Tracking Disadvantaged Adolescents’ Daily Emotion Dynamics: An experience sampling study of adolescents’ emotional responding, reactivity, and inertia in everyday life

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Author’s Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary institution.

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Bep N. Uink
Abstract

The daily ebb-and-flow of emotions serve as “building blocks” for psychological health (Wichers, 2013). Thus, understanding day-to-day emotional dynamics of youth embedded in the context of socioeconomic disadvantage can provide valuable insight for mental health conditions. This thesis utilized Experience Sampling Methodology (ESM) to map a range of emotional experiences among disadvantaged youth, including emotional responses across differing contexts, emotional reactivity to stressors, and emotional inertia.

Data were derived from the “How do you feel?” project, in which two hundred and six socioeconomically disadvantage youth reported their emotional states, social contexts and recent experiences of stressors, five times per day for seven days, using smartphones (i.e. the ESM phase). Adolescents’ psychopathology symptoms were assessed at pre-and post ESM. Hierarchical linear modelling (HLM) was used for main analyses.

Study 1 investigated adolescents' emotional responses to a recent stressor, and the conditioning effect of social context on these emotional responses. Findings suggested that adolescents' emotional responses to stressors were dampened when in the presence of peers, versus being alone or with family. Study 2 narrowed the lens to focus on individual differences in adolescents' reactivity to daily stressors based on youths’ externalizing symptomatology. Findings suggested a linear association between externalizing and emotion reactivity, such that adolescents with higher externalizing symptoms experienced greater increases in sadness, anger and loneliness, and greater decreases in excitement post-stressor, compared to their less-symptomatic peers. The third and final study further investigated the conditioning effect of adolescents' externalizing symptoms by examining the relation between
externalizing and the carry-over effects of emotions from one-time point to the next (i.e. emotional inertia). Adolescents higher in externalizing symptoms demonstrated stronger inertia for worry, but weaker inertia for happiness and excitement, compared to adolescents lower in externalizing symptoms.

In sum, this thesis provides convincing evidence of the role of contexts and individual differences in the daily emotional dynamics of disadvantaged adolescents. Continued parsing of individuals’ daily emotional experiences will be critical to scholars’ broader understanding of adolescent mental health.
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List of Original Publications

This thesis contains the following publications:


This thesis contains the following studies currently under peer-review:

CHAPTER ONE: OVERVIEW

Adolescence is often described as a period of emotional turmoil. For the first time in their life, adolescents must learn to anticipate, identify and modulate changes in their emotional states, and do so autonomously, to achieve desired outcomes (Dahl, 2004). This process is often broadly referred to as emotion regulation (Gross, 1998). The momentous challenge of this task is further highlighted when considering the dynamic nature of emotions. That is, emotions are not discrete or static events, but rather, dynamic processes that change from moment-to-moment, between contexts, and within and between days (Augustine & Larsen, 2012).

Because the development of self-control, the formation of appropriate emotional responses to stress, and the ability to enact context-appropriate behaviour, all stem from being able to reign in the dynamic aspects of daily emotions, a capacity for independent emotion regulation represents a critical developmental milestone for adolescents (Eisenberg et al., 2009). Importantly, too, difficulties in adaptive emotional responding during adolescence can have long-term, flow on effects to psychological functioning in adulthood (Masten & Cicchetti, 2010). Given such long-term cascading effects of poor emotional functioning during adolescence, it is especially crucial that scholars explore adolescents’ emotion dynamics during this formative stage. Accordingly, the three empirical studies in this thesis share a focus on examining adolescents’ daily emotion dynamics, in the form of emotional responsivity (Study 1), emotion reactivity (Study 2), and emotional inertia (Study 3).

Owing to scholars’ growing recognition of emotions as dynamic processes, an emotion dynamics framework has become a zeitgeist in the field of emotion research. The study of emotion dynamics involves examinations of the real-time,
temporal, and intensive aspects of an individual’s emotions, their emotional patterns, and the behaviours that are coupled with these patterns (Kuppens, Stouten, & Mesquita, 2009). Notably, Thompson (1994) makes clear the distinction between these emotion dynamics and emotion regulation. Here, emotion dynamics are conceptualized as the response parameters that individuals place around emotional states, during the process of emotion regulation. As an example, after a recent upset, a given adolescent might experience a spike in sadness (i.e. reactivity dynamic) and so subsequently engage in a pleasant activity to cheer up (i.e. emotion regulation). That said, the manifestation of emotion dynamics does not necessarily precede an individual’s regulation efforts, and some take the view that all emotion dynamics are underpinned by regulation (Eisenberg, Spinrad, Eggum, 2010; Koval, Pe, Meers, & Kuppens, 2013). Yet, what is clear, is that emotion dynamics and emotion regulation represent two separate constructs.

Although adolescents demonstrate a growing capacity to self-regulate, the biological and social changes that occur during this period render youth vulnerable to disrupted emotion dynamics. During this time, puberty-related brain changes bring about enhanced connectivity and fine-tuning in executive control circuitry that underlies adaptive emotional functioning (Casey, 2015; Luciana, 2013). However, the developmental process that leads to “adult-like” emotion regulation is protracted and adolescent regulation itself tends to be impaired. On top of this, adolescence brings with it the introduction of a variety of new experiences and challenges that catalyse intensified emotion dynamics.

A salient example of such challenges which youth face during adolescence is an increase in the experience of daily stressors. Daily stressors – or hassles - are defined as “the irritating, frustrating, distressing, demands that to some degree
characterize everyday transactions with the environment” (Kanner, Coyne, Shcaefer, & Lazarus, 1981). As youth ‘branch-out' and explore their physical and social environments in daily life, and adopt more adult-like roles in society, they come up against new stressors and challenges, which can trigger a cascade of emotional responses (Ham & Larson, 1990; Kanner et al., 1981). Consistent with this notion, past empirical evidence shows that daily hassles are associated with disruptions in adolescents’ daily emotional states (e.g. Schneider et al., 2006).

A second major challenge during adolescence is an increased risk for psychopathology, particularly externalizing symptoms, which are both an outcome of poor emotion regulation and a risk factor for deregulated emotion dynamics (Hollenstein & Lougheed, 2013; Silk, Steinberg & Morris, 2003; Wichers, 2013). Externalizing psychopathology is characterized by a cluster of behaviours including risk taking, aggressive and anti-social acts, substance use and delinquency (Achenbach, 1991). Pointing to the danger of this increased risk for externalizing symptomatology, youths’ participation in externalizing behaviours can have serious, unintended consequences, including incarceration, injury, and premature death (Blum & Nelson-MMari, 2004; Steinberg, 2008).

Evidently then, adolescence is a period where biological regulation systems are not yet fully functional, but also a time of significant stress and risk for psychopathology. Consequently, the three studies in this thesis are bound by their focus on these developmental vulnerabilities, unique to adolescence, and their relations to youths’ daily emotion dynamics.

The first empirical study (Chapter 3) examines adolescents’ emotion dynamics in the context of daily stressors. Unlike major life stressors, which occur with relative infrequency, daily stressors occur on a moment-to-moment basis and
thus require adolescents to quickly and effectively set parameters around their emotional responses (Schneiders et al., 2006; Williams & McGillicuddy-De Lisa, 1999; Wright, Creed, & Zimmer-Gembeck, 2010). As evidence of the longer-term impact of daily stressors, past research finds that the frequency of daily stressors is a stronger predictor of poor psychological well-being than major life stressors (Kanner, Coyne, Schaefer, & Lazarus, 1981). Further exposure to daily stressors during late adolescence is found to predict depressive symptoms in adulthood (Kogan, Yu, Allen, & Brody, 2015). Also, chronic exposure to daily stressors carries the potential to wear down adolescents’ ability to respond adaptively to major life events (Schulkin, 2003). Thus, investigations into adolescents’ emotion dynamics, in the face of daily stressors, have the potential to provide insight into youths’ broader emotional and psychological wellbeing.

Although past research indicates that daily hassles are associated with deviations in adolescents’ emotional states (e.g. Schneiders et al., 2006), what remains unclear is whether adolescents’ emotional responses to hassles differ as a function of their social context. Given that adolescence represents a time of developmentally novel social contexts (Somerville, 2013), a needed next step is for scholars to examine potential differences in how adolescents respond emotionally to daily hassles across a variety of social contexts. To this end, Study 1 examines the dynamic of emotional responding, and asks whether adolescents’ current social context (i.e. alone, with peers or with family) dampens or exacerbates emotional responses to daily stressors. Here, emotional responding is operationalized as deviations in an adolescent’s emotion (e.g. happiness) from their average level of happiness. Findings from Study 1 suggest that adolescents are less emotionally responsive to stressors across several emotions (i.e. sadness, worry, jealousy and
happiness) when they are with peers compared to when they are alone or with a family member, and these findings are especially true of girls. Findings indicate that peers may help youth to navigate the increased frequency of daily stressors that occurs during adolescence, thus helping them maintain healthier daily emotion dynamics.

The second empirical study (Chapter 4) continues this focus on emotion dynamics in relation to daily stress, and extends its lens to the role of youths’ externalizing symptomatology. Not only does externalizing symptomatology show a developmental uptick during adolescence, but theoretical accounts of adolescents’ externalizing behaviour assert that exaggerated emotional responses to stress contributes to the aetiology and maintenance of externalizing disorders (Beauchaine & McNulty, 2013; Casey, 2015; Crone & Dahl, 2012). Yet, there still exists a significant gap in the research literature examining adolescent’ in-vivo emotion responses to day-to-day stress as a function of their levels of externalizing symptomatology. Thus, Study 2 addresses this gap in the literature by examining whether externalizing symptomology conditions adolescents’ emotion reactivity to daily stressors.

In Study 2, emotion reactivity is operationalized as the change in a given adolescent’s emotion (e.g. happiness) between adjacent time-points (i.e. from pre-to post-stressor. Findings from Study 2 show that externalizing symptomatology is associated with greater emotion reactivity in sadness, anger, jealousy, and excitement. These findings are particularly noteworthy given the study deploys a continuous measure of externalizing symptomatology (versus dichotomizing groups of “high” versus “low” externalizing) and shows a consistent, linear relation between externalizing symptomatology and exacerbated emotion reactivity. Further, because
this examination controls for both depressive and social anxiety symptoms, findings represent a "pure" relation between externalizing symptoms and emotion reactivity to daily stress.

Follow-up analyses in Study 2 further assess the possibility that previous, elevated levels of emotion might potentially trigger a stressor, particularly for adolescents high in externalizing symptoms. Findings from this analysis show that prior negative emotion does not predict subsequent stressors for adolescents with relatively high levels of externalizing symptoms. Yet, for adolescents relatively low in externalizing symptoms, high levels of prior jealousy are protective against subsequent stressors, suggesting a stress-preventative effect.

The third and final study in this thesis (Chapter 5) maintains a focus on externalizing symptomatology, and assesses adolescents' continuity of emotional states (e.g. low happiness) as a possible marker for disrupted emotion dynamics. Specifically, the study centres on the dynamic of emotional inertia – the extent to which prior levels of a given emotion predicts current level of that emotion (Suls, Green, & Hillis, 1998). Here, higher emotional inertia represents a stronger carry-forward of emotion across time, and is considered a proxy of emotional inflexibility (Hollenstein, 2015; Koval & Kuppens, 2012). Past studies provide support for strong emotional inertia among depressed individuals (e.g. Koval, Kuppens, Allen, & Sheeber, 2012; van Roekel et al., 2016). Yet, because emotional inflexibility is a hallmark of many psychological disorders, strong emotional inertia should also distinguish adolescents with other forms of psychopathology, including externalizing symptomatology (Hollenstein, Granic, Stoolmiller, & Snyder, 2004). Thus, Study 3 examines individual differences in adolescents’ emotional inertia as a function of externalizing symptoms. Consistent with past studies (e.g. Koval & Kuppens, 2012),
emotional inertia is operationalised as the autoregressive coefficient between current emotion (e.g. happiness) and happiness at a previous time point.

Findings from Study 3 indicate that externalizing symptomatology is associated with stronger carry-forward of worry across the day, but weaker carry-forward of happiness and excitement. Findings suggest that youth with elevated externalizing symptoms may require additional assistance with calibrating daily emotion dynamics so that unhelpful emotion states don’t persist across their days, and likewise, to help propagate positive emotional states. Overall, the empirical studies in this thesis converge to offer key contributions to the emotion dynamics literature, and in particular, to the emerging body of emotion dynamics work concerned with adolescents’ psychological health. Combined, the three studies demonstrate the unique daily emotional landscapes tied to adolescents’ experience of daily stressors, common social contexts, and externalizing symptoms.

Correspondingly, a major challenge for researchers wishing to better understand adolescents' daily dynamics, is adequately capturing patterns of emotion in everyday life. Indeed, a body of research shows that "in-the-moment" versus retrospective reports of emotions differ substantially (Ben-Zeev, Young, & Madsen, 2009; Miron-Shatz, Stone, & Kahneman, 2009; Sato & Kawahara, 2011), because retrospective reports of emotions may be biased by cognitive processes. Moreover, an additional research challenge is how best to measure emotional responding to contingencies that arise in adolescents’ day-to-day life, including daily stressors. For instance, youth face biases when asked to retrospectively recall stressful events that occurred across their day (e.g. the tendency to recall more recent events; Trull & Ebner-Primer, 2009). Thus, scholars interested in further understanding adolescents' daily emotional dynamics ideally should capitalize on accessible methodologies for
working with youth, which can also capture "in-the-moment" relations between emotions and context, temporal relations between context and emotions, and temporal dependencies in emotions.

Consequently, the three empirical studies in this thesis leverage Experience Sampling Methodology (ESM) to capture emotional responding, reactivity, and inertia, among Australian adolescents. Data for these studies were derived from the “How do you feel? Adolescent behaviour, emotion, and technology use over time” study, a four-phase study comprised of focus groups, piloting, participant feedback/debriefing, and a larger ESM study using smartphones. Thus, these studies draw on best-practice for ambulatory assessment methods, and leverage adolescents’ burgeoning use of digital technology (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). Of major benefit, by facilitating youths’ real-time reporting of their emotions, contexts, and stressors across their days, ESM reduces the chance of retrospective recall bias in reports of emotions and stressful events (Trull & Ebner-Primer, 2009). Also, because youth complete ESM surveys through their day-to-day life, ESM reports provide a picture of adolescents’ daily lives, offering unique ecological validity (Scollon, Kim-Prieto, & Diener, 2003).

Beyond the selection of appropriate methodologies to tap the dynamic nature of emotions, a second major challenge for emotion dynamics research has been use of representative samples. Indeed, one of the strongest critiques of emotion research, and psychological research more broadly, is its general focus on middle-income youth, to the exclusion of youth living in socioeconomically disadvantaged settings (Bonveski et al., 2014; Coll et al., 1996; Russell, 1991). This gap in emotion research is important, because previous empirical work indicates that adolescents
living in contexts of low socioeconomic status (SES) tend to find it difficult to regulate both their emotions and their behaviour (Chen & Miller, 2013).

Arguably, youth living in low SES settings are among those populations most in need of prevention and intervention efforts that are based on improving emotional and behavioural control. Indeed, past research finds that youth in low SES settings experience significantly more psychological concerns, greater vulnerabilities for emotion regulation deficits, and more frequent day-to-day stress, compared to youth in more affluent settings (Chen & Miller, 2013; Evans et al., 2009; Johnson & Swendsen, 2015; Shonkoff et al., 2011). Further, rates of externalizing symptomatology are higher among adolescents in low SES settings compared to middle and high-income youth (Bongers, Koot, van der Ende, & Verhulst, 2004), adding yet another putative risk factor for disrupted emotion dynamics. Given that the aim of translational research is to bridge scientific theory to real-world practice, translational scholars should, to the extent possible, conduct studies with populations for which interventions are needed and intended. Hence, there is a critical need for empirical investigations that better elucidates the day-to-day emotion dynamics among socioeconomically disadvantaged adolescents.

Given the above risk factors, and given that emotional responses to contexts encountered across the day forms the building blocks of psychopathology and health (Wichers, 2013), the potential clinical applications of this work are worth emphasizing. In the case of daily stressors, being able to weather emotional "ups and downs", brought about by environmental demands, may sign-post good mental health (Kuppens, Oravecz, & Tuerlinckx, 2010; Kuppens & Verduyn, 2017). Likewise, disrupted emotional dynamics in the face of such demands may beacon psychological difficulties. Indeed, for youth who already manifest signs of
psychopathology (i.e. those who report elevated externalizing symptoms), unpacking the particular emotion dynamics which are especially disrupted across daily life, gives novel information for those ‘on the ground,’ working hands on with youth.

Subsequent chapters progress as follows. First, Chapter 2 provides a broader review of the research literature concerning various constructs considered in the thesis. Next, Chapters 3-5 contain manuscripts for Study 1, Study 2, and Study 3, respectively, each of which has been either published or is under review within peer-reviewed journals. Each of these chapters begins with a Preface section, which serves to link each empirical study to the broader conceptual framework of the thesis. The final chapter (Chapter 6) integrates results from the three empirical studies, links findings back to the emotion dynamics literature, and highlights potential practical applications for improving the emotional and psychological functioning of adolescents embedded in socioeconomic disadvantage.
CHAPTER TWO: LITERATURE REVIEW

With experience and practice, adolescents become skilful in adaptively responding to new contexts and challenges (Luciana, 2013). These challenges include increased exposure to daily stressors, changing social contexts, and a neurologically-based drive to engage in externalizing behaviours (Hollenstein & Lougheed, 2013). Successful responding to each of these challenges requires adolescents to place healthy parameters on their emotions, as they build a repertoire of skills to independently manage day-to-day life. However, the journey toward successful navigation of emotion dynamics is not always smooth sailing, and for some, brings with it increased risk for psychopathology (Bongers, Koot, van der Ende, Verhulst, 2004; Kessler, et al., 2005; Peterson, Compas, & Brooks-Gun, 1993). Moreover, adolescents’ environmental contexts can render them even more susceptible to difficulties in responding to new challenges (Cicchetti & Rogosh, 2002), and adolescents embedded in settings of socioeconomic disadvantage are among the most vulnerable (Chen & Miller, 2013).

This chapter outlines the constructs examined in the empirical studies in this thesis. I begin with a discussion of what research conducted from an emotion dynamics viewpoint can add to scholars’ understanding of adolescents’ emotional functioning. Next, I review empirical research which places adolescence as a vulnerability period for frequent daily stressors and disrupted emotional dynamics in the face of such stressors. This review is followed by a discussion of adolescents’ changing social contexts and levels of externalizing symptoms as putative factors influencing daily emotion dynamics (as captured by emotional responding, emotion reactivity, and emotional inertia). Next, I consider empirical literature regarding how
disadvantaged adolescents are especially at-risk of disrupted daily emotion dynamics. I conclude with an overview of the types of methodology used in these empirical studies – experience sampling methodology—a method ideally suited to measuring adolescents’ daily emotion dynamics.

**Emotion and Emotion Dynamics**

**Defining Emotion**

Because of the multitude of ways that emotion is conceptualised across the research literature, it is helpful to specify what is meant when referring to “emotion” (Cole, Martine & Dennis, 2004). Indeed, emotions are complex processes which involve activation across multiple systems including neurological and physiological systems, attention systems, and cognitive appraisal systems, as well as behavioural response tendencies and the subjective experience of ‘feeling’ (Gross, 2015). In fact, some scholars argue that individuals experience emotion at both an unconscious level (e.g. changes in physiology) and a conscious level, but that the experience of "feeling," only occurs when emotions come into conscious awareness (Russell, 2003). Thus, self-report measures of emotion, as utilized in this thesis, arguably only capture the phenomenological experience of emotion, whereas more objective measures (e.g. heart rate) capture the physiological and unconscious components of emotions. As a result, although the term "emotion" encompasses physiological, behavioural and subjective domains, the term is used specifically in this thesis to refer to the subjective experience of "feeling."

**What Emotion Dynamics Work adds to Emotion Research**

Scholars are increasingly calling attention to the benefits of emotion research when situated within an emotion dynamics framework (Gross, 2015; Kuppens & Verduyn, 2015; Trull, Lane, Koval, & Ebner-Priemer, 2015). As research into
emotion dynamics grows, it is worth highlighting what scholars can learn from research conducted within this emotion dynamics viewpoint, beyond what ‘traditional’ studies of emotion regulation can provide. Emotion regulation itself refers to a series of unconscious and conscious events that a given adolescent experiences or enacts, in response to stimuli, and to inform goal-directed behaviour (Gross, 1998). Thus, emotion regulation research primarily tells us how (and how effectively) adolescents modulate their emotions.

In contrast, emotion dynamics research investigates patterns in a given adolescent’s emotions, and behaviours linked to such patterns (Kuppens, Stouten, & Mesquita, 2009). Likewise, researchers can assess different varieties of emotion dynamics by considering temporal relations between emotions. For example, how much does the previous level of an emotion predict future levels of that emotion? (i.e. emotional inertia; Kuppens & Verudyn, 2015). Although sharing a conceptual overlap, emotion regulation and emotion dynamics refer to two distinct concepts. Emotion dynamics represent the limits that individuals place around emotion during their process of emotion regulation (Thompson, 1994). Notably, such emotional response parameters may not necessarily be consciously determined, and similar to emotion regulation, specific emotion dynamics can arise from unconscious processes (e.g. physiological changes in response to an event). As an example, change in the intensity of an emotion in response to a contingent event would be considered an emotion dynamic, captured under the term emotion “reactivity.” On the other hand, the actions, conscious or unconscious that an adolescent engages to reduce (or enhance) the intensity of the emotion would be considered under the banner of emotion regulation. Thus, although related, emotion dynamics and emotion regulation refer to two separate components of adolescents’ emotional functioning.
Given this intersection between emotion dynamics and emotion regulation, a consideration of how these two literatures inform each other, particularly how research situated with an emotion dynamics viewpoint can fill gaps in the existing emotion regulation literature, serves as a springboard for future emotion dynamics investigations. Illustratively, at the broadest level, the vast emotion regulation literature supports a robust link between effective emotion regulation strategies and healthy day-to-day operations (e.g. see Gross, 2002; and Southam-Gerow & Kendall, 2002 for reviews). Also, findings from emotion regulation studies widely show that youth who can enact adaptive emotion regulation strategies are at lower risk for psychopathology, including externalizing symptomatology (e.g. Beauchaine & McNulty, 2013). Thus, broadly speaking, the ample body of emotion regulation studies highlight that being able to effectively place limits on emotional experiences is critical for adolescents’ healthy psychological functioning.

That said, although previous emotion regulation studies offer crucial understandings of adolescents’ emotional functioning, two critiques of the area are also apparent. First, previous emotion regulation research has been unable to directly capture change in emotion, and thus cannot confirm that regulation has taken place. Second, traditional emotion regulation research has been unable to specify exactly what aspects of emotional experiences are being regulated (Cole et al., 2004; Thompson, 1994). As highlighted below, it is these critiques that the empirical studies in this thesis speak to, and in so doing, adopt an emotion dynamics approach to address. Further, although emotion regulation research has offered a cornerstone foundation for understanding adolescents’ day-to-day daily functioning, conducting further research from an emotion dynamics viewpoint can help overcome these limitations.
Inability to capture change. Perhaps the largest driver of emotion dynamics research has been scholars’ increasing recognition that emotions are not once-off, static events, but instead are dynamic processes that fluctuate across time and contexts (Augustine & Larsen, 2012; Trull et al., 2015). Driven by this focus on emotion as ever-changing, empirical investigations situated within an emotion dynamics framework tend to use repeated measures of emotion to capture fluctuations or change in emotions. In contrast, traditional emotion regulation studies seek to infer stability or whether change has occurred, most often by using one-point in time measures. For instance, youth tend to be asked to report how they alleviate unwanted emotional states or to indicate how often they use a variety of pre-identified emotion regulation strategies (e.g. self-blame, cognitive reappraisal; Garnefski, Legerstee, Kraaij, van den Kommer, & Teerds, 2002; Ng, Eckshtain, & Weisz, 2015; Seiffge-Krane et al., 1995). In kind, researchers have developed a number of self-report measures for assessing how adolescents regulate their emotion (e.g. the Adolescent Ways of Coping Questionnaire; Halstead, Johnson, & Cunningham, 1993; the Emotion Regulation Questionnaire for Children and Adolescents; Gullone & Taffe, 2011). Though highly useful in identifying the multitude of ways that youth manage emotion, unfortunately, such investigations offer relatively little insight into whether youths’ emotions have changed through their use of said regulation strategies (Cole et al., 2004).

In a bid to overcome this limitation, emotion dynamics research aims to capture differences in emotion across time and context. Notably, too, scholars have recently called attention to the importance of considering emotional stasis, or ‘non-change,’ and how this might be a marker for poor psychological functioning (e.g. Houban, Van Den Noortgate, & Kuppens, 2015; Kashdan & Rottenberg, 2010).
examples of how adoption of an emotion dynamics framework helps scholars capture changes in emotion, and thus better understand adolescents’ day-to-day experiences, past studies have examined within-person variations in youths’ emotional states across a set time (e.g. across the day; e.g. Schneiders et al., 2006; Larson & Richards, 1994) and specific contexts (e.g. school versus peers; e.g. Schneiders et al., 2007; Silk et al., 2011). In this way, by assessing micro-shifts in emotion to directly assess change, emotion dynamics research overcomes a central limitation of emotion regulation research. Critically, it is this examination of emotion change that emotion dynamics research uniquely offers to the broader emotion functioning literature, and which is especially salient to adolescents’ wellbeing.

**Inability to capture what is being regulated.** Though it may seem self-evident that it is emotion that is being regulated during emotion regulation processes, it is also worth noting that certain aspects of an emotional experience can and will fluctuate within a given time-period while other aspects will remain stable (Trull et al., 2015). Thus, emotion dynamics research has a parallel focus on ‘drilling down’ into the specific aspects of an emotional experience that fluctuate, or remain stable, across time and contexts. Conversely, and highlighting a second limitation, traditional emotion regulation research has been unable to capture which specific parameters of emotion are constrained or prolonged within emotion regulation processes. Hence, by capturing patterns in youths’ emotional experiences based on intensity, duration, or shape, for example, research conducted from an emotion dynamics perspective can better uncover the nuanced nature of adolescents’ daily emotional experiences.
Adolescent Psychopathology and Emotion Dynamics

Emotional dynamics (rather than strictly regulation) are especially critical for investigations into adolescents’ functioning. That is, knowing which aspects of the emotional experience change, versus remain stable, across time and context, can provide a novel and much needed lens into youths’ psychological wellbeing. For instance, from a theoretical standpoint, several emerging models of emotion highlight that individual differences in specific varieties of emotion dynamics underscore discrete forms of psychopathology. Illustratively, in their DynAffect model, Kuppens and colleagues (2010) propose that individuals each have a set point for typical intensity and valence of affect (i.e. their “affective home base”). Internal and external events temporally push individuals away from this affective set point. However, individuals can differ in the extent to which events push them away from their set point or in terms of their regulatory capacity to bring emotion back toward said set point. Further, individual differences in these two ‘push and pull’ processes are said to underscore risk for psychopathology.

Indeed, Kuppens and colleagues (2010) demonstrate that a pattern of emotion dynamics characterized by large and frequent deviations from one’s emotional set point, as well as stronger resistance to returning to the set point, is associated with college students’ depressive symptoms. One way to conceptualize the types of emotion dynamics laid out by DynAffect is that the extent to which an adolescent is pulled away from their set point can be considered a form of emotion reactivity, whereas their capacity to return to their set point can be considered a form of emotional recovery (or what Kuppens et al., refer to as “attractor strength”). Thus, as the model highlights, individual differences in emotion reactivity and recovery can
help to characterize the degree to which some individual experiences (or does not experience) the dynamic processes which culminate in risk for psychopathology.

Further, findings from past empirical studies suggest that there are some types of emotion dynamics which become impaired in specific psychopathologies whereas other types of dynamics function similar to healthy individuals. For instance, previous empirical work has linked depression to greater variability in positive and negative emotions and greater inertia in negative emotions, but not greater inertia in positive emotions (Gruber, Kogan, Quoidbach, & Mauss 2013; Kuppens, Sheeber, Yap, Whittle, Simmons, & Allen, 2012; Thompson, Matta, Jaeggi, Buschkuehl, Jonides, & Gotlib, 2012; van Roekel et al., 2016). Further, when compared to individuals diagnosed with major depression, individuals diagnosed with Borderline Personality Disorder demonstrate greater variability in positive and negative affect, and greater instability in negative affect, but not differences in overall levels of affect (Trull et al., 2008). Among youth, the intensity of positive emotion following a pleasant event distinguishes youth with social anxiety from youth with other types of anxiety (e.g. separation anxiety or generalized anxiety disorder; Morgan et al., 2017). These studies serve to highlight the value of adopting and emotion dynamics approach in research into the emotional functioning of youth with various forms of psychopathology. That is, by drilling down into the specific types of dynamics that are impaired in discrete forms of psychopathology, scholars can begin to form a phenotype of daily emotional functioning for each specific cluster of symptoms.

Likewise, Chow and colleagues (2005) propose a similar idea to DynAffect in their damped oscillator approach. Here, along with individual differences in the extent of deviation in affect, individuals are also thought differ in the rates of change
in emotions, which the authors refer to as acceleration and deceleration in affective states. Similar again, Davidson (2000) places individual differences in emotion reactivity and regulation (i.e. an individual’s “affective style”) at the core of psychopathology. Moreover, in their Flex3 model of socioemotional flexibility, Hollenstein and colleagues (2013) propose that deficits in emotional flexibility drive psychopathological outcomes.

The above models highlight two key ideas pertinent to the empirical studies in this thesis. First, investigations of individual differences in specific dimensions of emotional dynamics, (e.g. reactivity or recovery) and how these relate to distinct psychopathologies, has much potential for informing assessment and treatment of psychopathology. Second, several dimensions, rather than a single characteristic of daily emotional functioning, likely characterize distinct forms of youthful psychopathology (in the case of this thesis, externalizing symptomatology). By capturing and characterizing these discrete parameters of emotion associated with specific adolescent psychopathologies, scholars can glean a more nuanced understanding of how specific psychopathologies coincide with unique daily emotional landscapes.

**Putative Factors Associated with Adolescents’ Daily Emotion Dynamics**

Given the importance of studying multiple dimensions of emotion dynamics in unpacking youths’ daily emotional functioning, and theoretical assertions that such dynamics should change across contexts and that distinct patterns should fit discrete psychopathologies, a connected question arises as to which individual- and contextual-level factors researchers should prioritize in search of understanding adolescents’ daily emotional experiences. Here, theoretical models of adolescent development become especially germane, because they highlight for scholars which
contexts and challenges adolescents are most likely to encounter in their day-to-day life, and across this developmental period more generally (i.e. changes in risk for psychopathology). Leveraging this understanding, researchers can better identify which distinct emotion dynamic is most likely to be associated with adolescence-specific day-to-day events and psychopathology symptoms. Following this line of thought, each study in this thesis examines a distinct type of emotion dynamic – emotional responding, emotion reactivity, or emotional inertia – and does so in relation to two critical challenges of adolescence: an increase in exposure to daily stressors and increased externalizing symptoms.

