temporal stability in individuals' emotional states during mother-child interactions and adolescents' depressive

symptoms. For example, when adolescents' emotional states during parent-adolescent interactions showed a high degree of emotional inertia, operationalized as a high autocorrelation, this was related to higher levels of depressive symptoms (Koval, Kuppens, Allen, & Sheeber, 2012). Adolescents' emotional inertia also predicted the emergence of clinical depression 2.5 years later, above the emotional valence of parent-adolescent interactions (Kuppens et al., 2012). Furthermore, longer durations of adolescents' negative emotions and of mothers' negative emotions during mother-adolescent interactions have been associated with higher levels of adolescents' depressive symptoms (McMakin et al., 2011; Sheeber, Allen, Davis, & Sorensen, 2000; Sheeber et al., 2009; Sheeber et al., 2012). These studies, thus, showed the predictive effects of one dyad member's (i.e., mothers or adolescents) emotions on adolescents' depressive symptoms. However, most studies examining the predictive effects of one dyad member's emotions tended to neglect the other dyad member's emotions, and studies used different conceptualizations of moment-to-moment changes in individuals' emotions, such as autocorrelation or temporal stability. Therefore, the current study examined the role of emotional variability of both dyads members, namely mothers and adolescents, in predicting adolescents' internalizing problems.

Unresolved Issues in the Existing Research on Emotional Variability

Taken together, moment-to-moment changes in dyadic and individual emotions were related to adolescents' socio-emotional functioning. The current study extended previous studies in a number of important ways. First, an important question remained whether emotional variability in conflict interactions should be approached from a dyadic or individual stance. For prevention and intervention efforts it is crucial to know whether emotional functioning of dyads or individuals is most relevant to the development of internalizing problems. The current observational study therefore examined associations of emotional variability of dyads, emotional variability of mothers, and emotional variability of adolescents during conflict interactions with subsequent levels of adolescents' internalizing problems. Based on a dynamic systems approach (Fogel, 1993; Granic, 2005; Thelen & Smith, 1994), we hypothesized that emotional variability measured at a dyadic level would predict subsequent internalizing problems better than emotional variability measured at the individual level.

Second, the current study not only focuses on adolescents' internalizing problems, but also on mothers' internalizing problems. Mothers have been found

to report increased anxiety and depression when faced with repetitive and stressful conflicts over day-to-day issues with adolescents (Steinberg, 2001). Constructively engaging in conflict interactions with adolescents is also thought to be an important challenge for mothers during this age period and unsuccessful reconciliation could be experienced by mothers as personal failure (Branje et al., 2012; Silverberg & Steinberg, 1990). Indeed, emotional variability during mother-adolescent interactions was found to be concurrently related to maternal depression (Connell, Hughes-Scalise, Klostermann, & Azem, 2011). The current study contributed to this existing literature by examining longitudinal associations of emotional variability at an individual and a dyadic level with mothers' internalizing problems.

Third, no studies have examined the longitudinal link between emotional variability and internalizing problems over the course of adolescence. Adolescence may be a particularly important phase to examine the role of conflict interactions in emotional development of both mothers and adolescents, as the way mother-adolescent dyads handle conflict interactions is thought to be important for realigning their relationship and for healthy socio-emotional functioning (Adams & Laursen, 2007; Branje et al., 2012). Hence, this study examined whether emotional variability during early adolescence predicted mothers' and adolescents' internalizing problems five years later.

Finally, the current study addressed whether the emotional valence interacted with emotional variability when predicting internalizing problems. Several studies showed that associations between emotional variability and socio-emotional functioning did not depend on average levels of negativity or positivity during conflict interactions (Hollenstein et al., 2004; Kuppens et al., 2012; Van der Giessen et al., 2013). In contrast, when specifically examining the moderating effect of emotional valence (Lunkenheimer et al., 2011) showed that greater parent-child emotional variability combined with greater positive affect during the interactions predicted fewer externalizing problems during early childhood, suggesting that adaptive interactions during early childhood were characterized by a combination of more emotional variability and more positive affect. However, knowledge is still limited whether the emotional valence of conflict interactions moderates the longitudinal associations between emotional variability and internalizing problems of mothers and adolescents.

The Current Study

In sum, the current observational study examined longitudinal associations between emotional variability during mother-adolescent conflict interactions and internalizing problems of mothers and adolescents five years later. The current study specifically investigated the role of emotional variability of dyads, mothers, and adolescents for subsequent internalizing problems. Finally, it was also explored whether the emotional valence of conflict interactions moderated the longitudinal associations between emotional variability and internalizing problems.

Method

Participants

Participants were 92 mother-adolescent dyads who were a subsample of a larger longitudinal research project called “Research on Adolescent Development And Relationships Young” (RADAR Young). This is an ongoing longitudinal study in the Netherlands that focuses on the development of relationships and problem behavior in adolescence. The current study used data of the first (T1) and sixth (T6) measurement waves with a 5-year interval. At the first wave, the mean age of the mothers was 44.87 years ($SD = 4.83$), and the mean age of the adolescents was 13.01 years ($SD = .52$). The sample consisted of 54 boys (58.7%) and 38 girls (41.3%). At the first wave, adolescents were in the first grade of junior high. Most adolescents lived in medium or high SES families (92.4%).

Attrition in the observation sample was 18.48% from T1 to T6. Chi-square and *T*-test analyses revealed no differences in gender, family SES, age, and outcome variables between participants who participated at T1 and T6 and participants who dropped out of the study. Little’s (1988) Missing Completely At Random (MCAR) Test produced a normed χ^2 (χ^2/df) of 1.03 which indicates a good fit between sample scores with and without imputation (Bollen, 1989). Missing values were therefore imputed using Multiple Imputation techniques (LISREL 8.7) with an EM algorithm (Baraldi & Enders, 2010). Imputed data were used in further analyses.

Procedure

Participants were recruited from several randomly selected Dutch schools in the province of Utrecht, and the cities of Amsterdam, Rotterdam, The Hague, and Almere. Teacher screening and parent interviews were used to select the 497 families in the “RADAR Young” sample. Participants received written information

describing the research project. At the first wave, 102 mother-adolescent dyads were randomly selected from the total “RADAR Young” sample to also participate in videotaped interactions tasks. Ninety-two dyads were willing to participate and provided written informed consent. The present study used this subsample of 92 mother-adolescent dyads. During home visits, mothers and adolescents filled out several questionnaires, and they were videotaped during conflict interactions. In addition to the written instructions, research assistants provided verbal instructions about conflict interaction task and the questionnaires. Families received €100 per home-visit. This study was approved by the medical ethics committee of the University Medical Center in Utrecht.

Conflict Interaction Task

Mothers and adolescents were asked to choose an issue that they discussed most often during the last month. We provided the Interpersonal Conflict Questionnaire (Laursen, 1995), which lists topics of frequent family conflicts (e.g., chores, school problems, curfews), as an aid to selecting topics. Mothers and adolescents had to resolve the conflict issue within 10 minutes ($M = 7.59$ minutes; $SD = 2.00$ minutes), and their discussion was videotaped. Next, each conflict interaction task was coded using a simplified version of the SPecific AFFect coding system (SPAFF: Gottman, McCoy, Coan, & Collier, 1996). This modified SPAFF version has been applied successfully to parent-child interactions (Hollenstein et al., 2004). SPAFF identifies the affects or emotions expressed during parent-child interactions through a combination of verbal content, voice tone, facial expression, and physical cues. Coders categorized the affects displayed using four positive codes (affection, enthusiasm, humor, interest), five negative codes (complaining, sadness, fear, anger, contempt), and a neutral code (refers to statements and information exchange that are non-emotional in content and voice tone). The 10 mutually exclusive affect codes were recorded continuously in real time for mothers and adolescents independently. Observational codes were recorded using The Observer XT 9.0 (Noldus Information Technology, 2009). Coders were trained intensively over a 3-month period to achieve a minimum inter-observer criterion of 75% agreement and .65 kappa. To maintain these criteria, weekly discussion meetings were conducted. Twenty percent of the videotaped interactions were independently coded by two coders to provide estimates of reliability. Coders were unaware which sessions were used to assess observer agreement. The average inter-observer agreement at T1 was .73 kappa.

Measures

Emotional variability. The data of each conflict interaction were plotted on state space grids in GridWare 1.15a (Lamey, Hollenstein, Lewis, & Granic, 2004). This program plots the real-time emotions (SPAFF codes) during the conflict interactions on state space grids (see Figure 9a, 9b, and 9c). A grid represents all possible emotional combinations, and each cell on the grid represents a potential emotional state. A trajectory is plotted through the successive points on the grid in the same order that the emotions proceed in real time. In the current study, grids were created separately for sequences of emotional states of mother-adolescent dyads and sequences of emotional states of individuals, namely mothers and adolescents. For dyadic grids, the mother's coded emotions were plotted on the x-axis and the adolescent's emotions were plotted on the y-axis. During the conflict discussions, 10 possible emotions or SPAFF codes were available to both mothers and adolescents, and thus, the state space grids for dyads consisted of 100 cells (10 codes of mothers * 10 codes of adolescents). Each cell on the grid represents a dyadic emotional state. For individual grids of mothers we plotted coded emotions of mothers on both x-axis and y-axis, and for individual grids of adolescents we plotted coded emotions of adolescents on both x-axis and y-axis. Individuals (i.e., mothers or adolescents) only visit the cells along the diagonal, and each of these cells represents an individual emotional state. During the conflict discussions, 10 possible emotions or SPAFF codes were available to individuals, and thus the state space grids for individuals consisted of 10 cells (Hollenstein, 2012).

Two distinct measures of emotional variability (i.e., transitions and dispersion) were derived from GridWare 1.15a (Lamey et al., 2004) for mother-adolescent dyads, for mothers, and for adolescents separately. First, *transitions* assess the number of changes or movements per minute between cells on the state space grid, which refers to the amount of emotional flexibility. The number of transitions per minute was divided by the total duration in minutes of the interaction to correct for differences in total duration of the interactions. Higher values indicate more frequent changes per minute between emotional states and therefore more emotional variability (M dyads $T1 = 5.17$, $SD = 2.59$; M mothers $T1 = 3.09$, $SD = 1.79$; M adolescents $T1 = 2.16$, $SD = 1.81$). Second, *dispersion* assesses the spread of emotional states, which refers to the range of the emotional repertoire. Specifically, dispersion is calculated as the sum of the squared proportional duration across all cells adjusted for the total number of cells in the grid. Dispersion ranges from 0 to 1, with values close to one indicating that behavior was equally

distributed across cells and values of zero indicating that behavior was in only one cell. The formula that was used by GridWare to calculate dispersion is: $1 - [(n \sum (di/D)^2) - 1] / [n - 1]$. D refers to the total duration of the interaction, di is the duration in cell i on the grid, and n indicates the total number of possible cells on the grid. Higher values indicate a broader emotional repertoire and thus more emotional variability (M dyads T1 = .34, SD = .17; M mothers T1 = .25, SD = .16; M adolescents T1 = .19, SD = .14). Both measures of emotional variability have been shown to exhibit good reliability and predictive validity (Granic et al., 2007; Hollenstein et al., 2004). Furthermore, these measures can be used as both individual and dyadic indices of emotional variability.

The correlations between transitions and dispersion were quite high; .80 ($p < .001$) for dyads, .65 ($p < .001$) for mothers, and .88 ($p < .001$) for adolescents. Therefore, an *emotional variability* construct was created for dyads, mothers, and adolescents separately. Each emotional variability construct combined the Z-scores of transitions and dispersion, thereby reflecting two different aspects of emotional variability, namely emotional flexibility and the emotional repertoire. This resulted in one measure of emotional variability at a dyadic level and two measures of emotional variability at an individual level, namely emotional variability of mothers and adolescents. Higher scores indicate higher levels of emotional variability.

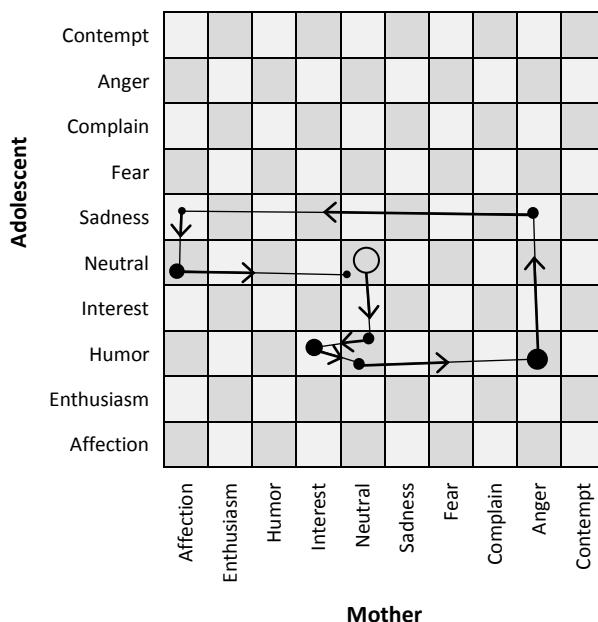


Figure 9a. An example of a dyadic state space grid depicting a sequence of emotions of a *mother-adolescent dyad*.

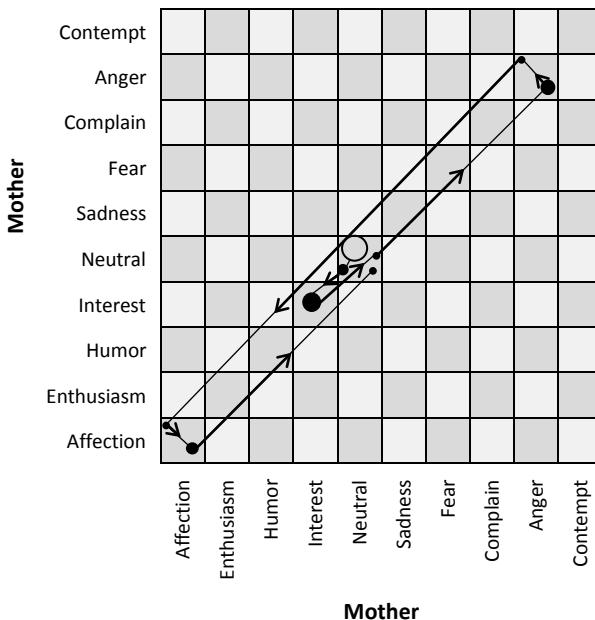


Figure 9b. An example of an individual state space grid depicting a sequence of emotions of the mother.