**Daily Stressors**

Before highlighting the developmental up-tick in experience of stressors during adolescence, it is worth discussing what is meant by “stressor” in this context. Here, a stressor is conceptualized as "any physical or psychological factor that perturbs or threatens to perturb homeostasis" (Sapolsky, 2004). Put another way, a stressor is any event which triggers the body to enact the stress response, commonly referred to as ‘fight or flight' (Canon, 1932; Hollenstein, McNeely, Eastabrook, Mackey, & Flynn, 2011). “Stressors” can be further broken down into two types: major life events, defined as severe and potentially life-changing events, for instance, parental divorce or death of a family member), or daily stressors (Compas, Davis, Forsythe, & Wagner, 1987). Daily stressors – or hassles – can be defined as “the irritating, frustrating, distressing, demands that, to some degree, characterize everyday transactions with the environment” (Kanner, Coyne, Shcaefer, & Lazarus, 1981). Thus, by definition, daily hassles represent an interaction between an individual and their context. Because a stress response can result from any change in environmental demands, daily positive events can also be viewed as daily stressors
(Lazarus & Folkman, 1987). However, the terms "hassles" and "daily stressors" are generally reserved for negatively valenced events.

**Daily Stressors during Adolescence**

Critically, adolescence is also a period where conditions for daily stressors manifest. During adolescence, youth encounter novel environments (e.g. transitioning from elementary to high school), navigation of increased emotional and behavioural autonomy from caregivers, and enhanced expectations for playing an increasingly independent role in resolving conflicts, all of which can eventuate in stressful events (Dahl, 2004; Larson & Ham, 1993; Spear, 2013). Further, too, major developmental tasks of adolescence can “trickle down” into daily stressors. For example, one key task of adolescence is branching outside of the family system and further consolidating peer relationships (Blakemore, 2008). Yet, this seeking out of peers and establishing new friendships can increase adolescents’ propensity for daily stressors, such as peer rejection and associated bouts of negative self-evaluation (Somerville, 2013).

A general sense of the frequency of daily stressors during adolescence can be gauged by reviewing studies that examine specific types of daily hassles. For example, Flook & Fulligni (2008) found 9th graders report an average of 7.13 school-related hassles and 6.22 family-related hassles across a two-week period. These findings suggest that, in terms of school related hassles, adolescents experience up to two hassles per day, with consideration also to be given to other types of hassles which likely co-occur. Using a daily hassles scale developed specifically for adolescents, Gallaty & Zimmer-Gembeck (2003) found that adolescents who are in a healthy romantic relationship report an average 2.71 romantic hassles, 1.4 friend-related hassles, and 1.33 family-related hassles per week,
with greater romantic and friend-related hassles among adolescents in unhealthy relationships. Here, these findings suggest that youth experiencing environmental risk (i.e. unhealthy relationships), report more frequent stressors, at least in the family and peer domains.

In relation to peer domains, given the increasing salience of peer relationships during this developmental period, it is not surprising that adolescents report relatively frequent peer-related stressors. Illustratively, using victimization as an example of “peer-based stress,” in a sample of 428 Mexican-American adolescents, just over a quarter (26%) of adolescents surveyed reported at least one instance of peer victimization across a 14-day period, and 5% reported experiencing three or more instances of peer victimization across the fortnight (Espinoza, Gonzales, & Fuligni, 2013). These findings are in-line with the notion that the primary developmental tasks of adolescence (i.e. developing peer connections) can also confer risk for daily stressors.

**Adolescents’ Capacity to Respond to Daily Stressors**

Parallel to the social changes of adolescence which see youth increasingly exposed to daily stressors, puberty-based brain changes result in increased sensitivity and reactivity to stress more generally (Spear, 2013). Developmental changes in the neural circuitry that underpin regulation of emotions and behaviour add to adolescents’ vulnerability to dysregulated emotions. Here, dysregulated emotions can be viewed as evidence of disrupted emotion dynamics, because impaired processing of affective input inhibits youths’ capability to place adaptive limits around an emotional response (Heller & Casey, 2016; Hollenstein, 2015).

Placing adaptive limits around an emotional response begins at a neurological level. Here, sub-cortical brain regions receive motivational and affective information
from cues in the environment. Structurally, sub-cortical brain regions send projections to areas in the pre-frontal cortex (PFC) that carry neural information about these motivation and affective drives. In turn, the PFC exerts executive control over inputs via "top-down" regulation (Casey, 2015). In this way, the PFC acts as a control center, integrating, regulating and inhibiting emotional responses (Crone & Dahl, 2012). It is through this top down-regulation of affective input that youth influence the multiple dynamics of an emotional response (e.g. intensity and duration of the response).

During adolescence, the neural connections between sub-cortical and PFC regions are undergoing continued change, paving the way for more ‘adult-like’ regulation capacities. Yet, as contemporary models of neurodevelopment highlight, the still-developing nature of these connections underscore adolescent-specific difficulties in emotion regulation (Casey, 2015; Crone & Dahl, 2012; Heller & Casey, 2016). Indeed, there is empirical evidence to suggest that the connectivity between sub-cortical and PFC regions changes over the course of development. For example, findings from neuroimaging studies show age-related differences in reactivity and recruitment of specific sub-cortical and pre-frontal areas during emotion regulation tasks (Hare, Tottenham, Galván, Voss, Glover, & Casey, 2008; McRae et al., 2012). Hare and colleagues (2008) show that amygdala (sub-cortical area) activation after exposure to a threat is higher among adolescents compared to children and adults. In addition, McRae and colleagues (2012) show that adolescents recruit different prefrontal areas during cognitive reappraisal of emotions compared to children and adults. Specifically, adolescents additionally recruit areas concerned with social processing, likely reflecting an enhanced focus on social contexts during this period. These findings point to developmental differences in recruitment of
certain areas during processing of affective input. In turn, these differences may contribute to adolescents’ difficulties in maintaining adaptive emotion dynamics in the face of daily stress.

Relatedly, there is evidence to suggest that adolescence marks a shift toward less automatic—and therefore slower—emotion regulation strategies. Illustratively, using a prediction error task to mimic reinforcement learning (i.e. learning from positive or negative feedback), van Den Bos and colleagues (2012) demonstrate that children show stronger neural connectivity between the striatum (a sub-cortical region underlying reinforcement learning) and medial PFC after receiving negative feedback on task performance, compared to adolescents and adults. By contrast, adolescents and adults showed stronger connectivity between the two areas when receiving positive feedback on task performance. These results suggest that while negative feedback guides reinforcement learning in childhood, adolescence marks a developmental shift toward reinforcement learning via positive feedback. Given that reinforcement learning is a key mechanism for emotion regulation skill development, this finding suggests that adolescence represents a time of shifting ways of learning emotion regulation skills. Although developmentally appropriate, such flexibility in the recruitment of alternate emotion regulation pathways renders adolescents’ emotion regulation less automatic and therefore slower and more effortful (Crone & Dahl, 2012).

How might these structural and functional brain changes affect adolescents’ capacity to respond to daily stressors? To answer this question, it is helpful to outline the information processing demands brought about by daily stressors. Though such stressors become common in adolescence, they still represent novel situations. The novelty of daily stressors is important, because contexts characterized by new
experiences carry an especially heavy executive load (Luciana, 2013). That is, the introduction of new stimuli increases the cognitive processing burden on adolescents’ still-developing emotion regulation systems. Although adolescents often demonstrate proficient executive functioning in low-affect conditions, the addition of daily stressors, which require youth to integrate social, emotional and cognitive inputs to resolve, can result in adolescents’ executive control systems becoming overburdened by emotional and motivational inputs (Luciana, 2013; Casey, 2015; Ernst, Pine, & Hardin, 2006).

Indeed, the experience of daily stressors is a prime example of a cue - both affective and motivational- that can trigger a need for enhanced effort in controlling the multiple aspects of an emotional response among adolescents. With the advent of a stressful event, an adolescent must necessarily engage in behaviour to resolve or respond to the stressor (i.e. the motivational component, even if this involves passive responding) and the stressor will also likely trigger an emotional response (Schneiders et al., 2006; Ernst, et al., 2006). Thus, daily stressors represent potent catalysts for emotional responding among adolescents. Within this thesis, Study 1 investigates this challenge by assessing how a recent occurrence of a daily stressor is associated with changes in adolescents’ emotions. Here, change in emotion is considered via the emotional responding dynamic, operationalized as within-person differences in levels of an emotion (e.g. happiness) in the moments after a stressor, compared to a given adolescent’s average level of happiness.

The role of social context. Though research has taken a developmental lens towards investigations of increased risk for daily stressors during adolescence, this has not occurred in parallel with investigations of how youths’ emotional responses to such stressors are informed by social contexts. Consequently, little is known about
how daily stressors and social contexts interact to impact adolescents’ daily emotion
dynamics. This gap is notable, not only because of the shifting nature of social
contexts during adolescence, but because of the central role that context is theorized
to play in youths’ emotional responses to stress (e.g. Compas, Connor-Smith,
Salzmtan, Thomsen, & Wadsworth, 2001; Lazarus & Folkman, 1987; Skinner &

Indeed, socio-contextual models of coping underscore the need for scholars
to consider the socially embedded nature of adolescents’ emotion dynamics. These
models of coping highlight that emotion regulation efforts do not occur in a vacuum;
rather, that individuals’ social contexts inform emotional responding (Klimes-
Dougan & Zeman, 2007; Lazarus & Folkman, 1987). Empirical support for these
socio-contextual accounts stems from youths’ reports that they would show different
emotional responses to stressful events, depending on whether they are with peers or
caregivers (Legerski, Biggs, Greenhoot, & Sampilo, 2015; Perry-Parish & Zeman,
2011; Zeman & Shipman, 1997). Here, the concept of emotion socialization agents
plays a role. Emotion socialization agents shape how individuals’ display emotion
through setting norms around how particular emotions are expressed (Klimes-
Dougan & Zeman, 2007). Throughout childhood, the family acts as a key emotion
socialization agent (Morris, Silk, Steinberg, Myers, & Robinson, 2007). Yet, given
the increasing salience of peers during adolescence, peers arguably come to play an
increasing role in how youth choose to display and ultimately regulate their internal
emotional states.

Beyond acknowledging that context is an important determinant of how a
given youth responds to changes in emotional states, scholars need to also
acknowledge the shifting social dynamics of adolescence when considering relations
between context and emotion dynamics. Empirical investigations show that adolescence is a developmental period where the relative presence and influence of various social contexts changes. For example, youth spend more time in the company of peers from childhood to adolescence (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996). Also, findings from neuroimaging studies show that youth are increasingly cognizant of their social environment as they progress through adolescence. Specifically, areas underpinning social cognition – referred to as the "social brain" - undergo rapid functional and structural change resulting in adolescents being especially “tuned in” to the presence of peers (Blakemore, 2008; Somerville, 2013).

Furthermore, past findings indicate that adolescents demonstrate a growing ability to leverage their peers in a bid to cope with stress more generally. For example, during the transition from elementary to high school, peer support is integral in reducing youths’ feelings of loneliness and isolation (Kingery, Erdley, & Marshall, 2011). Also, findings from studies utilizing experience sampling methods suggest that adolescents’ report more positively valanced emotional states when with peers compared to being in other social contexts (e.g. being alone, with family or at school; Silk et al., 2011; Schneiders et al., 2007; Larson & Richards, 1991; Morgan et al., 2017). These findings offer support for the notion that youths’ social and emotional contexts are embedded. Yet, despite the demonstrated association the role that peers can play in emotion socialization, provision of support, and associations between peers and adolescents' immediate emotional states, scholars are yet to examine how the peer context informs adolescents' emotional responses to stressors encountered in day-to-day life. Accordingly, in addition to examining the direct relation between daily stressors and emotional responding, Study 1 in this thesis
examines the potential conditioning role of recent social context (being alone, with family, or with peers) in the relation between adolescents’ daily stress and emotions.

**Externalizing Symptomatology**

As touched on earlier, a second adolescent-specific challenge that should potentially inform scholars’ understanding of adolescents’ emotion dynamics is an increased risk for externalizing symptomatology (Bongers et al., 2004; Galambos, Baker, & Almeida, 2003; Scarmella, Conger, & Simons, 1999). Importantly, externalizing symptoms represent one end of the internalizing-externalizing continuum proposed by Achenbach, and encompass behaviours of substance use, risk behaviour, anti-social and aggressive behaviour and minor delinquency (Achenbach, 1991). In contrast, and germane to this thesis, internalizing behaviours represent the opposite end of this continuum, and are typically characterized by withdrawal from the social context.

To some extent, the upturn in externalizing behaviours at adolescence is considered developmentally appropriate, perhaps driven in part by youths’ evolutionary imperatives to explore their environment and loosen ties to caregivers (Dahl, 2004). However, youths’ engagement in externalizing behaviours can have serious, unintended consequences (e.g. injury, incarceration; Blum & Nelson-MMari, 2004; Steinberg, 2008), and when repeatedly engaged in, to the extent that social and/or occupational functioning is impaired, can result in a diagnosis of an externalizing disorder (e.g. Oppositional Defiance Disorder, Conduct Disorder; American Psychiatric Association, 2013). Thus, adolescents’ engagement in externalizing behaviours also represents a significant public health concern.
Adolescents’ Externalizing Symptoms and Emotion Dynamics

Although there is a large body of literature which finds that adolescents who engage in externalizing behaviours exhibit ineffective emotion regulation (e.g. Eisenberg et al., 2009; Steinberg, 2008; Mullin & Hinshaw, 2007), as discussed earlier in this chapter, investigations focused on uncovering emotion dynamics can offer novel insights beyond what traditional emotion regulation studies offer. Unfortunately, decidedly less attention has been paid to relations between youths’ externalizing symptomatology and various emotion dynamics, despite theoretical accounts of externalizing symptomatology that place those youth who manifest such symptoms, as at-risk for disrupted emotion dynamics.

Consistent across models of externalizing is the notion that such behaviours arise, in part, out of momentary deficits in youths’ capability to control emotional inputs (with externalizing behaviours such as risk-taking and substance use theorized to arise from poor emotional control; Casey, 2015; Luciana, 2013; Ernst & Fudge, 2009; Chambers, Taylor, & Potenza, 2003). Hence, the notion of impaired emotion dynamics- evidenced by the inability to place adaptive parameters around emotional inputs- is a central feature of theoretical accounts of adolescent externalizing behavior. That said, empirical investigations into the direct relation between youths’ externalizing symptoms and various types of emotion dynamics in daily life have been limited.

Instead, the link between youthful externalizing symptoms and poor emotional functioning has largely been assessed indirectly via neuro-imaging or lab-based studies focused on reward sensitivity. Reward sensitivity refers to neuronal activation of brain “reward centres” in the presence of environmental rewards. Here, because adolescents in these lab-based studies must inhibit motivational desires for
salient environmental rewards, findings are used to infer adolescents’ capacity to control behaviour is limited by the presence of high motivational and emotional inputs.

In brief, heightened reward sensitivity has been linked to greater externalizing symptomatology among adolescents. For example, using fMRI, Galván and colleagues (2007) showed that activity in the nucleus acumens- a sub-cortical brain region linked to reward anticipation- was positively associated with future likelihood of engaging in risk behaviours. Further, individual differences in incentive motivation, that is, the innervation of reward-driven behaviour, are found to account for inter-individual variability in adolescents’ participation in externalizing behaviours (Aklin, Lejuez, et al., 2005; Bjork, Smith, Chen, & Hommer, 2011; Galván, Hare, Voss, Glover & Casey, 2007; Rao et al., 2011). Thus, findings from this literature serve to highlight the relation between adolescents’ immediate emotional environment and capability to inhibit externalizing behaviours.

Though the above studies are an integral first point in testing theoretical links between youths’ externalizing symptomatology and emotional functioning, the laboratory-based nature of the studies means that the proposed link between externalizing symptoms and emotion dynamics in the context of ‘real-life’ has yet to be examined. Further, while these studies point to high affective contexts propagating externalizing behaviour, less research has examined a correlate of this relation, i.e. examinations that seek to characterize the emotion dynamics of youth who already display externalizing symptoms. Consequently, little is known about how youth who display externalizing symptoms manage with emotionally evocative contexts (e.g. daily stressors), especially in real-world settings.
Going some way toward this goal, Silk and colleagues examined the dynamics of emotion intensity, lability, and range, among adolescents with elevated externalizing symptoms (Silk et al., 2003). Here, the focus was on adolescents’ average levels of emotion, average variation in emotion across testing periods, and time to return to normal from highest and lowest mood states in the last testing period. Although findings indicated that individual differences in intensity, and variability in negative emotions were related to youths’ externalizing symptoms (with externalizing linked to greater intensity and variability), this study, nor others, have not included a concurrent investigation of emotion dynamics in the face of daily stress. That is, research has yet to assess the relation between youths’ externalizing symptoms and patterns of emotion dynamics in response to environmental contingencies. Hence there is a need for examinations of youths’ emotions across the day and in the presence of daily stressors, capturing emotional responses “outside of the lab” of youth with externalizing symptomatology.

Among youth who already show signs of psychopathology (i.e. youth with elevated externalizing symptoms), unpacking the emotion dynamics which become perturbed throughout the events of daily life gives novel insight into what aspects of emotional responding to focus treatment. Perhaps most important for clinical interventions aimed at reducing the risk for externalizing psychopathology, capturing adolescents' emotion dynamics in-situ, during life "as it is lived," brings ecological validity to empirical findings (Wichers, 2013; Wilhelm & Grossman, 2010). In this way, empirical findings are a step closer to the goal of translating findings to practice and pinpointing which aspects of daily emotional experiences that those working on the with youth should give attention.
Emotion Reactivity in Daily Life

In response to the need for investigations that examine specific emotion dynamics associated with adolescents externalizing symptoms, the second study in this thesis (Chapter 4) examines the potential conditioning role of youths’ externalizing symptoms on emotion reactivity to daily stressors. Emotion reactivity is captured by assessing change in the intensity of a given adolescent’s emotion (e.g. happiness) from before to after a stressor. Importantly, this approach to measuring change in emotion offers different insights from investigations of emotional responding (e.g. study 1) in that emotion reactivity reflects a *temporal change* in emotion resulting from shifting in environmental conditions (i.e. experience of a stressor; Wenze & Miller, 2010). Further, such conceptualization of reactivity is consistent with the notion that emotions are not static, but dynamic processes unfolding across time (Kuppens et al., 2010).

In examining emotion reactivity to daily stressors among youth with externalizing symptoms, one question worth considering is whether these youths themselves, contribute to the manifestation of stressful events. Indeed, youth who display externalizing symptomatology are found to carry several traits which could see them perpetuate stressful events in their day-to-day lives. As one example, youths who engage in externalizing behaviours, particularly aggression, are found to carry a hostile intent attribution bias, which represents a tendency to attribute hostile intent to ambiguous acts (Dodge, 2006; Orobio de Castro, Merk, Koops, Verman, & Bosch, 2005). Dodge provides an excellent example of how such a bias can manifest in the generation of a daily stressor: if a student is bumped by someone in the school hallway they have two ways to interpret the bump - as an accident or as a deliberate provocation. Adolescents with a hostile-attribution bias are likely to decide the latter,
and subsequently engage in an aggressive act (e.g. a physical fight). Hence, similar to the stress-generation hypothesis (Hammen, 1992), the idea here is that youth with externalizing symptomatology are not passive recipients of stressful events, but rather, their internal liabilities see them at-risk for producing stressful events. Study 2 in this thesis additionally assessed this stress-generation hypothesis, by examining the conditioning role of youths’ externalizing symptoms on the relation between recent previous emotions and subsequent stressful events.

What About Emotional Stability? Adolescents’ Externalizing Symptoms and Emotional Inertia

Concomitant with the reasoning that adolescents with elevated externalizing symptomatology will show heightened emotion reactivity to stress, is the argument that the same biological systems which render youth vulnerable to exaggerated reactivity also promote vulnerability for poor emotional recovery. Indeed, contemporary approaches to psychological health highlight that emotional well-being comprises the capability to flexibly recover from recent unhelpful emotional states, perhaps more so than avoidance of such states (Houban et al., 2015; Kashdan & Rottenberg, 2010). Remaining stuck in unhelpful emotional states has been linked to poor psychological functioning, because such stasis in emotion is thought to represent low emotional flexibility. Hence, scholars interested in unpacking adolescents’ daily emotional dynamics must consider dynamics that tap temporal dependency of emotions, alongside indices of emotional change (Trull et al., 2015).

Emotional inertia represents temporal dependency in emotions or how closely linked emotions are in time (Kuppens, Allen, & Sheeber, 2010). Because emotional inertia represents becoming “stuck” in potentially unhelpful emotional states, despite changes in context, it represents an important index of daily emotional
functioning. Indeed, without the motivating forces of changing emotion states, goal-directed behaviour would not occur (Ernst & Fudge, 2009). Thus, the third and final study in this thesis (Chapter 5) considers the dynamic of emotional inertia, and examines the potential conditioning role of adolescents’ externalizing symptoms on emotional inertia.

**Disadvantaged Adolescents**

By identifying individual differences in the dynamics of emotional responding, emotional reactivity an emotional inertia, scholars can better identify groups of youth who are at-risk for disturbed emotional functioning. Once researchers have identified these differences, investigations can then turn to understanding the emotion regulation processes which underscore such differences, and develop interventions accordingly (Kuppens & Verduyn, 2015; Thompson, 1994).

That said, from a knowledge translation viewpoint, programs that aim to improve youths’ emotional functioning will be most efficacious when driven by empirical research with youth whom comprise their intended population (Damschroder et al., 2009; Yoshikawa, Aber, & Beardslee, 2012). A voluminous body of research supports the presence of a SES-health gradient – wherein youth who grow up in low SES settings experience poorer physical and mental health outcomes compared to their more affluent peers (see Chen and Miller, 2013 and Shonkoff et al., 2011 for reviews). According to this literature, how adolescents respond physiologically, behaviourally and emotionally to stressful events is the central mediator in the SES-health gradient. Despite these findings highlighting the importance emotional responding to stress among youth living in lower SES settings, most empirical investigations into adolescents’ daily emotion dynamics has focused
on middle-to high-income youth, to the exclusion of adolescents who live in low SES settings. Further, the dearth of empirical studies focused on disadvantaged youths is particularly evident in studies of emotion dynamics after daily stressors.

This paucity of research focusing on daily emotion dynamics of youth who live in low SES settings is concerning for two primary reasons. First, past research suggests that adolescents living in contexts of low SES tend to find it particularly difficult to regulate both their emotion and their behaviour and are at increased risk of developing externalizing problems (Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Wadsworth & Achenbach, 2005; Wadsworth et al., 2008). Hence, because disadvantaged youths experience a combination of risk factors for disrupted daily emotion dynamics – i.e. poor emotion regulation and greater chance of developing externalizing symptomatology there is a critical need for research which elucidates the day-to-day emotion dynamics among this group.

Second, given that translational research aims to bridge scientific theory to real-world practice, translational scholars should, to the extent possible, conduct studies with the populations for which interventions are intended. There is continued concern across stakeholders that disadvantaged youth have reduced access and usage of psychological services. Indeed, in a local context, the most recent iteration of the Australian Mental Health Plan (www.health.gov.au) has highlighted a need to adapt prevention and intervention services to fit the cultural and social context of youth living in socioeconomic disadvantage. Yet, national survey data show that youth in low SES settings are less likely to access psychological services, despite experiencing more frequent behavioural difficulties than their higher SES counterparts (Sawyer et al., 2001; Lawrence et al., 2015). This trend is echoed internationally, with U.S adolescents from low income families thrice as likely to
report unmet mental health care needs, compared to those from middle or high-income families (Newacheck, Hung, Park, Brindis, & Irwin, 2003). The mismatch between youths' need and uptake of services arguably reflects that these services, which have been largely developed based on existing research with higher-income youth, do not necessarily match the needs and experiences of disadvantaged youth. Thus, there is a pressing need for scholars to better understand how disadvantaged youth experience daily dynamics to develop and enhance contextually informed interventions.

**Emotional Dynamics in Response to Daily Stressors among Disadvantaged Adolescents**

Though there is a dearth of empirical studies on disadvantaged adolescents’ emotion dynamics in response to daily stress, there is some evidence to suggest youth in low SES settings experience more frequent daily stressors than their more affluent counterparts. Illustratively, Evans and colleagues (2009) examined 104 adolescents from a rural region in the US. Half of the participants were from families living at-or-below the poverty line, and half were from middle-income families. They found that adolescents living at-or-below the poverty line reported more frequent family hassles (e.g. lack of privacy, being nagged by parents) compared to their peers from middle-income households. Interestingly, low and middle-income adolescents in the study reported similar amounts of peer-related hassles during school hours. These finding suggests that disadvantaged youth do experience more frequent hassles but that immediate physical context (i.e. the school yard or classroom) can influence socioeconomic disparities in the frequency of daily hassles.

Further, in a smaller sample of 35 adolescents, Johnson and Swendsen (2015) used self-reported social standing as an index of socioeconomic status, and found
that youths lower in social standing report more family-related hassles, compared to youths higher in social standing. Low social standing youth also reported greater levels of sad and anxious affect after experiencing peer-related hassles. Similar results were found for when perceived family status was used as an indicator of SES, with adolescents lower in perceived family status experiencing greater anxious affect after peer-related hassles, compared to adolescents with higher perceived family status.

Not only are disadvantaged youth at-risk of greater exposure to daily stressors, there is some evidence that such stressors are categorically different from those experienced by youth in higher SES settings. For instance, among US adolescents living in an urban setting, Miller and colleagues (2003) found that the most common types of hassles reported by disadvantaged adolescents were: “being offered sex for money by drug addicts”, “being teased for having poor grades”, and “having to work to help pay family bills”. Alarmingly, 84.5% of adolescents reported having been pressured to join a gang by friends ‘a lot’ of the time. These findings serve to highlight that the hassles, to which low SES youth are exposed, extend well-beyond ordinary day-to-day events (e.g. missing the bus).

Beyond this empirical evidence which suggests that youth in disadvantaged settings have significant exposure to hassles, there are several theoretical viewpoints which suggest that disadvantaged adolescents demonstrate impaired emotional dynamics in the face of such daily stress. For example, Biological Sensitivity to Context Theory (Ellis & Boyce, 2008) asserts that the stress response systems of youth who grow up in adverse circumstances (i.e. low SES) develop heightened physiological reactivity to stress. This idea is supported by empirical findings which indicate that adolescents in low SES settings demonstrate stronger physiological
reactivity to lab-based stressors compared to their middle-income counterparts, particularly heightened cardiac reactivity (e.g. Chen, Langer, Raphaelson, & Matthews, 2004; Evans & English, 2002). Hence, the threshold for activation of stress responses systems (e.g. emotional responding) may be lower for youth in disadvantaged settings.

Likewise, diathesis-stress approaches (Zuckerman, 1999) highlight that disadvantaged adolescents carry numerous internal vulnerabilities, which when triggered in the presence of heavy stress, can result in poor coping outcomes. Illustratively, past empirical work finds that youth in low SES settings carry several vulnerabilities that place them at risk for dysfunctional responses to stress (e.g. lower optimism, weaker executive functions; maladaptive coping strategies; Finkelstein, Kubzansky, Capitman, & Goodman, 2007; Landis et al., 2007; Hackman & Farrah, 2009). Importantly, it is well-operating executive functions that are necessary to evaluate and inhibit emotional responses to daily stress, and these serve to allow fast resolution of associated challenges (Luciana & Collins, 2012).

Last, and representing a third theoretical viewpoint, allostatic load models underscore the pernicious role of pervasive stress-such as that found in low SES contexts- on individuals’ health. In brief, allostasis involves a series of physiological and behavioural responses to a stressor, guided by central nervous system activation, and drives the body into a state of temporary change, to ready the body to meet environmental demands (Schulkin, 2003). To the extent to which a stressor desists, allostasis can be an adaptive process. However, if allostatic responses persist well after the initial stressor dissipates, or if allostasis is frequently activated, as in the context of chronic stress, allostatic overload occurs. Because of this continued
activation of the body's stress response systems, over time, these systems become overburdened and wear down (McEwen, 2013).

A body of research highlights that disadvantaged youth are at risk of allostatic overload due to high chronic stress (Chen & Miller, 2012; Evans, 2004; Evans & Kim, 2013; Fuller-Rowell, Evans & Ong, 2012; Goodman, McEwen, Bin, Dolan, & Adler, 2005; Lupien, King, Meany & McEwen, 2001; Theall, Dury, & Shirtcliff, 2012). Illustratively, using a cumulative neighbourhood risk index as a marker of chronic stress, Theall and colleagues (2012) demonstrated that adolescents in neighbourhoods which were ranked as “very high” in cumulative stress were 1.47 times more likely to have elevated biomarkers of allostatic load compared to adolescents in neighbourhoods characterised by “low” cumulative stress. Here, the chronic stressors of neighbourhood crime, poverty, and off-premise alcohol density were the strongest predictors of allostatic load. These results suggest a link between neighbourhood disadvantage and the potential for allostatic overload in youth.

Allostatic overload provides an especially useful lens for considering emotion dynamics and associated risk factors for disadvantaged youth. Given heightened risk for exposure to daily stressors, disadvantaged youth may often experience repeated activation of stress response systems lead to significant ‘wear and tear’ of such systems. As a result, disadvantaged youth will arguably be less able to modulate and recalibrate emotional states during and after stressors. Overall, coupled with disadvantaged youths’ low capacity to enact adaptive coping responses, such wearing-down of stress response systems may render them youth at-risk of disrupted emotion dynamics, particularly in the face of recent stress.
Capturing Emotion Dynamics as they Unfold: Experience Sampling

Methodology

Given an identified need to examine disadvantaged adolescents’ emotion dynamics, a question of suitable methodology then follows - how best to measure such change? ESM is a method of self-report wherein participants record their 'in-the-moment' thoughts, emotions, and behaviours in the context of their daily lives (Scollon et al., 2003). Thus, the method represents an ecologically valid way of capturing human experiences "as they are lived" (Csikszentmihalyi & Larson, 1987).

The use of ESM to measure adolescent emotions and behaviour was pioneered throughout the 1970's and 1980's. Initial studies focused on continuity and instability in youths’ emotions across development, as well as adolescent time use (e.g. Csikszentmihalyi, Larson & Prescott, 1977; Csikszentmihalyi & Larson, 1987). Unfortunately, due to the relative complexity of statistical software which could adequately analyse the data captured by ESM, the method was relatively underused during the 1990’s and early 2000’s. Yet, as statistical methods for analysing complex data have advanced (as well as technology for capturing real-time data-e.g. smartphones), so too has popularity of ESM as a method for capturing emotional dynamics. Indeed, several recent review articles advocate for the increased use of ESM for emotion research (e.g. Wilhelm & Grossman, 2010; Kuppens & Verudyn, 2015; Blysma & Rottenberg, 2011).

Essentially, ESM is a type of longitudinal design, but the method offers a novel approach to more traditional longitudinal research designs. Though traditional longitudinal designs provide insight into how developmental phenomena unfold across typically longer time intervals (e.g. from year to year or 6 months to 6 months), ESM captures shorter-term, "micro" changes, which occur from day-to-day
or even hour-to-hour. Thus, ESM allows for real-time monitoring of psychological processes as they unfold across a short time period (Scollon et al., 2003). Because of this ability to capture moment-to-moment shifts in psychological constructs, ESM has often been being referred to as an intensive longitudinal design.

Because emotions are, by nature, dynamic, emotion scholars can benefit from a method which allows for collection of data, across different time periods and contexts, wherein differences in emotional states are expected to occur. ESM is well suited to these demands, because participants can record their emotional states across a variety of times (e.g. morning versus night, weekday versus a weekend) and across a variety of physical and social contexts. In addition, the repeated measurement of emotion across adjacent time periods allows for analysis of temporal dependency between emotions and events, and between emotions, and this is part-and-parcel of the emotion dynamics research focus (Trull et al., 2015; Wenze & Miller, 2010).

ESM also speaks to several limitations associated with research conducted with experimental and once-off survey designs. For instance, experimental designs attempt to systematically eliminate the influence of extraneous variables on emotion processes. Yet, because of this, experimental paradigms do not replicate the real-world contexts which adolescents are embedded in daily life, and subsequently findings can be low in ecological validity. Consequently, researchers can only speculate that experimental findings apply in real-world settings (Wilhelm & Grossman, 2010). By contrast, ESM studies which explore links between adolescents’ daily contexts and emotional experiences add to experimental findings by tapping into a range of factors which inform adolescent “real life” emotion dynamics.
Likewise, the retrospective nature of once-off surveys can introduce memory bias that is considerably reduced by employing ESM (Trull & Ebner-Primer, 2009). Retrospective recall bias can stem from many sources including individuals only recalling events with greater personal meaning, recalling more novel or more recent events, or events which are consistent with current mood states. Illustratively, past research finds that a state of demoralized mood impacts recalls of events, such that stressors are rated as more uncontrollable, more life-changing and more undesirable (Raphael & Cloitre, 1994). Also, there is evidence that retrospective reports of emotion can differ significantly from ‘in-the-moment’ reports (Ben-Zeev, Young, & Madsen, 2009; Miron-Shatz, Stone, & Kahneman, 2009; Sato & Kawahara, 2011). For example, adolescents’ retrospective reports of overall affect tend to be higher compared to momentary and twice-daily reports of affect (Shirer et al., 2005). Last, retrospective recall bias has also been documented in relation to reporting of frequency of daily stressors and how individuals are coping with stressors (Stone et al., 1998). By facilitating reports of events and emotion as they occur, ESM overcomes these limitations of once-off survey designs.

**The Current Thesis**

Previous theoretical and empirical work underscores the importance of considering adolescents’ daily emotion dynamics, broadly speaking, in terms of their emotional functioning and psychological wellbeing. Yet, past empirical examinations have only begun to scratch the surface in terms of unpacking risk factors associated with adolescents’ disrupted dynamics, and this is particularly true for adolescents living in low SES contexts. ESM is well-suited to capturing the time- and context-dependent nature of adolescents’ daily emotion dynamics and thus useful for speaking to these critical research questions.
The literature reviewed throughout this chapter identifies two central gaps in understanding disadvantaged youths’ daily emotional dynamics. First, the relation between disadvantaged youths’ exposure to daily stressors and change in emotions remains unknown, and more specifically, whether a given adolescents’ current social context conditions this relation. The first study in this thesis (Study 1) aims to address this gap by testing the direct relation between daily stressor and emotional responding, and the conditioning effect of social context on youths’ emotional responding to daily stressors. Second, despite numerous theoretical models that point to exaggerated emotion reactivity and difficulty with emotional recovery among adolescents with elevated externalizing symptomatology, no research to date has directly assessed this possibility, particularly within disadvantaged samples. Study 2 and Study 3 in this thesis aim to address these gaps in the literature, by assessing individual differences in disadvantaged youths’ emotion reactivity (Study 2) and emotional inertia (Study 3) based on levels of externalizing symptomatology. In sum, it is expected that the current investigations and associated findings will provide novel insights into the daily emotional landscapes of disadvantaged youth.
PREFACE TO CHAPTER 3

Aims

- To identify whether within-person changes in positive and negative emotions (i.e. difference in intensity of a current emotion compared to average level of that emotion) are related to recent exposure to daily stressor, among disadvantaged adolescents
- To examine the potential conditioning role of current social context on disadvantaged adolescents’ emotional responding to daily stressors
- To identify potential gender differences in the role of current social context on disadvantaged adolescents’ emotional responding to daily stressors

Emotion dynamics refer to the parameters that adolescents place around their emotional experience (Thompson, 1994). Learning to independently regulate these dynamics is a central developmental task of adolescence. Yet, the still-developing nature of emotion regulation systems sees adolescents vulnerable to disrupted emotion dynamics in daily life. Little is known about what specific aspects of
adolescents’ daily emotional dynamics are impacted by the contexts and challenges that the developmental period brings. Hence, a major focus of this thesis is the examination of emotion changes, ‘in-vivo’, across two developmentally-informed experiences of adolescence.

A first step in unpacking adolescents’ daily emotion dynamics is pinpointing the everyday contexts in which youths’ emotions are expected to change. Past research shows that daily stressors become frequent occurrences during adolescence and that such stressors are associated with changes in adolescents’ emotion states (Ham & Larson, 1993; Kliker, Wrzus, Rauers, & Riediger, 2017; Schneiders et al., 2006). The increase in daily stressors seen across adolescence is attributed to youth taking on new, more adult-like roles in society, and having to autonomously navigate multiple novel events (e.g. starting high school, negotiating peer relationships). Thus, daily stressors represent developmentally-informed experiences which become frequent in adolescent day-to-day life.

Though research has begun to identify adolescents’ emotional responses to daily stressors, two significant gaps in the research were identified. First, prior studies investigating the daily stress-emotion relation have, in large, neglected tests of this relation among adolescents living in low SES settings. This gap in the literature is important to address, considering evidence that low SES settings confer risk for stressful events (Grant et al., 2003; Evans et al., 2009) and hence youth in these settings are more at-risk daily stressors. Second, research has yet to explore the role of social context in informing emotional responses to daily stress. Yet, because social contexts inform both the expression and regulation of emotion (Klimes-Dougan et al., 2007; Zeman & Shipman, 1997), whom youth are with after they experience a stressor arguably influences the extent to which they will deviate from
their average level of emotion. In particular, though the family unit is an important socializing force for children, peers become increasingly important in adolescents’ lives and may act to shape adolescents’ emotional responses (Klimes-Dougan et al., 2007; Silk et al., 2007).

In filling these above gaps in the literature, Study 1 examined whether 1) disadvantaged adolescents experienced differences in levels of emotion (sadness, anger, worry, jealousy, loneliness, happiness, excitement) in the moments they reported a recent stressor compared to moments without a stressor, and 2) whether emotional responses to stressors were conditioned by adolescents’ current social context (i.e. being with peers vs. being alone; being with peers vs. being with family). Like previous studies, emotional responding to stress was examined by comparing an adolescent’s current intensity of happiness, for example, to their average level of happiness across the week. Overall, Study 1 gained insight into the way in which daily stress is associated with disrupted emotion dynamics, specifically emotional responsivity. Further, Study 1 showed the conditioning role of social context in emotional responsivity to daily stress.
CHAPTER THREE – STUDY 1

The following is a modified version of the published co-authored paper, however, it is formatted in accordance with the authors’ instructions for submission to the *International Journal of Behavioral Development*. The bibliographic details of the co-authored paper, including all authors, are:


My contribution to the paper involved: I adapted experience sampling items relating to daily stressors and social contexts, collected and cleaned data, and formulated the research questions. I analysed the data and drafted the manuscript. My co-authors then reviewed the manuscript draft and suggested edits.

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Abstract

Previous Experience Sampling Method (ESM) studies demonstrate that adolescents’ daily emotional states are heavily influenced by their immediate social context. However, despite adolescence being a risk period for exposure to daily stressors, research has yet to examine the influence of peers on adolescents’ emotional responses to stressors encountered in their daily life. Adolescents ($N = 108$) from a low-SES school completed ESM reports of their social context, minor stressors and emotions, 5 times a day for 7 days. Based on previous findings that the peer context is experienced as positive and rewarding, we expected being with peers would be associated with lower post-stress negative emotions and higher happiness, compared to being with family or alone. As expected, being with peers after a stressor was associated with lower sadness, worry and jealousy compared to being alone, and lower sadness compared to being with family. Gender differences emerged for the influence of peers on sadness, worry, jealousy and happiness. These findings highlight the salient influence of peers on adolescents’ emotional reactivity to stressors as they occur in their natural environment. Findings are discussed in
reference to peers as important emotion socialization agents during adolescence and in terms of theories of coping and emotion regulation.

**Key words: daily stressors, emotions, experience sampling, peers, social context**

Disadvantaged youth report less negative emotion to minor stressors when with peers: An experience sampling study

During adolescence, daily challenges emerge as a consequence of entering more complex social relationships and navigating increasingly autonomous roles. As a result of such changes, adolescents are at risk of increased exposure to minor, daily stressors (Ham & Larson, 1990). Unfortunately, the intensity of emotion that can result from these stressors is associated with elevated internalizing and externalizing symptoms (Silk, Steinberg, & Morris, 2003). Thus, adolescents’ exposure to daily stressors can have significant psychological cost. In an effort to understand factors that might dampen the influence of daily stressors on adolescents’ emotions we examine social context as a potential moderator of adolescents’ emotional responses to moment-to-moment stressors, among a sample of socioeconomically disadvantaged adolescents. We use the experience sampling method (ESM) to gather temporally accurate reports of the emotions, social contexts and stressors that adolescents experience in their day-to-day lives.

The importance of examining social context in adolescents’ responses to daily stress
Previous ESM research suggests that minor, daily stressors are associated with elevations in state negative affect among adolescents (Schneiders et al., 2006). Although the experience of intense negative affect is not necessarily maladaptive, developmental changes that occur during adolescence may make it more difficult for adolescents to regulate such intense emotion. For instance, puberty brings about rapid neuronal growth in adolescents’ appetitive, approach systems which serves to draw adolescents towards increased motivational and emotional inputs, including excitement seeking and peers (Galvan, Hare, Voss, Glover, & Casey, 2007; Modecki, 2009). However, the protracted fine-tuning of the cognitive control system results in adolescents’ inability to effectively regulate the upsurge in these motivational and emotional inputs (Luciana, 2013). As a result, adolescents arguably find it difficult to regulate the surges in emotion that are associated with daily stressors and are consequently at risk of maladaptive patterns of daily emotional flux (Neumann, van Lier, Frijns, Meeus, & Koot, 2011; Suveg, Payne, Thomassin, & Jacob, 2009). Thus, it is imperative that research identify factors which may moderate adolescents’ emotional responses to daily stressors.

Following on from this, theoretical perspectives on coping highlight the role that social context plays in stress responses. For instance, transactional models of coping highlight the iterative process that individuals undergo in order to formulate a response to stress (Lazarus & Folkman, 1987). Adolescents first evaluate the degree of support afforded to them by their environment, and then determine their perceived efficacy to cope with a stressor. Perceived support thus influences the adolescent’s coping efforts. Moreover, adolescents’ responses to stress involve a dynamic interaction between the individual and environment. As such, taking into account the potential influence of the social context in which an adolescent is embedded
following a stressor may be especially important to understanding adolescents’ coping responses.

**Examining the Influence of Peers on Adolescents’ Emotions**

Given the potential influence of social context on adolescents’ stress responses it is worth considering whether specific social contexts are influential in shaping adolescents’ emotional responses to stress. Peers are a salient social context during adolescence (Centifanti, Modecki, MacLellan, & Gowling 2014; Steinberg, 2008). For instance, youths spend increasing amounts of time with peers as they transition into adolescence, even after accounting for time spent in school (Larson & Richards, 1991; Larson, Richards, Moneta, Holmbeck, & Duckett, 1996). At the same time, adolescents spend more time alone, arguably as a result of increased desire for independence. By contrast, adolescents spend decreasing amounts of time with their family. The increasing amount of time spent with peers, relative to family, probably indicates that the peer context matches adolescents’ developmental needs (Eccles et al., 1993). For instance, adolescent friendships are characterized by increased disclosure of intimate information, which may facilitate development of emotional autonomy, as well as understanding of self and others (Parker & Gottman, 1989). Likewise, adolescence is a period of heightened desire for social acceptance (Somerville, 2013) which can be achieved in the peer context.

**How Peers May Shape Adolescents’ Stress Response**

There is preliminary evidence to suggest peers play a particularly potent role in helping adolescents to cope emotionally with stress. For example, having strong friendships, numerous friends and high peer acceptance protects against surges in loneliness during adolescents’ transition from elementary to middle school (Kingery, Erdley, & Marshall, 2011). By contrast, jealousy can emerge from a lack of
perceived emotional support among friends (Parker, Low, Walker, & Gamm, 2005).
However, given that daily stressors are far more common than major life stressors
(Compas, Davis, Forsythe, & Wagner, 1987), and are the events and experiences that
make up adolescents’ daily lives, it is likely that peers also play a recurrent role in
shaping adolescents’ emotions during times of stress. Specifically, because receipt of
peer support is linked with reduced loneliness and jealousy, the company of peers
may be associated with lower post-stress loneliness and jealousy compared to other
social contexts.

In addition, peers may be associated with more positively valenced emotional
states after a stressor because adolescents experience peers, in general, as a positive
and rewarding context. One neuro-imaging study shows increased activity in brain
‘‘reward centers’’ when adolescents are with peers, especially compared to when
they are alone (Chein, Albert, O’Brien, Uckert, & Steinberg, 2011). Further,
preliminary ESM work demonstrates that being with peers is associated with greater
positive affect, lower anger and lower sadness, compared to being with family or
being alone (Larson & Richards, 1991; Schneiders et al., 2007; Silk et al., 2011).
Likewise, adolescents experience the peer context as more ‘‘open’’ and ‘‘free’’
compared to the family context, whereas parental relationships are experienced as
more punitive (Larson, 1983). In fact, while peers seem to be associated with
positive affect, spending time with family and spending time alone may both be
associated with more negative affect for adolescents.

Moreover, peers may shape adolescents’ emotional responses to daily
stressors because they act as emotion socialization agents. Emotion socialization
agents directly or indirectly promote the expression of emotion (Klimes-Dougan et
al., 2007), and thus may influence the degree to which an adolescent chooses to
express emotion within a particular context. There is some evidence to suggest that peers (i.e., a close friend) may actually serve as a cue for adolescents to down-regulate their negative emotions, in an effort to fit in. For instance, as compared to parents, adolescents perceive their best friend as less supportive of, and expect more negative feedback from, negative emotional displays (Zeman & Shipman, 1997). Further, in lab-based observations, supportive responses to emotion talk from a close friend increases subsequent emotion talk, whereas dismissing responses result in minimizing emotion talk (Legerski, Biggs, Greenhoot, & Sampilo, 2015). These findings highlight the ways in which adolescents’ friends can shape the expression of emotion. Moreover, adolescents may be more likely to down-regulate their negative emotions with peers due to peer norms not favoring uncontrolled outbursts of emotion (von Salisch, 2001). While one conclusion from these findings could be that peers may not be helpful to adolescents’ coping, it could be that adolescents are acutely aware of emotion display rules within the peer group and thus would be more likely to down-regulate their negative emotion with peers, possibly resulting in better coping outcomes.

**Gender Differences**

It is also possible that peer effects may vary by gender. Illustratively, girls perceive their peers as more supportive of their expression of negative emotion (Zeman & Shipman, 1997). Further, boys who show deregulated sadness around their peers are lower in peer acceptance, whereas the same is not found in girls (Perry-Parish & Zeman, 2011). These findings suggest that adolescent girls may experience more emotional benefits from being in the presence of peers after experiencing a stressor compared to boys. However, adolescent girls are also at higher risk than boys for co-rumination with friends, a process which involves
repeatedly discussing emotionally provoking problems that is associated with negative affect (Rose, 2002). Thus, it is possible that among girls, due to co-rumination, peers may be associated with greater negative affect after a stressor.

**Using ESM to Assess Social Context-Emotion Relations**

Although previous studies provide important insight into the role peers play in shaping adolescents’ stress responses, for the most part, these studies have relied upon participants’ imagined emotional responses to hypothetical situations across different social contexts, or observations of peer dyads in laboratory settings. Alternatively, the use of ESM allows for the examination of social context-emotion relations in response to stressors that occur in the adolescents’ natural environment. Moreover, ESM allows for “in-the-moment” sampling of emotions and events as they occur throughout the day, reducing the possibility of retrospective recall bias of emotions and events (Myen-Germeyns et al., 2009). Thus, studies that assess adolescents’ momentary emotional responses to stressors in relation to the different social contexts in which adolescents spend time can provide unique, ecologically valid insight into adolescents’ daily lives.

**Current Study**

Although previous research indicates that adolescents experience the peer, family, and alone contexts differently, no study to our knowledge has directly compared the influence of the peer context with family or being alone on adolescents’ levels of emotion after a momentary stressor. Thus, the current study uses ESM to examine whether adolescents’ social context, in the hours after a stressor, moderates the relation between exposure to a stressor and emotion. In addition, we run exploratory tests for gender differences in the influence of social context on adolescents’ emotional reactivity to stress. We use ESM to examine...
emotional response to stress, that is, the post-stress increase or decrease in an emotion, relative to an adolescent’s typical level of that emotion. Importantly, this type of emotional response is not to be mistaken for emotional dysregulation, which reflects a range of emotion regulation difficulties, such as non-acceptance of distress and poor emotion recognition, and represents a habitual way of responding to stress rather than an aspect of the temporal dynamics of daily emotion (Weinberg & Klonsky, 2009).

Notably, our sample is comprised of low socioeconomic status (SES) adolescents. Because economically disadvantaged adolescents report higher rates of exposure to daily stressors (Evans, Vermeylen, Barash, Lefkowitz, & Hutt, 2009), our sample should help to better highlight the role of contexts in adolescents’ emotional reactivity to stressors. We chose a range of emotions with which to examine these proposed relations, including happiness, sadness, anger, loneliness, jealousy and anxiety. First, we chose to examine the primary emotions of happiness, sadness and anger. Because of links to peer support, we also chose to examine the emotions of loneliness and jealousy. In addition, because daily stressors are associated with higher state anxiety among adolescents (Schneiders et al., 2006), we examine post-stress worry. Importantly, previous ESM research demonstrates that peers set the emotional tone when adolescents are with both friends and family and when peers are physically absent (e.g., talking to peers on the phone; Larson & Richards, 1991). Thus, moments when participants were with family and friends and when they were talking to friends online were included in the “peers” category.

Consistent with previous research, we expected adolescents’ happiness to be higher and negative emotions to be lower when they were with peers compared to when they were alone or with family. Further, because previous research has found
that peers tend to be supportive and rewarding contexts, we expected that being with peers in the hours after a stressor would be associated with lower negative emotion and higher happiness compared to being alone or being with a family member. Analyses examining possible gender differences were exploratory. No specific hypotheses about gender differences in social context-emotional response relations were set due to diverging evidence, which suggests that girls not only benefit more from peer presence during times of stress, but also are at greater risk of co-rumination than boys.

Method

Participants

Participants were 112 adolescents; however, two participants withdrew consent during the study and another did not commence the ESM phase. One participant only completed the first day’s worth of ESM surveys and was excluded from the current analyses. Thus, the final sample consisted of 108 adolescents (Mage = 14.7, SD = .92, age 13–16 years, girls = 68.6%) from a low socioeconomic status (SES) school in Western Australia. The school’s SES was determined by an Index of Community and Socio-Education Economic Disadvantage, allocated to each school in the state (ISCEA; Australian Curriculum, Assessment & Reporting Authority, 2013). ISCEA values are determined based on the school’s geographical location, parental education and occupational levels and percentage of Indigenous and non-English speaking background students. The majority of participants reported their ethnicity as Caucasian (71.6%); other ethnicities were 7.3% Maori, 3.7% African, .9% Asian, .9% Aboriginal or Torres Strait Islander, and 11.0% “other”. 4.6% of participants did not report their ethnicity. There was no significant gender difference in age, $t\left(91\right) = .136, p = .892$; girls $Mage = 14.72$ years, boys $Mage = 14.73$ years.
Procedure

Data collection took place over the 2 weeks in the final school term of 2013 and over 3 weeks in the first term of 2014. Data were collected in two time periods due to a limited number of smartphones, although data from both periods was combined for the final sample. Adolescents and their parents were invited to participate in the study and gave written consent prior to participating. Approval for the study was granted by the University Human Ethics Committee. Participants did not receive any financial compensation for participation in the study.

Pre and Post-ESM Phase. Prior to beginning the ESM phase, and immediately after, participants completed a computerized survey which contained questions about demographics (e.g., gender, parental education level) as well as other variables of interest. This method provides more stable, trait-level indicators of measures of interest. Specific to this study, depression, social anxiety and externalizing were measured pre- and post-ESM, and were included as between-level covariates in all analyses.

ESM Phase. During the ESM phase, participants reported on their current emotions, social context, physical location, minor stressors (negative events) and positive events across the day. Participants completed the ESM surveys 5 times a day for 7 days. The sampling phase included time points when participants were in and out of school as well as weekdays and a weekend, and thus captured moments where participants were in a variety of social and physical contexts. Participants did not complete any ESM surveys during class hours. Instead, participants completed “lunch time” surveys during their lunch break.

Participants were sent text messages containing web-links to the ESM surveys and instructed to complete each survey as soon as possible. Surveys closed
within an hour of being sent, thus eliminating the opportunity for a participant to complete multiple surveys at once, for example, at the end of the day. A reminder message was sent 5 minutes before each survey closed in order to maximize response rates. The surveys were sent in half-hour time blocks, five per day, in the hours between 7:30 am and 9:30 pm on weekdays (Morning; 7:30–8:00 am, Lunch = 1:15 pm only, After school = 3:30–4:00 pm, Dinner = 6:30–7:00 pm and Night = 9:00–9:30 pm), and between 9:00 am and 10:00 pm on weekends (Mornings: 9:00–9:30 am; Night 9:30–10:00 pm). The exact survey times within these half-hour time blocks were randomized to reduce the possibility of participants habituating to a set response time. Participants received training in using the smartphones prior to commencing the ESM phase and a researcher was always available to resolve any technical issues.

**Person-level Measures**

**Depression.** Participants completed the Reynolds’s Adolescent Depression Scale, 2nd edition (RADS-2; Reynolds, 2004). The RADS-2 is a 30 item self-report questionnaire that assesses risk of diagnosis of depression (e.g., “How often do you feel sad”; 1 = Almost never, 4 = Most of the time). Participants who scored above a clinical-cut off score, based on the average of their pre-and post-ESM scores, were coded as risk of clinical depression ($N = 16$; pre-ESM $\alpha = .82$, post-ESM $\alpha = .87$, test–retest $r = .81$).

**Social Anxiety.** Participants completed the 18-item self-report Social Anxiety Scale for Adolescents (SAS-A; La Greca, 1998; e.g., “I worry about what others think of me”, “I get nervous when I meet new people”; 1 = Not at all, 5 = All the time). Participants’ total scores from the pre-and post-ESM phases were averaged for a
final social anxiety variable with higher scores reflecting higher levels of social anxiety symptoms (pre-ESM $\alpha = .96$, post-ESM $\alpha = .96$, test–retest $r = .62$).

**Externalizing.** Externalizing symptoms were measured with 15 self-report items designed to measure anti-social, delinquent and substance use behavior that adolescents typically engage in (Fredricks & Eccles, 2006; e.g. “How often in the last 6 months have you gotten in a physical fight with someone? . . . been drunk?”; 0 = None, 7 = 31 or more times). Thus, higher scores represented more frequent participation in externalizing behaviors. Participants’ scores from the pre- and post-ESM phases were averaged for a final externalizing variable (pre-ESM $\alpha = .85$, post-ESM $\alpha = .90$, test–retest $r = .88$).

**ESM Measures**

**Momentary Stressors.** Adolescents’ exposure to minor stressors throughout the day was assessed by asking “Since you were last messaged, has anything bad happened to you?” at each sampling moment. A similar question format has been used in previous ESM research (Schneiders et al., 2006). Importantly, the question format meant that participants reported on stressors that had already occurred, within the last 2–5 hours. Participants then rated how severe the event was (1 = “Sort of bad”, 5 = “Very bad”) and provided a brief description of the event. Only events that were rated $\geq 3$ on the severity item were included in the current analyses, given that perceived severity of a stressor influences coping responses (Lazarus & Folkman, 1987). Likewise, to ensure events tapped substantive external events from which adolescents could conceivably “bounce back” in the short term, events that related to an adolescent’s internal state (e.g., “Nothing, I just feel bad”; .26% of events) and events that referred to major life stressors (e.g., “Found out a friend’s dad is dying”) were excluded from the analyses. A dummy variable was created for
negative events (0 = no bad event since last messaged, 1 = bad event since last messaged). Positive events across the day were assessed in a similar way, and positive events with a valence of ≥ 3 (1 = “Sort of good”, 5 = “Very good”) were included as a level 1 co-ovariate in the main analyses.

**Social Context.** Participants’ social context at each sampling moment was assessed by asking “Right now, who are you with?” (alone, a friend, a number of friends, with friends who are online, a family member, teacher, boyfriend/girlfriend or “other”). The option of “with friends who are online” assessed whether adolescents were physically alone but interacting with peers via the internet. Two separate dichotomous variables were created to indicate whether adolescents were 1) with peers versus alone (pVa; 0 = alone, 1 = peers), and 2) with peers versus family (pVf; 0 = family, 1 = peers). Being with a friend, a number of friends, with online friends or with friends and family were re-coded as being “with peers”. Romantic peers were excluded from the peer category. Participants were not asked to indicate whether friends were same-sex; thus, friends could have been same-sex or mixed-sex.

**Momentary Emotion.** Adolescents’ emotions across the day were assessed by asking “Right now, how are you feeling?” at each sampling moment. Specific to the current study, participants rated how happy, sad, angry, lonely, worried and jealous they were feeling (1 = “Not at all”, 5 = “Very much”).

**Physical Location.** Adolescents also reported on their current physical location at each sampling moment (at home, school, at a family member’s house [not home], going somewhere/transport, in a public place, at work, at sport or “other”). Specific to the current study, physical location data were used to assess where adolescents
were most likely to be when they were in the presence of peers, and thus provide descriptive data regarding activities they were engaged in when with peers.

**Analyses**

Data from the first day of the sampling phase were excluded from analyses, to allow participants to adapt to the sampling protocol, resulting in 3,240 possible sampling moments in total. For descriptive analyses, frequency of negative events was summed and levels of each emotion were averaged across the 6 days. Table 1 presents pairwise correlations between study variables.

Because the data were nested (repeated measures nested within person) a series of variance-component models were run prior to the main analyses in order to examine whether hierarchical-linear modelling (HLM) was appropriate. Significant within-and between person variance in each emotion (Table 2) indicated that HLM was appropriate for the data (Hox, 2010). All main analyses were estimated using HLM in Mplus V7 (Muthen & Muthen, 2012). Separate models were run for each emotion and for each social context comparison (pVa; pVf).

Level 1 random-intercept models (Equation 1) tested for 1) the main effect of negative event on emotion, 2) the main effect of social context on emotion and, 3) whether the main effect of negative event on emotion was conditioned by social context (Negative event X Social context interaction). Concurrent positive event and time of day were included as level 1 covariates. A quadratic time of day covariate was used in the happiness models (Barber, Jacobson, Miller, & Peterson, 1998; Csikszentmihalyi & Hunter, 2003).

\[
\text{Emotion}_{ij} = \beta 0j + \beta 1j (\text{negative event}) + \beta 2j (\text{social context}) + \beta 3j (\text{positive event}) + \beta 4j (ToD) + \beta 5j (\text{negative event x social context}) + eij. \tag{1}
\]
As Equation 1 demonstrates, an adolescent’s emotion score at any time point was a function of the following: $\beta_{0j}$, their average intercept value of negative event on emotion for the week, $\beta_{1j}$ whether they had a negative event at that sampling moment, $\beta_{2j}$ their social context in the moment when the negative event was reported, $\beta_{3j}$, whether they had a positive event at that sampling moment, $\beta_{4j}$, time of day, $\beta_{5j}$, the interaction of negative event and social context and $(e_{ij})$, an error term for the individual Level 2 random-intercept models estimated the main effect of gender on adolescents’ average level of each emotion for the week. Depression status, social anxiety and externalizing scores were entered as level 2 covariates (Equation 2).

\[
\beta_{0j} = \gamma_{00} + \gamma_{01} \text{(gender)} + \gamma_{02} \text{(depression)} + \gamma_{03} \text{(social anxiety)} + \gamma_{04} \text{(externalizing)} + \mu_{0j}
\]

An adolescent’s emotion score for the week was a function of the average emotion for the whole sample ($y_{00}$) as well as their gender, depression status, social anxiety level, externalizing symptoms, and an error term ($u_{0j}$). Last, in exploratory analyses, we split the data file by gender to examine whether the above Negative event X Social context interaction effects differed between genders. We did not test for a 3-way cross-level interaction of Gender X Negative event X Social context due to limited power in our sample to detect such an effect. Instead, any significant 2-way interactions were probed by plotting the simple slopes for each gender. Unstandardized coefficients with standard errors are presented for simple slopes.

**Results**

**Compliance and Missing Data**

The median number of completed ESM reports across the six days was 17 (56.7%, SD = 7.58, Range = 1–30). In total, 60% of participants completed ≥ 50% of
ESM reports. Our compliance rate was slightly lower than previous ESM studies with adolescents (e.g., Schneiders et al., 2006), although consistent with another ESM study that does not offer incentives for participation (Suveg et al., 2009). All missing data were estimated with full information maximum likelihood (FIML) procedure. The advantage of the FIML procedure is that it uses all the information provided by the observed data and thus does not require a participant to have data at every sampling moment (Enders, 2010). Girls completed significantly more ESM reports than boys, \( t(104) = -2.31, p < .05 \); girls = 71.4%, boys = 25.6%.