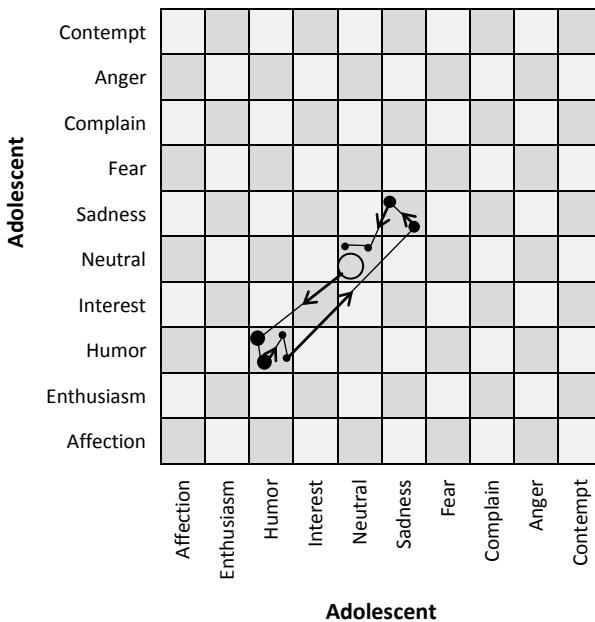


Figure 9c. An example of an individual state space grid depicting a sequence of emotions of the adolescent.

Emotional affect ratio. To capture the overall emotional valence of the interactions, we calculated the *emotional affect ratio*. Affect ratios have been found to be good predictors of individuals' well-being during adolescence and adulthood (Fredrickson & Losada, 2005; Silk et al., 2011). We first derived from GridWare the total duration in seconds of positive affect and negative affect of mother-adolescent dyads. The grids were divided into two distinct regions, based on whether positive or negative affect was expressed during the interaction. Positive affect included the SPAFF codes affection, enthusiasm, humor, and interest. Negative affect included the SPAFF codes complain, sadness, fear, complain, anger, and contempt. Next, to correct for differences in interaction duration, the duration of positive and negative affect of dyads was each divided by the total duration of the interaction and then multiplied with 100 ((e.g., duration negative affect / duration total interaction) *100)). This way, the duration of positive affect and the duration of negative affect of dyads represented the percentage of positive and negative affect as a function of the total duration of the interaction. Finally, these corrected measures of positive and negative affect were used to calculate an emotional affect ratio. This ratio represents the proportion of positive versus negative affect of dyads during an interaction (negative affect / (positive affect + negative affect)). Higher scores indicated that dyads showed more negative affect than positive affect during interactions.

Mothers' internalizing problems. The Adult Self-Report ASR (Achenbach & Rescorla, 2003) was used to assess *mothers' internalizing problems*. Mothers completed the 39 items of the subscales "Withdrawn" (e.g., I am fearful or anxious), "Somatic Complaints" (e.g., heart pounding) and "Anxious/Depressed" (e.g., I keep from getting involved with others) which together comprises the internalizing problems scale. Good reliability and validity have been demonstrated for the ASR. Items were rated on a three-point scale ranging from 0 (not true) to 2 (often true). The 39 items were averaged to compute a mean score, with higher mean scores indicating higher levels of internalizing problems. Cronbach's alpha was .90 at T1 and .90 at T6 in the current study.

Adolescents' internalizing problems. To assess adolescents' internalizing problems we used two questionnaires. The Reynolds Adolescent Depression Scale 2nd edition (RADS-2) measured *adolescents' depressive symptoms*. This is a self-report measure designed as a clinical tool for the identification of depression in adolescents (Reynolds, 2004). Adolescent completed the subscales 'Dysphoric Mood' (8 items; "I feel like crying"), 'Negative Self-Evaluation' (8 items; "I feel I am

bad") and 'Somatic Complaints' (7 items; "I am tired"). Items were rated on a four-point scale ranging from 1 (almost never) to 4 (most of the time). To compute a mean score all items were averaged with higher mean scores indicating higher levels of depressive symptoms. Internal consistency, test-retest reliability, and validity all have been strongly established (Reynolds, 2004). The RADS-2 was translated to Dutch using the procedure described by Varni, Seid, and Rode (1999), including forward and backward translation, and pilot testing. Cronbach's alpha was .94 at T1 and .95 at T6 in the current study.

The Dutch version of the original 38-item Screen for Child Anxiety Related Emotional Disorders (SCARED: Birmaher et al., 1997) measured *adolescents' anxiety symptoms*. The SCARED is a self-report questionnaire that assesses the occurrence of adolescent anxiety symptoms on a three point Likert scale: 0 (almost never), 1 (sometimes), or 2 (often). Adolescents completed the subscales "Panic Disorder symptoms" (e.g., I'm afraid of having anxiety or panic attacks), "Generalized Anxiety Disorder symptoms" (e.g., I worry if others will like me), "Separation Anxiety Disorder symptoms" (e.g., I worry something bad might happen to my parents), "Social Phobia symptoms" (e.g., I feel shy with people I don't know well), and "School Anxiety symptoms" (e.g., I worry about going to school). The 38 items were averaged to compute an overall anxiety symptoms mean score, with higher mean scores indicating higher levels of anxiety symptoms. Psychometric properties of the SCARED have shown to be good in several studies (Hale, Crocetti, Raaijmakers, & Meeus, 2011). In the current study, Cronbach's alpha was .91 at T1 and .94 at T6.

Strategy of Analyses

We used hierarchical regression analyses to examine whether emotional variability at T1 predicted mothers' internalizing problems at T6, adolescents' depressive symptoms at T6, and adolescents' anxiety symptoms at T6. We conducted analyses separately for each measure of internalizing problems, and we controlled for gender, internalizing problems at T1, and the emotional affect ratio at T1 in the first step of all analyses. Because emotional variability of dyads is comprised of emotional variability of mothers and adolescents, it was not possible to include emotional variability of dyads and of individuals as predictors in the same hierarchical regression analysis. Therefore, we ran separate analyses for emotional variability of dyads and individuals. Furthermore, in order to investigate independent contributions of mothers' and adolescents' emotional variability at T1

on internalizing problems at T6, we used emotional variability of mothers and emotional variability of adolescents as predictors in separate analyses. The current study, therefore, examined independent contributions of emotional variability of dyads, mothers, and adolescents on subsequent internalizing problems. Finally, to examine whether associations between emotional variability at T1 and internalizing problems at T6 were moderated by the proportion of negative and positive affect expressed at T1, statistical interactions between emotional variability and the emotional affect ratio were entered as a final step in all analyses. Variables were centered before creating the interaction terms.

Table 11. Zero-order Correlations Between Emotional Variability, Internalizing Problems, and the Emotional affect ratio

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Emotional variability dyads T1	-									
2. Emotional variability mothers T1	.84**	-								
3. Emotional variability adolescents T1	.74**	.35**	-							
4. Mothers' internalizing problems T1	-.10	-.13	-.03	-						
5. Adolescents' depressive symptoms T1	.01	-.09	-.07	.14	-					
6. Adolescents' anxiety symptoms T1	-.06	-.20	.05	.15	.66***	-				
7. Mothers' internalizing problems T6	-.24*	-.29**	-.11	.47**	.14	.15	-			
8. Adolescents' depressive symptoms T6	-.14	-.26**	-.08	.15	.26*	.50***	.15	-		
9. Adolescents' anxiety symptoms T6	-.16	-.30***	-.06	.15	.44**	.41***	.16	.79***	-	
10. Emotional affect ratio T1	.11	-.05	.33***	.06	-.03	.09	.23*	.02	.19	-
<i>M</i>	0.00	0.00	0.00	0.19	1.60	1.35	0.16	1.57	1.26	56.31
<i>SD</i>	0.96	0.91	0.97	0.17	0.51	0.35	0.17	0.62	0.29	24.66

Note. The emotional variability construct combined the Z-scores of transitions per minute and dispersion, and therefore the mean score represented here is zero. For the raw mean score of transitions per minute and dispersion, the reader is referred to the description of the measures in the method section on page 116/117. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Results

Descriptive Statistics

Table 11 presents the descriptive statistics of all study variables and the zero-order correlations between all study variables. It is noteworthy that emotional variability of mothers and emotional variability of adolescents were only moderately correlated ($r = .35$), in particular compared to correlations of both emotional variability of mothers and adolescents with emotional variability of dyads. Using the Fisher r-to-z transformation the significance of the difference between correlation coefficients of emotional variability of dyads and emotional variability of mothers ($r = .84$) and emotional variability of dyads and emotional variability of adolescents ($r = .74$) was calculated. The analysis showed no significant differences between these correlations ($Z = 1.81, p < .01$).

Emotional Variability at a Dyadic Level and Internalizing Problems

Table 12 presents standardized beta coefficients, R-squares, and changes in R-squares are reported for each step of the three hierarchical regression analyses.¹ In three separate hierarchical regression analyses mothers' internalizing problems at T6, adolescents' depressive symptoms at T6, and adolescents' anxiety symptoms at T6 were regressed on *emotional variability of dyads* at T1. Results of these three analyses showed that predictors of *the first step* significantly predicted these outcome measures. Higher levels of mothers' internalizing problems at T1 and of the emotional affect ratio at T1 significantly predicted higher levels of mothers' internalizing problems at T6. Also, adolescent girls had significantly higher levels of depressive symptoms and anxiety symptoms at T6 than adolescent boys. Higher levels of adolescents' depressive symptoms at T1 significantly predicted higher levels of adolescents' depressive symptoms at T6, and higher levels of adolescents' anxiety symptoms at T1 significantly predicted higher levels of adolescents' anxiety symptoms at T6. Furthermore, in all three analyses, results of the *second step* revealed that after controlling for gender, internalizing problems at T1, and the emotional affect ratio, emotional variability of dyads at T1 significantly predicted mothers' internalizing problems at T6, adolescents' depressive symptoms at T6,

¹ We checked whether results were the same when using the duration of positive affect and the duration of negative affect instead of the emotional affect ratio and similar results were found. In order to reduce the number of variables in our analysis we decided to retain the emotional affect ratio in current analyses.

and adolescents' anxiety symptoms at T6. This indicates that when mother-adolescent dyads showed less emotional variability at T1, mothers showed a relative increase in internalizing problems from T1 to T6, and adolescents showed a relative increase in depressive symptoms and anxiety symptoms from T1 to T6. Finally, in all three analyses, results of the *third step* showed that the two-way interaction between emotional variability of dyads and the emotional affect ratio did not contribute significantly to the prediction of the outcome measures. Emotional variability of dyads at T1 accounted for 5% of the variance in mothers' internalizing problems at T6 ($F(4, 87) = 10.07, p < .001$), for 3% of the variance in adolescents' depressive symptoms at T6 ($F(4, 87) = 14.56, p < .001$), and for 4% of the variance in adolescents' anxiety symptoms at T6 ($F(4, 87) = 9.47, p < .001$).

In sum, in line with our expectations less emotional variability of dyads at T1 significantly predicted a relative increase in mothers' internalizing problems, adolescents' depressive symptoms, and adolescents' anxiety symptoms from T1 to T6. These longitudinal predictive effects of emotional variability at a dyadic level were of considerable strength, also considering that we controlled for gender, previous levels of internalizing problems, and the overall emotional valence of the interaction.

Emotional Variability at an Individual Level and Internalizing Problems

Table 13 and Table 14 present standardized beta coefficients, R-squares, and changes in R-squares for each step of the three hierarchical regression analyses for mothers' and adolescents' emotional variability respectively. In three separate hierarchical regression analyses mothers' internalizing problems at T6, adolescents' depressive symptoms at T6, and adolescents' anxiety symptoms at T6 were regressed on *emotional variability of mothers* at T1 (see Table 13). The results of the *first step* were the same as with the analyses at the dyadic level.² In all three analyses, results of the *second step* showed that, after controlling for gender,

² In order to also examine unique contributions of emotional variability of mothers and adolescents at T1 on internalizing problems at T6, we also entered emotional variability of mothers and adolescents jointly as predictors in the three hierarchical regression analyses. Results showed that only predictors of the first step significantly predicted the three outcome measures, and regression paths were similar to those reported in Table 13 and 14. Most importantly, results of the second step showed that neither emotional variability of mothers nor emotional variability of adolescents at T1 significantly predicted the three outcome measures. Thus, there was no effect of emotional variability of mothers while controlling for emotional variability of adolescents and vice versa. Finally, results revealed that both two-way interactions and three-way interactions among emotional variability of mothers, emotional variability of adolescents, and the emotional affect ratio did not contribute significantly to the prediction of the three outcome measures.

internalizing problems at T1, and the emotional affect ratio, emotional variability of mothers at T1 significantly predicted mothers' internalizing problems at T6, adolescents' depressive symptoms at T6, and adolescents' anxiety symptoms at T6. These results indicated that when mothers showed less emotional variability at T1, mothers showed a relative increase in internalizing problems from T1 to T6, and adolescents showed a relative increase in depressive symptoms and anxiety symptoms from T1 to T6. Finally, in all three analyses, results of the *third step* showed that the two-way interaction between emotional variability of mothers and the emotional affect ratio did not contribute significantly to the prediction of the outcome measures. Emotional variability of mothers at T1 accounted for 5% of the variance in mothers' internalizing symptoms at T6 ($F(4, 87) = 9.88, p < .001$), for 4% of the variance in adolescents' depressive symptoms at T6 ($F(4, 87) = 15.29, p < .001$), and for 5% of the variance in adolescents' anxiety symptoms at T6 ($F(4, 87) = 10.21, p < .001$).