**Descriptives**

Negative events rated \( \geq 3 \) were a relatively low occurrence in the current sample. The average number of these negative events across the 6 days was 1.22 (\( SD = 1.60 \), Range 0–7). Negative events were reported on 6.8% of completed sampling moments and just over half of the participants (51.4%) reported at least one negative event across the 6 days. Social anxiety was positively related to number of negative events (Table 1). Number of negative events did not differ significantly according to year of study; \( t(106) = -0.241, p > .05 \). Participants reported being with peers most often (49.7% of completed sampling moments), followed by family (34.7%) and being alone (20.4%). On weekdays, participants were most likely to be with peers during lunch time, and on weekends they were most likely to be with peers during mornings.

**Adolescents’ Physical Locations and Time with Peers.** On average, during the weekdays, participants were most likely to be “going somewhere” when with peers in the mornings (34.05%), “at school” with peers during lunchtimes (95.60%), “at home” with peers during the afternoons (34.68%), in a “public place” with peers during dinner times (45.8%) and “at home” with peers during night times (90.9%).
During the weekend, participants were most likely to be “at home” when they were with peers during the mornings (36.4%), during lunchtimes (41.65%) and afternoons (40%), most likely to be “in a public place” with peers during dinner times (23.35%) and most likely to be at a “friend’s house” during night times (40.33%). Note that Friday nights were included as weekends. These results suggest that participants connected with their peers through a variety of physical contexts.
Table 1. Pair-wise correlations between study variables.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Negative event</td>
<td>1.13 (1.58)</td>
<td>1.00</td>
<td>.416**</td>
<td>-.103</td>
<td>.352**</td>
<td>.216*</td>
<td>.236*</td>
<td>.277**</td>
<td>.364**</td>
<td>.091</td>
<td>-.050</td>
<td>.210*</td>
</tr>
<tr>
<td>2.</td>
<td>Positive event</td>
<td>2.44 (2.78)</td>
<td>.354***</td>
<td>1.00</td>
<td>.337***</td>
<td>-.108</td>
<td>-.170</td>
<td>-.085</td>
<td>-.033</td>
<td>-.139</td>
<td>-.012</td>
<td>-.209*</td>
<td>-.098</td>
</tr>
<tr>
<td>3.</td>
<td>Happy</td>
<td>3.45 (.67)</td>
<td></td>
<td></td>
<td>1.00</td>
<td>-.159</td>
<td>-.143</td>
<td>-.160</td>
<td>-.263*</td>
<td>-.094</td>
<td>.018</td>
<td>.231*</td>
<td>-.242*</td>
</tr>
<tr>
<td>4.</td>
<td>Sad</td>
<td>1.69 (.89)</td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.839**</td>
<td>.750**</td>
<td>.808**</td>
<td>.791**</td>
<td>.173</td>
<td>.246*</td>
<td>.153*</td>
</tr>
<tr>
<td>5.</td>
<td>Lonely</td>
<td>1.74 (.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.754**</td>
<td>.794**</td>
<td>.696**</td>
<td>.156</td>
<td>.324**</td>
<td>.227*</td>
</tr>
<tr>
<td>6.</td>
<td>Jealous</td>
<td>1.50 (.78)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.820**</td>
<td>.682**</td>
<td>.153</td>
<td>.661*</td>
<td>.211*</td>
</tr>
<tr>
<td>7.</td>
<td>Worried</td>
<td>1.59 (.78)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.683**</td>
<td>.191</td>
<td>.437**</td>
<td>.304**</td>
</tr>
<tr>
<td>8.</td>
<td>Angry</td>
<td>1.65 (.81)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.132</td>
<td>.271**</td>
<td>.194*</td>
</tr>
<tr>
<td>9.</td>
<td>Externalizing</td>
<td>.54 (.67)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.204*</td>
<td>.028</td>
</tr>
<tr>
<td>10.</td>
<td>Depression</td>
<td>.16 (.37)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.454**</td>
</tr>
<tr>
<td>11.</td>
<td>Social Anxiety</td>
<td>50.7 (17.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>12.</td>
<td>Gender (Girls)</td>
<td>69%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note. N = 96–100. Negative event frequency range = 0–7, Positive event frequency range = 0–16. Happy, Sad, Lonely, Jealous, Worried, Angry range = 1–5. Externalizing range = 0–2.9. Depression 0 = not at risk of depression, 1 = at risk of depression. Social anxiety range = 18–90.

*p < .05; **p < .01
HLM Analysis: Main Effects

Person-Level Variables. As Table 2 demonstrates, participants at risk of depression experienced significantly higher jealousy and worry across the week compared to participants not at risk of depression. In addition, participants higher in social anxiety demonstrated significantly higher loneliness compared to participants lower in social anxiety. No other significant main effects were found for level 2 predictors.

Adolescents’ Emotional Reactivity to Negative Events. Level 1 models revealed a significant main effect of negative event for all of the emotions under examination, except jealousy (Table 2). These results suggested that negative events were associated with lower happiness and higher negative emotions compared to an individual’s average level of each emotion for the week.

Adolescents’ Social Contexts and Momentary Emotions. Consistent with our expectations, being with peers was associated with significantly higher happiness compared to being alone or with family, and with significantly lower loneliness compared to being alone (Table 2). Surprisingly, no other significant main effects of social context were found. However, the significant main effects should be interpreted in light of the significant Negative event X Social context interactions found in the next step of the analysis and reported below.

HLM Analysis: Interaction Effects

Negative Event x pVa. There was a significant interaction effect for Negative event X pVa for sadness (Table 2). Consistent with our expectation, being with peers was associated with lower post-stress sadness compared to being alone (Figure 1a). As Figure 1 demonstrates, the relation between negative event and sadness was positive for adolescents who were alone after the event, but negative for adolescents who were with peers after the event. Inspection of simple slopes revealed that the slope
Table 2. Results from HLM analyses.

<table>
<thead>
<tr>
<th></th>
<th>Happy</th>
<th>Sad</th>
<th>Lonely</th>
<th>Jealous</th>
<th>Worried</th>
<th>Angry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b [95% CI, Lower, Upper]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1 variance</td>
<td>.681 [.04, .10]**</td>
<td>.519 [.43, .64]**</td>
<td>.600 [.52, .76]**</td>
<td>.361 [.29, .47]**</td>
<td>.478 [.40, .58]**</td>
<td>.539 [.45, .64]**</td>
</tr>
<tr>
<td>(null model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 variance</td>
<td>.369 [.26, .45]**</td>
<td>.659 [.35, .86]**</td>
<td>.611 [.33, .78]**</td>
<td>.476 [.22, .67]**</td>
<td>.532 [.30, .67]**</td>
<td>.462 [.24, .68]**</td>
</tr>
<tr>
<td>(null model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICC</td>
<td>.295</td>
<td>.560</td>
<td>.505</td>
<td>.569</td>
<td>.527</td>
<td>.461</td>
</tr>
<tr>
<td>Random intercepts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>-.322 [-.68, -.03]</td>
<td>.387 [-.15, .99]</td>
<td>.574 [27,1.3]</td>
<td>1.00(471.7)*</td>
<td>.972 [.52, .15]**</td>
<td>.198 [-.19, .59]</td>
</tr>
<tr>
<td>Social anxiety</td>
<td>-.007 [-.01, .00]</td>
<td>.009 [-.00, .01]</td>
<td>.010 [-.00, .01]</td>
<td>.004 [-.00, .01]</td>
<td>.009 [-.00, .01]</td>
<td>.008 [-.00, .02]</td>
</tr>
<tr>
<td>Externalizing</td>
<td>.097 [-.56, .23]</td>
<td>.150 [-.11, .32]</td>
<td>.138 [-.06, .30]</td>
<td>.024 [-.16, .21]</td>
<td>.090 [-.11, .25]</td>
<td>.140 [-.06, .34]</td>
</tr>
<tr>
<td><strong>Peers vs. Alone model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative event</td>
<td>-.527 [-.81, -.34]**</td>
<td>.622 [-.25,1.0]**</td>
<td>.362 [.10, .62]**</td>
<td>.105 [-.08, .29]</td>
<td>.528 [.25, .80]**</td>
<td>.862 [.57,1.2]**</td>
</tr>
<tr>
<td>Positive event</td>
<td>.535 [.39, .68]**</td>
<td>-.173 [-.30, -.05]*</td>
<td>-.273 [-.40, -.15]**</td>
<td>-.037 [-.13, .06]</td>
<td>.021 [-.14, .18]</td>
<td>-.239 [-.36, -.12]**</td>
</tr>
<tr>
<td>Time of day</td>
<td>-.023 [-.12, .08]</td>
<td>.001 [-.03, .29]</td>
<td>.033 [-.01, .07]</td>
<td>.020 [-.02, .06]</td>
<td>.019 [-.02, .05]</td>
<td>.016 [-.02, .05]</td>
</tr>
<tr>
<td>Peers vs. Alone</td>
<td>.503 [.35, .66]**</td>
<td>-.165 [-.31, -.02]</td>
<td>.456 [-.62, -.30]**</td>
<td>-.026 [-.12, .06]</td>
<td>-.013 [-.12, .09]</td>
<td>-.056 [-.16, .05]</td>
</tr>
<tr>
<td><strong>Peers vs. Family model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative event</td>
<td>-.602 [-.80, .40]**</td>
<td>.301 [.06, .54]*</td>
<td>.136 [-.03, .30]</td>
<td>-.109 [-.21, .01]</td>
<td>.176 [.00, .35]</td>
<td>.532 [.30, .76]**</td>
</tr>
<tr>
<td>Positive event</td>
<td>.504 [.35, .66]**</td>
<td>-.136 [-.25, -.04]*</td>
<td>-.187 [-.29, -.09]**</td>
<td>-.020 [-.10, .60]</td>
<td>-.075 [-.20, .05]</td>
<td>-.132 [-.23, -.04]**</td>
</tr>
<tr>
<td>Time of day</td>
<td>.107 [.02, .20]</td>
<td>.021 [-.01, .05]</td>
<td>.017 [-.01, .05]</td>
<td>.011 [-.01, .04]</td>
<td>.012 [-.02, .04]</td>
<td>.006 [-.02, .04]</td>
</tr>
<tr>
<td>Peers vs. family</td>
<td>.245 [.13, .36]**</td>
<td>.080 [-.17, .01]</td>
<td>-.038 [-.12, .04]</td>
<td>.002 [-.06, .06]</td>
<td>-.043 [-.12, .04]</td>
<td>-.032 [-.12, .04]</td>
</tr>
<tr>
<td><strong>2-way Interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative event x peers vs. alone</td>
<td>.503 [-.25,1.25]*</td>
<td>-.137 [-.22, -.58]**</td>
<td>-.510 [-1.0, .02]</td>
<td>-.832 [-1.3, .36]</td>
<td>-.902 [-1.5, -.32]*</td>
<td>-.208 [-.90, .48]</td>
</tr>
<tr>
<td>Negative event x peers vs. family</td>
<td>.427 [-.00, .86]</td>
<td>-.868 [-1.4, -.33]**</td>
<td>-.015 [-.41, .44]</td>
<td>-.258 [-.94, .61]</td>
<td>-.081 [-.24, .31]</td>
<td>.251 [-.23, .73]</td>
</tr>
</tbody>
</table>

Note. N (Level 1) = 880–1142, N (Level 2) = 91–100. ICC = intra-class correlation.
*p < .05; **p < .01.
for “alone” was significantly different from zero, $b = .491 (.21), p < .05$, whereas the slope for “peers” was not significantly different from zero, $b = -.88 (.50), p > .05$. This result suggests that being alone after a negative event was associated with a lower level of sadness compared to other time points in an adolescent’s week, whereas being with peers was not associated with a lower level of sadness.

![Graph](image)

*Figure 1a.* Simple slopes of sadness on negative event, alone versus with peers (N = 95). Lower bound = -.41, upper bound .006, slopes significant outside of bounds.

A similar pattern was found for negative event x with family versus with peer for sadness (N = 95, lower bound = -.69, upper bound = .05, slopes significant outside of bounds). Exploratory examination of gender differences also showed a similar pattern for the interaction of negative event and alone versus with peers for sadness in girls (N = 68, lower bound = -.50, upper bound = .02, slopes significant outside of bounds).

There was also a significant interaction effect for worry (Table 2, Figure 1b). The relation between negative event and worry was positive for adolescents who were alone after the event and for adolescents who were with peers after the event. However, inspection of simple slopes revealed that the slope for “alone” was significantly different from zero, $b = .819(.17), p < .01$, but that the slope for
“peers” was not significantly different from zero, $b = .079(.13), p > .05$. Thus, being alone after a stressor was associated with higher worry, relative to other time points, whereas being with peers was not associated with increases in worry. Further, being alone after a stressor was associated with higher worry compared to being with peers.

![Figure 1b](image)

*Figure 1b.* Simple slopes of negative event, alone versus with peers on worry ($N = 94$, lower bound = -0.22, upper bound = 0.20, slopes significant outside of bounds).

Exploratory examination of gender differences also showed a similar pattern for the interaction of negative event and alone versus with peers for worry in girls ($N = 67$, lower bound = -0.26, upper bound = 0.10, slopes significant outside of bounds).

Last, there was a significant interaction effect of Negative event X pVa for jealousy (Figure 2). As Figure 2 demonstrates, being with peers after a negative event was associated with lower jealousy compared to being alone. The form of the interaction was such that there was a positive association between negative event and jealousy for adolescents who were alone, but a negative relation between event and jealousy for adolescents who were with peers after the event. Both the slope for “alone” and for “peers” were significantly different from zero, $b = .374(.17), p < .05; b = -.301(.19), p < .01$. This result suggests that being with peers after a stressor
was associated with lower levels of jealousy, compared to other time points in an adolescent’s week, as well as compared to being alone.

\[Figure 2.\] Simple slopes of jealousy on negative event, alone versus with peers (N = 93, lower bound = -0.27, upper bound = 0.11, slopes significant outside bounds).

Exploratory examination of gender differences also showed a similar pattern for the interaction of negative event and alone versus with peers on jealousy, in girls (N = 66, lower bound = -0.22, upper bound = 0.15, slopes significant outside of bounds).

**Negative Event x pVf.** Next, we examined the interaction effect of Negative event X pVf. Analyses revealed a significant interaction of Negative event X pVf for sadness (Table 2). Similar to the Negative event X pVa result, adolescents who were with family after a negative event demonstrated higher levels of sadness, compared to adolescents who were with peers after the event (see Figure 1). Thus, as expected, being with peers was associated with lower post-stress sadness compared to being with family. Inspection of simple slopes revealed that the slope for ‘‘family’’ was significantly different from zero, \(b = 0.612(.21), p < .05\), whereas the slope for and for ‘‘peers’’ showed was not significantly different from zero, \(b = -0.010(.17), p > .05\). This result suggests that being with peers after a stressor was associated with lower
sadness, compared to being with family, and that being with family was associated with higher sadness, relative to other time points. No other significant interaction effects of Negative event X pVf were found.

**Exploratory Gender Differences**

**Negative Event x pVa.** A gender difference emerged in the interaction of Negative event X pVa for sadness, worry, jealousy and happiness. The interaction of Negative event X pVa was significant for sadness, worry and jealousy for girls, $b = -1.40 (.51); b = -1.04 (.37); b = -0.926 (.30), p < .05$, but not for boys, $b = -0.893 (1.6); b = .839 (.93); b = .268(.42), p < .05$. Inspection of simple slopes suggested that the interactions were in the same form as those found in the full sample (see Figure 1). Thus, being with peers after a negative event was associated with significantly lower sadness, worry and jealousy, compared to being alone, for girls but not for boys.

By contrast, there was a significant interaction effect of Negative event X pVa on happiness for boys, $b = 2.46 (.31), p < .05$, but not for girls, $b = .322 (.48), p > .05$. As Figure 3 demonstrates, there was a positive relation between negative event and happiness for boys who were with peers after the event, whereas there was a negative relation between event and happiness for boys who were alone after the event. For this interaction, inspection of simple slopes revealed that the slope of “peers” was significant from zero, $b = .832(.36), p < .05$, as was the slope for “alone” was significant from zero, $b = -1.18(.17), p < .001$. Thus, for boys, being with peers after a negative event was associated with higher happiness, relative to other time points, and compared to being alone.
Figure 3. Simple slopes of happiness on negative event from exploratory examination of gender differences, alone versus peers for boys only (N = 27, lower bound = -0.39, upper bound = -0.13, slopes significant outside of bounds).

**Negative Event x pVf.** There was a significant interaction effect of Negative event X pVf for sadness for girls, $b = -0.805 (.36), p < .05$, but not for boys. The form of the interaction was similar to that found in the full sample (see Figure 1). Inspection of simple slopes revealed that the slope of ‘‘peers’’ was not significantly different from zero, $b = -0.077 (.18), p > .05$, but that the slope for ‘‘family’’ was significantly different from zero, $b = 0.569 (.24), p < .05$, for girls only.

**Discussion**

The current study addressed an important gap in the research literature by examining the influence of social context on adolescents’ emotional responses to daily stressors. As expected, being with peers in the hours after a stressor was associated with lower levels of sadness, worry and jealousy, compared to other social contexts. Further, the influence of peers differed between girls and boys. Overall, the findings suggest that peers are important in shaping adolescents’ moment-to-moment emotional responses to stress. In what follows, we discuss the current findings in
relation to how adolescents experience the peer context, before linking findings to social-contextual theories of coping.

**Time with Peers during Adolescence**

Given that the peer context represents a space for positive developmental and affective experiences (Silk et al., 2011; Parker & Gottman, 1989), it is not surprising that participants in the current study spent the majority of their waking hours with peers. Interestingly, participants were most likely to be with peers during school hours, suggesting that time with peers was dependent upon access to peers. Participants also engaged with peers across a variety of physical contexts which mapped onto a daily routine. For example, participants were most likely to be “going somewhere” with peers on weekday mornings, probably reflecting the commute to school. These findings suggest that time with peers outside of school hours may have been limited by external factors, for instance, lack of transportation, and that participants took advantage of physical settings where they could engage with peers. These findings are consistent with previous ESM studies that demonstrate that adolescents spend the majority of their time with peers (Larson et al., 1996; Larson & Richards, 1994).

**The Influence of Peers on Adolescents’ Post-Stress Emotions**

The major aim of the current study was to examine whether the peer context conditioned relations between momentary stressors and emotions. Peers become a salient influence on behavior and emotional states during adolescence and play an important role in adolescents’ coping via the provision of social support (Chein et al., 2011; Kingery et al., 2011; Larson & Richards, 1991; Silk et al., 2011). Thus, we expected that that being with peers after a stressor would be associated with more positively valenced emotional states, compared to being alone or with family. The current findings largely ratified our expectations, and add to the literature by
demonstrating that peers shape adolescents’ ‘‘in-the-moment’’ emotional responses to stress.

Specifically, being with peers was associated with lower post-stress sadness compared to being alone and with family. One possible explanation for this finding is that adolescents may downregulate overt displays of sadness within the peer context out of fear of negative consequences (e.g., teasing; von Salisch, 2001; Zeman & Shipman, 1997). Arguably, if participants were cognizant of peer expectations around attenuating displays of sadness, this could influence the subjective experience of sadness within the peer context (von Salisch, 2001). Indeed, how others react to emotion displays can influence further regulation efforts (Gilbert, 2015; Legerski et al., 2015). By contrast, adolescents expect parents to be more supportive of displays of sadness (Zeman & Shipman, 1997) and may be more comfortable displaying sadness when alone, resulting in greater overt displays of sadness within these contexts.

Similar to sadness, being with peers after a stressor was associated with lower worry and jealousy, compared to being alone. Previous research demonstrates that peers are important sources of social support during times of major stress (Kingery et al., 2011). Arguably, peers could offer social support throughout the day, even for relatively minor stressors. As a consequence of having received social support, participants in the current study may have experienced less worry about the stressor. Indeed, transactional models of coping point to a process whereby individuals evaluate the resources in their environment which can serve to bolster their coping efficacy (Lazarus & Folkman, 1987). Likewise, jealousy among peers can arise from the perception that a friend is not available to meet emotional needs (Parker et al., 2005). Thus, participants who approached their peers during times of stress, and received support, may have gained a sense of emotional needs being met,
leading to lower jealousy compared to other contexts. Indeed, sharing intimate information is a key characteristic of adolescent friendships (Parker & Gottman, 1989).

**Gender Differences**

When we explored possible gender differences, the above findings regarding the conditional effect of peers on emotional responding to stressors did differ by gender. Specifically, the conditional effect of peers on the relation between experiencing a stressor and sadness, worry and jealousy held firmly for girls, but not boys. Girls’ peer relations are characterized by higher social support, and girls expect more emotional support from peers for displays of sadness compared to boys (Slavin & Rainer, 1990; Zeman & Shipman, 1997), which may account for these findings. Interestingly, though, being with peers after a stressor was associated with higher happiness compared to being alone or with family only for boys, suggesting that peers played a role in shaping boys’ positive emotion after a stressor. That being said, girls comprised the majority of our sample (roughly 69%), and many of these gender differences could simply be attributable to our diminished power to detect effects among boys in our sample. Disadvantaged boys can be difficult to engage in intensive studies such as this one, and future research should endeavour to heavily recruit and possibly over-sample boys from socioeconomically disadvantaged backgrounds. Nevertheless, the current findings point to potential gender differences in the conditioning effect of peers on adolescents’ emotional reactivity to momentary stressors.

**The Role of State Emotion in Adolescents’ Well-Being**

Although the above findings suggest that peers are associated with more positively valenced post-stress emotional states, it is worth commenting on one assumption underlying our interpretation of study findings. It is possible that lower
state negative emotion (or higher state happiness) is not necessarily indicative of an adolescent’s successful coping, or indeed, overall emotional well-being. Previous ESM work demonstrates that healthy adolescents experience less intense positive affect, compared to pre-adolescence and, that event well-adjusted adolescents experience elevations in negative affect on days with stressors (Larson, Moneta, Richards, & Wilson, 2002; Schneiders et al., 2006). These studies suggest that temporal lows in emotional states are not necessarily associated with maladaptive outcomes. Moreover, “time out” from positive emotions may be adaptive in some contexts (Gilbert, 2015).

This being said, previous work also demonstrates links in internalizing and externalizing symptoms and greater peaks in negative affect on days with stressors, compared to healthy adolescents (Schneiders et al., 2006). Thus, it may be that the extent of emotional responding to stress, rather than the absolute level of emotion, is associated with maladaptive outcomes. Indeed, greater emotional variability is predictive of adolescents’ depression and problem behavior (Neumann et al., 2011).

Importantly, although the current study did not examine change in an individual’s emotion after a stressor (compared to pre-event levels), the findings suggest that being with peers is associated with lower emotional states, compared to other social contexts. By extension, peers may help dampen the emotional flux that adolescents experience as a result of exposure to daily stressors.

**Peers as emotion socialization agents and social-contextual theories of coping**

Although we did not directly observe adolescents’ emotion socialization processes, the current findings add weight to the view that peers are emotion socialization agents (Klimes-Dougan et al., 2014). Specifically, findings demonstrate that peers shape adolescents’ levels of emotion in response to momentary stressors. Further, our findings expand on laboratory-based findings (e.g., Legerski et al.,
2015) and suggest that everyday events provide a context in which peer emotion socialization occurs. Moreover, the current findings support notions of the embedded nature of adolescents’ emotional and social worlds, and are consistent with social-contextual theories of coping which highlight interactions between the individual’s environment and their emotional response to the stressor (Lazarus & Folkman, 1987).

**Next Steps**

Although the findings fill an important gap in our understanding on the influence of peers on adolescents’ stress responses, several questions remain unanswered. First, because we did not measure adolescents’ objective displays of sadness across different social contexts, we cannot comment on whether adherence to peer norms resulted in lower sadness within the peer context. Future research would benefit from examining objective displays of sadness within the peer context, along with subjective reports of sadness, in order to understand whether adolescents deliberately regulate displays of sadness within the peer group to remain in-line with peer norms. Gathering ESM data on adolescents’ overt displays of emotion, and more broadly, emotion socialization practices within the peer context, will allow researchers to examine the mechanisms by which peers influence adolescents’ emotional experiences.

Relatedly, the current findings could be explained by participants seeking out specific contexts during times of stress. Because the peer context is generally experienced as positive and rewarding (Chein et al., 2011) participants may have sought out peers during times of stress as an “emotional tonic” for transient dips in affect. Indeed, lowered emotional states may prompt a desire to re-connect with others (Gilbert, 2015). Participants may also have actively sought time alone during times of heightened negative emotion, possibly as an emotional reprieve from stress.
(Larson, 1997). Due to the nature of the data examined here, we cannot say whether participants actively sought out peers after a stressor. Thus, future research would benefit from examining whether adolescents actively seek out specific contexts during times of stress as a way to regulate emotion.

Second, although we did not find support for the notion that girls’ negative emotion would be higher if they were with peers after a stressor, possibly due to co-rumination (Rose, 2002), we did not directly measure co-rumination in the current study. Thus, examining whether adolescent girls engage in co-rumination on a daily basis, and whether this diminishes the positive effect of peers on girls’ post-stress emotions, remains an important empirical question. Third, because participants were only asked to indicate whether they were with a family member we were unable to examine the influence of different family members (e.g., mother, father, siblings) on post-stress emotion. Previous research suggests that mother, father and sibling relationships follow a unique relational pattern across adolescence (Larson & Richards, 1991). As a consequence, different family members may have different influences on adolescents’ emotional reactivity. Likewise, adolescent peer relationships are complex and multi-dimensional, and future studies would benefit from a nuanced examination of different peer relationships, for instance, the influence of a best-friend versus other friends, and same-sex versus mixed-sex friendships, on adolescents’ emotional responses to stress.

Last, the number of momentary stressors reported (that were at least moderate in strength) was relatively low in the current study, especially given the disadvantaged nature of the sample (Evans et al., 2009). Although participants were briefed on what types of events could be used to answer this question, asking participants to report on “bad” events rather than stressful events could have meant participants failed to report on minor stressors that they did not judge as “bad”.
Concomitantly, although our use of a socioeconomically disadvantaged sample represents strength, in allowing us to better understand how disadvantaged adolescents navigate daily stressors, it could also be seen as a possible limitation, in that it limits the extent to which study findings can be generalized to adolescents from middle-income contexts.

**Conclusion**

All told, the current findings suggest that peers are influential in shaping adolescents’ emotional responses to stressors that occur across the day. The importance of these findings is highlighted when considering the emotional impact that daily stressors can have on adolescents. Given that adolescence is a developmental period where youths are at risk for increased exposure to stressors and exacerbated stress responses, and also a time when peers become increasingly salient (Kingery et al., 2011; Modecki, 2008), it is important that researchers and clinicians gain a clear understanding of when the peer context may be beneficial to adolescents. Although the current findings cannot speak to the underlying mechanisms, peer contexts were linked with more positively valenced post-stress emotions. These findings represent a first step in delineating the relative influence of peers on adolescents’ emotional responses to minor stressors, compared to family and alone contexts. Based on the current findings, adolescents may be encouraged to seek out peers as an ‘‘emotional tonic’’ after exposure to stressors that occur as they go about their daily lives. Being among peers during times of stress may offer adolescents an open, supportive and rewarding space which may help dampen the emotional turbulence that adolescence can bring.
PREFACE TO CHAPTER FOUR

Aims

- To “drill down” into temporal relations between emotions and stressors, and identify whether disadvantaged adolescents’ show changes in positive and negative emotions after a recent daily stressor (i.e. change in intensity of an emotion from pre-to-post stressor)
- To identify whether levels of externalizing symptoms condition adolescents’ emotional reactivity to daily stressors
- To examine whether adolescents with higher levels of externalizing symptoms generate more daily stressors across the week, compared to their peers who were lower in externalizing symptoms

Study 1 offered preliminary evidence that disadvantaged adolescents’ emotional dynamics are impacted by the recent occurrence of a stressor, and that this relation is conditioned by their current social context. Specifically, findings suggested that seeking out peers may help remediate some of the emotional impact of daily stressors in youths’ day-to-day life. For disadvantaged youth, who typically have low uptake of ‘formal’ mental health services (Lawrence et al., 2015) the school yard and classroom, where youth spend a substantial portion of their time interacting with peers, may represent informal contexts for emotional support after a stressor.

Findings from Study 1 provide a broad snapshot of how disadvantaged youth -as a whole- respond emotionally to daily stressors. But, there is growing interest in unpacking how individual differences in emotional dynamics are tied to symptoms of psychopathology (e.g. Koval et al., 2010). Risk for externalizing symptomatology increases in adolescence, as youth experience increases in incentive motivation, drawing them toward reward seeking behaviour (Luciana & Collins, 2012; Luciana,
2013). Yet, while this biological vulnerability promotes risk for participation in externalizing behaviours, it is only in interaction with environmental contexts that this risk is fully realized. Specifically, contexts which are characterized by high affect are where adolescents’ biological vulnerability to emotion dysregulation is most likely to manifest (Luciana, 2013). As findings from Study 1 illustrate, daily stressors represent such affectively-laden contexts.

To tap into how adolescents’ daily emotion dynamics are tied to externalizing symptomatology in daily contexts, Study 2 examined changes in adolescents’ emotions after a stressor, based on levels of externalizing symptoms. In Study 1, change in emotion was characterized as the difference between an adolescents’ current level of an emotion (e.g. happiness) compared to their average level of that emotion across the week. Moving toward a more fine-grained sense of how emotions are tied to context, Study 2 examined emotion change in terms of reactivity is useful. The dynamic of reactivity reflects change in level of an emotion from before a stimulus to after a stimulus (Wenze & Miller, 2010). Thus, the ‘yardstick’ for change is the level of an emotion at the preceding time point instead of a weekly average, and measures of reactivity given insight into how much an emotion has increased or decreased from the preceding time point.

Based on the notion that the vulnerabilities that confer risk for externalizing behaviours could also confer risk for the occurrence of daily stressors, a secondary aim of Study 2 was to test whether adolescents who were higher in externalizing symptoms experienced more frequent daily stressors, particularly after a peak in negative emotions, compared to their peers who were lower in externalizing symptoms. Overall, findings from Study 2 indicated that emotion reactivity for sadness, anger, jealousy, loneliness, and excitement was greater among adolescents
who were higher in externalizing symptoms compared to adolescents lower in externalizing symptoms.
CHAPTER FOUR - STUDY 2

This following is a post-peer-review, pre-copyedit version of an article published in *Journal of Psychiatry and Human Development*. The final authenticated version is available online at: https://doi.org/10.1007/s10578-018-0784-x. The paper is formatted in accordance with the authors’ instructions for submission to the journal. The bibliographic details of the co-authored paper, including all authors, are:


My contribution to the paper involved: I adapted experience sampling items relating to daily stressors and social contexts, collected and cleaned data, and formulated the research questions. I analysed the data and drafted the manuscript. My co-authors then reviewed the manuscript draft and suggested edits.