Finally, in three separate hierarchical regression analyses mothers' internalizing problems at T6, adolescents' depressive symptoms at T6 and adolescents' anxiety symptoms at T6 were regressed on *emotional variability of adolescents* at T1 (see Table 14). In all three analyses, results of the *second step* showed that, after controlling for gender, internalizing problems at T1, and the emotional affect ratio, emotional variability of adolescents at T1 did not significantly predict mothers' internalizing problems at T6, adolescents' depressive symptoms at T6, and adolescents' anxiety symptoms at T6. Finally, in all three analyses, results of the *third step* showed that the two-way interaction between emotional variability of adolescents and the emotional affect ratio did not contribute significantly to the prediction of the outcome measures.

Taken together, results showed that less emotional variability of mothers at T1 significantly predicted a relative increase in mothers' internalizing problems, adolescents' depressive symptoms, and adolescents' anxiety symptoms from T1 to T6. Emotional variability of adolescents at T1 did not significantly predict mothers' internalizing problems, adolescents' depressive symptoms, and adolescents' anxiety symptoms at T6. It should be noted that regression coefficients regarding emotional variability of adolescents appeared to be in the same direction and almost as strong as regression coefficients regarding emotional variability of mothers.

Table 12. Longitudinal Hierarchical Regression Analyses Predicting Mothers' Internalizing Problems and Adolescents' Depressive and Anxiety Symptoms at T6 as a Function of Emotional Variability of Dyads at T1

	Mothers' internalizing problems T6			Adolescents' depressive symptoms T6			Adolescents' anxiety symptoms T6		
	R^2		R^2 change	R^2		R^2 change	R^2		R^2 change
	Step 1	.27	.27***	.37	.37***	.0	.27	.27***	.0
Gender		.01			.23*		.31**		
Internalizing problems T1		.46***			.53***		.30**		
Emotional affect ratio T1		.21*			-.05		.06		
Step 2									
Gender		.04			.25**		.34**		
Internalizing problems T1		.44***			.52***		.27**		
Emotional affect ratio T1		.22*			-.04		.07		
Emotional variability Dyads		-.23*			-.22*		-.21*		
Step 3									
Gender		.03			.25*		.34**		
Internalizing problems T1		.43***			.52***		.28**		
Emotional affect ratio T1		.22*			-.04		.07		
Emotional variability Dyads		-.24*			-.22*		-.21*		
Emotional variability		.03			.02		.02		
Dyads*Emotional affect ratio		.00			.00		.00		

Note. Gender: 0 = male, 1 = female. R^2 = squared multiple correlation, B = standardized regression coefficient. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 13. Longitudinal Hierarchical Regression Analyses Predicting Mothers' Internalizing Problems and Adolescents' Depressive and Anxiety Symptoms at T6 as a Function of Emotional Variability of Mothers at T1

	Mothers' internalizing problems T6						Adolescents' depressive symptoms T6						Adolescents' anxiety symptoms T6					
	<i>R</i> ²		<i>R</i> ² change		<i>B</i>		<i>R</i> ²		<i>R</i> ² change		<i>B</i>		<i>R</i> ²		<i>R</i> ² change		<i>B</i>	
	Step 1	.27	.27***				.37	.37***				.27		.27	.27***			
Gender				.01					.23*						.30**			
Internalizing problems T1				.46***					.53***						.30**			
Emotional affect ratio T1				.21*					-.05						.06			
Step 2																		
Gender				.01					.23**						.32**			
Internalizing problems T1				.44***					.51***						.25**			
Emotional affect ratio T1				.20*					-.06						.04			
Emotional variability Mothers T1				-.21*					-.21*						-.24*			
Step 3																		
Gender				.01					.41						.28			
Internalizing problems T1				.45***					.23**						.32**			
Emotional affect ratio T1				.21*					.51***						.25**			
Emotional variability Mothers T1				-.20**					-.06						.04			
Emotional variability				-.07					-.15						-.24*			
Mothers*Emotional affect ratio										-.05					-.01			

Note. Gender: 0 = male, 1 = female. R^2 = squared multiple correlation, B = standardized regression coefficient. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 14. Longitudinal Hierarchical Regression Analyses Predicting Mothers' Internalizing Problems and Adolescents' Depressive and Anxiety Symptoms at T6 as a Function of Emotional Variability of Adolescents at T1

	Mothers' internalizing problems T6			Adolescents' depressive symptoms T6			Adolescents' anxiety symptoms T6		
	<i>R</i> ²		<i>R</i> ² change	<i>R</i> ²		<i>R</i> ² change	<i>R</i> ²		<i>R</i> ² change
	Step 1	.27	.27***	.37	.37***	.05	.27	.27***	.06
Gender		.01			.25*			.30**	
Internalizing problems T1		.46***			.53***			.30**	
Emotional affect ratio T1		.21*			-.05			.06	
Step 2		.29	.02		.39	.02		.28	.01
Gender		.07			.28**			.34**	
Internalizing problems T1		.45***			.53***			.29**	
Emotional affect ratio T1		.25*			-.02			.08	
Emotional variability		-.17			-.16			-.18	
Adolescents T1									
Step 3		.30	.01		.39	.00		.28	.00
Gender		.08			.28**			.34**	
Internalizing problems T1		.45***			.53***			.29**	
Emotional affect ratio T1		.25*			-.01			.08	
Emotional variability Adolescents T1		-.15			-.15			-.18	
Emotional variability		-.06			-.05			-.06	
Adolescents*Emotional affect ratio									

Note. Gender: 0 = male, 1 = female. R^2 = squared multiple correlation, B = standardized regression coefficient. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Discussion

How emotions are handled from moment-to-moment during mother-adolescent conflict interactions might provide important information regarding mothers' and adolescents' internalizing problems over time. The main goal of the current observational study was to examine longitudinal associations between emotional variability during mother-adolescent conflict interactions in early adolescence and mothers' and adolescents' internalizing problems five years later. This study builds upon existing studies by examining emotional variability at a dyadic and an individual level (i.e., mothers and adolescents). Findings revealed that less emotional variability of dyads and less emotional variability of mothers in early adolescence predicted relative increases in mothers' and adolescents' internalizing problems from early to late adolescence. These results were not moderated by the emotional valence of the conflict interactions.

The Role of Emotional Variability for Mother' and Adolescents' Internalizing Problems

Consistent with a dynamic systems approach (Granic, 2005) and with prior research (Connell et al., 2011; Hollenstein et al., 2004; Van der Giessen et al., 2013), the current study demonstrated that emotional variability at a dyadic level was negatively related over time to mothers' internalizing problems, and adolescents' anxiety and depressive symptoms. Mother-adolescent dyads that showed a tendency to remain in very few dyadic emotional states during conflict interactions in early adolescence reported an increase in internalizing symptoms over the course of adolescence. Moreover, these results were not moderated by the emotional affect ratio, indicating that the association between low emotional variability and more internalizing problems did not depend on the emotional valence of the conflict interactions. In line with our expectations, our results seem to offer support for the potential maladaptive function of rigidity in the dyadic emotional repertoire during conflict interactions in early adolescence for internalizing problems of both mothers and adolescents five years later. More emotionally rigid mother-adolescent dyads might be less able to successfully handle emotions during conflict interactions and may be less equipped to flexibly deal with the various emotional challenges and changes that take place during adolescence (Branje et al., 2012; Collins & Steinberg, 2006). These dyads might have difficulties expressing, sharing, adapting, and regulating their emotions during

conflict interactions (Granic, 2005; Gross, 2007), thereby being less able to openly communicate about their feelings and emotions with each other. Less open communication in mother-adolescent relationships has also been found in other studies to be related to internalizing problems (e.g., Kerr & Stattin, 2000). Although it was not possible to infer definitive causal relationships on basis of our analyses, current results indicated that mother-adolescent dyads that showed limited emotional variability in their emotional repertoire were at increased risk for subsequent internalizing problems.

Furthermore, findings revealed that mothers' emotional variability in early adolescence predicted mothers' internalizing problems and adolescents' anxiety and depressive symptoms five years later, while adolescents' emotional variability in early adolescence did not predict these internalizing problems of mothers and adolescents over time. Thus, only among mothers, but not among adolescents, limited emotional variability predicted relative increases in internalizing problems over time. Notwithstanding, it should be noted that differences between regression paths of mothers' and adolescents' emotional variability appeared to be rather small. While current results contradicted earlier studies which showed that adolescents' limited capacity to shift emotions was related concurrently and longitudinally to their depressive symptoms (Koval et al., 2012; Kuppens et al., 2012; Sheeber et al., 2009), present findings extended earlier studies which showed that mothers' longer durations of negative affect and their difficulty returning from a negative emotional state to a neutral or positive emotional state during conflict interactions also predicted children's emotional adjustment (McMakin et al., 2011; Sheeber et al., 2000). These findings might reflect that mothers, instead of adolescents, are the driving force behind dyadic emotional variability. Mothers who freely display a wide range of emotions might teach adolescents to appropriately express, adapt, and regulate a big variety of emotions (Granic, 2005; Morris et al., 2007), and adolescents may, therefore, contribute to dyadic levels of emotional variability mostly through responding to mothers' emotional variability during these conflict interactions. As such, mothers' potentially drive emotional variability of dyads, which would explain the finding that mothers' emotional variability was negatively associated with subsequent internalizing problems. Eventually, mothers and adolescents may be both able to adequately handle the emotional arousal during conflict interactions, explaining the result that emotional variability of dyads was a predictor for both mothers' and adolescents' healthy socio-emotional functioning. Future research could extend our

results by specifically examining the dynamic interplay between emotional variability of mothers and emotional variability of adolescents during conflict interactions. To conclude, current findings that mothers' emotional variability predicted subsequent internalizing problems of mothers and adolescents may suggest that mothers might have pulled mother-adolescent dyads into more emotional variability during conflict interactions.

Altogether, we think that the most important message to be gleaned from this study is that vital information may be missing about the mother-adolescent system when reducing emotional variability during conflict interactions to individuals within these dyads. Earlier studies (e.g., Kuppens et al., 2012) often exclusively focused on adolescents' emotions during mother-adolescent interactions, thereby neglecting mothers' emotions. However, the present study showed that less emotional variability of mothers and dyads, instead of emotional variability of adolescents, was associated longitudinally with more internalizing problems. These results highlight that when studying emotional variability of individuals in isolation from the dyad valuable information is potentially left unaccounted. Mothers' and adolescents' emotions during conflict interactions are embedded within a dyadic system. Emotional expressions during conflict interactions reflect what goes on between individuals; emotions of individuals shape the interaction, and the interaction in turn shapes emotions of individuals (Campos et al., 2011; Hinde, 1997). Therefore, in accordance with a dynamic systems approach (Fogel, 1993; Granic & Patterson, 2006), we argue that emotional variability during conflict interactions should be approached from a dyadic stance.

Strengths, Limitations, and Future Directions

Although the current study has a number of important strengths, such as the longitudinal and multi-method design, several limitations should also be noted. First, this study examined emotional variability during mother-adolescent conflict interactions, thereby focusing on moment-to-moment emotional changes that occur within one specific context or *dynamic flexibility* (Hollenstein, Lichtwarck-Aschoff, & Potworowski, in press). However, many of the challenges of adolescence reflect the increasing complexity of social contexts, and interpersonal and emotional demands are different across these contexts (Collins & Steinberg, 2006). In some contexts, for instance, during playful activities, too much emotional variability might not be adaptive because it could reflect that emotions are not well regulated and controlled by the dyad. Also, mother-adolescent dyads regularly

move together from one context to the next, for instance, from a playful context into an interpersonal conflict, and dyads need to adapt emotional expressions to the shifting demands of such different contexts which has been referred to as *reactive flexibility* (Hollenstein et al., *in press*). The results of this study could be extended by examining over the course of adolescence the role of emotional variability of dyads for internalizing problems both within (dynamic flexibility) and across (reactive flexibility) different interaction contexts.

Furthermore, earlier studies conceptualized emotional variability in different ways. Emotional variability has, for instance, been defined as emotional inertia, indicating the extent that one's current emotional state is predictable from one's prior emotional state during interactions (Kuppens et al., 2012). In line with earlier studies on emotional variability in parent-child interactions (Granic et al., 2003; Hollenstein et al., 2004), this study defined emotional variability as the amount of transitions between emotional states and the spread of emotional states. Importantly, although emotional inertia is computationally distinct from dispersion and transitions (inertia has been based on the ratio values of emotional intensity in multi-second measurements rather than the real-time categorical approach of state space grid measures), it is possible that they are related. However, it is not yet clear how and future research should examine associations among these different types of emotional variability and whether they are differentially related to internalizing problems.

Finally, the current data were gathered from a relatively homogeneous sample of mothers and adolescents mostly from white middle-class families, which limits the generalizability of the findings. For example, the way mothers and adolescents tend to express and share emotions during interactions is suggested to be depended on cultural factors (Gross, 2007). Future research could contribute to the literature by examining emotional variability and internalizing problems among cross-cultural samples.

Conclusion

The present study represents a novel and important contribution to the literature by examining longitudinal associations between emotional variability during mother-adolescent conflict interactions and mothers' and adolescents' internalizing problems. This study extended existing studies and clarified that a rigid emotional repertoire of both dyads and mothers in early adolescence predicted relative increases in mothers' and adolescents' internalizing symptoms. However,

emotional variability of adolescents was not associated with mothers' and adolescents' internalizing problems. Consistent with a dynamic systems approach (Fogel, 1993; Granic & Patterson, 2006), the results of the current suggest that the role of changes in the emotional repertoire during conflict interactions for subsequent internalizing problems might not be fully understood by considering emotional variability of individuals studied in isolation from the dyad, thereby suggesting that emotional variability should be approached from a dyadic stance. For healthy socio-emotional functioning of mothers and adolescents over time, adaptive conflict interactions during early adolescence should be marked by the ability of mother-adolescent dyads to flexibly switch across a wide range of positive and negative emotions. Limited emotional variability of mother-adolescents dyads may be part of a broader risk profile for internalizing problems in late adolescence that could be targeted by prevention or early intervention efforts.



7

General Discussion

The current dissertation aimed to understand longitudinal associations between parent-adolescents relationships and adolescents' psychosocial problems over the course of adolescence on a micro- and a macro-level. The *first aim* was to examine the longitudinal associations between internalizing and externalizing problems during adolescence on a macro-level. The *second aim* was to understand longitudinal associations between parent-adolescent relationship quality and adolescents' psychosocial problems on a macro-level. The *third aim* was to address how the structure of parent-adolescent interactions on a micro-level was related to parent-adolescent relationship quality and adolescents' psychosocial problems on a macro-level. In this concluding chapter the results regarding these key issues of this dissertation are summarized (also see Table 15), and results and recommendations for future research are discussed. Finally, strengths and limitations of this dissertation are addressed, followed by some concluding remarks.

Summary of the Main Findings

The Macro-Level: Co-occurrence of Aggressive Behavior and Depressive Symptoms

In *Chapter 2*, we examined with a multi-informant design the bidirectional associations between aggressive behavior and depressive symptoms during early adolescence, and we investigated whether gender moderated these associations. The longitudinal design allowed us to examine the expectations of two contrasting perspectives about the temporal ordering of depressive symptoms and aggressive behavior: The failure model (Capaldi, 1992), which suggests that aggressive behavior precede or predict depressive symptoms, and the acting out model (Carlson & Cantwell, 1980), which states that depressive symptoms precede or predict aggressive behaviors. These two models were tested simultaneously with multigroup cross-lagged path analysis.

Results showed concurrent and longitudinal associations between aggressive behavior and depressive symptoms in early adolescence. With regard to the concurrent associations, higher levels of aggressive behavior were related to more depressive symptoms (i.e., T1 correlation), and a relative increase in aggressive behavior was associated with a relative increase in depressive symptoms (i.e. correlated change at T2 and T3). With regard to the longitudinal associations, the results showed that aggressive behavior predicted subsequent higher levels of depressive symptoms, which was consistent with the failure model (Capaldi, 1992)

and earlier studies (Curran & Bollen, 2001; Moilanen, Shaw, & Maxwell, 2010; Van Lier & Koot, 2010). However, results did not support the acting out model (Carlson & Cantwell, 1980; Vieno, Kiesner, Pastore, & Santinello, 2008; Wiesner, 2003) that proposes that depressive symptoms precede aggressive behavior. In line with several studies (e.g., (Van Lier & Koot, 2010) who did not find gender differences in the temporal ordering of more broadband externalizing and internalizing problems, observed associations in *Chapter 2* were operating similarly across female and male adolescents in our sample.

In sum, findings of *Chapter 2* suggested that aggressive behavior and depressive symptoms of early adolescent boys and girls were associated. Even more so, these findings provide empirical support for the idea that adolescents' aggressive behavior precedes or predicts adolescents' depressive symptoms. It may therefore be recommended to consider cross-domain associations between aggressive behavior and depressive symptoms for prevention and intervention efforts.

The Macro-Level: Perceptions of Autonomy Support and Depressive Symptoms

In *Chapter 3*, we examined bidirectional associations between parents' and best friends' perceived autonomy support and adolescents' depressive symptoms from early to late adolescence. We also investigated whether age and gender moderated these associations. To disentangle the direction of effects over time between perceived autonomy support and depressive symptoms, we employed multigroup cross-lagged path models.

Consistent with assumptions of Self-Determination Theory (SDT, Ryan & Deci, 2000) and earlier cross-sectional studies (e.g., La Guardia, Ryan, Couchman, & Deci, 2000; Soenens, Park, Vansteenkiste, & Mouratidis, 2012), findings showed that perceived parental autonomy support and adolescents' depressive symptoms were concurrently and longitudinally associated. Specifically, we demonstrated bidirectional associations between perceived parental autonomy support and adolescents' depressive symptoms, thereby finding support for a parent effect model and child effect model. Adolescents' who perceived lower levels of support for their wishes, opinions and needs from their parents, reported higher levels of depressive symptoms over time (parent effect). Also, adolescents who reported more depressive symptoms perceived lower levels of autonomy support from parents over time (child effect). The child effect appeared to be significantly stronger than the parent effect. Results were similar for early and late adolescent

boys and girls. Finally, in line with an earlier cross-sectional study (Eccles, Early, Fraser, Belansky, & McCarthy, 1997), yet in contrast with assumptions of SDT (Ryan & Deci, 2000) and earlier studies (Allen et al., 2006; Deci, La Guardia, Moller, Scheiner, & Ryan, 2006), no concurrent and longitudinal associations were found between perceived autonomy support from best friends and adolescents' depressive symptoms. Perceptions of best friends' autonomy support did not become more strongly related to depressive symptoms over the course of adolescence, thereby suggesting that perceptions of autonomy support are especially important in parent-adolescent relationships.

Taken together, the longitudinal findings in *Chapter 3* expanded results from previous cross-sectional studies (e.g., La Guardia et al., 2000; Soenens et al., 2012) and these results suggested that perceptions of parental autonomy support are positively associated with adolescents' well-being across age and gender. The extent to which parents were perceived as supporting autonomy appeared to be more closely related to adolescents' depressive symptoms than the extent to which best friends were perceived to support autonomy. Based on these findings it could be suggested that prevention and treatment programs should focus on the mutual interplay between adolescents' depressive symptoms and perceptions of parental autonomy support.

Linking the Micro- and Macro-Level: Emotional Variability and Psychosocial Functioning

In *Chapter 4*, we investigated with an observational design heterogeneity in the development of emotional variability in mother-adolescent conflict interactions, and the associations with the development of adolescents' psychosocial functioning. First, to examine whether there were distinct developmental trajectories of emotional variability, we conducted Multivariate Latent Class Growth Analyses (MLCGAs). Second, to examine whether the emotional variability trajectories showed distinct initial levels and change rates of aggressive behavior, perceived autonomy support, and perceived conflict frequency, we performed multigroup Latent Growth Models (LGMs).

Consistent with our expectations we found two types of mother-adolescent dyads that followed different developmental trajectories of emotional variability: Low variability dyads (52% of our sample) and high decreasing variability dyads (48% of our sample). Low variability dyads were characterized by stable and lower levels of emotional variability across adolescence, indicating that these dyads

maintained a limited emotional repertoire during conflict interactions throughout adolescence. High decreasing variability dyads were characterized by higher initial levels of emotional variability and decreasing levels of emotional variability as adolescents grew older, indicating that these dyads seem to navigate adolescence with a temporary broader emotional repertoire during conflict interactions. Moreover, consistent with the definition of emotional variability, high decreasing variability dyads showed both more positive affect and negative affect over time than low variability dyads.

In line with a dynamic systems approach (Granic, 2005; Thelen & Smith, 1994) and previous studies (Hollenstein, Granic, Stoolmiller, & Snyder, 2004; Lichtwarck-Aschoff, Kunnen, & Van Geert, 2009), high decreasing variability dyads were characterized by a more optimal developmental profile of psychosocial functioning than low variability dyads. Although adolescents from low variability first reported decreases in aggressive behavior, towards middle adolescence they reported increases in aggressive behavior and eventually showed higher levels of aggressive behavior than adolescents from high decreasing variability dyads. Furthermore, even though results showed no initial differences between both type of dyads, mothers and adolescents from high decreasing variability dyads perceived higher levels of autonomy support over time and adolescents from these dyads also reported lower levels of conflict frequency over time. Mothers from high decreasing and low variability dyads did not differ with regard to their levels over time of perceived conflict frequency.

In short, results in *Chapter 4* suggested that adaptive mother-adolescent conflict interactions were marked by a broad range of emotional states: High decreasing variability dyads seemed to be characterized by stable and lower levels of adolescents' aggressive behavior and an increase in perceived relationship quality. Hence, it could be argued that temporary increased levels of emotional variability of dyads is over time associated with less adjustment problems and changes towards a more egalitarian mother-adolescent relationship. These results might help mother-adolescent dyads to understand how to adapt dyadic interaction patterns during conflicts to developmental changes that take place during adolescence, namely by expressing a broad range of both positive and negative emotions during conflict interactions.

Linking the Micro- and Macro-Level: Emotional Variability, Maternal Control, and Adolescent Disclosure

In *Chapter 5*, using an observational design we addressed longitudinal associations between emotional variability during mother-adolescent conflict interactions in early adolescence and mothers' perceptions of adolescent disclosure and maternal control in early and late adolescence. We controlled for prior levels of adolescent disclosure and maternal control as well as for the emotional valence (i.e., types of emotions expressed) of the conflict interactions. We used a path analysis to examine these associations.

In general, results were consistent with the suggestions from a dynamic systems approach (Granic, 2005; Thelen & Smith, 1994) and earlier studies (Branje, 2008; Lichtwarck-Aschoff et al., 2009) stating that emotional variability of dyads in early adolescence is adaptive for dealing with relational challenges that arise during adolescence. Emotional variability and adolescent disclosure were positively associated in early adolescence; when mother-adolescent dyads were able to flexibly switch among a broad range of emotions during conflict interactions, mothers perceived that adolescents disclosed more information about friends, activities and whereabouts to them. Furthermore, more emotional variability in early adolescence predicted relative decreases in maternal control from early to late adolescence, indicating that more emotional variability of mother-adolescent dyads during conflict interactions in early adolescence enabled mothers to relax control over the course of adolescence.

Taken together, findings in *Chapter 5* revealed considerable predictive effects of emotional variability to adolescent disclosure in early adolescence and in particular to maternal control in late adolescence, thereby suggesting that more emotional variability in mother-adolescent conflict interactions is helpful in adaptively dealing with these relational challenges that arise during adolescence. More emotional variability of mother-adolescent dyads might be reflective of more open communication patterns during conflict interactions, and within such a safe and supportive context adolescents might feel safe to disclose to mothers about activities, friends, and whereabouts, and mothers might be able to relax control over the course of adolescence.

Linking the Micro- and Macro-Level: Emotional Variability and Internalizing Problems of Mothers and Adolescents

In *Chapter 6*, using an observational design we aimed to understand whether emotional variability during mother-adolescent conflict interactions in early adolescence predicted mothers' and adolescents' internalizing problems in late adolescence, and whether emotional variability in conflict interactions should be approached from a dyadic or individual stance. We specifically investigated whether emotional variability of mother-adolescent dyads and emotional variability of individuals (i.e., mothers or adolescents) were differentially related over time to mothers' internalizing symptoms and adolescents' depressive and anxiety symptoms. Finally, we also explored whether the emotional valence of the conflict interactions moderated the longitudinal associations between emotional variability and internalizing problems. We used hierarchical regression analyses to examine these associations.

Consistent with a dynamic systems approach (e.g., Granic, 2005) and with prior research (e.g., Granic, O'Hara, Pepler, & Lewis, 2007; Hollenstein et al., 2004), results demonstrated that emotional variability of mother-adolescent dyads in early adolescence predicted mothers' and adolescents' internalizing problems five years later. Furthermore, extending results of some earlier studies (e.g., McMakin et al., 2011; Sheeber, Allen, Davis, & Sorensen, 2000) emotional variability of mothers in early adolescence was also related to mothers' and adolescents' internalizing problems in late adolescence. Yet, in contrast with other studies (e.g., Koval, Kuppens, Allen, & Sheeber, 2012; Kuppens et al., 2012), emotional variability of adolescents in early adolescence did not predict mothers' and adolescents' internalizing problems five years later. Thus, only among mothers, but not among adolescents, limited emotional variability was related relative increases in internalizing problems over time. These longitudinal associations between emotional variability and internalizing problems were not moderated by the emotional valence of the conflict interactions, thereby supporting earlier studies (e.g., Hollenstein et al., 2004).

To conclude, findings in *Chapter 6* offered support for the potential maladaptive function of rigidity in the emotional repertoire of mother-adolescent dyads during conflict interactions in early adolescence for subsequent internalizing problems of mothers and adolescents. Present results might also indicate that mothers pulled mother-adolescent dyads into more emotional variability during conflict interactions, by showing that less emotional variability of mothers, instead

of emotional variability of adolescents, was longitudinally associated with more internalizing problems. Earlier studies (e.g., Kuppens et al., 2012) often exclusively focused on adolescents' emotional states during mother-adolescent interactions as a predictor of social emotional functioning, thereby neglecting mothers' emotional states. However, results in *Chapter 6* showed that vital information may be missing about the mother-adolescent system when reducing emotional variability during conflict interactions to individuals within these dyads. Therefore, we argued, in accordance with a DS approach (Fogel, 1993; Granic & Patterson, 2006), that emotional variability during conflict interactions should be approached from a dyadic stance. Preventions and treatments efforts should focus on teaching mother-adolescent dyads to learn to express, share, modulate and shift out of a wide variety of both positive and negative emotions during conflict interactions.