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Abstract
Numerous theories assert that youth with externalizing symptomatology experience intensified emotion reactivity to stressful events; yet scant empirical research has assessed this notion. Using in-vivo data collected via experience sampling methodology, we assessed whether externalizing symptoms conditioned adolescents’ emotion reactivity to daily stressors (i.e. change in emotion pre-post stressor) among 205 socioeconomically disadvantaged adolescents. We also assessed whether higher externalizing symptomology was associated with experiencing more stressors overall, and whether adolescents’ emotional upheavals resulted in experiencing a subsequent stressor. Hierarchical linear models showed that adolescents higher in externalizing symptoms experienced stronger emotion reactivity in sadness, anger, jealousy, loneliness, and (dips in) excitement. Externalizing symptomatology was not associated with more stressful events, but a stress-preventative effect was found for recent upheavals in jealousy among youth low in externalizing. Findings pinpoint intense emotion reactivity to daily stress as a risk factor for youth with externalizing symptoms living in socioeconomic disadvantage.

Keywords: experience sampling, emotion reactivity, externalizing, socioeconomic disadvantage, adolescents
Socioeconomically Disadvantaged Adolescents with Elevated Externalizing Symptoms Show Heightened Emotion Reactivity to Daily Stress: An Experience Sampling Study

Adolescents living in settings of socioeconomic disadvantage face a myriad of daily stressors unique to their environment. For instance, in addition to the typical stressors of adolescence, such as schoolwork and conflicts with parents, disadvantaged youth face additional stressors associated with exposure to violence within their communities and familial financial hardship (Miller, Webster, & MacIntosh, 2003). Concomitantly, relative to youth living in more advantaged settings, disadvantaged youth are also characterized by increased likelihood of involvement in externalizing behaviors, including aggression, delinquency, and substance use (Bongers, Koot, van der Ende, & Verhulst, 2004; Grant et al., 2003).

These dual-liabilities that are associated with living in low socioeconomic environments—elevated stress-exposure and externalizing behaviors, are in turn characterized by their own risks. In particular, both factors have been characterized in terms of increased risk for intense emotional responding to events, including intense emotion reactivity (Boyce & Ellis, 2005; Eisenberg et al., 2000; Plattner et al., 2007). However, research is yet to examine whether intense emotion reactivity, as linked to youths’ externalizing symptoms, manifests in daily life. When frequent and uncontrolled, such reactivity in the form of surges in negative emotion or dips in positive emotion can potentiate risk for longer-term detrimental mental health outcomes (Hollenstein & Lougheed, 2013; Neumann, van Lier, Frijns, Meeus, & Koot, 2011). Consequently, unpacking this interplay between adolescents’ externalizing symptoms and emotion reactivity to stress in every-day life can offer valuable translational information to better support youth living within the context of socioeconomic disadvantage.
Accordingly, here we characterize adolescents’ emotion reactivity to daily stressors, and assess the possibility that externalizing symptoms are linked with adolescents’ exacerbated stress reactions. We also examine a second, complimentary possibility, in that youth high in externalizing symptoms may themselves contribute to the manifestation of their day-to-day stressors. We test these questions using “in-situ” experience sampling methodology (ESM) in a relative large sample of socioeconomically disadvantaged youth. Deploying such an ecologically valid approach to better characterize how youth with externalizing symptoms navigate stressors in their day-to-day life arguably holds the potential to inform whole-child approaches to prevention and intervention in disadvantaged settings.

Adolescents’ Experience of Daily Stressors

Despite numerous theoretical assertions that youth with elevated externalizing symptoms are vulnerable to strong emotion reactivity to stressful events (Beauchaine & McNulty, 2013; Luciana, 2013), surprisingly scant data exists to support this notion, and this is especially the case in relation to experienced daily stressors. Indeed, previous investigations of the daily stress-emotion relation have not disentangled the role of psychopathology—externalizing symptoms in particular—and emotion reactivity to stress in a single study. This gap in the literature is important because everyday stressors become more common during adolescence, are comparably frequent, tend to be predictable, and tend to be more controllable than major life events (Ham & Larson, 1990; Seiffge-Krane & Stemmler, 2003). Moreover, responding to daily stressors may deplete youths’ capability to respond to major stressors when they do occur (Wagner, Compas, & Howell, 1988).

Daily stressors represent minor, moment-to-moment annoyances that result from an individual’s interaction with their environment (Kanner, Coyne, Shcaefer &
Unlike major live stressors (e.g. parental divorce, death of a family member), daily stressors are experienced more proximally and result from youth ‘bumping up’ against the challenges posed by day-to-day life (Lazarus & Folkman, 1984). For this reason, understanding the impact of these proximate stressors on emotional wellbeing can provided need insight into adolescents’ daily emotional landscapes. Such insight is especially valuable for better deciphering how emotion reactivity relates to youthful externalizing behaviours.

The impact of daily stressor on emotional wellbeing has oftentimes been investigated using ESM, which can be leveraged to facilitate youths’ reporting of their experienced events and current emotions as they go about day-to-day life, across various times and settings, and with themselves as their own control (Nezlek, 2001). Unfortunately, however, previous research employing such ESM approaches has unfortunately largely assessed emotional responses, rather than emotion reactivity (that is, emotion change because of experiencing a stressor). However, existing work suggests that frequent daily stressors are indeed associated with higher overall negative affect, as well as higher same-day levels of negative mood and lower positive mood (Flook, 2011; Ham & Larson, 1990). Further, Schneiders and colleagues (2006) showed that adolescents report higher than usual depressed/anxious affect and lower than usual positive affect in moments after experiencing a minor stressor. Moreover, this finding was attenuated among youth characterized by poor wellbeing, low self-esteem and high internalizing and externalizing symptoms. Although not focused on externalizing symptoms or emotional reactivity per se, Schneider et al.’s research does highlight connections between adolescents’ psychopathology and atypical affect in relation to daily stress, and suggests a need to further unpack relations between specific forms of psychopathology and adolescents’ emotional reactivity to daily stress.
In an early example of ESM work that points to the likelihood that youth at risk for externalizing psychopathology have difficulties with placing parameters on their emotion across the day, Silk and colleagues (2003) examined emotion intensity, lability, and range among adolescents with externalizing symptomatology (Silk, Steinberg & Morris, 2003). Silk et al.’s work focused on average levels of emotion, average variation in emotion across testing periods, and time to return to normal from highest and lowest mood states in the last testing period, among middle-income youth using ESM. They found that externalizing symptoms were associated with higher reported levels of negative emotion (anger, sadness, and anxious affect) on average and greater variability in negative emotions. While informative, however, this work did not assess daily experiences and thus cannot speak to contingencies associated with adolescents’ experiencing of evocative stimuli. Thus, it remains empirically untested as to whether intense emotion reactivity to day-to-day stress indeed characterizes youth with externalizing symptoms.

**Adolescents’ Externalizing Symptoms and Emotion Reactivity**

In general, adolescents’ still-evolving neural circuitry renders them less able to exert “top-down” control of their emotions relative to other age groups, particularly when cognitive control systems become “flooded” with intense motivational or emotional inputs (Casey, 2015; Luciana, 2013). However, some youth are more vulnerable to emotion regulation difficulties than others, and adolescents with externalizing symptomatology are among those who are particularly at risk of being overwhelmed during intensive affective states (Beauchaine & McNulty, 2013; Luciana, 2013). One aspect of such difficulties with emotion regulation is evidenced by intense emotion reactivity, which can be best characterized as a parameter that youth place around their levels of an emotion during the process of emotion regulation.
That said, because the bulk of research assessing emotional responses in relation to adolescents’ externalizing symptoms has used trait-based measures of emotion regulation (rather than reactivity) there is limited understanding of the temporal dynamics experienced by these adolescents in daily life (Kuppens & Verduyn, 2017). Indeed, contemporary approaches to emotion research emphasise that emotion is not a once-off, static event. Rather, emotions occur in a dynamic fashion, unfolding across time, and these dynamics may reflect risk (or protective) factors for psychological maladjustment (Kuppens, Oravecz, Tuerlinckx, 2010; Kuppens & Verduyn, 2017). In contrast to trait-based measures of emotion regulation, which provide insight into how youth modulate emotional experiences more generally, ESM measures of emotion reactivity (change in emotion after encountering a stimulus), provide unique insight into the temporal course of emotions, and are arguably more reflective of adolescents’ everyday experience.

What little research that does exist in relation to externalizing symptoms and emotion reactivity has been conducted largely in lab-based settings, and so cannot speak to emotion dynamics unfolding across time (Kuppens & Verduyn, 2017). Notably, we do not include in this discussion physiological measures of emotion, which reflect a discrete component of the emotional experience, do not necessarily converge with subjective measures, and are beyond our scope here. That said, extant lab-based findings highlight that children and adolescents who engage in externalizing behaviors tend to experience more intense negative emotion in response to stimuli, relative to youth low in externalizing symptoms (e.g. Eisenberg et al., 2000). Further, youth institutionalized for juvenile delinquency react with more intense anger and sadness to an induced laboratory stress task than do non-delinquent youth (Plattner et al., 2007). Yet distilling adolescents’ emotion reactivity via their emotion-change as a result of day-to-day stress remains a needed area of
inquiry, because it is this lack of constraint in the emotion regulation process that arguably contributes to cumulative challenges faced by youth, particularly those with externalizing symptoms. Further, because the ways in which adolescents respond emotionally to the “ups and downs” of daily life form the building blocks of psychopathology (Wichers, 2013), understanding such emotion reactivity to daily stress can provide important insight into the aetiology and maintenance of externalizing symptoms.

**Socioeconomic Disadvantage and Reactivity to Stress**

Though the above studies provide preliminary insight into adolescents’ emotion experiences, a subset of which deploy ESM to assess reported emotions in daily life, these studies have generally focused on middle-income youth, to the exclusion of youth living in low SES settings. This discrepancy in the literature is particularly notable, given evidence that disadvantaged youth experience more frequent daily stressors relative to their more affluent peers (Evans et al., 2009; Johnson & Swendsen, 2015), and given known health disparities for youth living in low SES settings, which may be mediated by high stress reactivity (Chen & Miller, 2012). Indeed, past research finds that youth in low SES settings are particularly vulnerable to exacerbated reactivity to stress, due to high stress exposure that results in allostatic overload (e.g. Lupien, King, Meany, & McEwen, 2001; Theall, Durry, & Shirtcliff, 2012). Allostatic overload occurs when the body’s stress response systems become activated repeatedly, frequently, or in a sustained manner, and as a consequence experience “wear and tear” (Schulkin, 2003). Such “wear and tear” of stress response systems renders individuals less capable of adaptive responding to future stressors. Thus, youth living in the context of socioeconomic disadvantage may struggle to form healthy responses to daily stressors due to a burdened allostatic process and heightened sensitivity to stress.
Importantly too, wearing down of the stress responses system can manifest ‘blunted’ stress responses (Ganzel et al., 2010). Indeed, there is some evidence that adolescents who live in disadvantaged neighbourhoods and who experience frequent daily stressors show blunted stress reactivity in a lab-based setting, in the form of lower cortisol reactivity (e.g. Brenner et al., 2013). Yet, as noted above, physiological components of reactivity may not necessarily converge with subjective components, and thus the question remains as to whether disadvantaged youth show exaggerated emotion reactivity, when measured by youths’ subjective reports of emotions. Likewise, it remains an open question as to whether this reactivity is especially pronounced based on levels of externalizing symptomatology.

**Stress Generation among Adolescents Higher in Externalizing Symptomatology**

Concomitant to the idea that youth higher in externalizing symptomatology experience heightened emotional reactivity to daily stressors is the notion that these youths may also serve to generate at least some of the stressors which they encounter. For instance, ‘stress generation’ models posit that some individuals with psychopathology symptoms (in this case, depressive symptoms) carry internal liabilities which serve to perpetuate their manifestation of specific stressors (Hammen, 1992). That is, vulnerabilities associated with psychopathology confer problems with interpersonal competencies and coping, which in turn, may serve to contribute to stress occurrence. Likewise, externalizing symptomatology is characterized by social skills and information-processing deficits (Guerra, Boxer & Kim, 2005) which arguably facilitate conditions for daily stressors. Illustratively, youths’ externalizing behaviors are linked to hostile attribution biases, which precipitate aggressive and coercive interactions that may perpetuate stress (Dodge, 2006). Further, youth who display externalizing behaviors are likely to experience peer rejection and harsh parenting (Miller-Johnson et al., 2003; Kim et al., 1999),
which, in may foster conditions generative to interpersonal stressors. Indeed, cross-sectional research suggests positive associations between externalizing psychopathology and frequency of interpersonal stressors (Rudolph et al., 2000). Thus, while the idea that symptoms of psychopathology foretell heightened propensity for stressors has previously been applied mainly to individuals with depression, its basic precept holds, and this liability may hold true for externalizing symptomology, as well.

The Current Study

Using ESM, the current study takes a high-resolution approach to assess the conditioning (e.g. moderating) effect of externalizing symptoms on disadvantaged adolescents’ emotional reactivity to stressors across day-to-day life. We expected that adolescents who were higher in externalizing symptomatology would show greater increases in negative emotions (sadness, anger, jealousy, loneliness, and worry) and greater decreases in positive emotions (excitement, happiness) in response to stressors, relative to youth who were lower in symptomology. Previous lab-based studies indicate that youths’ externalizing symptoms are linked to strong reactivity in both high and low arousal emotions (e.g. anger and sadness; Plattner et al., 2007). Hence, we examine a wide range of discrete emotions to tap high versus low arousal emotions (e.g. worry versus sadness; Russell, 2003). Additionally, we include an examination of excitement and happiness to address a needed area of research (Gilbert, 2012) and capture possible dips in pleasurable emotions due to stress. As a second aim, we examined stressors as an outcome of adolescents’ emotional experiences and assessed whether relations between reported emotions and subsequent occurrence of a stressful event was likewise conditioned on adolescents’ level of externalizing symptoms. In line with a stress generation hypothesis, we expected that adolescents higher in externalizing symptoms would
experience more stressors compared to their normative peers. We further expected that prior emotional upheavals would predict a subsequently increased likelihood of experiencing a stressor for adolescents higher in externalizing symptoms.

Method

Participants

Participants were 213 adolescents from two low SES public schools in metropolitan Western Australia. Schools were recruited based on their designation as relatively low SES, as ranked on national Index of Community Socio-Educational Advantage (ISCEA; Australian Curriculum, Assessment & Reporting Authority, 2013). ISCEA values are determined based on key household indicators, including parental education and occupation levels, ethnicity, household income, and single parent status, as well as school-level indicators including percent of Indigenous students. In this context, a score below 1000 is considered below-average, and the two schools were rated below 1000. Five participants withdrew consent, and two failed to commence the ESM phase. Thus, the final sample size was 206 (Mage = 14.6 years (SD = 1.2), 12-17 years; girls = 61%). The majority of study participants reported Caucasian (73.8%) ethnicity. Other ethnicities were Maori (5.8%) African (1.9%) Asian (3.4%) Aboriginal or Torres Strait Islander (7.8%) and “other” (1.9%). 5.2% of participants did not report ethnicity.

Procedure

Data were collected in cohorts of 20-25 participants per week. Participants and their parents/guardians were given information letters about the study and gave written consent before commencing. Ethics approval was obtained from the University Human Ethics Research Committee, and approval was obtained from the State Department of Education. Participants received no financial remuneration for participation in the study but were given unlimited use of a recent model iPhone® with phone and data credits to enhance engagement.
**Pre- and post-ESM phase.** Prior to the ESM phase, participants completed a computerized baseline survey (pre-ESM survey) containing questions about demographics, externalizing behavior and other constructs (e.g. internalizing symptoms). Immediately after completing the ESM phase, participants completed the same computerized survey (post-ESM survey). The survey was given twice to tap underlying stability of attributes for inclusion as person-level (level-2) variables.

**ESM phase.** Participants completed ESM reports 5 times a day for 7 days. Participants used a recent model iPhone® provided by the research team to complete ESM reports. They were sent links to the web-based ESM surveys via text messages and were instructed to click on the link and complete the survey as soon as possible or at a time of nearest convenience. Each survey was closed to responses within an hour of being sent (e.g. Schneiders et al., 2006). Surveys were sent in five, half-hour time blocks each day during times previously piloted in a separate adolescent sample. Exact survey times varied within allocated timeframes to prevent participants from habituating to a set response time. Further, the research team was onsite at each school throughout the study and were contactable via phone outside of school hours to troubleshoot any technical issues.

**Person-Level Measures**

**Externalizing symptomatology.** Externalizing symptomatology was assessed based on the average of 15 self-report frequency items tapping how often participants had engaged in antisocial, delinquent, aggressive, and substance-using behaviors in the last six months (e.g. skipped school without parent permission; gotten in a physical fight). This measure has been used in previously published research on adolescent externalizing (e.g. Fredricks & Eccles, 2006) and in our lab’s previously published ESM research (Uink, Modecki, & Barber, 2017). Scales were averaged across the pre-and post ESM surveys so that externalizing frequency was
conceptualized as a person-level (level-2) variable. The measure demonstrated good validity within this sample as evidenced by small to moderate but significant positive correlations with depression scores and social anxiety scores (Table 1), as well as with recent life stressors \( r = .40, p < .001 \), and negative correlations with resistance to negative peer influence \( r = - .29, p < .001 \). Internal reliability and test-retest reliability was high \( (\text{pre-ESM } \alpha = .84, \text{post-ESM } \alpha = .88; \text{test-retest } = .86) \).

For descriptive purposes (Table 1), we also summed the number of externalizing behaviors in which adolescents reported engaging within the last six months \( (1 = \text{engaged in the behavior}; 0 = \text{did not engage}) \). Twelve percent of adolescents endorsed that they engaged in 10 of the 15 possible behaviors at least once over the last 6 months \( (\text{S.D.} = 3.8; \text{Range} \ 0 - 13) \). In terms of substance use, over a third \( (37.4\%) \) of participants reported alcohol use, 19.9\% binge drinking, and 11.2\% use of illegal drugs. For antisocial and aggressive behaviors, 20.9\% of participants had truanted school, 17.1\% had been in a physical fight, and 6.3\% had been in trouble with the police.

**Person-level covariates.** Other level 2 covariates included gender \( (0 = \text{male}, 1 = \text{female}) \), depression symptoms and social anxiety symptoms. Depression and social anxiety were included as covariates to account for potential individual differences in emotion reactivity attributable to these forms of psychopathology, and thus better parse the role of externalizing symptoms on reactivity. Depression was measured with the well-validated Reynolds Adolescent Depression Scale 2\textsuperscript{nd} edition \( (\text{RADS-2}; \text{Reynolds}, 2004) \), based on 30 self-report items tapping common experiences of depression (e.g. “I feel lonely”; \( 1 = \text{Almost Never}; 4 = \text{Most of the Time} \)). Participants’ pre-and post-ESM scores were totalled and then averaged across both time points to create a person-level depression score. Internal reliabilities at pre- and post-ESM were good \( (\text{pre-ESM } \alpha = .84, \text{post-ESM } \alpha = .88) \) as was test-retest
reliability (.82). The well-validated Social Anxiety Scale for Adolescents (SAS-A; La Greca, 1998) was used to assess social anxiety. It consists of 18 items, such as “I worry about doing something new in front of others;” (1 = Not at All; 5 = All the Time). Total scores at pre- and post-ESM were averaged to create a person-level social anxiety score. The SAS-A had good reliability in this sample (pre-ESM α = .96, post-ESM α = .96, test-retest = .76). To assist with model convergence, adolescents’ depression and social anxiety scores were rescaled (i.e. divided by 10).

**ESM Measures**

**Positive and negative emotion.** At each sampling moment, adolescents rated how they were feeling on a 5-point Likert scale (1 = Not at all, 5 = Very much). Specific to the current study, adolescents rated how sad, angry, lonely, jealous, worried, excited, and happy they were “right now.” Emotions were based on prior ESM studies (e.g. Schneiders, et al., 2006; Silk et al., 2003) and from our lab’s pilot work (Uink et al., 2017). Importantly, participants reported on a stressor after having reported their emotions at each sampling moment, reducing the risk of a reporting bias for emotion. Our emotion reactivity construct, in turn, tapped emotion at the current sampling moment (t = 0) controlling for emotion at the previous time point (t-1).

**Momentary stressors.** At each sampling moment, momentary stressors were assessed by asking participants “Since you were last messaged has anything bad happened to you?” This item was drawn from previous ESM research with adolescents (e.g. Schneiders et al., 2006). Participants additionally rated the severity of the event (1 = Sort of Bad; 5 = Very Bad). Only events that were rated a three or more on the severity item were included in the current analyses in order to tap only those events that were likely to be emotionally salient. Similar to previous studies (e.g. Schneiders et al., 2006) we used a dichotomous bad event variable as the
independent variable, rather than severity of stressor, because we were primarily interested in change in a given adolescent’s emotion after an event had occurred (vs. not occurred), rather than change in emotion based on severity of stressor.

Additionally, use of a dichotomous variable allowed us to include all sampling moments in analyses, including moments where no bad event was reported. Adolescents’ from the first cohort were further asked to describe each bad event at each time point via an open-ended question, and further details of types of stressors reported can be found in Uink et al., (2015).

**Momentary positive events.** Main analyses also controlled for momentary positive events as a level-1 covariate. Positive events were measured and coded in a similar manner as momentary stressors and were considered a salient event if they were rated a three or more in valence (1 = Sort of Good; 5 = Very Good).

**Analyses**

Main analyses utilized HLM because repeated measures of events and emotion were nested within- person (Hox, 2010). Analyses were conducted using Mplus version 7 (Muthén & Muthén, 2012). We took a bottom-up approach to model building, beginning with variance component models and working toward intercepts-and-slopes-as-outcomes models. Separate models were estimated for each emotion. Level-1 variables were centered on an individual’s average for the week (i.e. group-mean centered), and level-2 variables were centered on the group’s average (i.e.; grand-mean centered; Enders & Tofighi, 2007).

**Question 1: Do externalizing symptoms condition adolescents’ emotion reactivity to stressors?**

As equation 1a) shows, an adolescent’s emotion reactivity was modelled as a function of the predicted average (intercept value) of emotion for the week ($\beta_0j$),
emotion at t-1 (β1j), whether they had a stressor or positive event that moment (β2j; β3j) and variation around their momentary emotion average (eij).

\[ \text{Emotion Reactivity}_{ij} = \beta_{0j} + \beta_{1j} (\text{emotion t-1}) + \beta_{2j} (\text{stressor}) + \beta_{3j} (\text{positive event}) + e_{ij}. \] (1a)

After Level 1 models had been estimated, we modelled Level-1 intercepts at Level-2 of the model (Equation 1b). As shown in equation 1b, an adolescent’s average emotion reactivity was modelled as function of the average level of emotion across the sample (γ00), plus externalizing, depressive, and social anxiety symptoms and gender on the intercept (γ01- γ04), and their deviation around the sample mean (μ0j). Next, to test for between-person differences in emotion reactivity, we allowed the within-person slope of emotion on stressors to vary across individuals (i.e. the random-slopes component of the model). Following this, we regressed externalizing and the other level-2 covariates onto the within-person slope (Equation 1c). Thus, in Equation 1c, γ10 represents the pooled slope coefficient of the within-person relation between emotion and stressor; γ11-γ14 represents cross-level interactions on the level-1 slope, and μ1j represents an adolescent’s deviation around the average slope.

\[ \beta_{0j} = \gamma_{00} + \gamma_{01} (\text{Externalizing}) + \gamma_{02} (\text{Depression}) + \gamma_{03} (\text{Social Anxiety}) + \gamma_{04} (\text{Gender}) + \mu_{0j} \] (1b)
\[ \beta_{1j} = \gamma_{10} + \gamma_{11} (\text{Externalizing}) + \gamma_{12} (\text{Depression}) + \gamma_{13} (\text{Social anxiety}) + \gamma_{14} (\text{Gender}) + \mu_{1j} \] (1c)

**Question 2:** Do youth higher in externalizing report more momentary stressors than youth lower in externalizing symptoms?

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1 We initially included frequency of major life stressors (sum of 11 items from the Adolescent Perceived Event Scale; Compas et al., 1987) as a level 2-covariate. More specifically, major life stressors did not account for significant variance in reactivity for any emotion (sad b = .020, p = .07; angry b = -.06, p = .21; jealousy b = -.012, p = .50; lonely b = .063, p = .15; worried b = -.016, p = .67; excitement b = -.037, p = .22; happy b = -.027, p = .44). Nor did major life stress account for significant variability in proportion of daily stressors within our sample (b = 2.0 (1.6), p >.05). thus, we excluded major stressors for model parsimony.
Single-level regression models were used to estimate individual differences in stressor frequency based on externalizing symptoms and other person-level covariates. Stressor frequency was derived by calculating the proportion of sampling moments in which a stressor was reported divided by the total number of sampling moments completed. Similar to van Roekel et al., (2016) this operationalization usefully facilitated our ability to account for differences in number of sampling moments completed across participants.

**Question 3. Does externalizing condition the association between previous emotion and likelihood of a subsequent stressor?**

A series of two-level intercepts-and-slopes-as-outcomes models were used to test our final hypothesis that emotion at t-1 would predict stressors at t = 0, and this relation would be conditioned by externalizing symptoms. We used logit models because stressor was a dichotomous variable. Logit models were similar to those in equations 1a-c, with two exceptions: 1) stressor was the outcome rather than predictor, and 2) momentary positive events were not included at level-1. Emotion t-1 was group mean centered, so level-1 coefficients can be interpreted as a change in the log likelihood of stressor based on a one-unit increase from an individual’s typical level of that emotion (Enders & Tofighi, 2007).

**Results**

**Compliance, Data Preparation, and Missing Data**

Given heterogeneity in whether participants reported on the final sampling moment of the study (morning), we excluded the final time point from analyses, resulting in 34 time points across the sampling phase. Less than 1% (.8%) of the 7004 sampling moments were incomplete due to technical error or a school

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2 An HLM format was not required as each individual had only one overall frequency value. Thus there were no within-person differences to be modeled.
scheduling conflict. Thus, the final amount of possible sampling moments was 6948. In these analyses, of the possible 6948 sampling moments, 62% were completed, which translates to 4,308 sampling moments in total. This missing data rate is similar to well-known youth ESM studies without financial compensation for completed surveys (Larson, 1983) and is better than rates often found with experience-sampling of at-risk individuals (e.g. Kauer, Reid, Sanci, & Patton, 2009, 30.4% completed; Crooke et al., 2013, 43% completed; Swendeman, Comulada, Ramanathan, Lazar, & Estrin, 2015, 50% completed).

One advantage of HLM regression models is that study participants are not assumed to be measured on the same number of time-points; thus, youth with incomplete data are included in the analysis (Gibbons, Hedeker, & DuToit, 2010). Moreover, we estimated models using Full Information Likelihood Method (FIML), which is best practice for treatment of missing data (Enders, 2010). In this context, FIML also offers additional advantages of less restrictive assumptions about data missingness (e.g. versus generalized estimating equation (GEE) models; Gibbons et al., 2010). Further, models were estimated using robust standard errors to account for possible variable non-normality (Mass & Hox, 2004). Finally, to rule out the possibility that findings of heightened emotion reactivity among high externalizing youth could be a consequence of our models’ missing data estimates, we also conducted a sensitivity analysis. Models were re-run with listwise deletion, and these resulted in similar trends for cross-level interactions (with the exception of one non-significant finding) and all of the same main effects. Thus, all reported findings make use of all observed data using FIML.

**Descriptives**

Emotions were averaged and salient stressors and positive events were summed across the week for descriptive analyses (see Table 1). Number of stressors
ranged from 0-24, and number of positive events ranged from 1-30. Participants reported a salient stressor on 22% of days sampled.

**Variance component models.** Significant within-and-between person variance in each emotion and interclass correlation coefficient (ICC) values above .10 supported the use of HLM for the reactivity models (top of Table 2). Likewise, ICC values above .17 for the stress generation models (e.g. question 3) indicated a need for HLM (Hox, 2010).

**Question 1: Do externalizing symptoms condition adolescents’ emotion reactivity to stressors?**

**Main effects of stressor predicting emotion reactivity.** In this set of analyses, participants’ days in which they recorded more than one stressor (less than 6%) were excluded because of possible qualitative differences between days with one versus multiple negative events. As shown under the level 1 co-variates section of Table 2, recent stressors were associated with significant momentary increases in each of the negative emotions and significant decreases in the positive emotions.

**Main effects of level-2 covariates predicting average emotion.** Examination of the level-2 main effects indicated that externalizing symptoms were associated with significantly higher happiness across the week. Depressive symptoms were associated with significantly higher negative emotions and lower positive emotions across the week. Last, social anxiety symptoms were associated with significantly higher loneliness, excitement and happiness across the week (Table 2, Level 2 Intercepts).

**Stressor X Externalizing cross-level interactions.** As indicated in the bottom-half of Table 2, there were significant cross-level interactions of Stressor x Externalizing for five out the seven emotions tested (sadness, anger, loneliness, jealousy, and excitement). We further explored these significant interaction effects
Table 1

Descriptives and correlations between study variables

<table>
<thead>
<tr>
<th></th>
<th>Mean (S.D)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Happy</td>
<td>3.37(1.9)</td>
<td>1.00</td>
<td>.497**</td>
<td>-.292**</td>
<td>-.235**</td>
<td>-.341**</td>
<td>-.244**</td>
<td>-.126**</td>
<td>-.190**</td>
<td>.300**</td>
<td>.028</td>
<td>-.285**</td>
<td>-.117**</td>
<td>-.107**</td>
</tr>
<tr>
<td>2.Excited</td>
<td>2.24(1.4)</td>
<td>--</td>
<td>1.00</td>
<td>.020</td>
<td>.029</td>
<td>-.050**</td>
<td>.003</td>
<td>.117*</td>
<td>-.050**</td>
<td>.301**</td>
<td>.034*</td>
<td>-.109**</td>
<td>.006</td>
<td>-.062**</td>
</tr>
<tr>
<td>3.Angry</td>
<td>1.48(94)</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.493**</td>
<td>.581**</td>
<td>.447**</td>
<td>.485**</td>
<td>.270**</td>
<td>.134**</td>
<td>.085**</td>
<td>.309**</td>
<td>.197**</td>
<td>.023</td>
</tr>
<tr>
<td>4.Worried</td>
<td>1.60(1.0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.636**</td>
<td>.435**</td>
<td>.519**</td>
<td>.202**</td>
<td>.071**</td>
<td>.084**</td>
<td>.430**</td>
<td>.292**</td>
<td>.070**</td>
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<tr>
<td>5.Sad</td>
<td>1.57(1.0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.549**</td>
<td>.531**</td>
<td>.200**</td>
<td>.136**</td>
<td>.064**</td>
<td>.404**</td>
<td>.296**</td>
<td>.135**</td>
</tr>
<tr>
<td>6.Lonely</td>
<td>1.60(1.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.505**</td>
<td>.117**</td>
<td>.098**</td>
<td>.137**</td>
<td>.349**</td>
<td>.260**</td>
<td>-.021</td>
</tr>
<tr>
<td>7.Jealous</td>
<td>1.33(81)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.086**</td>
<td>.087**</td>
<td>.142**</td>
<td>.334**</td>
<td>.240**</td>
<td>.039*</td>
</tr>
<tr>
<td>8.Stressor</td>
<td>2.00(3.5)</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.064*</td>
<td>.036</td>
<td>.191*</td>
<td>.086</td>
<td>.163*</td>
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<td>9.Positive Event</td>
<td>5.00 (5.7)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>1.00</td>
<td>-.101</td>
<td>-.212**</td>
<td>-.059*</td>
<td>.040</td>
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<tr>
<td>10.Externalizing</td>
<td>1.46(6.0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.244**</td>
<td>.158**</td>
<td>-.095**</td>
</tr>
<tr>
<td>11.Depression</td>
<td>5.78(1.15)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.626**</td>
<td>.225**</td>
</tr>
<tr>
<td>12.SA</td>
<td>4.74(1.6)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>--</td>
</tr>
<tr>
<td>13.Gender</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>1.00</td>
</tr>
</tbody>
</table>

Notes: N = 206. Gender (0 = male, 1 = female). Stressor and positive event frequency, events with severity ≥3 on a scale of 1 (Sort of Bad/Good) – 5 (Very Bad/Good). SA = social anxiety.