Table 15. Summary of the Main Findings

Chapter	Level	Results
Chapter 2	Macro-level	<ul style="list-style-type: none"> ® In early adolescence, aggressive behavior predicted subsequent higher levels of depressive symptoms. ® Findings were similar for boys and girls.
Chapter 3	Macro-level	<ul style="list-style-type: none"> ® Throughout adolescence, higher levels of perceived parental autonomy support were related concurrently and longitudinally to lower levels of adolescents' depressive symptoms. Longitudinal associations appeared to be bidirectional in nature. ® No concurrent and longitudinal associations were found between perceived autonomy support from friends and adolescents' depressive symptoms. ® Findings were similar for early and late adolescent boys and girls.
Chapter 4	Micro-level and macro-level	<ul style="list-style-type: none"> ® Two types of mother-adolescent dyads were distinguished over the course of adolescence that showed distinct developmental trajectories of emotional variability, namely low variability dyads and high decreasing variability dyads. ® High decreasing variability dyads were characterized by a more optimal developmental profile of aggressive behavior and relationship quality than low variability dyads.
Chapter 5	Micro-level and macro-level	<ul style="list-style-type: none"> ® In early adolescence, emotional variability of mother-adolescent dyads was positively related to perceived adolescent disclosure. ® Higher levels of emotional variability of mother-adolescent dyads in early adolescence predicted relative decreases in perceived maternal control from early to late adolescence.
Chapter 6	Micro-level and macro-level	<ul style="list-style-type: none"> ® Higher levels of emotional variability of mother-adolescent dyads in early adolescence predicted relative decreases in mothers' and adolescents' internalizing problems from early to late adolescence. ® Higher levels of emotional variability of mothers in early adolescence also predicted relative decreases in mothers' and adolescents' internalizing problems from early to late adolescence. <p>Longitudinal associations were not moderated by the emotional valence of the conflict interactions.</p>

Conclusions, Implications, and Future Directions

Psychosocial Problems during Adolescence

The current dissertation clearly revealed that, also in a general population of adolescents, aggressive behavior and depressive symptoms were concurrently linked during early adolescence (*Chapter 2*), indicating that adolescents who show more aggressive behavior also report more depressive symptoms (Wolff & Ollendick, 2006). Second, early adolescents' aggressive behavior predicted subsequent higher levels of depressive symptoms, which is in agreement with several earlier studies (e.g., Curran & Bollen, 2001; Van Lier & Koot, 2010). These results raise the question how these seemingly distinct types of problems come to be concurrently and longitudinally related to each other.

One of the most prominent explanations in the current literature is based on the failure model (Capaldi, 1992), which suggests developmental cascades between competence and behavior problems. It is thought that aggressive behavior leads to multiple failures experienced by adolescents, such as academic skill deficits and rejection by the family and by peers, which in turn may lead to an increased risk for depressed mood (Capaldi, 1992; Masten & Cicchetti, 2010). Several studies found evidence for such developmental cascades from externalizing problems to diminished social competence to internalizing problems from early childhood to late childhood (Van Lier & Koot, 2010) and from childhood to young adulthood (Masten et al., 2005). Also, cascade paths were found from externalizing problems at age 6 to low academic competence at age 8 to internalizing problems at age 10 (Moilanen et al., 2010). Hence, social and academic failures could explain our longitudinal association from aggressive behavior to depressive symptoms found in the current dissertation (*Chapter 2*).

Another prominent explanation in the current literature is based on the acting out model (Carlson & Cantwell, 1980), which states that underlying depressive feelings of children and preadolescents are acted out by displaying aggressive behavior. Since we were not able to capture longitudinal associations from depressive symptoms to subsequent aggressive behavior in *Chapter 2*, the current dissertation did not seem to support an acting out model. This might be due to our specific focus on depressive symptoms and aggressive behavior in early adolescence (Beyers & Loeber, 2003; Herrenkohl et al., 2010), and our multi-informant approach (Vieno et al., 2008; Wiesner, 2003).

Considering the relatively small longitudinal effects from aggressive behavior to depressive symptoms and the absence of longitudinal effects from depressive symptoms to aggressive behavior, it is perhaps even more likely that the link between aggressive behavior and depressive symptoms can be explained by common risk factors (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003; Wolff & Ollendick, 2006). Emotion regulation problems could represent such an underlying risk factor that leads to these separate but associated problem behaviors. Emotion regulation refers to internal and external processes that are involved in initiating, maintaining, and modulating emotional expressions (Thompson, 1994), and emotion regulation difficulties are considered to be costly in the pursuit of long-term goals such as well-being (Cole & Hall, 2008). Emotion regulation problems have indeed been tied to both aggressive behavior and depressive problems in adolescence (e.g., Gross, 2007; Silk, Steinberg, & Morris, 2003). Results of the current dissertation also provided preliminary evidence for the role of emotion regulation problems in the co-occurrence of externalizing and internalizing problems, by showing that emotional rigidity of mother-adolescent dyads during conflict interactions was related to both aggressive behavior (*Chapter 4*) and internalizing problems of adolescents (*Chapter 6*). Emotional rigidity was conceptualized as the inability of dyads to flexibly switch among a broad range of emotions during interactions, and it is thought that these dyads, thus, experience difficulties with flexibly adapting and regulating their emotions during conflict interactions (Granic, 2005). Potentially, a susceptibility of adolescents to both externalizing and internalizing problems could be explained by the inability to flexibly switch among emotions during mother-adolescent conflict interactions. Therefore, more research is needed that specifically addresses the role of emotional rigidity during mother-adolescent conflict interactions as a common risk factor in explaining in the longitudinal association between aggressive behavior and depressive symptoms during adolescence.

The Importance of Emotional Variability during Conflict Interactions

The current dissertation demonstrated the potentially adaptive function of more emotional variability of mother-adolescent dyads during conflict interactions for adolescents' and mothers' psychosocial problems (*Chapter 4* and *6*) as well as for mother-adolescent relationship quality (*Chapter 4* and *5*). These findings confirm theoretical suggestions (Fogel, 1993; Granic, 2005; Thelen & Smith, 1994) and extend earlier empirical findings (e.g., Connell, Hughes-Scalise, Klostermann, &

Azem, 2011; Hollenstein et al., 2004; Lichtwarck-Aschoff et al., 2009). Nonetheless, why would it be adaptive for mother-adolescent dyads to show more emotional variability during conflict interactions? An important challenge for mother-adolescent dyads is to constructively engage in conflict interactions during adolescence, which is thought to be partly dependent on how emotions are expressed and handled (Adams & Laursen, 2007; Jones, 2001). More open communication patterns are expected to enable mother-adolescent dyads to adequately deal with such differences in opinions, because dyads that openly communicate are capable to express their thoughts and emotions, to put across their point of view clearly, and to adjust discrepant perceptions accordingly (Branje, Laursen, & Collins, 2012). We, therefore, think that more emotional variability of dyads during conflict interactions is an indicator of more open communication patterns and a context which is supportive and accepting of a broad range of, both positive and negative, emotions. This enables dyads to freely and safely explore alternative or new ways of interacting with each other (Granic, Hollenstein, Dishion, & Patterson, 2003; Lichtwarck-Aschoff et al., 2009). Thus, more emotionally variable mother-adolescent dyads seem to be able to adequately deal with emotional challenges of conflict interactions during adolescence, which is related to emotional and relational competence of both adolescents and mothers over time.

Emotional competence. Results of the current dissertation revealed that more emotionally variable dyads experienced fewer psychosocial problems over time (*Chapter 4 and 6*). Because more emotionally variable mother-adolescent dyads are considered to handle the emotional turmoil during conflict interactions more adequately, these dyads might provide a context in which adolescents can acquire adaptive emotion regulation skills (Granic, 2005) and in which even mothers can enhance their emotion regulation skills. Potentially, the experience of expressing and modulating different types of emotions in response to a difficult emotional conversation topic can benefit adolescents' and mothers' emotional competence, thereby resulting in fewer psychosocial problems over time.

The current literature has provided indirect support for this hypothesis. During late childhood more emotional variability in parent-child interactions has been found to contribute to higher emotion regulation skills of children (Lunkenhimer, Hollenstein, Wang, & Shields, 2012), and, in turn, higher emotion regulation of adolescents has been related to fewer internalizing and externalizing problems (De Rubeis & Granic, 2012; Eastabrook, Flynn, & Hollenstein, in press; Silk et al., 2003).

Despite these promising results, the literature examining emotional variability, emotion regulation, and psychosocial problems is still largely independent, has a cross-sectional character, and has predominantly focused on adolescents and adults (i.e., mothers) separately. Therefore the nature of the relation among these different facets of emotional competence of mother-adolescent dyads is not understood yet. Most research also has relied on questionnaire methods for examining emotional variability and emotion regulation. However, we think that questionnaires fail to capture the dynamic, fluctuating, and contextually specific emotion regulation skills that mothers and adolescents together deploy when navigating the challenges of real-life interactions (Cole, Martin, & Dennis, 2004). Therefore, future research needs to study the specific nature of the relation between emotional variability and emotion regulation during mother-adolescent interactions and the longitudinal links to mothers' and adolescents' psychosocial problems during adolescence.

Relational competence. Furthermore, results of the current dissertation demonstrated that more emotionally variable dyads showed higher levels of mother-adolescent relationship quality as well as a more optimal reorganization of the mother-adolescent relationship over time (*Chapter 4* and *5*). Due to adolescents' increasing need for autonomy, mother-adolescent dyads need to find a new balance between adolescents' autonomy and privacy on the one hand, and maternal control and access to information on the other hand (Laursen & Collins, 2009; Smetana, 2011). More open communication during conflict interactions can provide a context for recognizing, negotiating and resolving discordant expectations of mothers and adolescents regarding such issues, which is considered to be important for reorganizing mother-adolescent relationships towards a more equal and horizontal nature (Branje et al., 2012). Because more emotional variability probably reflects more open communication, more emotionally variable dyads might be better able to negotiate adolescents' autonomy during conflict interactions. More emotional variability is also thought to characterize mother-adolescent dyads that are in the middle of reorganizing their interaction patterns to adjust to newly arising relational demands (Granic et al., 2003; Lichtwarck-Aschoff et al., 2009). We think that more emotionally variable mother-adolescent dyads, therefore, show changes towards a more egalitarian relationship, as indicated by more adolescent disclosure during adolescence, less maternal control by late adolescence, increases in maternal autonomy support from early to late adolescence, and decreases in conflict frequency from early to

late adolescence. To conclude, more emotional variability of mother-adolescent dyads during conflict interactions serves an important function in adaptively dealing with various relational challenges that arise during adolescence, and in realigning mother-adolescent relationships towards a more equal and horizontal nature.

Emotional Variability and Emotional Valence: Are all Emotions Adaptive during Conflict Interactions?

The state space grid method (Hollenstein, Lichtwarck-Aschoff, & Potworowski, in press) that was used in the current dissertation allowed us to also capture the emotional valence of conflict interactions, thereby referring to the types of emotions that were expressed by mother-adolescent dyads during conflict interactions. It has been argued (Granic, 2005) and found (Granic et al., 2007; Hollenstein et al., 2004) during childhood that associations between emotional variability of dyads and healthy functioning do not depend on average levels of negativity or positivity during conflict interactions. The current dissertation also indeed revealed that during adolescence limited emotional variability of dyads during conflict interactions was associated with psychosocial and relational problems, irrespective of the emotional valence of these conflict interactions (*Chapter 4, 5, and 6*). Additionally, more emotional variability of dyads reflected both higher levels of positive and negative emotions of these dyads (*Chapter 4*) and even relatively more negative than positive emotions of these dyads (*Chapter 5 and 6*). Together, these findings provided support for the definition of emotional variability; when dyads showed more emotional variability they were able to flexibly switch among both positive and negative emotions during conflicts. In addition, these results also supported propositions of emotion theorists (e.g., Campos, Frankel, & Camras, 2004; Gross, 2007; Izard, 2009) that all emotions, both positive and negative, are important to express for healthy development. This means that some degree of negativity of mother-adolescent dyads during conflict interactions is appropriate and does not necessarily lead to psychosocial problems, as long as it is managed effectively by these dyads. Therefore, being stuck in either positive or negative emotions is what is problematic, and not the average amount of either positive or negative emotions (Granic, 2005).

Nevertheless, it might seem rather counterintuitive that rigidity in positive emotions is also problematic. Being stuck in anger or disgust might have very different implications from being stuck in a pattern of enthusiasm or happiness. For

example, it could be thought that mother-adolescent dyads that show rigidity in positive emotions are well-adjusted as they are able to discuss and resolve conflicts with a positive emotional tone. However, conflict interactions are directly confrontational and anger provoking for dyad members (Jones, 2001), and mother-adolescent dyads that remain continuously in a mutual positive emotional state might not be adapting well to the emotional demands of this context. This can potentially explain why rigidity in negative emotions as well as rigidity in positive emotions during mother-adolescent conflict interactions is related to relational and psychosocial problems. Notwithstanding, emotional demands are different across interactions contexts (Collins & Steinberg, 2006) and as such, rigidity in positive emotions may not be equally precarious across these contexts. Empirical evidence indeed has shown that during problem solving interactions a combination of less emotional variability and less positive affect of parent-child dyads contributed to children's higher levels of externalizing problems over time (Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011). Hence, future research should examine whether rigidity in positive emotions is equally problematic for mother-adolescent dyads as rigidity in negative emotions across different interaction contexts over the course of adolescence.

Emotional Variability during Conflict Interactions: Dyadic or Individual Processes?

The current dissertation clearly demonstrated the benefits of higher levels of emotional variability of mother-adolescent dyads during conflict interactions (*Chapter 4, 5, and 6*), thereby focusing on the movement of mother-adolescent dyads from one dyadic emotional state to another over the course of an interaction. We, therefore, argue that when studying the merits of emotional processes during dynamic interactions, such as conflict interactions, it is necessary to examine these emotional processes at a dyadic level. During mother-adolescent conflict interactions emotions are embedded within a relational and dynamic context; both mother and adolescents are continuously active and engaged in the communication in order to regulate the interaction and potentially solve the conflict (Fogel, 1993; Granic, 2005; Hinde, 1997). The expression and adaptation of emotions during conflicts could, therefore, be argued to reflect what goes on between these dyad members, and as such be important for healthy functioning. While an individual within a dyad might pull the dyad into more emotional variability during these conflicts, measuring how only one individual's effort to deal with emotions during conflict interactions is associated with relational or

psychosocial outcomes, might potentially leave valuable information unaccounted. Namely, if we would have approached emotional variability solely from the adolescents' viewpoint, thereby following earlier studies (e.g., Koval et al., 2012; Lichtwarck-Aschoff et al., 2009), we would have missed the interesting findings that emotional variability of mothers and dyads predicted subsequent internalizing problems of mothers and adolescent (*Chapter 6*). To conclude, we think of mother-adolescent conflict interactions as a dynamic context (Fogel, 1993; Granic, 2005; Thelen & Smith, 1994), and we therefore argue that it is necessary to measure the emotional expressions of mother-adolescent dyads as they unfold in real-time over the course of a conflict interaction.

The finding that more emotional variability of mothers instead of more emotional variability of adolescents predicted fewer internalizing problems over time (*Chapter 6*), might reflect that mothers drive emotional variability of mother-adolescent dyads. By freely displaying a wide range of emotions mothers teach adolescents a variety of emotions as well as to appropriately express, adapt, and regulate these emotions (Morris, Silk, Steinberg, Myers, & Robinson, 2007). In this way, adolescents might contribute to dyadic emotional variability mostly through responding to mothers' emotional variability during these conflict interactions. Nonetheless, mothers are also expected to dynamically and reciprocally alter their emotions with respect to the ongoing and anticipated emotions of their adolescent children (Campos, Walle, Dahl, & Main, 2011; Fogel, 1993; Hinde, 1997; Kim, Conger, Lorenz, & Elder, 2001; Morelen & Suveg, 2012). An understanding of the micro-level emotional exchanges between mothers and adolescents is essential to comprehend recurring dyadic patterns of emotional variability that eventually affect developmental outcomes. This information is also particularly important for prevention and intervention, because it is these interaction patterns that practitioners work to improve on. Therefore, future research should extend results of the current dissertation by investigating the dynamic interplay between emotional variability of mothers and emotional variability of adolescents both within and across conflict interactions, thereby also unraveling in what specific ways mothers and adolescents contribute to dyadic levels of emotional variability.

Adolescents' Autonomy in the Context of Parent-Adolescent Relationships

Adolescents have a basic inclination to act in a self-determined fashion (Ryan & Deci, 2000); they want to decide what to do, when to do it and how to do it. Therefore, adolescents need ample opportunities to assert themselves in

relationships with parents and this is important for healthy functioning (Smetana, 2011). The current dissertation provides support on both a micro- and a macro-level for the idea that expressing and experiencing autonomy in supportive parent-adolescent relationships is associated with positive developmental outcomes over time (Grotevant & Cooper, 1986; Ryan & Deci, 2000). On a micro-level, more emotionally variable mother-adolescent dyads were found to report higher levels of autonomy support and higher levels of adolescents' well-being in the long run (*Chapter 4 and 6*). On a macro-level, adolescents' perceptions of higher levels of parental autonomy support were also found to be beneficial for their well-being, and in turn, higher levels of well-being were found to be beneficial for adolescents' perceptions of parental autonomy support (*Chapter 3*). Thus, parent-adolescent relationships that nurture adolescents' autonomy, thereby providing support for all kinds of emotions, thoughts, feelings, and choices, are found to promote well-being.

We think that through open and supportive communication patterns, adolescents can assert themselves in conflict interactions with their parents. Because adolescents in more emotionally variable dyads are able to flexibly express their emotions, they are probably more capable in expressing themselves in conversations with their parents. Also, through flexibly expressing emotions, parents in more emotionally variable dyads may adequately model appropriate self-assertion and independence for adolescence. Over time, multiple interaction sequences create expectations of adolescents about the generally high level of autonomy support in relationships with their parents, which in turn will further contribute to autonomous expressions in conflict interactions. As such, adolescents' autonomy development is suggested to evolve through constant exchanges between parents and adolescents on micro- and macro-levels of organization (Fogel, 1993; Hinde, 1997; Lichtwarck-Aschoff, Kunnen, & Van Geert, 2010), and adequately handling these autonomy processes can contribute to adolescents' well-being (Smetana, 2011). Future research could enhance our understanding how emotional processes during interactions are interrelated over time to the emergence of more long-term perceptions of adolescents about autonomy support and examine how this dynamic process is related to adolescents' well-being.

A Developmental Contextual Perspective on Emotional Variability

Is there an optimal level? Although results of the current dissertation demonstrated that more emotional variability during conflict interactions in adolescence is adaptive, more emotional variability does not necessarily have to be prosperous. The merits of emotional variability of dyads might depend on the age of children or the social context.

First, different developmental periods are expected to allow for different levels of emotional variability of dyads. For example, more emotional variability of mother-toddler dyads has been found to be associated with higher levels of adjustment problems, indicating that emotional variability in toddlerhood might be an indicator of emotional dysregulation rather than emotional flexibility (Lunkenheimer et al., 2011). This raises the question why more emotional variability is problematic for toddlers and adaptive for adolescents. During early childhood, toddlers observe their mother's reactions to their emotional expressions thereby learning the function of different emotions (Abe & Izard, 1999; Morris et al., 2007). In more emotionally variable mother-toddler dyads emotional expressions and patterns are less predictable and this lack of consistency and contingency may interfere with the development of toddlers' emotion regulation skills. In contrast, more emotional variability of dyads during adolescence is seen as a precondition for adaptation (Granic et al., 2003; Lichtwarck-Aschoff et al., 2009; Thelen & Smith, 1994). From early adolescence onwards, mother-adolescent dyads need to adjust interaction patterns and reorganize their relationship to meet adolescents' increasing need for autonomy (Laursen & Collins, 2009; Smetana, 2011). It is thought that in adolescence more emotional variability of dyads during (conflict) interactions allows mother-adolescent dyads to explore new or alternative interaction patterns if needed and, thus, enables mother-adolescent dyads to adaptively realign relationships towards a more equal and horizontal nature (Branje, 2008; Lichtwarck-Aschoff et al., 2009). Taken together, we think that the benefits of emotional variability differ depending upon the specific developmental age of children.

Second, different contexts are also expected to allow for different levels of emotional variability of dyads. In some contexts, for instance when playing a game, too much emotional variability of mother-adolescent dyads might not be adaptive because it could reflect that emotions are not well regulated and controlled by the dyad. In other contexts, for instance, when solving a difficult cognitive or social task, a certain amount of focus and rigidity of mother-adolescent dyads might be

necessary to solve the task. Research has shown that emotional variability indeed differs across contexts; adolescents and their parents demonstrate greater emotional variability during positive discussions than during discussions of negative topics (e.g., Hollenstein & Lewis, 2006). Therefore, we think that the merits of emotional variability differ depending upon the particular context of the interaction.

The conditional benefits of emotional variability have led us to think that probably too little or too much emotional variability might both be problematic. That is, as we mentioned before, too little emotional variability of dyads might reflect that emotional responses become inhibited, stereotyped, and invariable, and this is also a characterizing feature of many disorders (Zahn-Waxler, Klimes-Dougan, & Slattery, 2000). On the other hand, too much emotional variability might reflect liability of emotions (Cole & Hall, 2008), which has been associated with psychopathology among adolescents and adults (e.g., Bowen, Baetz, Hawkes, & Bowen, 2006; Silk et al., 2011; Wichters et al., 2010). Two recent studies have indeed found evidence for a curvilinear association between emotional variability and conflict frequency in adolescence (Lichtwarck-Aschoff et al., 2009) and emotion regulation in late childhood (Lunkenheimer et al., 2012). Hence, we think that moderate levels of emotional variability of mother-adolescent dyads might also be associated with the most desirable psychosocial and relational outcomes over the course of adolescence, but this has yet to be examined. Therefore, to understand under which circumstances what levels of emotional variability of dyads are most desirable for well-being, longitudinal research from early childhood to late adolescence should systematically investigate both within and across different interaction contexts emotional variability of dyads across the full range.

Reciprocal processes. Although the current dissertation showed that more emotional variability during conflict interactions is adaptive (*Chapter 4, 5, and 6*), we did not examine the developmental order between emotional variability and both psychosocial and relational adjustment. Several developmental theories have argued that both individual, and contexts change, and that interrelations between emotional processes, relationships and development should therefore be considered to be processes of continuously ongoing, bidirectional processes of interaction (e.g., Belsky, 1997; Bronfenbrenner, 1986; Sameroff & MacKenzie, 2003). In *Chapter 3* we also showed on a macro-level bidirectional associations between perceived parental autonomy support and adolescents' depressive symptoms. Furthermore, a dynamic systems approach specifically recognizes the

existence of reciprocal interactions between micro- and macro levels of organization (Fogel, 1993; Granic, 2005; Hinde, 1997; Van Geert, 2006). As mentioned earlier, through bottom-up processes, real-time interactions are thought to provide the means by which higher order patterns of relationships and psychosocial health emerge, which in turn exert top-down influences on real-time interactions. We, therefore, expect that emotional variability during mother-adolescent interactions is also bidirectionally related over time to the development of the mother-adolescent relationship and mothers' and adolescents' well-being. Still, future research should examine whether such longitudinal and bidirectional associations between emotional variability and relational or psychosocial problems exist, and should also elucidate whether emotional variability precedes adjustment problems or vice versa. A potentially useful design could be to test whether emotional rigidity of dyads predicts a first onset of a disorder among adolescents and mothers who are at high risk. It would also be useful to explicitly manipulate emotional variability of dyads in order to examine whether relational and psychosocial problems decrease accordingly.

Underlying mechanisms. Now that we have clearly demonstrated the benefits of more emotional variability during mother-adolescent conflict interactions (*Chapter 4, 5, and 6*), another important next step is to understand the underlying mechanisms that might give rise to more or less emotional variability of mother-adolescent dyads. Mother-adolescent attachment might be a mechanism through which inter-dyadic differences in subsequent emotional variability emerge. Securely attached individuals tend to develop the expectation that their emotional expressions will be attended to in a sensitive and relatively predictable way (Bowlby, 1980). As such, securely attached mother-adolescent dyads might feel safe to openly express their emotions and to be able to manage their emotions flexibly depending upon the environmental demands. Indeed secure attachments, as well as specific aspects of secure attachments (i.e., preference for open communication and more sensitivity), have been related to the development of adaptive emotion regulation skills in children and mothers (Borelli et al., 2010; DeOliveira, Moran, & Pederson, 2005; Gresham & Gullone, 2012).

Several individual characteristics of both mothers and adolescents might also represent underlying mechanisms that can explain inter-dyadic differences in emotional variability. Potentially, emotional variability of dyads might depend upon certain personality traits of mothers and adolescents (Hollenstein et al., in press; Kashdan & Rottenberg, 2010; Rothbart, 2007). Openness to experience may be

important; in order to be emotionally flexible mother-adolescent dyads need to be open to what interpersonal experiences and external circumstances offer. Also, extraversion might be relevant; in order to be emotionally flexible mother-adolescent dyads should not feel overwhelmed by negative emotions. More openness and more extraversion have been found to be related to better emotion regulation skills (e.g., Gresham & Gullone, 2012; Gross & John, 2003; Jaffe, Gullone, & Hughes, 2010), and might, therefore, also be related to emotional variability of dyads.

Furthermore, effortful control (capacities) should be considered as a likely mechanism; clearly both mothers and adolescents need to be able to inhibit impulses or urges, to focus attention, and to control thoughts and feelings in order to achieve flexible emotional expressions of dyads (Hollenstein et al., *in press*; Rothbart, 2007). Neuro-cognitive indices of effortful control, that are thought to subsume emotion regulation, have been related to emotional variability in parent-child interactions. Relatively more dorsomedial activity of the brain was related with greater emotional variability of dyads (Granic, Meusel, Lamm, Woltering, & Lewis, 2012). Finally, physiological capacities of mothers and adolescents might also underlie inter-dyadic differences in emotional variability (Hollenstein et al., *in press*; Kashdan & Rottenberg, 2010). The respiratory sinus arrhythmia (RSA), referring to the periodic fluctuations in heart rate that are linked to breathing, has been argued to play an important role in regulating overt emotional responses (Larsen, Berntson, Poehlmann, Ito, & Cacioppo, 2008). Research showed that low resting RSA and low RSA regulation are linked to emotion regulation problems (e.g., Beauchaine, 2001; Butler, Wilhelm, & Gross, 2006; Hinnant & El-Sheikh, 2009). Even more relevant, cross-sectional evidence has indeed shown a link between higher RSA regulation of both mothers and adolescents and more emotional variability of mother-adolescent dyads during positive and conflict discussions (Connell et al., 2011).

Taken together, future longitudinal research needs to address whether these extrinsic and intrinsic factors contribute to the development of greater emotional variability of mother-adolescent dyads. In order to examine this, longitudinal studies need to track mother-adolescent interactions as well as interpersonal (e.g., attachment quality) and individual characteristics (e.g., brain development, personality/temperament, physiological capacities) of mother-adolescent dyads as they proceed over the course of development.

Strengths and Limitations

The five empirical studies presented in this dissertation were characterized by several major strengths. The longitudinal nature of the data sets that were used, allowed us to examine linkages over time between parent-adolescent relationships and adolescents' psychosocial problems, thereby extending current knowledge generated by cross-sectional studies. We were able to reveal direction of effects in *Chapter 2* and *3*, to investigate associated developmental changes in *Chapter 4*, and to explore longitudinal predictions in *Chapter 5* and *6*.