*p < .05, **p < .01
Table 2

Emotion Reactivity Models

<table>
<thead>
<tr>
<th></th>
<th>Sad</th>
<th>Angry</th>
<th>Jealous</th>
<th>Lonely</th>
<th>Worried</th>
<th>Excited</th>
<th>Happy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 Variance</strong></td>
<td>.559[.48,.64]**</td>
<td>.566[.49,.64]**</td>
<td>.330[.27,.39]**</td>
<td>.612[.53,.69]**</td>
<td>.552[.48,.63]**</td>
<td>1.10 [1.0, 1.2]**</td>
<td>.941[.87,1.0]**</td>
</tr>
<tr>
<td><strong>Level 2 Variance</strong></td>
<td>.561[.42,.70]**</td>
<td>.369[.26,.50]**</td>
<td>.326[.20,.45]**</td>
<td>.547[.39,.70]**</td>
<td>.460[.35,.57]**</td>
<td>.871[.70,1.0]**</td>
<td>.489[.40,58]**</td>
</tr>
<tr>
<td><strong>ICC</strong></td>
<td>0.50</td>
<td>0.34</td>
<td>0.47</td>
<td>0.47</td>
<td>0.54</td>
<td>0.454</td>
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Random-Intercept Models

<table>
<thead>
<tr>
<th></th>
<th>Slope Variance</th>
<th>Random Models</th>
<th>Level 1 Covariates</th>
<th>Level 2 Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 Covariates</strong></td>
<td></td>
<td></td>
<td>Good Event</td>
<td>Bad Event</td>
</tr>
<tr>
<td>Emotion t-1</td>
<td>.199[.14,.26]**</td>
<td>.101[.04,.17]*</td>
<td>.262[.17,.35]**</td>
<td>-.223[-.29,-.14]**</td>
</tr>
<tr>
<td>Depression</td>
<td>.170[.08,.26]**</td>
<td>.145[.09,.21]**</td>
<td>.147[.08,.23]**</td>
<td>-.181[-.25,-.10]**</td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>.072[-.00,.15]</td>
<td>.027[-.02,.08]</td>
<td>.094[.02,.19]*</td>
<td>.107[.03,.19]*</td>
</tr>
<tr>
<td>Externalizing</td>
<td>.049[-.10,.20]</td>
<td>.091[-.42,.22]</td>
<td>.116[-.00,.23]</td>
<td>.107[.03,.19]*</td>
</tr>
<tr>
<td><strong>Level 2 Covariates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.135[-.01,.28]</td>
<td>-.02[-.15,.13]</td>
<td>-.005[-.12,.11]</td>
<td>-.097[-.26,.06]</td>
</tr>
<tr>
<td>Depression</td>
<td>.170[.08,.26]**</td>
<td>.145[.09,.21]**</td>
<td>.147[.08,.23]**</td>
<td>.137[.05,.22]*</td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>.072[-.00,.15]</td>
<td>.027[-.02,.08]</td>
<td>.094[.02,.19]*</td>
<td>.116[.02,.21]*</td>
</tr>
<tr>
<td>Externalizing</td>
<td>.049[-.10,.20]</td>
<td>.091[-.42,.22]</td>
<td>.116[-.00,.23]</td>
<td>.107[.03,.19]*</td>
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Random-Slope Models

<table>
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<tr>
<th></th>
<th>Slope Variance</th>
<th>Random Models</th>
<th>Level 1 Covariates</th>
<th>Level 2 Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 Covariates</strong></td>
<td>.954[.68,.13]**</td>
<td>.822[.61,.10]**</td>
<td>.016[.01,.03]*</td>
<td>.314[-.28,.91]</td>
</tr>
<tr>
<td>Emotion t-1</td>
<td>.206[-.15,.27]**</td>
<td>.101[.04,.17]*</td>
<td>.263[.17,.35]**</td>
<td>.239[.18,.30]**</td>
</tr>
<tr>
<td>Depression</td>
<td>-.213[-.28,.15]**</td>
<td>-.176[-.24,.11]**</td>
<td>-.091[-.14,.04]*</td>
<td>.171[.13,.21]**</td>
</tr>
<tr>
<td>Social Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externalizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: N (Level 1) = 6682, N (Level 2) = 205. ICC = inter-class correlation. *Coefficients shown only for random slopes for table parsimony. 

*p<.05, **p<.001.
by calculating the simple slopes for adolescents at ±1 S.D the centred mean of externalizing and plotted interactions using bar graphs (Figures 1a-2)\(^3\).

As Figure 1a illustrates, a recent stressor was linked with increases in sadness at both high and low levels of externalizing. Simple slope values showed that adolescents higher in externalizing symptoms reported greater increases in sadness after a stressor, compared to adolescents lower in externalizing symptoms (high externalizing \(b = 1.25(.20), p <.001\); low externalizing \(b = .766(.10), p <.001\)). A similar trend was found for anger (see Figure 1a), such that adolescents higher in externalizing symptoms showed a larger increase in anger from pre-to-post stressor, compared to adolescents lower in externalizing symptoms (high externalizing \(b = 1.14(.12), p <.001\); low externalizing \(b = .603(.07), p <.001\)). Inspection of simple slopes for jealousy suggested that adolescents higher in externalizing symptoms reported a significant increase in jealousy from pre-to-post stressor (\(b = .160(.03), p <.001\); see Figure 1a). Though adolescents low in externalizing also reported an increase in jealousy post-stressor, this change in jealousy was not significantly different from zero (\(b = .046(.03), ns\)).

As Figure 1b demonstrates, adolescents higher in externalizing symptoms also reported increased loneliness from pre-to-post stressor (\(b = .274(.14), p <.05\)). By contrast, adolescents lower in externalizing symptoms reported a decrease in loneliness though inspection of the simple slope showed that this decrease was not significantly different from zero (\(b = -.169(.19), ns\)).

As Figure 2 illustrates, adolescents higher in externalizing symptoms reported significant decreases in excitement post-stressor (\(b = -.058(.13), p <.001\)).

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\(^3\) We used bar graphs to show changes in emotion based on the interaction of (dichotomous) Stressor x (continuous) Externalizing. We did so in order to facilitate interpretation of the figures in terms of change in emotion as a function of stressor occurrence or non-occurrence.
Adolescents lower in externalizing symptoms also reported decreased excitement, though this change was not significantly different from zero (b = -0.324(0.53), ns).

Figure 1a. Increase in sadness post-stressor, based on levels of externalizing. A similar pattern was found for anger and jealousy. †significant change in emotion (p < 0.05)

Figure 1b. Changes in loneliness post-stressor, based on levels of externalizing. †significant change in emotion (p < 0.05)
Figure 2. Decreases in excitement post-stressor based on levels of externalizing. †significant change in emotion ($p<.05$)

**Days with multiple stressors.** We re-ran main analyses to include days where participants reported more than bad event (less than 6% of days), to check whether the above relations between externalizing and emotion reactivity held when we included days characterized by more chronic stress. Results suggested that that the main effects of emotion on bad events were similar when days with more than one bad event were included in analyses, and the pattern of cross-level interactions was fairly similar. However, the cross-level interaction of Externalizing x Stressor became non-significant for jealousy and loneliness, whereas the cross-level interaction of Externalizing x Stressor for happiness reached significance. Overall, these findings suggest that individual differences in reactivity based on externalizing may differ somewhat depending on chronicity of daily stressors, at least for emotions such as jealousy, loneliness, and happiness.

**Person-level covariates.** As shown in Table 1, there was a significant cross-level interaction of Social Anxiety x Stressor for sadness. Inspection of simple slopes revealed that youth higher in social anxiety (+1 $SD$) showed a significant and stronger increase in sadness post-stressor compared to youth lower in social anxiety.
(± 1 SD; high anxiety b = 2.00(.56), p <.001; low anxiety b = .013(.58), p =.981). No other significant interactions were found for person-level covariates.

**Question 2: Do youth higher in externalizing symptoms report more momentary stressors than youth lower in externalizing symptoms?**

Results from the single-level regression model showed that there was no significant difference in proportion of stressors across the week based on externalizing symptoms (β= .121(.03), ns), gender (β = .017(.01), ns), or social anxiety symptoms (β = -.121(.01), ns). However, depression symptoms were significantly and positively associated with proportion of negative events across the week (β =.190(.01), p <.05).

**Q3. Does externalizing condition the association between previous emotion and likelihood of a subsequent stressor?**

**Main effects of emotion at T-1 predicting a subsequent stressor.** Level-1 logistic models showed a significant main effect of 1stressor at t = 0 on anger t- (b = .320[.15, .51], p <.05), such that a one-unit increase in anger at t-1 was associated with increased likelihood of having a stressor at t = 0. No other significant main effects of stressor t=0 on emotion t-1 were found (sad: b = -.043[-.28, .20]; jealous: b = -.133[-.45, .18]; lonely: b = -.147[-.35, .05]; worry: b=0.00[-.00, .00]; excitement: b=-.001[-.01, .01]; happy b = .001[-.00, .00], ns).

**T-1 Emotion X Externalizing cross-level interactions.** When we examined the random-intercept-and-slopes logit models, there was a significant cross-level interaction of Jealousy t-1 x Externalizing (b = .679[.30, 1.1], p < .05). We probed this interaction by plotting the regression of stressor at t = 0 on jealousy at t-1 at ± 1 S.D of the centred mean of externalizing. The simple slope for low externalizing was significant and negative (b = -1.20(.39), p <.05). This finding suggests that, for adolescents lower in externalizing symptoms, recent increases in jealousy--above
their typical average level of jealousy--were associated with a significant decreased likelihood of experiencing a stressor at subsequent time point. The simple slope for adolescents’ high in externalizing symptoms was also negative, though not significantly different from zero (b = -.387(.33), ns). There were no other significant cross-level interactions for Emotion t-1 x Externalizing on stressor at t=0.

**Discussion**

We took a high-resolution, dynamic approach to better characterize how adolescents living in the context of socioeconomic disadvantage react to contingencies of stressors experienced across their day. We leveraged ESM to assess adolescents’ emotion reactivity—that is, emotion change—as a result of experiencing a recent stressor, and to determine whether adolescents experience greater emotional reactivity as a function of higher levels of externalizing symptomatology. This test was important because no research to date had yet assessed adolescents’ emotion reactivity to daily events in vivo. Nor has research assessed the potential conditioning role of externalizing symptomatology in and of itself (nor while controlling for other key symptoms of psychopathology), despite numerous theoretical assertions that emotion reactivity to stress is exacerbated among those with elevated symptomology. Our empirical findings largely supported these theoretical contentions that youth with elevated externalizing symptoms show exaggerated emotion reactivity. Specifically, adolescents who were high in externalizing symptoms reported greater increases in sadness, anger, jealousy, and loneliness, and greater dips in excitement after exposure to a stressor, relative to youth who were low in symptomatology.

A secondary study aim was to examine the role of externalizing symptomatology in generating daily stressors. Externalizing symptomatology was not associated with a higher likelihood of stressful events. However, we found
surprising, preliminary evidence of a conditioning effect. For youth low in externalizing symptoms, recent upheavals in jealousy were associated with lower risk of encountering a subsequent stressor; whereas this relation was not significant for youth high in externalizing. Thus, it may be the case that youth who are low in externalizing symptoms are able to capitalize on emotional upheavals in jealousy to prompt adaptive coping methods (e.g. situation modification, cognitive reappraisal), which diminish the likelihood of experiencing a stressor (Gross & John, 2003).

**Adolescents’ Externalizing Symptoms and Emotion Reactivity**

In-line with numerous models of adolescent externalizing psychopathology (e.g. Beauchaine, & McNulty, 2013; Casey, 2015; Luciana, 2013) our findings provide in-situ empirical support for the notion that elevated externalizing symptomatology is associated with exaggerated emotion reactivity to day-to-day stressors across a range of discrete emotions. Importantly, youth who were low in externalizing also experienced surges in sadness, anger, and jealousy as a result of recent stressors, but these were less intense. Moreover, these youth did not experience significant increases in loneliness nor significant dips in excitement—again pointing to more contained emotion responses overall for youth lower in externalizing symptomology.

This finding of exaggerated emotion reactivity as a linear function of externalizing symptomatology may be attributable to executive function deficits (Luciana, 2013). That is, youth who are especially high in externalizing symptoms tend to be characterized by diminished cognitive-control capacity, which may manifest in diminished ability to place parameters around emotional responses in the hours after a stressor. Indeed, the onset of a stressor triggers a need for adolescents’ quick integration of challenging social and affective demands. For youth with limited
capabilities for information integration, experiencing stressors may overwhelm concomitant needs for regulation of affect.

Youth who display externalizing symptomatology tend to be characterized by numerous internal risk factors which may also help to account for their amplified emotion reactivity, including hostile attribution biases and difficulties in selecting prosocial behavioural responses (Dodge, 2006; Guerra, Boxer, & Kim, 2005). Any one of these might inform how stressors are perceived and responded to. Likewise, youthful externalizing behaviour is linked with a host of ecological risk factors for heightened emotion reactivity including peer rejection, parent–child conflicts, parenting stress, and modelling of aggressive responses by caregivers (Buodo, Moscardino, Scrimin, Alto, & Palomba, 2013; Cotter & Smokowski, 2016; Moretti, Obsuth, Odgers, & Reebye, 2006; Sentse et al., 2010). Such ecological risks may also contribute to higher reactivity among youth high in externalizing symptoms.

This is not to say that youth with externalizing symptomatology will consistently manifest deficits linked with dysregulated affect. Rather, adolescents often effectively regulate their experiences in emotionally neutral conditions, but contexts of high stress “tip the balance” and lead to difficulties modulating emotional experiences (Luciana, 2013; Modecki, Guerra, & Zimmer-Gembek, 2017). Indeed, our results suggest that the introduction of momentary stressors brings about a context that temporarily diminishes the capacity to put limits on the current emotional experience for highly symptomatic externalizing youth. This notion is largely borne out by our findings that adolescents with higher externalizing symptoms generally did not show higher levels of emotions across the week, with the exception of happiness (and we speculate that higher happiness may reflect sensation seeking propensity or reward-seeking; Ernst & Fudge, 2009). Rather, the
role of externalizing symptomatology was seen in the relative strength of the peaks and troughs in emotion when there had been a recent stressful event.

Notably, that externalizing symptomatology was associated with exaggerated emotion reactivity may also be attributable, at least in part, to conceptual overlap between the two constructs. That is, some forms of externalizing behavior, such as reactive aggression, imply behavioural under-control of emotions such as anger (Hinshaw, 2002). That said one major strength of our study design was our ability to disentangle this theoretically implied behavioral manifestation of weak emotional control (i.e. externalizing behavior) from the dynamic of emotion reactivity via moment-to-moment changes in emotion. This is the first study, to our knowledge, to do so, and capturing reactivity to environmental contingencies remains a critical element to understanding youthful externalizing and the challenges these youth face in day-to-day life.

There were some differences in relations between externalizing symptomatology and emotion reactivity when we included days with multiple stressors. One possible explanation for this slight pattern of differences is that youth with elevated externalizing symptoms may habituate to stressors on days with multiple stressors, and thus not experience the same exaggerated emotion reactivity, at least in terms of loneliness and jealousy. At the same time, it appears that the role of externalizing symptomatology in happiness reactivity may only become evident with the experience of multiple stressors. This may perhaps indicate that reactivity of positive emotions may be subject to different stress-thresholds or be activated by cumulative environmental triggers. These findings point to the need to further distinguish between experiences of ‘once off’ stressors versus accumulated stressors in unpacking in-vivo stress-emotion relations among at-risk youth.
Despite emotion dysregulation being a diagnostic feature of Major Depressive Disorder and Social Anxiety Disorder (APA, 2013), it is worth mentioning that neither was associated with exaggerated emotion reactivity (with the exception of sadness for social anxiety). There are several potential explanations for these findings. First, although distinguished by emotion dysregulation, youth high in internalizing symptoms may not be characterized by heightened emotion reactivity per se. In line with conceptualizations of depressed mood, youth with higher levels of depression reported lower positive emotions and higher negative emotions overall. Though some previous ESM studies report that depressive symptoms are associated with greater intensity and variability in negative emotions among adolescents (e.g. Silk et al., 2003), these parameters (intensity, variability) represent distinct aspects of the emotion experience, and would not necessarily be expected to translate to greater emotion reactivity to environmental contingencies (Trull, Lane, Koval, & Ebner-Priemer, 2015). Thus, it may be that adolescents with elevated depressive symptoms, although designated by emotion dysregulation, manifest higher overall negative emotion, lower positive emotion, and greater variability between highs and lows, but not heightened emotion reactivity.

Second, greater sadness reactivity found among youth high in social anxiety is consistent with past findings, where youthful anxiety was associated with greater intensity in sadness when responding to recent negative events (Tan et al., 2012). Youths’ social anxiety symptoms were also related to higher overall loneliness, happiness, and excitement. The positive relation between social anxiety and loneliness may be due to the behavioural avoidance aspects of social anxiety (APA, 2013). That is, socially anxious youth typically avoid social interactions, which in turn may lead to heightened feelings of loneliness. In a similar vein, recent work suggests that socially anxious youth report more intense positive affect compared to
healthy peers, (though only when in the company of peers; Morgan et al., 2017).
Thus, heightened overall positive emotions among youth high in social anxiety is a
topic worth considering within future research; in particular, social context may play
a role in delineating these positive emotion dynamics.

Adolescents’ Stress Generation

Informed by a stress-generation model (Hammen, 1992) we expected that
adolescents with high externalizing symptoms would report more frequent stressors
across the sampling period, compared to their less symptomatic peers. However, we
found no significant difference in frequency of stressors based on externalizing.
Previous research found externalizing symptom- based differences in the generation
of controllable, non-interpersonal stressors (Rudolph et al., 2000). Importantly,
however, this difference did not hold for stressors that were outside of adolescents’
control or those that were interpersonal in nature. One explanation for this finding
may be that youth regularly experienced negative events which are outside their
control, given they were all embedded within a common setting of socioeconomic
disadvantage (Brady & Matthews, 2002). Here, then, any internal liability which
might have led to a greater generation of stressors among youth high in externalizing
may have been overridden by shared socioeconomic context of risk.

We also expected that recent upheavals in emotion might predict the
subsequent occurrence of a stressor, and that this relation might be exacerbated for
youth higher in externalizing. We found only preliminary evidence that recent
upheavals in emotion affected the likelihood of experiencing a subsequent stressor,
and only for youth who were lower in externalizing symptoms. Recent surges in
jealousy seemed to elicit a protective response among youth who were lower (but not
higher) in externalizing symptoms. It may be the case that, in anticipation of
imminent stressors, these youths are engaging in antecedent-focused emotion
regulation strategies. Antecedent-focused coping involves noticing situations in which a stressor is likely to occur and taking actions to prevent or mitigate the impact of the stressor (Gross & John, 2003). Thus, it is possible that youth lower in externalizing symptoms were able to “tune into” recent upheavals in jealousy and that this triggered an antecedent-focused coping response. As an example of such a response, an adolescent may experience an increase in jealousy when they see a friend spending time with another clique or peer-group, but may potentially avoid a subsequent argument if they employ cognitive reappraisal (e.g. reasoning that it is normal for a friend to want to spend time with others).

Implications

The current study takes a contemporary approach to assessing adolescents’ emotion regulation, “drilling down” to the dynamic aspects of emotion that characterize distinct psychopathologies (Trull et al., 2015). As such, we were able to extend beyond broad descriptions of youth with externalizing symptomatology as having “emotion regulation deficits,” to a more nuanced picture (Modecki & Mazza, 2017). Here, we pinpoint intense reactivity to momentary stressors as a key aspect of the emotional experience which these youth face difficulties constraining. Moreover, although externalizing symptomatology is often associated with dysregulation of high arousal emotions such as anger, our findings also suggest that adolescents who present with externalizing symptoms experience significant difficulties in stabilizing emotions more typically associated with depressive disorders (i.e. sadness). Such findings point to a need for broad attention towards emotional wellbeing in highly symptomatic youth. Because youths’ emotional responses to the “ups and downs” of daily life form the building blocks of psychopathology (Wichers, 2013), developing strategies to constrain in-the-moment responses to stress may be a useful mechanism for reducing their externalizing symptomatology. Thus, symptomatic youth may
benefit from learning to “tune into” their current context and emotional states and using immediate contexts as a guide for when and how to prepare for ensuing challenges (Modecki et al., 2017).

In addition, this study has important implications for how scholars conceptualize and study theorized emotion control deficits in youth with externalizing symptomatology. Owing to the intensive, “real-time” nature of ESM, we were able to capture temporal relations between youths’ exposure to daily stressors and changes in emotion. This is the first study, to our knowledge, to examine links between externalizing and emotional reactivity, where emotion reactivity is characterized by temporal change in emotion. In doing so, our conceptualization of reactivity is consistent with contemporary views of emotion as a dynamic process that unfolds across time (Kuppens et al., 2010). More broadly, our findings that individual differences in adolescents’ externalizing symptomatology are linearly associated with heightened emotion reactivity across the week, highlights the need for scholars to consider the daily ebb-and-flow of youthful emotions in relation to symptoms of psychopathology.

**Limitations**

This study is novel in its focus on emotion reactivity among at-risk youth, but findings need to be considered in light of several limitations. First, though a significant study contribution was the examination of externalizing symptomatology in relation to the stress-emotion dynamic among disadvantaged youth, our focus does limit the generalizability of findings to low SES youth. Future studies may seek to include comparisons to youth living within mid- and high-SES settings. Second, our participants maintained above average (but not model) compliance across the 34 timepoints. That said, this is the case with any longitudinal study design with high-risk samples, and we used best practice techniques for handling missing data (e.g.
Moreover, to further ensure stability of study findings, we re-ran analyses with alternative handling of missing data and our pattern of findings were consistent.

Third, we did not directly test whether youth with elevated externalizing symptoms showed deficits in other indices of emotion reactivity, for instance physiological changes. Some previous studies have demonstrated differences in physiological reactivity based on children’s levels of externalizing symptoms (e.g. Kalvin, Bierman, & Gatzke-Kopp, 2016). Similarly, given findings of allostatic overload among disadvantaged youth (Theall et al., 2012), future studies would benefit from examining relations between daily stressors, biomarkers of allostatic load and subjective and physiological indicators of emotion reactivity.

Fourth, our measurement of momentary stressors was limited to occurrence and severity, and did not include additional features of stressors (e.g. predictability, controllability of the stressor; Schneiders et al., 2006). This limitation represents the trade-off between time constraints within ambulatory assessments and desire for comprehensive measurement of constructs of interest. Future research deploying ESM to measure stress-emotion relations should consider gathering more nuanced data surrounding types of stressors, appraisal of stressors, and the like. Additionally, future research should potentially consider tapping experience of stressors specific to low SES contexts (e.g. witnessing violence and substance abuse, fear of theft by others; Miller, et al., 2002; Odgers & Russell, 2017; Russell, Wang, & Odgers, 2016) to more comprehensively understand stress-emotion relations within this important and under-studied population.

Fifth, and in line with past work (e.g. Schneiders et al., 2006; Silk et al., 2003), we did not counterbalance the order in which adolescents were presented with in-vivo questions. In this case, we opted to preserve our emotion measure as uncontaminated by stress reports. That said, future research could consider assessing
whether such order of reporting introduces bias, and if so, consider counterbalancing momentary assessments. Finally, though our focus here was on detecting youths’ emotion reactivity in relation to externalizing symptomatology, and understanding the role of externalizing in the generation of daily stressors, future studies would benefit from examination of the possible impact of daily stressors on youths’ subsequent externalizing symptoms. Likewise, relations between stress and in-vivo externalizing behaviors would be worth examining, to better understand potential moment-to-moment reciprocal associations.

**Conclusion**

The current study addressed an important research gap by examining links between externalizing symptomatology and emotion reactivity to daily stressors among disadvantaged adolescents “in vivo.” Our findings offer original empirical evidence that strong emotion reactivity to day-to-day stressors and externalizing symptomatology are linked. Moreover, preliminary findings indicate that youth low in externalizing may deploy adaptive strategies to cope with moment-to-moment emotion shifts, and so this might be a promising strategy for youth. In all, adolescents living within the context of socioeconomic disadvantage, particularly those with externalizing symptoms would benefit from assistance in learning to impose constraints around their daily emotional experiences.

**Summary**

This study used ESM to assess disadvantaged adolescents’ emotion reactivity to stressors that occurred in the context of their day-to-day life. Emotion reactivity was operationalized as change in emotion from pre-post- stressor, and thus provided a temporal measure of adolescents’ emotion dynamics in response to external events. Two hundred and six adolescents living in low SES settings completed reports of emotions and stressors 5× per day for 7 days and externalizing symptoms were
assessed twice via self-report, pre-and post-ESM sampling. HLM analyses showed that adolescents high in externalizing symptoms reported greater post-stress increases in negative emotions, and greater decreases in excitement relative to adolescents low in externalizing symptoms. Moreover, recent upheavals in jealousy were associated with decreased likelihood of a subsequent stressor only for adolescents low in externalizing. Those “on the ground,” working directly in prevention and intervention programming with disadvantaged adolescents should aim to teach emotion-management strategies which facilitate youths’ placing adaptive parameters around their emotional responses to day-to-day stressors, and this may be especially useful for youth with externalizing symptoms.
Aims

- To examine the temporal dependency of positive and negative emotions (i.e. emotional inertia) among disadvantaged adolescents
- To identify whether disadvantaged adolescents’ externalizing symptoms relate to stronger inertia for negative emotions and weaker inertia for positive emotions

Together, findings from Study 1 and Study 2 demonstrated that disadvantaged adolescents’ emotion dynamics (emotional responding and emotion reactivity) are associated with stressors in day-to-day life, and that emotion reactivity to daily stressors is conditional upon levels of externalizing symptoms.

Beyond examinations of how much adolescents deviate from their typical or recent emotion states, scholars have considered processes which may slow adolescents from returning to normal or previous emotional states after such perturbations. In fact, contemporary approaches to mental health highlight that healthy psychological functioning is a much to do with how far youth travel from their emotional “set-points” as it is to do with how difficult it is for them to return to such set points (e.g. Chow et al., 2005; Hollenstein, 2015; Kuppens et al., 2010).

One way to capture a process of emotion recovery has been to examine emotional inertia. Emotional inertia represents the extent to which previous levels of an emotion predict current levels of that emotion (Suls et al., 1998). It is thus operationalized as the temporal dependency of emotion, or the autoregressive coefficient of current emotion on that emotion at a temporally preceding timepoint (Koval & Kuppens, 2012). Strong emotional inertia (in this case, for negative
emotions) is viewed as unhealthy because changes in emotional states, so long as they are appropriate to context, serve an adaptive function of alerting and preparing youth for changes in environmental demands (van Roekel et al., 2017).

Remaining with the idea that developmental experiences inform adolescents’ emotion dynamics, Study 3 maintained a focus on the role of externalizing symptomatology and examined whether disadvantaged adolescents’ levels of emotional inertia were conditioned by externalizing symptoms. Overall, Study 3 showed that adolescents higher in externalizing showed stronger inertia for worry, but weaker inertia for happiness and excitement, compared to their peers lower in externalizing symptoms.
CHAPTER FIVE – STUDY 3

The following is a modified version of a co-authored paper, currently in preparation for the journal *Emotion*. The paper is formatted in accordance with the authors’ instructions for submission to the journal. The bibliographic details of the co-authored paper, including all authors, are:


My contribution to the paper involved: I adapted experience sampling items relating to daily emotions, collected and cleaned data, and formulated the research questions. I analysed the data and drafted the manuscript. My co-authors then reviewed the manuscript draft and suggested edits.

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Abstract

Strong carry-forward of negative emotion – characterized as *emotional inertia*—has been linked to psychopathology, namely internalizing symptoms (e.g. depression) and generally among adults. Surprisingly, whether high emotional inertia for negative emotion characterizes other forms of psychopathology (i.e. externalizing symptoms) among adolescents remains unknown. Also unexplored, is the relation between adolescents’ externalizing symptoms and inertia for positive emotions. We address these gaps in the literature and examine whether adolescents’ self-reported externalizing symptoms are associated with higher emotional inertia for negative emotions (worry, sadness, jealousy, loneliness, anger) and lower inertia for positive emotions (happiness, excitement). Leveraging experience sampling methodology, socioeconomically disadvantaged adolescents (N = 156; M<sub>age</sub> = 14.6 years, SD = 1.3) reported their current emotion, as well as exposure to positive and negative events, 5 x per day for 7 days. Multi-level autoregressive models showed that—controlling for depression, social anxiety, gender, average emotion, and recent events—youths’ externalizing symptoms were linearly related to strong carry-forward of worry, and weak carry-forward of happiness and excitement. Additionally, adolescents’ depressive symptoms were associated with stronger inertia for sadness, jealousy and loneliness, and social anxiety symptoms were associated with stronger inertia for sadness. Findings suggest that youth with externalizing symptoms may benefit from learning to better “tune into” affective signals within their environment, which may help them to better modulate negative emotions and promote continuity in positive emotions.