Another important strength is that most studies in this dissertation used multiple informants (i.e., mothers and adolescents) and/or multiple methods (i.e., observations and questionnaires) to assess parent-adolescent relationships and psychosocial problems. Even more so, a particular innovative strength is that three studies (*Chapter 4*, *5*, and *6*) examined the role of real-time dynamics of emotional patterns during mother-adolescent conflict interactions (micro-level) for subsequent long-term relational and psychosocial outcomes (macro-level). A dynamic systems orientation (Granic, 2005; Thelen & Smith, 1994; Van Geert, 1994) enabled us to approach these real-time emotional dynamics (emotional variability) as something that provides crucial information about the nature of these conflict interactions. It also allowed us to give process-level explanations of adolescents' relationships and well-being, and as such the current dissertation uniquely contributes to the existing literature.

The five empirical studies in the current dissertation also showed several limitations which need to be addressed. One important limitation is that the current dissertation employed relatively homogeneous samples (e.g., participants were mostly Caucasian and had relatively high SES), which limited the generalizability of the findings beyond the samples used. The way parents and adolescents tend to express and share emotions during interactions, tend to value conflicts and adolescent autonomy, and tend to report psychosocial problems is to a certain extent dependent on cultural factors (Gross, 2007; Rescorla et al., 2013; Smetana, 2011). Still, we found variation in our measures and we were able to explain variance in relationships and psychosocial problems. Thus, even with rather homogeneous samples we were able to find meaningful differences. Notwithstanding, extending results of the current dissertation to culturally diverse samples could even further increase our understanding of parent-adolescent

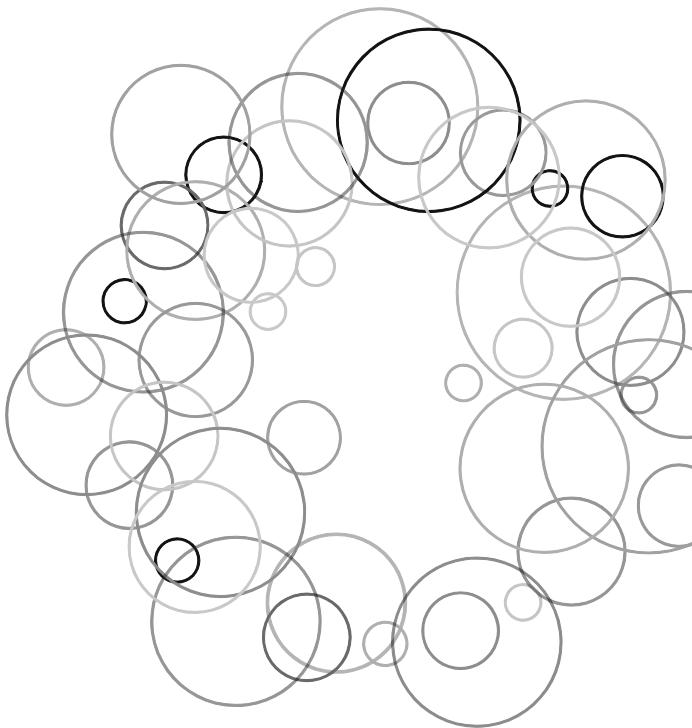
relationships, adolescents' psychosocial problems, and associations among these domains over the course of adolescence.

Furthermore, in *Chapter 4, 5, and 6*, we specifically used a conflict discussion to assess emotional variability of mother-adolescent dyads. Many of the challenges of adolescence reflect the increasing complexity of social contexts, and interpersonal and emotional demands are different across these contexts (Collins & Steinberg, 2006). As discussed earlier, the merit of emotional variability might depend on the developmental age of children and the specific social context. Therefore, to understand what levels of emotional variability seem most desirable under what circumstances, it seems rather important to examine the role of emotional variability for well-being within and across different age groups (i.e., toddlers, school-aged children, and emerging adults), different interaction tasks (i.e., positive discussion, problem-solving task), and even different interaction partners (i.e., fathers, siblings, friends, and intimate partners).

Finally, it is noteworthy that conceptualizations of emotional variability in the current dissertation were in no way exhaustive. In line with several existing studies (Branje, 2008; Hollenstein et al., 2004; Lunkenheimer et al., 2011), we used in *Chapter 4* the range of the emotional repertoire to capture emotional variability, and we used in *Chapter 5* and *6* a composite measure of emotional variability reflecting the range of the emotional repertoire as well as the amount of switches between emotional states. Nonetheless, earlier studies have also employed other conceptualizations of emotional variability such as the mean durations of emotional states (Granic & Dishion, 2003), the level of organization and predictability of emotional states (Dishion, Nelson, Winter, & Bullock, 2004), and the degree to which an emotional state is predictable from a prior emotional state also referred to as emotional inertia (Kuppens et al., 2012). Although all of these definitions of emotional variability capture slightly different structural aspects of real-time interactions, it is expected that they are related. Nevertheless, it is not yet clear how. Future research should examine associations among these different types of emotional variability and, in particular, investigate whether they are differentially related to mother-adolescent relationship quality and adolescents' and mothers' psychosocial problems.

Concluding Statement

Taken together, adolescence is a developmental phase that is marked by profound transformations in parent-adolescent relationships. Parent-adolescent dyads need to adapt long-standing expectations and interactional patterns to accommodate adolescents' developmental needs. As such, adolescence can be a rather challenging time for parents and adolescents. The present dissertation has provided important and unique insights in longitudinal associations between parent-adolescent relationships and adolescents' psychosocial problems over the course of adolescence. We showed positive associations on a macro-level between aggressive behavior and depressive symptoms over the course of early adolescence, as well as negative and bidirectional associations on a macro-level between perceptions of parental autonomy support and adolescents' depressive symptoms throughout adolescence. The current dissertation contributed in particular to the growing acknowledgment that real-time emotional processes of parent-adolescent dyads on a micro-level are important for understanding the development of well-being and relationships on a macro-level during adolescence. More emotional variability of parent-adolescent dyads during conflict interactions seems to be a protective factor for parents' and adolescents' psychosocial problems over time, and appears to be an important mechanism in the development towards egalitarian parent-adolescent relationships. To conclude, in order to successfully navigate adolescence, both parents and adolescents must play an active role in relationship reorganizations instead of just "going through the motions".



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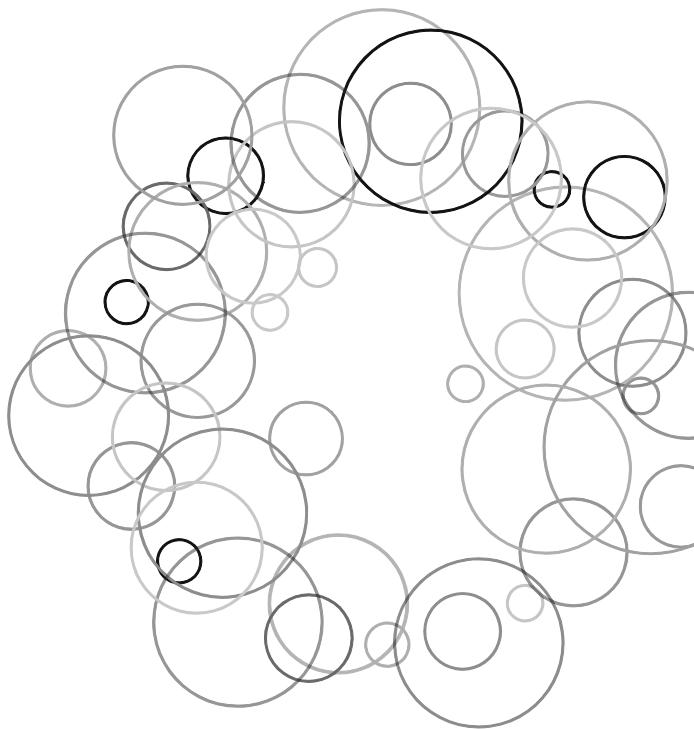
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Summary

Summary

Adolescence is a developmental phase that is marked by profound transformations in parent-adolescent relationships and it is a rather sensitive period for the development of psychosocial problems. Some parent-adolescent dyads might lack adaptive skills and qualities, which could increase the risk for adolescents' psychosocial problems. In order to prevent adolescents' psychosocial problems, it is therefore important to identify specific risk factors within parent-adolescent relationships that are longitudinally associated with these problems.

The purpose of the current dissertation was to understand longitudinal associations between parent-adolescents relationships and adolescents' psychosocial problems over the course of adolescence. We employed two distinct levels of conceptualization. A macro-level perspective was used to describe rather stable aspects of parent-adolescent relationships and adolescents' psychosocial problems across a longer period of time. A micro-level perspective was used to describe the variability of emotional patterns displayed by parent-adolescent dyads during real-time interactions.

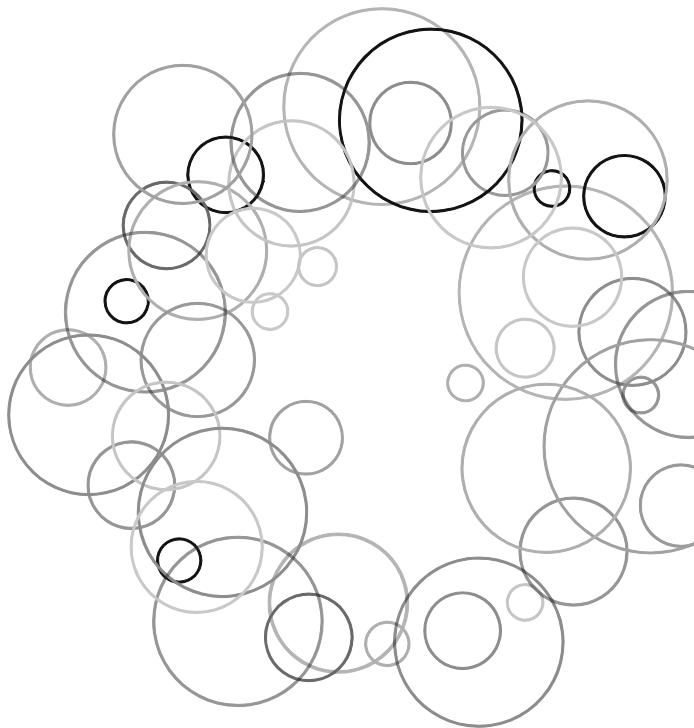
Our *first aim* was to examine on a macro-level bidirectional associations between aggressive behavior and depressive symptoms from early to middle adolescence. Results revealed that aggressive behavior and depressive symptoms were concurrently and longitudinally linked for boys and girls during early adolescence. Higher levels of aggressive behavior were related to higher levels of depressive symptoms. Over time, early adolescents' aggressive behavior predicted subsequent higher levels of depressive symptoms. It may be recommended to consider cross-domain associations between aggressive behavior and depressive symptoms for prevention and intervention efforts.

Our *second aim* was to examine on a macro-level bidirectional associations between perceived autonomy support from both parents and friends and adolescents' depressive symptoms from early to late adolescence. Findings showed that perceived parental autonomy support was negatively associated with the existence and development of adolescent boys' and girls' depressive symptoms. Longitudinal associations were bidirectional, yet paths from depressive symptoms to parental autonomy support (child effect) tended to be stronger than paths from parental autonomy support to adolescents' depressive symptoms (parent effect). No concurrent and longitudinal associations were found between perceived autonomy support from best friends and adolescents' depressive symptoms. Throughout adolescence, the extent to which parents were perceived as supporting autonomy appeared to be more closely related to adolescents' depressive

symptoms that the extent to which best friends were perceived to support autonomy. As such, prevention and treatment programs should focus on the mutual interplay between adolescents' depressive symptoms and their perceptions of parental autonomy support.

Our *third aim* was to investigate the role of emotional variability in mother-adolescent conflict interactions on a micro-level for mother-adolescent relationship quality and adolescents' psychosocial health on a macro-level. Emotional variability reflects the ability of mother-adolescent dyads to flexibly switch among a broad range of emotional states from moment-to-moment during conflict interactions. The current dissertation revealed that higher levels of emotional variability in early adolescence were associated with stable and lower levels of adolescents' aggressive behavior from early to late adolescence as well as with relative decreases in internalizing problems of mothers and adolescents from early to late adolescence. Furthermore, more emotional variability in early adolescence was associated with more adolescent disclosure in early adolescence, was predictive of relative decreases in maternal control from early to late adolescence, and was related to mean-level increases in perceived autonomy support and mean-level decreases in perceived conflict frequency over time. It is noteworthy that these associations were irrespective of the types of emotions expressed (e.g., anger, happiness) during the conflict interactions. Altogether, more emotional variability of mother-adolescent dyads during conflict interactions in early adolescence seems to be adaptive for dealing with emotional and relational challenges that arise during adolescence. As such, prevention and treatment efforts should focus on teaching mother-adolescent dyads to learn to express, share, modulate and shift out of a wide variety of positive and negative emotions during conflict interactions.

In sum, we demonstrated longitudinal associations between parent-adolescent relationships and adolescents' psychosocial problems during adolescence. In particular, how parent-adolescent dyads handle emotions from moment-to-moment during conflict interactions can provide important information about the development of adolescents' relationships well-being.



Summary in Dutch

Summary in Dutch

De adolescentie is een leeftijdsperiode waarin de ouder-kind relatie belangrijke veranderingen ondergaat. Daarnaast is de adolescentie een sensitieve periode voor de ontwikkeling van psychosociale problemen. Sommige ouder-kind dyades missen adaptieve vaardigheden en kwaliteiten waardoor adolescenten een groter risico lopen om psychosociale problemen te ontwikkelen. Om psychosociale problemen tijdens de adolescentie te voorkomen, is het daarom belangrijk om potentiële risicofactoren binnen ouder-kind relaties te identificeren.

Het doel van het huidige proefschrift was om longitudinale associaties tussen de ouder-kind relatie en psychosociale problemen tijdens de adolescentie beter te begrijpen. Daarbij hebben we gebruik gemaakt van twee niveaus van conceptualisatie. Een macro-niveau werd gebruikt om relatief stabiele aspecten van relaties en psychosociale problemen bij adolescenten over een langere periode te beschrijven. Een micro-niveau werd gebruikt om variabiliteit in emotionele patronen van moment-tot moment tijdens conflict interacties van moeder-kind dyaden te beschrijven.