Keywords: emotional inertia, adolescents, externalizing, experience sampling method
Carrying Forward the Bad: Adolescents with Externalizing Symptoms Display Strong Inertia for Negative, but not Positive, Emotions

In daily life, the ability to shift out of negative emotional states and maintain positive emotional states plays a critical role in psychological wellbeing (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Hollenstein, 2015). Because emotions serve to draw individuals’ attention to stimuli, broadcast pertinent information to the self and others, and facilitate social communication (Larsen, 2000; Mesquita & Boiger, 2014), many of the adaptive benefits of emotion derive from their temporal links to the environment. That is, individuals who can easily transition out of unhelpful emotional states (i.e. those that inhibit appropriate responding to context), or remain in helpful emotional states, show adaptive outcomes (Gross, 2015; Hollenstein, 2015). Indeed, matching emotions to shifting environmental demands is a marker of resilience and better mental health (Rottenberg, Gross, & Gotlib, 2015; Waugh, Thompson, & Gotlib, 2011). In the case of positively valanced emotions, individuals who can propagate positive emotion states are arguably characterized by better psychological functioning, because positive emotions appear to be more adaptive when they remain stable over time (Gruber, Kogan, Quoidbach, & Mauss, 2013; Gruber, Mauss, & Tamir, 2011). Conversely, when negative emotions become “stuck” in the context of ordinary life, this suggests an un-coupling of emotion from context, and arguably signposts reduced psychological health (Kuppens, et al., 2012; Kuppens, Allen, & Sheeber, 2010).

Such immobility or stasis of emotion is referred sometimes to as “emotional inertia.” Specifically, emotional inertia characterizes the extent to which previous levels of an emotion predict later levels of that emotion (i.e. the “carry forward” of emotion across time; Koval & Kuppens, 2012). Consistent with the notion that carrying forward negative emotions, despite potential changes in the environment,
links with poor psychological functioning, a growing body of research has shown that strong emotional inertia for negative affect is associated with certain mental health difficulties, including depressive symptomology, fear of negative evaluation, and neuroticism (Koval & Kuppens, 2012; Pe et al., 2015; Suls, Green, & Hillis, 1998). Scholars theorize that this strong emotional inertia is underscored by a decoupling of an individual’s emotional state from their context, such that the functional property of emotions, that is, to alert individuals to changing environmental demands, becomes impaired (Kashdan & Rottenberg, 2010; Koval & Kuppens, 2012). This notion that change or stasis in emotion occurs in interaction with an individual’s context, particularly their social context, is central to contemporary functionalist theories of emotion (e.g. Barrett, 2009; Mesquita & Boiger, 2014).

While the above studies have provided insight into links between psychopathology and inertia for negative emotions, relatively fewer studies have focused on inertia for positively valanced emotions (e.g. happiness, excitement). This is the case despite growing recognition that dynamics of positive emotion are equally important to negative emotion in understanding risk for psychopathology (Fredrickson, 2004; Gilbert, 2012). That said, related work on emotional variability suggests that frequent shifts in levels of positive affect is associated with poorer psychological functioning (Gruber, et al., 2013). Because frequent shift is affect suggest relatively low inertia, it is plausible that the carry-forward of positive emotions is adaptive, rather than maladaptive, as in the case of negative emotions. As Gruber and colleagues highlight, it may be that re-acclimating positive emotions to a continuously changing ecosystem is not only exhausting, but also linked to maladaptive behaviors. Thus, individuals who already show maladaptive behaviours
(e.g. psychopathology symptoms) may show relatively weak carry-inertia for positive emotions.

Although the bulk of empirical investigations into emotional inertia have focused on adults, assessing links between emotional inertia and psychopathology is especially crucial for adolescents, because they are in a critical developmental period characterized by changes in the variability of their emotions (Maciejewski, Lier, Branje, Meeus, & Koot, 2015). Moreover, the task of independently recovering from unhelpful emotional states and maintaining positive emotion states is especially salient for adolescents, because puberty-based brain changes place youth at increased vulnerability for dysregulated affect, and societal expectations demand more autonomous emotion regulation (Hollenstein & Lougheed, 2013). Among the few studies to examine emotional inertia among adolescents, findings parallel adult investigations tying strong inertia for negative emotions to internalizing symptomatology (Kuppens, Allen, & Sheeber, 2012; Kuppens et al., 2012; van Roekel, et al., 2017). However, at variance with findings surrounding negative emotions, studies that have assessed adolescents’ inertia for positive emotions have failed to find significant differences in inertia based on psychopathology (e.g. anxiety, Morgan et al., 2017; depression, van Roekel, et al., 2016; 2017; see Kuppens, Allen, & Sheeber, 2012 for an exception when behavioral observations are used to measure emotional inertia).

That said, the limited amount of inertia research with adolescents, as with adults, has focused exclusively on the role of internalizing (e.g. depression and anxiety symptoms), to the exclusion of externalizing problems. While internalizing and personality facets tied to internalizing (e.g. low self-esteem) are one form of psychopathology which may manifest strong inertia for negative emotions, externalizing symptoms (e.g. risk behaviours, delinquency) are also tied to a
disconnect between negative emotions and context (i.e. the proposed mechanism for strong emotional inertia; Hollenstein, Granic, Stoolmiller, & Snyder, 2004; Koval & Kuppens, 2012). For instance, adolescents’ uncoupling of emotion from context can be an outgrowth of environmental risk. Illustratively, Lichtwarck-Aschoff and colleagues (2009) found that adolescent girls experience diminished range for negative emotions – suggesting fewer shifts between high and low levels of negative affect - with repeated exposure to high-conflict environments (i.e. mother-daughter conflicts). Similarly, Mrug and colleagues (2008) found a positive relation between adolescents’ exposure to violence and emotional distress up until a certain level of exposure, but then levels of distress plateaued and subsequently decreased with greater exposure to violence. Here, detaching negative emotion from context may afford a protective function for adolescents in high-threat environments, by preventing constant activation of the stress response and subsequent wear and tear of bodily stress responses systems (Boyce & Ellis, 2005).

Furthermore, previous work examining the emotional functioning of youth with externalizing symptoms provides indirect evidence of a strong carry-forward of negative emotional states. For example, lab-based research highlights that adolescents with externalizing symptoms have asynchronous physiological responses to their mothers during a discussion task, suggestive of a decoupling of physiological components of emotion from context (Woltering, Lishak, Elliot, Ferraro, & Granic, 2015). Other research, using experience sampling methods (ESM), points to difficulties among youth with externalizing symptoms in “coming down” from recent peaks in negative emotion (e.g. anger and sadness; Silk, Steinberg, & Morris, 2003). Further, lab observations of parent-child dyads indicate that rigidity in affective behavior is related to higher levels of child delinquent and aggressive behavior, both cross-sectionally and over time (Granic, O’Hara, Pepper, & Lewis et
al., 2007; Hollenstein et al., 2004; Lunkenheimer, Albrecht, & Kemp, 2013). These findings converge to suggest that adolescents with elevated externalizing symptoms may experience strong inertia for negative emotions.

However, unlike inertia for negative emotions, relative stasis in positive affect may represent healthy adolescent functioning, including low levels of externalizing symptoms (Kashdan & Rottenberg, 2010; Gruber et al., 2013; Tugade, Fredrickson, & Barret, 2005). Functional theories of emotion (e.g. broaden and build theory) highlight that psychopathology occurs as an offshoot of not maintaining positive emotions in the face of environmental adversity (Fredrickson, 2004; 1998). Here, Fredrickson highlights that positive emotions serve to expand an individual’s attentional focus and assist in problem solving. In addition, sharing positive emotions with others can build psychological capital that individuals can call upon in future times of stress (Fredrickson, 2004).

Despite theoretical arguments that individual may benefit from relatively stable positive emotions, only a handful of studies have examined links between psychopathology symptoms and inertia for positive emotions. Interestingly, among these studies here has been little empirical support for a relation between psychopathology symptoms (e.g. depression, sensitivity to social evaluative threat) and inertia for positive emotions (van Roekel, et al., 2017; 2016; Koval & Kuppens, 2012). This lack of findings supporting a link between psychopathology symptoms and inertia for positive emotions may be due to a focus on youths’ internalizing symptomatology. Instead, youth who display externalizing symptomatology may carry their own unique resistance (or susceptibility) to change in positive emotions. Importantly, too adolescence is a period characterized by heightened variability in positive emotions, as well as susceptibility for poor emotional regulation and increased externalizing behaviors (Hollenstein & Lougheed, 2013; Larson, Moneta,
Richards, & Wilson, 2002; Modecki, 2008), suggesting a need to understand potential relations between youthful externalizing and inertia for positive emotions. Because relative instability in levels of positive emotions characterises poor psychological functioning (Fredrickson, 2004; Gruber et al., 2003) weak inertia for positive may characterize adolescents with externalizing symptomatology.

The Current Study

The dynamic of emotional inertia informs part of the "ebb and flow" of daily emotions, and as such, represents a building block for mental health (Wichers, 2013). Thus, understanding links between adolescents’ externalizing symptoms and emotional inertia is critical to growing our understanding of the role of emotional stability in the aetiology and maintenance of youths’ externalizing behaviors. Although prior findings point to the possibility of associations between adolescents’ externalizing symptoms, strong inertia for negative emotions, and weak inertia for positive emotions, research has yet to directly determine these relations. Those studies that have examined within-person dynamics reflecting emotion stability have focused exclusively on internalizing symptomatology, overlooking ties with youths’ externalizing symptomatology. It is also the case that a large share of emotional inertia studies have assessed this dynamic among adults or young adults, to the exclusion of work with adolescents. Such a gap is notable, given that adolescents may be particularly vulnerable to being “stuck” in negative emotional states and to heightened variability in their positive emotions (Hollenstein & Lougheed, 2013; Larson, et al., 2002).

The current study addresses these gaps in the research literature by assessing adolescents’ inertia for positive and negative emotions, and based on levels of externalizing symptoms. We assess a range of discrete emotions (worry, sadness, jealousy, loneliness, anger, happiness, and excitement) to best capture putative links
with externalizing symptomatology. In an effort to over-sample youth at-risk for
externalizing symptomatology, we recruited adolescents from two low
socioeconomic status (SES) high schools. These adolescents completed ESM reports
of their current emotions and positive and negative events, five times a day for seven
days. ESM assessment facilitated our modelling of temporal dependencies in
emotion and thus our characterization of emotional inertia (Koval, Pe, Meers, &
Kuppens, 2013). Additionally, similar to previous work (Koval et al., 2015) we
control for change in emotion due to recent occurrence of a positive and negative
events, to disentangle emotion reactivity from emotional inertia. Further, we control
for potential relations between youths’ internalizing symptoms (depression, social
anxiety) and average emotion on their reported emotion levels.

Method

Participants

Participants were part of the ‘How Do You Feel? Adolescent Behaviour,
Emotion and Technology Use over time study; the study had ethical approval for the
research team to conduct initial focus groups with youth, to pilot ESM, youth
feedback groups, and the final, larger ESM data collection (on which the current
study is based), from the Murdoch University Human Research Ethics Committee
and the Department of Education (permit # 2013/141; D13/0537672). Participants
were recruited from two low SES schools in Australia. Both schools were rated on
an index of school, community and educational advantage (ISCEA), indicating low
SES (Australian Curriculum, Assessment and Reporting Authority, 2013). ISCEA
scores are calculated within each state, based on parental education and occupation
levels, the number of Indigenous and non-English speaking background students,
and geographic location. Students in grades 8 -12 were given parent and student
information letters about the study and returned signed consent forms. Five
participants withdrew consent during the study, and two participants failed to commence the ESM phase. Participants who were deemed non-compliant (see Results section) were excluded from study analyses. Thus, the final sample consisted of 156 adolescents ($M_{age} = 14.6$ years ($SD = 1.3$), 12-17 years, girls = 66%). 74.5% of participants reported their ethnicity as Caucasian, 8.3% Aboriginal or Torres Strait Islander, 3.7 % Maori, 1.3 % Asian, 2.6% African, 5.1% “other” and 4.5% did not report their ethnicity.

Procedure

**Pre-and-post ESM phases.** Participants completed two computerized surveys (Pre-ESM survey, Post-ESM survey) containing questions about psychological traits (e.g. externalizing behavior, depression, social anxiety) and demographics. The Pre-ESM survey occurred immediately before the commencement of the ESM phase and the Post-ESM survey occurred once participants had completed the ESM phase. Completing the same survey twice allowed us to establish the stability of traits measured by the surveys.

**ESM phase.** Our ambulatory assessment approach was designed in accordance with several youth focus groups and was further pilot tested followed by youth debriefings to assist with method refinements (author cite removed). For the current study, we loaned participants iPhone® 5 or 6’s, equipped with free calling and internet access, and these facilitated their access to our web-based ESM surveys. Participants were texted a link to ESM surveys, 5 times per day for 7 days (e.g. Monday-following Monday). Surveys were sent at random times within set half-hour time periods, apart from weekday lunch-time surveys, which were programmed to occur during participants’ lunch breaks so as not to interrupt class time. We programmed each survey to close after an hour of being sent based on piloting and to ensure participants did not ‘save up’ surveys and complete multiple surveys at once.
Participants completed the first ESM survey in the presence of research team members who checked understanding of the ESM protocol and helped resolve any issues. The research team was also on-site at the schools each day with snacks and supervised space for youth to congregate, and were available via phone after-hours to address any technical issues with the phones. Beyond use of phones and credits, participants did not receive additional financial incentives for study participation.

**Pre-and Post-ESM Measures**

**Externalizing symptoms.** Participants responded to 15 self-report items about how often they had engaged in risky, substance use, antisocial and aggressive behavior over the last six months (e.g. About how often in the last six months have you been in trouble with the police? Been in a physical fight? Skipped school without parent permission? 0= Never; 7 = 31 or more times). This measure was adapted from the longitudinal Michigan Study of Adolescent Life Transitions and has shown to be a valid measure of adolescent externalizing behavior (Fredricks & Eccles, 2006; Vernon, Modecki, & Barber, 2017). For scoring, each item was recoded into a binary variable (0 = had not engaged in the behavior; 1 = had engaged in the behavior at least once) and then all items were summed. This method has been recognized as a successful summative method for scoring multiple-item measures of externalizing behavior (Osgood, McMorris, & Potenza, 2002). Participants final ‘Externalizing’ score were derived by averaging the totals of their pre-and post-ESM scores. Internal reliability at pre-and post-ESM was high (pre-ESM alpha α=.86; post-ESM α =.94) and test-retest reliability was acceptable (.70).

**Person-level covariates.** Alongside externalizing, we assessed for main effects of participant gender, depressive symptoms, social anxiety symptoms, and average emotion across the week on participants’ momentary emotion, to account for potential differences in affect based on these factors. A dichotomous variable was
created for "gender" (0 = male; 1 = female). Participants completed the 30 item self-report Reynolds Adolescent Depression Scale 2nd Edition (RADS-2; Reynolds, 2004). The RADS-2 assesses the frequency of symptoms of clinical depression in adolescents. Example items include "I feel sorry for myself," "I feel like having fun with other students" (1 = Almost never; 4 = Most of the time). Participants’ total scores from the pre-and post-ESM surveys were averaged to create a final, continuous depression score (pre-ESM α = .84, post-ESM α = .88, test-retest = .82).

Participants also completed 18 items from the self-report Social Anxiety Scale for Children and Adolescents (SAS-A; La Greca, 1998). The SAS-A is a well-validated measure of the frequency of social anxiety symptoms in adolescents (e.g. “I feel that others are making fun of me”; 1 = Not at all, 5 = All the time). Total scores from the pre-and post-ESM surveys were averaged to create a final Social Anxiety variable (pre-ESM α = .96, post-ESM α = .96, test-retest = .78). Final scores of the SAS-A and RADS-2 were rescaled (i.e.; divided by ten) to assist with model convergence.

**ESM Measures**

**Momentary Emotion.** Participants rated their current levels of worry, sadness, jealousy, loneliness, anger, happiness, and excitement at each sampling moment (1 = Not at all; 5 = Very Much). Emotional inertia values were derived from participants’ reports of momentary emotions (see Analysis).

**Moment-level Covariates.** Participants reported whether they had a positive and negative event since they were last messaged and rated event severity (1 = Not so good/bad' 5 = Very good/bad). To capture events that were most likely to affect adolescents’ wellbeing, we included as a covariate positive and negative events that participants rated as ≥ 3 in severity.

**Analysis**
We utilized a hierarchical linear modelling (HLM) approach given that repeated measures of emotion were nested within persons. HLM is ideally suited for these data, because it allows for non-independence between observations (Hox, 2010) and enabled us to model the extent to which person-level factors (e.g. externalizing symptomatology) conditioned the strength of within-person processes (i.e. emotional inertia). We assessed the appropriateness of HLM for these data by assessing interclass correlation coefficients (ICC’s); all ICC values were above .10, indicating that HLM was appropriate (see Table 2).

We used a series of multilevel autoregressive models to estimate individual differences in emotional inertia based on levels of externalizing symptoms. We ran separate models for each emotion. Consistent with previous studies (e.g. Koval et al., 2013) we operationalized inertia as the autoregressive coefficient of current emotion \( t = 0 \) on a lagged version of itself (i.e. emotion at the previous time point: \( t-1 \)). All models were run in Mplus V8 (Muthén & Muthén, 2012). We first estimated models with random-intercepts only, i.e. allowing the regression of emotion on externalizing, depression, social anxiety, gender vary across adolescents\(^4\).

Additionally, we regressed each adolescent’s average value for each emotion \( t-1 \) (i.e. the average of emotion \( t-1 \) across the week) onto the intercept at level-2. Doing so allowed us to control for between-person differences in overall levels of emotion (Enders & Tofghi, 2007) and provides an estimate of the emotion intercept separate from overall mean level of emotion (Bolger & Laurenceau, 2013 Next, we allowed the slopes for emotion \( t-1 \) on emotion to vary across adolescents (i.e. random-slopes component of the models) and then regressed externalizing onto the random slope to

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\(^4\) We re-ran the models without depression, social anxiety and gender regressed onto the emotion intercept and found a similar pattern of results.
test whether externalizing accounted for individual differences in emotional inertia for each emotion.⁵

**Centering.** Consistent with best practice in this type of HLM, all level-1 predictors were group-mean centered and level-2 predictors were grand-mean centred (Enders & Tofighi, 2007; Hamaker & Grassman, 2010). Because group-mean centering removes between-person variance in level-1 predictors, doing so provides a ‘pure’ estimate of within-person autoregressive relations (Hamaker & Grassman, 2010). Group-mean centering also allows for an important substantive interpretation of associated regression coefficients, such that level-1 coefficients represent a change in the outcome (in this case, emotion) associated with a one-unit deviation from an individual's average (e.g. rather than the sample average; Enders & Tofighi, 2007). As such, the autoregressive coefficients which represent emotional inertia in the current models are interpretable as the extent to which an individual's deviation from their typical level of an emotion, at t-1, accounts for their current emotion state (t = 0).

**Depression, social anxiety and gender.** Although the primary focus of the study was to assess individual differences in emotional inertia based on adolescents’ externalizing, we repeated the above analyses with depressive symptoms, social anxiety symptoms, and gender as the predictor of the level-2 slopes, respectively. Thus, we additionally tested whether adolescents’ levels of depression, social anxiety and/or gender could account for individual differences in emotional inertia.

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⁵ A sensitivity check to assess whether results remained the same at the within-day level (i.e. removing between-day time lags) was accomplished by adding a ‘time elapsed between sampling moments’ variable at Level 1 of the models. Findings for the cross-level interactions remained similar, with the exception of Excitement t-1 X Externalizing, which became trend level significant (p = .071).
Results

Data Preparation, Compliance, and Missing Data

We excluded the final sampling moment (morning) from the main analyses because it was not temporally linked to any same-day emotion, resulting in 34 time points per participant. In addition, less than 1% (.8%) of sampling moments were incomplete due to a technical error or a school scheduling conflict. We based compliance rates on how many momentary reports of emotion were completed. Consistent with past ESM studies focused on inertia (e.g. Koval & Kuppens, 2012; van Roekel et al., 2017) participants who completed less than 40% (i.e. less than 14 reports) of emotion reports were deemed non-compliant and were excluded from current analyses. Thus the median response among participants in this study was 24, which translates to a median response rate of 71% (i.e. 24/34 possible reports per participant).

One advantage of HLM is that participants do not have to provide data for the same number of time-points; thus, all compliant youth were included in the analysis (Gibbons, Hedeker, & DuToit, 2010). Further, all models were estimated using Full Information Likelihood Method (FIML), in accordance with best practice (Enders, 2010). FIML also offers the advantage of less restrictive assumptions about data missingness (e.g. versus generalized estimating equation (GEE) models; Gibbons et al., 2010). Additionally, we tested stability of our estimates by running models with listwise deletion and comparing estimates. Main effects were parallel across models and two out of the three significant cross-level interactions for externalizing (reported below) remained statistically significant (with the other interaction at trend p = .14, likely due to reduced power). Thus, all reported results use an inclusive
strategy (FIML) that uses all the information of the observed data. Further, all models were estimated with robust standard errors to account for variable non-normality (Mass & Hox, 2004).

Descriptives

We summed positive and negative events across the week and averaged emotions across the week for descriptive purposes (Table 1). Table 1 presents pairwise correlations between study variables. Of note, there were significant, positive associations between youths’ externalizing symptoms and each of the negative emotions and excitement.

Main Effects: Emotion t-1, Recent Positive and Negative Events

Table 2 presents the inertia coefficients for each emotion along with main effects for momentary positive and negative events (see ‘Level-1 Intercepts’). As shown in Table 2, a degree of inertia was present in all emotions examined. We calculated approximate R$^2$ values for inertia coefficients (Hox, 2010) to establish the amount of variance explained in current emotion by emotion at t-1. Percent of variance explained ranged from between 4.2-17.3% (worry = 5.8%; sadness = 6.5%; jealousy = 17.3%; loneliness = 4.2%; anger = 9.9%; happiness = 4.2%; excitement = 6.9%). Table 2 also demonstrates that recent negative events were associated with a significant increase in each negative emotion and significant decreases in happiness and excitement. Conversely, recent positive events were associated with significant increases in positive emotions and decreases in negative emotions. Importantly, because these models controlled for recent positive and negative events, findings suggest that youths’ prior emotion accounted for a significant amount of variance in their current emotion, above and beyond any change in emotion brought about by recent events.
### Table 1

**Descriptives and correlations between study variables**

<table>
<thead>
<tr>
<th></th>
<th>Mean (S.D)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Happy</td>
<td>3.37(1.2)</td>
<td>1.00</td>
<td>.429**</td>
<td>-.279**</td>
<td>-.185**</td>
<td>-.328**</td>
<td>-.199**</td>
<td>-.071**</td>
<td>-.200**</td>
<td>-.296**</td>
<td>-.023</td>
<td>-.289**</td>
<td>-.129**</td>
<td>-.076**</td>
</tr>
<tr>
<td>2. Excited</td>
<td>2.24(1.4)</td>
<td>--</td>
<td>1.00</td>
<td>-.047**</td>
<td>.011</td>
<td>-.086**</td>
<td>.036*</td>
<td>.089*</td>
<td>.059**</td>
<td>.253**</td>
<td>.018**</td>
<td>-.112**</td>
<td>-.003</td>
<td>-.056**</td>
</tr>
<tr>
<td>3. Angry</td>
<td>1.48(.84)</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.329**</td>
<td>.467**</td>
<td>.260**</td>
<td>.273**</td>
<td>.292**</td>
<td>-.122**</td>
<td>.119**</td>
<td>.326**</td>
<td>.199**</td>
<td>-.019</td>
</tr>
<tr>
<td>4. Worried</td>
<td>1.60(1.0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.410**</td>
<td>.240**</td>
<td>.323**</td>
<td>.188**</td>
<td>-.068**</td>
<td>.120**</td>
<td>.440**</td>
<td>.283**</td>
<td>.025</td>
</tr>
<tr>
<td>5. Sad</td>
<td>1.57(1.0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.379**</td>
<td>.342**</td>
<td>.252**</td>
<td>-.129**</td>
<td>.075**</td>
<td>.424**</td>
<td>.301**</td>
<td>.088**</td>
</tr>
<tr>
<td>6. Lonely</td>
<td>1.60(1.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.263**</td>
<td>.076**</td>
<td>-.110**</td>
<td>.140**</td>
<td>.370**</td>
<td>.265**</td>
<td>-.064**</td>
</tr>
<tr>
<td>7. Jealous</td>
<td>1.33(.81)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.061**</td>
<td>-.056**</td>
<td>.189**</td>
<td>.353**</td>
<td>.245**</td>
<td>-.022</td>
</tr>
<tr>
<td>8. NE</td>
<td>1.70(2.8)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>-.033*</td>
<td>.065**</td>
<td>.100**</td>
<td>.037**</td>
<td>.036*</td>
</tr>
<tr>
<td>9. PE</td>
<td>(5.9)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>-.036*</td>
<td>-.098**</td>
<td>-.038*</td>
<td>-.035*</td>
</tr>
<tr>
<td>10. Externalizing</td>
<td>1.46(.60)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.255**</td>
<td>.208**</td>
<td>-.118**</td>
</tr>
<tr>
<td>11. Depression</td>
<td>5.78(.15)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.670**</td>
<td>.145**</td>
</tr>
<tr>
<td>12. SA</td>
<td>4.74(1.6)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>.265**</td>
</tr>
<tr>
<td>13. Gender</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Notes: N = 156. Gender (0 = male, 1 = female). NE = average frequency of salient negative events; PE = average frequency of salient positive events; i.e. events higher than 3, on a scale from 1 = Sort of Bad/Good to 5 = Very Bad/Good. SA = social anxiety. All level 1 variables group-mean and all level 2 variables grand-mean centred for correlations.

*p < .05, **p < .01
Table 2

Results from random-intercept and random-intercept-and-slopes models.

<table>
<thead>
<tr>
<th></th>
<th>Worry</th>
<th>Sadness</th>
<th>Jealousy</th>
<th>Loneliness</th>
<th>Anger</th>
<th>Happiness</th>
<th>Excitement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 Variance</strong></td>
<td>.547 [.47, .63]**</td>
<td>.537 [.46, .62]**</td>
<td>.307 [.24, .37]**</td>
<td>.575 [.49, .66]**</td>
<td>.527 [.45, .61]**</td>
<td>.901 [.83, .98]**</td>
<td>1.03 [.93, 1.1]**</td>
</tr>
<tr>
<td><strong>Level 2 Variance</strong></td>
<td>.459 [.33, .59]**</td>
<td>.466 [.34, .59]**</td>
<td>.349 [.19, .50]**</td>
<td>.492 [.34, .65]**</td>
<td>.276 [.20, .36]**</td>
<td>.486 [.38, .59]**</td>
<td>.850 [.66, 1.0]**</td>
</tr>
<tr>
<td><strong>ICC</strong></td>
<td>.472</td>
<td>.485</td>
<td>.472</td>
<td>.549</td>
<td>.353</td>
<td>.351</td>
<td>.438</td>
</tr>
</tbody>
</table>

**Random Intercept Models**

**Level 1 Intercepts**

<table>
<thead>
<tr>
<th></th>
<th>Emotion (t-1)</th>
<th>Negative Event</th>
<th>Positive Event</th>
<th>Externalizing</th>
<th>Depression</th>
<th>Social Anxiety</th>
<th>Gender (0=male)</th>
<th>Average Emotion t-1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.261 [.20, .32]**</td>
<td>.176 [.12, .24]**</td>
<td>.240 [.18, .31]**</td>
<td>.061 [.02, .10]*</td>
<td>.088 [.03, .16]**</td>
<td>.154 [.12, .19]**</td>
<td>.183 [.14, .23]**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.480 [.36, .60]*</td>
<td>.704 [.55, .89]**</td>
<td>.115 [.03, .20]*</td>
<td>.217 [.08, .35]*</td>
<td>.700 [.61, .92]**</td>
<td>-.635 [.80, .49]**</td>
<td>-.189 [.31, .07]*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.133 [.20, -.06]*</td>
<td>-.237 [.31, -.17]**</td>
<td>-.074 [.12, -.03]*</td>
<td>-.202 [.28, -.15]**</td>
<td>-.233 [.32, -.17]**</td>
<td>.696 [.61, .79]**</td>
<td>.652 [.54, .76]**</td>
<td></td>
</tr>
</tbody>
</table>

**Level 2 Intercepts**

<table>
<thead>
<tr>
<th></th>
<th>.000 [.00, .00]</th>
<th>-.002 [.04, .00]</th>
<th>-.003 [.01, .00]</th>
<th>-.007 [.02, .03]*</th>
<th>-.01 [.00, .00]</th>
<th>.002 [.00, .01]</th>
<th>.003 [.00, .01]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.007 [.21, .37]</td>
<td>.004 [.00, .01]**</td>
<td>.002 [.01, .01]</td>
<td>-.013 [.02, .01]*</td>
<td>.008 [.02, .00]</td>
<td>.000 [.02, .02]</td>
<td>.008 [.00, .02]</td>
</tr>
<tr>
<td></td>
<td>.003 [.14, .00]</td>
<td>-.001 [.06, .04]</td>
<td>-.007 [.06, .00]</td>
<td>.000 [.01, .10]</td>
<td>-.033 [.11, .04]</td>
<td>.002 [.01, .02]</td>
<td>-.006 [.01, .00]</td>
</tr>
<tr>
<td></td>
<td>.005 [.01, .02]</td>
<td>-.008 [.02, .04]</td>
<td>-.016 [.00, .34]</td>
<td>.013 [.13, .04]</td>
<td>.005 [.20, .030]</td>
<td>.015 [.02, .05]</td>
<td>-.042 [.02, .06]*</td>
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<td></td>
<td>991 [.98, 1.0]**</td>
<td>.978 [.96, .99]**</td>
<td>10.0 [.98, 10.2]**</td>
<td>1.05 [.01, 1.1]**</td>
<td>1.03 [.99, 1.06]**</td>
<td>9.83 [.97, 10.0]**</td>
<td>.996 [.97, 1.0]**</td>
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**Random Slopes Models**

|                      | Slope Variance | .044 [.03, .06]** | .034 [.02, .05]** | .053 [.04, .07]** | .009 [.00, .02] | .050 [.03, .07]** | .024 [.01, .04]** | .028 [.01, .05]** |

**Level 1 Covariates**

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<th>Positive Event</th>
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<th>Depression</th>
<th>Social Anxiety</th>
<th>Gender (0=male)</th>
<th>Average Emotion t-1</th>
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<td>.125 [.03, .22]**</td>
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<td>-.058 [.10, -.01]**</td>
<td>-.202 [.27, -.13]**</td>
<td>-.235 [.31, .16]**</td>
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**Level 2 Covariates**


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<td>-.018[-.04,.01]</td>
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</table>

Note: N (Level 1) = 4929-5304, N (Level 2) = 141-156. *Level 2 intercepts are not presented here for table parsimony.

*p<.05, **p<.001.
Main Effects: Externalizing, Depression, Social Anxiety, Gender and Average Emotion

As shown in Table 2 (‘Level-2 Intercepts’) externalizing symptoms were associated with significantly lower loneliness across the week. Depressive symptoms were associated with significantly higher sadness across the week, but surprisingly, also significantly lower loneliness. Girls’ reports significantly lower excitement across the week than boys. Table 2 also shows that the main effect of average emotion t-1 was significant across all emotions tested. Thus, adolescents with higher average negative emotions at t-1 showed higher current negative emotions, and likewise for positive emotions.