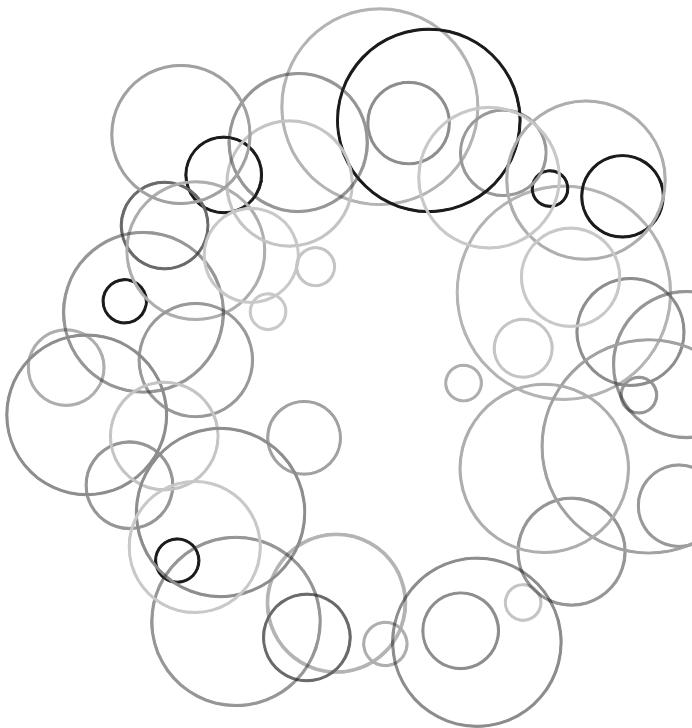
Het *eerste doel* was om op macro-niveau de richting van effecten tussen agressief gedrag en depressieve symptomen tijdens de vroege adolescentie te onderzoeken. De resultaten toonden aan dat tijdens de vroege adolescentie voor jongens en meisjes agressief gedrag en depressieve symptomen zowel cross-sectioneel als longitudinaal gerelateerd waren. Tijdens de vroege adolescentie was meer agressief gedrag gerelateerd aan gelijktijdig meer depressieve symptomen en was meer agressief gedrag voorspellend voor meer depressieve symptomen een jaar later. Deze bevindingen laten zien dat preventies en interventies rekening moeten houden met associaties tussen probleemgedrag in deze verschillende domeinen.

Het *tweede doel* was om op macro-niveau van de vroege tot de late adolescentie de richting van effecten te onderzoeken tussen enerzijds percepties van adolescenten over de mate van autonomie steun van ouders en beste vrienden en anderzijds de depressieve symptomen bij adolescenten. De bevindingen toonden aan dat tijdens de gehele adolescentie percepties van autonomie steun van ouders negatief samenhangen met het ontstaan en ontwikkelen van depressieve symptomen bij adolescenten. De longitudinale relaties bleken wederkerig te zijn. Echter, het effect van depressieve symptomen naar autonomie steun van ouders (kind-effect) bleek sterker te zijn dan het effect van autonomie steun van ouders naar depressieve symptomen (ouder-effect). Er werden van de vroege tot de late adolescentie geen relaties gevonden tussen percepties van

autonomie steun van beste vrienden en depressieve symptomen bij adolescenten. Dit wil zeggen dat de mate waarin adolescenten ervaren dat ouders hun autonomie steunen sterker gerelateerd is aan depressieve symptomen bij adolescenten dan de mate waarin adolescenten ervaren dat beste vrienden hun autonomie steunen. Preventie en interventie programma's zouden daarom zich meer moeten richten op de wederkerige relatie tussen de symptomen van depressie bij adolescenten en hun percepties over de autonomie steun die ouders geven.

Het *derde doel* was om de rol van emotionele variabiliteit tijdens conflict interacties van moeders en kinderen (micro-niveau) voor de relatiekwaliteit van moeders en kinderen en psychosociale problemen van kinderen (macro-niveau) te onderzoeken gedurende de adolescentie. Emotionele variabiliteit reflecteert de mate waarin moeder-kind dyades in staat zijn om tijdens conflict interacties van moment tot moment flexibel hun emotionele expressies aan te passen. Meer emotionele variabiliteit tijdens de vroege adolescentie blijkt gerelateerd te zijn aan stabiele en lage niveaus van agressief gedrag bij kinderen gedurende de adolescentie en aan een relatieve afname in internaliserende problemen bij moeders en kinderen gedurende de adolescentie. Daarnaast blijkt dat meer emotionele variabiliteit tijdens de vroege adolescentie ook geassocieerd is met het openlijk delen van informatie tijdens de vroege adolescentie, met een relatieve afname in ouderlijke controle gedurende de adolescentie, met een gemiddelde toename van moederlijke autonomie steun en met een gemiddelde afname in de conflict frequentie gedurende de adolescentie. Deze associaties bleken niet afhankelijk te zijn van het soort emotionele expressies (bijv., boosheid of blijheid) die moeder-kind dyades tijdens de conflict interacties lieten zien. Tezamen, laten de resultaten zien dat meer emotionele variabiliteit van moeder-kind dyades tijdens conflict interacties in de vroege adolescentie een adaptieve strategie is om emotionele en relationele veranderingen gedurende de adolescentie tegemoet te treden. Zodoende zouden preventies en interventies moeder-kind dyades moeten leren om flexibel positieve en negatieve emoties te uiten, te delen, te moduleren alsook te switchen.

Samenvattend, we hebben aangetoond dat er longitudinale associaties bestaan tussen ouder-kind relaties en psychosociale problemen bij kinderen gedurende de adolescentie. We lieten met name zien dat onderzoek naar de mate waarin moeder-kind dyades in staat zijn om hun emoties van moment tot moment aan te passen tijdens conflict interacties belangrijk is en nieuwe informatie kan verschaffen over de ontwikkeling van relaties en welbevinden van adolescenten.



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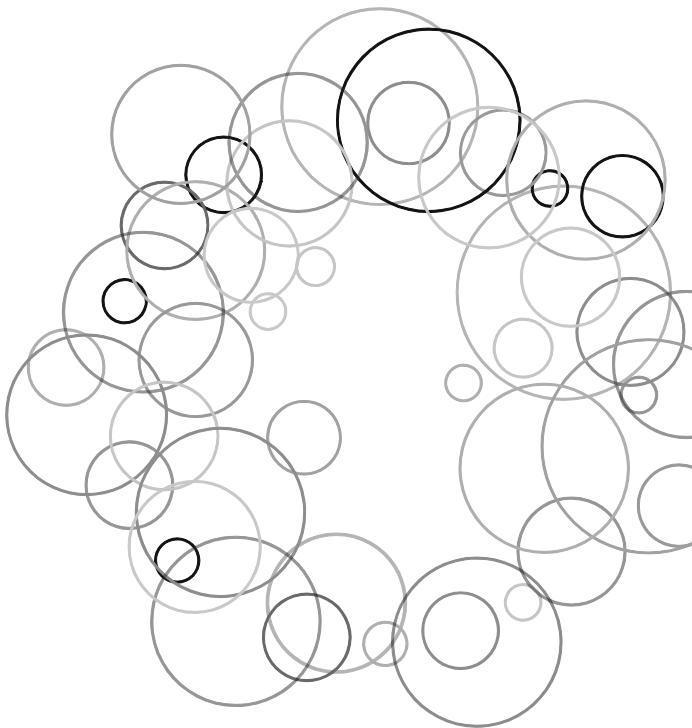
Naast collega's zijn er natuurlijk ook mensen buiten het werk die ik hier graag wil bedanken. Allereerst, wil ik mijn hele **schoonfamilie** en alle **vrienden van Onno** bedanken voor de interesse in mijn werk en de gezelligheid tijdens alle etentjes, fuiven en skivakanties. Dan mijn Utrechtse vriendinnetjes: **Anne**, **Maartje**, **Rianne**, **Simone** en **Yvonne**. Bedankt voor de overheerlijke aanschuifmaaltjes op dinsdag, de zinnige en onzinnige kletspraat, de feestjes en de laatste maanden de onwijs lieve steun. De interesse die jullie tonen in mijn "rare en vreselijke werk" is voor mij van onschabbelijke waarde. Ik kijk uit naar de vele gezellige momenten die nog gaan komen. Mijn vriendinnetje **Leonie** wil ik bedanken voor onze fantastische vriendschap. Als ik je nodig heb, dan ben je er. Samen tv kijken onder een kleedje, naar de film, kokkerellen, terrasjes pakken of zelfs naar Papendrecht; het zijn heerlijke momenten die mij helpen om de stress op het werk te relativiseren. Met pijn in mijn hart neem ik afscheid van ons geliefde stadje Utrecht, maar absoluut niet van jou! Onze vriendschap is voor altijd.

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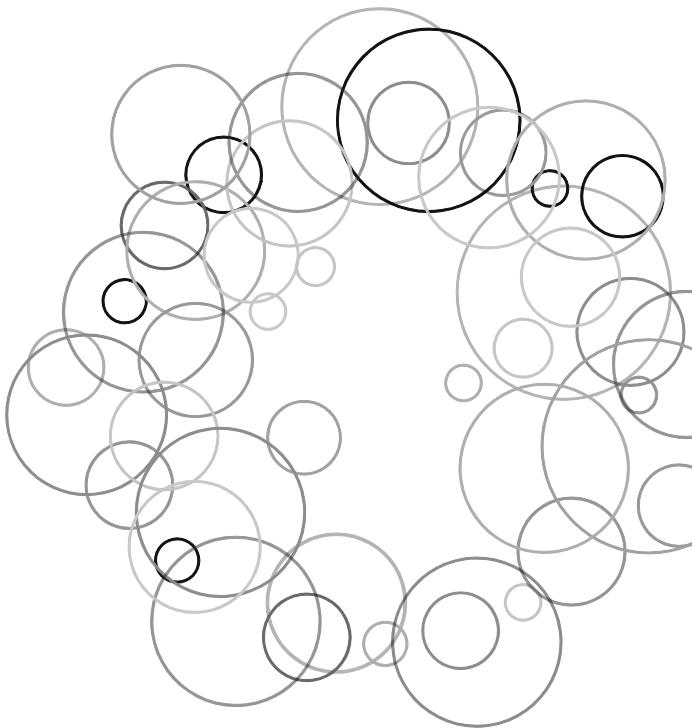
Curriculum Vitae

Curriculum Vitae

Daniëlle van der Giessen was born on October 25th, 1986, in Ridderkerk. After completing pre-university education at De Lage Waard in Papendrecht (2004), she studied Pedagogical Sciences at Utrecht University (2004-2007). She obtained, cum laude, a research master's degree in the Development and Socialization in Childhood and Adolescence (2007-2009). In June 2009, she started her PhD-project at the Research Centre of Adolescent Development at Utrecht University. Daniëlle wrote her dissertation on the development of parent-adolescent relationships and adolescents' psychosocial problems (2009-2013). She employed innovative dynamic systems methods in her dissertation to investigate the role of emotional variability in parent-adolescent interactions for healthy functioning of adolescents.

As a PhD-candidate, Daniëlle enjoyed a number of international activities. She organized and participated in several international conferences, symposia, and workshops. She had the opportunity in 2009 to travel to Isabela Granic at the Hospital for Sick Children in Toronto to get trained in the Specific AFFect Coding System (SPAFF). In addition, she was selected to attend an international summer school of the European Association for Research on Adolescence and the Society for Research on Adolescence (EARA/SRA, 2011), and she was elected to be a PhD-representative for PhDs of Child and Adolescent Studies (CAS) at Utrecht University.

In addition, she gained teaching experience as a lecturer in a course aimed at teaching bachelor students academic skills, as a supervisor of master's theses and as a coding supervisor training research assistants the Specific Affect Coding System. Daniëlle will continue her research and teaching activities as a Post-Doc at the University of Amsterdam.



Publications

Publications

This dissertation

- Van der Giessen, D.**, Branje, S. J. T., Frijns, T., & Meeus, W. H. J. (2013). Dyadic variability in mother-adolescent interactions: Developmental trajectories and associations with psychosocial functioning. *Journal of Youth and Adolescence*, 42, 96-108. doi:10.1007/s10964-012-9790-7
- Van der Giessen, D.**, Branje, S., Hollenstein, T., Hale, W., Koot, H. M., & Meeus, W. (2013). Emotional variability in mother-adolescent interactions and internalizing problems of mothers and adolescents: Dyadic and individual process. *Manuscript submitted for publication*.
- Van der Giessen, D.**, Branje, S., Keijsers, L., Van Lier, P. A. C., Koot, H. M., & Meeus, W. (revised and resubmitted). Emotional variability during mother-adolescent conflict interactions: Longitudinal links to adolescent disclosure and maternal control. *Journal of Adolescence*.
- Van der Giessen, D.**, Branje, S., & Meeus, W. (in press). Perceived autonomy support from parents and friends: Longitudinal associations with adolescents' depressive symptoms. *Social Development*
- Van der Giessen, D.**, Branje, S., Overbeek, G., Frijns, T., Van Lier, P. A. C., Koot, H. M., & Meeus, W. (2013). Co-occurrence of aggressive behavior and depressive symptoms in early adolescence: A longitudinal multi-informant study. *European Review of Applied Psychology*, 63, 193-201.
doi:10.1016/j.erap.2013.03.001

Other publications

- Maciejewski, D. F., Van Lier, P. A. C., Neumann, A., **Van der Giessen, D.**, Branje, S. J. T., Meeus, W. H. J., & Koot, H. M. (2013). The development of adolescent generalized anxiety and depressive symptoms in the context of adolescent mood variability and parent-adolescent negative interactions. *Journal of Abnormal Child Psychology*. Advance online publication. doi:10.1007/s10802-013-9797-x