Cross-Level Interactions: Adolescents’ Externalizing Symptoms Predicting Emotional Inertia

As shown in the bottom half of Table 2, there were significant cross-level interactions of Emotion t-1 X Externalizing predicting Emotion t for worry, happiness, and excitement. Thus, adolescents’ externalizing symptoms accounted for significant between-person differences in inertia for these three emotions. We probed these interactions by plotting simple slopes of current emotion on emotion t-1 at ± 1 S.D above the centred mean of the externalizing variable (i.e. ‘high’ externalizing vs. ‘low’ externalizing). We then graphed the inertia coefficients for adolescents at low versus high externalizing, to characterize the relation between externalizing symptoms and inertia (Figures 1a-2b).

As Figure 1a) illustrates, adolescents at both high and low levels of externalizing symptoms showed positive inertia values for worry (i.e. higher worry at t-1 was associated with higher current worry). Yet, inspection of simple slope values suggested that adolescents high in externalizing symptoms showed stronger inertia
for worry compared to adolescents low in externalizing symptoms (high externalizing $b = .301(.09), p = .001$; low externalizing $b = .179(.09), p = .04$). This finding suggests that adolescents higher in externalizing symptoms carried forward worry to a larger extent than adolescents lower in externalizing symptoms, net of mean levels of worry overall, and net of good and bad events that occur across their day.

Figure 1a. Inertia for worry at high vs. low externalizing (±1SD). N = 145. Error bars represent standard error of simple slopes.

Figure 1b. Inertia for happy at high vs. low externalizing (±1SD). N = 156. Error bars represent standard error of simple slopes.
As Figure 1b) shows, adolescents at both high and low levels of externalizing symptoms showed positive inertia values for happiness. Inspection of simple slopes revealed that adolescents high in externalizing symptoms showed relatively weaker inertia for happiness compared to adolescents low in externalizing symptoms, though neither coefficient was significantly different from zero (high externalizing b = .101(.15), ns; low externalizing b = .201(.14), ns). A similar pattern of results was found for excitement (Figure 1c). That is, adolescents high in externalizing symptoms showed relatively weaker inertia for excitement compared to adolescents low in externalizing symptoms (high externalizing b = .123(.08), ns; low externalizing b = .225(.08), p = .001). Here however, for youth low in externalizing, the inertia coefficient was statistically significant.

![Figure 1c. Inertia for excitement at high vs. low externalizing (±1SD). N = 145. Error bars represent standard error of simple slopes.](image)

**Cross-Level Interactions: Adolescents’ Depression, Social Anxiety, Gender**

**Predicting Emotional Inertia**

As Table 2 demonstrates, the cross-level interaction of Depression x Emotion t-1 was significant for sadness, jealousy and loneliness. Similar to the above models, we probed the simple slopes of inertia at high (+ 1 S.D) and low (- 1 S.D) levels of depressive symptoms, as well as plotted the inertia coefficients at both high and low
depression (Figure 2a-2b). As Figure 2a) illustrates, there was a positive relation between prior sadness and current sadness, and this relation was stronger among adolescents high in depression versus low in depression (high depression b = .183(.05), \( p < .001 \); low depression b = .036(.04), \( ns \)), with the inertia coefficient statistically significant only for youth high in depression. A similar pattern of results was found for jealousy (high depression b = .258(.08), \( p = .001 \); low depression b = .054(.08), \( ns \)). Hence, adolescents higher in depressive symptoms carried forward recent sadness and jealousy more extensively than adolescents lower in depressive symptoms. A slightly different pattern of results emerged for loneliness. As Figure 2b) demonstrates, there was a positive relation between loneliness t-1 and current loneliness among adolescents high in depression (b = .105(.03), \( ns \)), but this relation was negative relation among adolescents low in depression (b = -.045(.03), \( ns \)). This pattern of results suggests that adolescents high in depressive symptoms carried forward recent levels of loneliness, but that higher previous loneliness was associated with lower current loneliness among adolescents low in depressive symptoms, though neither coefficient was statistically different from zero.

![Figure 2a. Inertia for sadness at high vs. low depression (±1SD). N = 145. A similar trend was found for jealousy. Error bars represent standard error of simple slopes.](image-url)
Last, as Table 2 shows, the interaction of Social Anxiety X Sadness t-1 predicting current sadness was also significant (see Figure 3). There was a positive relation between sadness t-1 and current sadness, and this relation was relatively stronger among adolescents with high (+1SD) social anxiety (b = .183(.50), ns) compared to adolescents low (-1SD) in social anxiety (b = .041(.50), ns). In these analyses, gender did not account for any individual differences in emotional inertia.

**Figure 2b.** Inertia for loneliness at high vs. low depression (±1SD). N = 145. Error bars represent standard error of simple slopes.

**Figure 3.** Inertia for sadness at high vs. low social anxiety (±1SD). N = 145. Error bars represent standard error of simple slopes.

**Discussion**

Emotional inertia, or the degree to which individuals “carry forward” their emotions, is a dynamic that warrants increased attention because it is distinct from
other emotion patterns (e.g. Houben, Van Den Noortgate, & Kuppens, 2015; Koval & Kuppens, 2012), and given emerging links to psychopathology symptoms (e.g. Kuppens et al., 2012; van Roekel et al., 2016). In a novel application of the inertia dynamic, the current study examined inertia for emotions (both positive and negative) among an at-risk sample of adolescents and explored whether youths’ externalizing symptoms conditioned this relation. Our findings show that strong inertia for negative emotions (i.e. worry) and weak inertia for positive emotions (happiness, excitement) is a dynamic uniquely tied to youths’ externalizing symptomatology. We found a significant linear relation between externalizing symptoms and youths’ inertia coefficients, above and beyond key constructs that might also influence youths’ inertia, including between-person differences in overall levels of emotion across the week and recent negative and positive events, thus distinguishing inertia from average emotions and from emotion reactivity (Koval et al., 2015). We also controlled for (and tested) plausible difference due to internalizing symptoms (depression, social anxiety) and gender, so our approach was conservative and our resulting findings arguably robust.

**Adolescents’ Externalizing Symptoms and Inertia for Negative Emotions**

Although worry is an emotion more commonly associated with internalizing disorders (e.g. anxiety and depression; APA, 2013), in a unique application of inertia, our findings suggest that adolescents’ externalizing symptoms are tied to greater carry-forward of worry among an at-risk sample of adolescents. Indeed, previous findings indicate that adolescents in low SES settings tend to mis-attribute threat to ambiguous stimuli (e.g. Chen, Langer, Raphaelson, & Mathews, 2004), a process tied to misinterpreting environmental demands. While heightened states of worry may prepare youth for upcoming challenges, maintaining worry after a threat
has dissipated can result in the “wear and tear” of stress response systems and lead to poorer health outcomes (Boyce & Ellis, 2005). Our finding of a positive linear relation between externalizing symptoms and inertia thus indicates a point for concern.

That said links between externalizing and inertia for worry also makes intuitive sense, given the myriad of challenges faced by youth with externalizing symptoms in day-to-day life. The lives of youth who display elevated externalizing symptoms are characterized by numerous external stressors including parental hostility, harshness and intrusiveness (Buhler, Benson, & Gerard, 2006). These and other associated stressors may lead youth to carry-forward recent states of worry. In this instance, it may be that worry is indicative of threat-focused apprehension, which serves to prepare youth for an imminent stressor (Chen et al., 2004) or indicative of a broader hostile-attribution bias (Guerra, Huesmann, & Spindler, 2003). Hence, youth with elevated externalizing symptoms may remain in states of worry for longer periods of time in an effort to maintain a state of vigilance or preparedness. While such vigilance within at-risk contexts can be adaptive, it can also bring with it “wear and tear” on compensating physiological systems, and aggressive responding to neutral events. As a result, youth with elevated externalizing symptoms may benefit from intervention strategies which seek to enhance their dexterity in shifting out of negative emotional states, especially when no longer in line with current needs (Modecki, Zimmer-Gembeck, & Guerra, 2017).

Our finding is also consistent with previous work examining externalizing symptoms, which suggests a decoupling of negative emotions from context among youth (e.g. rigidity of parent-child interactions and child externalizing; Hollenstein, et al., 2004; asynchronous physiological responses in parent-adolescent dyads;
Woltering et al., 2015). Unlike the current study, past work has focused on decoupling of emotional states between parents and children, rather than a within-person examinations of such decoupling. Regardless of how assessed, however, strong emotional inertia is thought to stem from youths’ failure to shift their emotional state to match environmental demands (Hollenstein, 2015; Koval & Kuppens, 2012). Indeed, among healthy youth, the detection of a change in environmental demands catalyses a noted discrepancy between current and necessary emotional states, which in turn triggers youth to shift their emotions, either in terms of emotional valence, arousal, or both (Cunningham, Dunfield, & Stillman, 2013). However, this process of flexibly matching emotions with context is cognitively demanding, and taxes youths’ available resources (Luciana, 2013). For youth with externalizing symptoms, then, whom already struggle with cognitive demands tied to information processing and emotion regulation (Luciana, 2013; Telzer, Fuligni, Lieberman, & Galván, 2013), this recalibration of emotional state to match environmental demands may be impaired or protracted.

**Adolescents’ Externalizing Symptoms and Inertia for Positive Emotions**

Another novel contribution of this study was the exploration of links between reduced inertia for positive emotions and adolescent externalizing symptoms. Notably, our results indicated that the carry-forward of happiness and excitement is attenuated among youth at higher levels of externalizing symptoms. These results suggest that, unlike for worry, youthful externalizing symptomatology is associated with relatively low emotional stasis when it comes to positive emotions. This raises a intriguing question, then, is strong inertia for positive emotion fundamentally maladaptive?
Some foundational scholars have argued that, in theory, the antithesis to emotional inertia is low resistance to change in emotions (Koval & Kuppens, 2012), which can be characterized as “emotional flexibility” (e.g. Hollenstein, 2015). Indeed, by this account, such flexibility may link to better psychological outcomes. For instance being able to match positive emotions to changes in one's environment should facilitate context-appropriate responding (Hollenstein, 2015; Kashdan & Rottenberg, 2010). Yet the bulk of previous work, while forming the cornerstone of empirical understanding of inertia, has focused on negative emotions, and has found only inconsistent relations between inertia for positive emotions and symptoms of psychopathology (e.g. depression, van Roekel et al., 2017; 2016; anxiety, Morgan et al., 2017). Notably too, this work has not yet accounted for externalizing, and in adolescents, in particular, there is good theoretical justification to suggest the opposite—that *stasis* in positive emotions underscores wellbeing.

Indeed, broaden and build theories posit that psychological functioning and resilience are underscored by being able to experience positive emotions *despite* aversive contexts, possibly reflecting high resistance to change in positive emotions. Illustratively, Gruber and colleagues (2013) demonstrated that lower variability in positive affect was associated with higher levels of life satisfaction and subjective happiness. They suggest that relatively stable positive affect indicates less extreme "ups and downs" in happiness, and is thus indicative of healthy psychological functioning. The current finding lends support to this notion, in that resistance to change (i.e. low emotional inertia) for happiness and excitement was inversely and linearly related to adolescents’ externalizing symptoms. Thus, being able to maintain positive emotions (regardless of mean emotion levels across the week which were controlled for in our analyses), was tied to healthier behavioral functioning. Again,
these findings are conservative in that they controlled for other person-level (e.g. internalizing) and momentary-level (e.g. good and bad events) factors which might serve to trigger fluctuating positive emotional states.

**Adolescents’ Internalizing Symptoms and Emotional Inertia**

Although not a primary aim of the study, we were also able to test for individual differences in inertia based on adolescents’ internalizing symptoms (i.e. depressive and social anxiety symptoms). Consistent with past work (e.g. van Roekel et al., 2017), we found that adolescents’ depressive symptoms were associated with stronger inertia for negative emotions (sadness, jealousy and loneliness). Additionally, adolescents’ social anxiety symptoms were associated with stronger inertia for sadness. Here, becoming desensitized from a stressful environment is a proposed mechanism that maintains internalizing symptoms (Rottenberg, et al., 2005). Interestingly, youth with relatively low levels of depressive symptoms demonstrated an inverse, albeit not statistically significant, relation between prior and current loneliness. One explanation for this pattern may be that these youth are especially apt at implementing strategies (e.g. seeking social support) which serve to decrease their loneliness and perhaps other dysphoric symptoms. Indeed, perceived social support is linked to lower levels of loneliness among adolescents, as well as lower depressive symptoms (Kaltiala-Heino, Rimpela, Rantanen, & Laippala, 2001; Kingery, Erdley, & Marshall, 2011).

**Adolescent Psychopathology and Emotional Functioning**

Our findings that adolescent psychopathology symptoms – both externalizing and internalizing – were associated with individual differences in emotional inertia boosts scholarly calls for an emotion dynamics approach to psychopathology research (Hollenstein, 2015; Kuppens et al., 2010; Trull et al., 2015; Wichers, 2013)
including accounts of adolescent psychopathology (author cite removed). Indeed, only by characterizing the various indices of emotional instability and variability which characterize adolescents’ emotional experiences -- including emotional inertia as a key dimension--will scholars gain a truly nuanced picture of the emotional patterns that characterize youthful psychopathology. Such emotion dynamics accounts serve to expand scholarly understandings of the link between adolescent emotions and mental health, beyond descriptions based solely on differences in average levels of positive and negative emotions, or even their emotion reactivity (author cite removed; Koval & Kuppens, 2012).

Indeed, our findings that adolescents’ externalizing symptoms did not account for individual differences in overall levels of worry, happiness or excitement, but did account for the inertia of these emotions, is consistent with contemporary models of emotion (e.g. Hollenstein, 2015; Kuppens, Oravecz, & Tuerlinckx, 2010). Whereas adolescents’ internalizing symptoms were associated with differences in average levels of affect (higher levels of sadness and loneliness) as well as indications of inertia for these emotions. These findings suggest that different types of psychopathology symptoms are paired with different emotion patterns, at least among adolescents. Yet the bulk of previous work has focused on adults (e.g. Koval & Kuppens, 2012; Pe et al., 2015; Suls, Green, & Hillis, 1998), and almost no research has taken into account externalizing symptoms (e.g. Hollenstein et al., 2004 and Granic et al., 2007 accounts of emotional rigidity). All told, that we found different inertia patterns based on type of psychopathology highlights the need for wider consideration of youths’ emotion dynamics when characterizing links with mental health.

Limitations
The current findings should be taken in line with study limitations. First, although our use of auto-correlations is in-line with previous operationalizations of inertia (Jahng, et al., 2008; Jongerling, Laurenceau, & Hamaker, 2015), future research might more fully explore whether inertia differs when adolescents actually experience a change in context (Houben et al., 2015). That is, although inertia research has not typically assessed for context change per se, other approaches might assist in conclusively asserting that strong inertia is a true indicator of emotional insensitivity to context. As one example, emerging findings suggest that adolescents’ level of affective flexibility may be state-dependent, such that a given youths’ level of affective flexibility depends on the emotional tone of their setting (i.e. pleasant versus high conflict context; Mancini & Luebbe, 2018). Here we controlled for recent positive and negative events, which provides estimates of inertia uncontaminated by emotion reactivity and lends confidence to our conclusions; however further work in this arena will be fruitful for the field.

Second, although we focused on adolescents' subjective reports of emotions, thus representing affective experiences of emotional inertia (e.g. Koval & Kuppens, 2012; van Roekel et al., 2016), others have assessed temporal dependency of physiological aspects of emotion over micro-time period (e.g. Koval et al., 2015). While subjective aspects of emotion are used for diagnosis of psychopathology (APA, 2013), future research might benefit from triangulation of subjective, physiological and behavioral aspects of inertia to gain a more comprehensive understanding of the daily emotional landscape of adolescents with elevated externalizing symptoms. Third, although we assume youths’ motives were consistent with seeking positive affect/pleasure (rather than pain, i.e. pro-hedonic), we acknowledge that individuals may carry other goals for emotion regulation (e.g.,
contra-hedonic goals, social goals; Tamir, 2016). Thus, youths’ carrying-forward of worry and their failure to carry forward positive emotion may actually be consistent with their emotion regulation goals, and further work might explore this idea. Last, because we focused on socio-economically disadvantaged youth in an effort to over-sample those at-risk for externalizing behaviors. Thus, our findings may not necessarily generalize to youth in middle or high SES settings, and future research might compare inertia and externalizing among more affluent samples of youth.

**Conclusion**

Adolescence is a developmental period marked by difficulties in emotional functioning and heightened engagement in externalizing behaviors (Hollenstein & Lougheed, 2013). Yet past research, while formative to the field, has focused primarily on inertia for negative emotions among adults, to the exclusion of adolescents and always in relation to internalizing. The current addresses a core area of understanding, demonstrating that adolescents’ externalizing symptoms are indeed tied to emotional inertia. That is, we found a linear relation between increased externalizing symptoms and stronger carry-forward of worry and weaker carry-forward of happiness and excitement. Importantly, these findings were conservative in that they controlled for momentary events (e.g. Koval et al, 2015) and average emotion levels across the week, which themselves might explain youthful inertia. They were also conservative in controlling for other types of mental health problems, including depression and anxiety symptoms. All told, findings add to a growing body of research suggesting that adolescents with externalizing psychopathology have unique emotional dynamics, including emotional inertia. At-risk youth, and those with externalizing symptoms in particular, may require assistance in establishing a healthy "ebb and flow" of emotion in daily life.
CHAPTER SIX: GENERAL DISCUSSION

Learning to independently regulate the ‘ebb and flow’ of emotions in daily life represents a central task of adolescence. Yet, this task is made particularly difficult by simultaneous biological, social, and neurobiological changes associated with the onset of puberty (Crone & Dahl, 2012). Socially, adolescents are exposed to a greater number of daily stressors and challenges, which they are expected to increasingly independently resolve. Neurologically, sub-cortical connections among prefrontal brain regions undergo fine-tuning during adolescence. Although these changes pave the way for a more sophisticated, ‘adult-like’ emotion regulation capacity, in the interim youth remain challenged in placing appropriate constraints around emotional responses in their day-to-day life. It is a focus on youths’ capacity to deploy these emotional constraints that was the central focus of the empirical studies in this thesis.

Characteristically, these constraints (or parameters) that adolescents place around their emotional experiences have been referred to as ‘emotion dynamics’ (Thompson, 1994). Though much empirical research has been dedicated toward understanding adolescents’ use of emotion regulation strategies, the bulk of this research has failed to tap into the dynamic nature of emotions. Hence, the three empirical studies in this thesis adopted an emotion dynamics approach to better characterize youths’ daily emotional functioning. Here, emotions are viewed as dynamic processes that fluctuate with time and context, rather than static, once-off events (Kuppens & Verudyn, 2015).

In an effort to best capture the dynamic nature of emotions in daily life, each empirical study leveraged ‘in situ’ experience sampling methodology (ESM) to
gather youths’ repeated reports of their emotions across their day. Doing so meant that each study could respond to two central gaps in the broader emotion regulation literature. Namely, what individual and contextual level factors are associated with changes in adolescents’ daily emotion dynamics, and which specific aspects of adolescents’ emotional experiences are changed (or remain stable) throughout daily life?

Indeed, a driving force behind empirical examinations of adolescents’ daily emotion dynamics is the quest to better characterize youths’ daily emotional landscapes, particularly for youth experiencing symptoms of psychopathology (i.e. externalizing behaviours). Such information is important and useful, because understanding the distinct aspects of emotion dynamics with which these youths struggle can provide novel entry points for interventions aimed at reducing externalizing behaviours. That said, programs and interventions aimed at helping youth recalibrate maladaptive emotion dynamics arguably requires an evidence-base drawn from those youth who are meant to be targeted by (and benefit from) such intervention efforts (Yoshikawa, Aber, & Beardslee, 2012). Because most empirical investigations into adolescents’ daily emotional dynamics has centered on youth living in middle-to-high income settings, there is a paucity of empirical findings from which to draw regarding youth most at-risk for facing psychological difficulties during adolescence, those residing within low SES settings.

Youth characterized by socioeconomic disadvantage differ from their more advantaged peers in terms of physiological and behavioral responding to challenges and carry unique risk factors (e.g. elevated allostatic load and high chronicity of stress; Chen & Miller, 2012; Theall et al., 2015). These factors arguably influence program content and delivery. Further, as numerous implementation models
highlight, features of youths’ social cultural setting, including how the community prioritizes need and community norms, will also interact with these individual-level factors to inform the success of programs and interventions (Damschroder et al., 2009). Perhaps it is not surprisingly then, national survey data reveals that youth living in low SES settings in Australia are less likely to access psychological services, despite reporting higher rates of psychological disorders (Sawyer, et al., 2001; Lawrence et al; 2015). Similar trends are found in the internationally, for instance, disadvantaged youth in the US have three times the amount of unmet psychological health care needs compared to their higher-SES counterparts (Newacheck, Hung, Park, Brindis, & Irwin, 2003). Thus, in a bid to address this gap in knowledge regarding disadvantaged youths’ daily emotion functioning (and dynamics), the three studies comprising this thesis sought to better describe the emotional landscapes of day-to-day life for these youths.

Specifically, each empirical study examined a distinct element of emotion dynamics: emotional responding (Study 1), emotion reactivity (Study 2), and emotional inertia (Study 3) among a sample of youth who have been under-represented in research to date, youth living in socio-economic disadvantage. This investigation began with a focus on daily stressors as a catalyst for differential responding in the intensity of youths’ emotions. Previous empirical work showed that daily stressors are more frequent during adolescence, and likewise, are associated with fluctuations in emotional states (Ham & Larson, 1990; Schneiders et al., 2006). Yet, few studies had examined disadvantaged adolescents’ emotional responses to daily stressors, despite low SES contexts providing a hotbed for such stressors to manifest (Santiago, Wadsworth, & Stump, 2011). Furthermore, despite adolescence representing a time of significant social change, research had yet to
examine the conditioning role of social context in adolescents’ ‘in vivo’ responses to daily stress.

Study 1 thus addressed this gap in the literature and examined the moderating role of social context on disadvantaged youths’ emotional responding to daily stressors. It was hypothesized that recent occurrence of a stressor would be associated with within-person change in emotion, but that being with peers after a stressor (versus alone or with family) would dampen negative emotional responses. Here, change in emotional responding was operationalized as difference in intensity of an emotion (e.g. sadness) after a stressor, compared to a given adolescent’s average level of sadness. Findings were in line with study 1’s hypotheses in that daily stressors were associated with higher than average sadness, worry, loneliness, anger, and lower than average happiness. Further, and especially for girls, being with peers after a stressor was associated with dampened increases in sadness and worry, compared to being alone or with family. For boys only, being with peers meant smaller dips in happiness post-stressor. Interestingly, the peer context was associated with lower jealousy, compared to average, even after a stressor had occurred. Thus, findings from Study 1 offered a useful lens at to the socially-embedded nature of adolescents’ emotional responding to daily stressors. That is, who adolescents are with when they experience challenges or hassles matters.

Buoyed by findings from Study 1 showing that daily stressors were a catalyst for disrupted emotion dynamics, Study 2 focused on the potential conditioning role of psychopathology on youths’ emotion reactivity to daily stressors, focusing on externalizing symptomatology. Recent theoretical explanations of adolescent externalizing behaviors highlight that such behavior is tied to exacerbated emotional responses to stress, particularly when youth are in affectively-laden contexts (e.g.
Thus, it was hypothesized that adolescents’ externalizing symptoms would be related to greater emotion reactivity to daily stressors, due to struggles to place appropriate parameters around their emotional responses. Here, emotion reactivity was operationalized as temporal change in emotion from pre-to-post stressor, across a range of discrete emotions. As expected, externalizing symptomatology was related to greater emotion reactivity for several emotions (i.e. sadness, anger, jealousy, loneliness, and excitement).

Acknowledgment of the many vulnerabilities that tend to characterize youth with externalizing symptoms, led to a supplementary research question, as well. Namely, are externalizing symptoms tied to more frequent experience of stressors, and, likewise, for youth high in externalizing, is the experience of negative emotion tied to “generation” of a subsequently stressful experience? It was argued that youth who display externalizing behaviors carry numerous internal and external vulnerabilities (e.g. hostile attribution biases, peer rejection, parental modelling of aggressive responses; Dodge, 2006; Miller-Johnson et al., 2003; Moretti, Obsuth, Odgers, & Reebye, 2005) that would facilitate the increased likelihood of generating daily stressors. Further, based on the notion that youth high in externalizing symptoms experience behavior control deficits in high-affect conditions (Luciana, 2013), it was expected that these youths would be more likely to germinate stressors after a recent emotional upheaval.

That said, however, findings from Study 2 provided no evidence of this ‘stress generation’ effect. Rather, there was some evidence of a protective effect of recent upheavals in jealousy for youth low in externalizing. That is, recent peaks in jealousy were associated with a decreased likelihood of a subsequent stressor, though only among youth who were relatively low in externalizing symptoms.
Overall, study indicated that while externalizing symptoms were not related to stress generation generally, when a stressor did occur, youth who were relatively higher in externalizing experienced a more exaggerated emotional response (i.e. greater emotion reactivity) compared to their less-symptomatic peers.

Following on from these findings showing that adolescents’ externalizing symptoms were related to increased emotion reactivity, in Study 3, the focus was on whether externalizing symptoms would also be associated with difficulties in emotional recovery. Hence, the third and final study examined individual differences in the dynamic termed “emotional inertia”, based on youths’ levels of externalizing symptomatology. Here, emotional inertia was operationalized as the extent to which an emotion was carried forward across time (i.e. the self-predictive nature of emotion; Koval & Kuppens, 2012). This study was based on the fundamental notion that change in emotion can be adaptive, serving to alert youth to changes in their environment, but that this adaptive function tends to be dampened in individuals with psychopathology (Rottenberg, Gross, & Gotlib, 2005). Based on the idea that strong-carry forward of negative affect is tied to psychopathology symptoms, it was hypothesized that adolescents’ externalizing symptoms would be associated with greater inertia for negative emotions. Conversely, based on previous findings that relative instability in positive emotion is associated with poorer psychological wellbeing, it was hypothesized that youthful externalizing would be related to weaker inertia for positive emotions. These hypotheses were somewhat supported, in that youth externalizing symptoms were related to stronger inertia for worry, but weaker inertia for happiness and excitement.

Collectively, these three empirical studies help to improve scholars’ understanding of the daily emotional dynamics of disadvantaged adolescents, as a
function of daily stressors, social contexts and externalizing symptomatology. The remainder of this chapter integrates essential elements from these findings with the existing literature, touching on both theoretical and clinical implications. The chapter concludes with a discussion of study limitations and suggestions for future research.

Empirical Context and Significance

Do Disadvantaged Adolescents’ Daily Stressors Impact Daily Emotional Dynamics?

As children transition to adolescence they are expected to play a more independent role in managing and resolving stressors, particularly in response to more common and manageable daily stressors (Wright, Creed, & Zimmer-Gembeck, 2010). One way to gauge youths’ progress toward achieving this form of socioemotional competence is to examine the parameters that adolescents place around their emotional responses to such stressors. As part of this investigation, examining youths’ emotional responses to daily stressors is useful starting point, because these responses characterize the result of youth ‘bumping up’ against daily challenges brought about by everyday life (Lazarus & Folkman, 1984). Also, given previous evidence that youth living in disadvantaged settings experience more frequent, more uncontrollable, and more severe daily stressors than their higher SES counterparts (Brady & Mathews, 2002; Evans et al., 2009; Miller, Webster, & MacIntosh, 2003), it was especially important that these examinations focus on the daily stress-emotion relations among disadvantaged youth.

Findings studies 1 and 2 provide evidence that disadvantaged youths’ exposure to daily stressors is linked to disrupted emotion dynamics, both when emotion dynamics are measured as an index of emotional responding (i.e. change from average) and emotion reactivity (i.e. temporal change from pre-to-post
stressor). Indeed, disadvantaged youth are particularly susceptible to disrupted emotion dynamics because of numerous internal and external risk-factors (e.g. allostatic overload; Theall et al., 2015; higher physiological reactivity; Evans & English, 2002; and less-effective coping methods; Landis et al., 2007). Consistent with past studies (e.g. Schnieders et al., 2006; Ham & Larson, 1991), higher than average negative affect and lower than average positive affect was an outcome of exposure to daily stressors, across both studies. Further and adding a unique contribution to the research literature, findings from Study 1 and 2 also converge to show that experiencing stressful events was linked with noticeable changes in disadvantaged youths’ daily emotion dynamics, both in terms of responding (change from average) and reacting (change from pre-to post stressor).

**Does social context matter?** Not only has much previous research been conducted with middle-high SES samples, studies on adolescents’ emotional dynamics in the face of daily stress have also been somewhat limited though their assessment of emotional responding in a relatively de-contextualized manner. Although socio-contextual models of coping indicate that individuals’ responses to stress are intricately linked with their context (e.g. Lazarus & Folkman, 1987), previous research has largely failed to examine the role of immediate social contexts in adolescents’ in-situ emotional responses to stress. That said, some prior ESM work has made initial progress in this regard, and prior ESM work shows that adolescents report more positively valanced emotional states (e.g. greater positive affect and lower anger and sadness) when in the presence of peers versus being at school, alone, or with family (Larson & Richards, 1991; Schneiders, Nicolson, Berkhof, Feron, van Os, & deVries, 2007; Silk et al., 2011). Likewise, findings from the social
support literature underscore the important role of perceived peer support in facilitating adolescents’ coping outcomes (e.g. Kingery, Erdley, & Marshall, 2011).

Thus, while taken together, several past studies highlight the socially embedded nature of emotion regulation, research had yet to leverage ESM in a convergence of these two literatures. Study 1 filled this gap to demonstrate a palliative effect of peers on youths’ emotional responding to stress. Although being with peers after a stressor did not completely ameliorate the emotional aftermath of a stressor (with the exception of jealousy), adolescents being in the presence of peers was associated with less intense sadness, worry and happiness, compared to being alone or with a family member. The unique salience of peers during adolescence was theorized to drive the particularly palliative effect of peers on stress-induced emotional responding.

In relation to these discrete emotions for which the palliative effects of the peer context were found, previous findings highlight that adolescents may be particularly cognizant of overt displays of sadness when in the presence of peers (von Salisch, 2011; Zeman & Shipman, 1997). Hence, the current finding that post-stress sadness was less intense when adolescents were with peers may be tied to adolescents’ potentially down-regulating sadness to avoid overt displays. This explanation fits with the notion the peers become important socialization agents from family members as children transition to adolescence (Klimes-Dougan et al., 2007).

Regarding findings for worry, it may be that seeking out peers during times of stress results in provision of social support, such as receiving advice or problem-solving (Kingery et al., 2011). Thus, an adolescent may arguably feel more confident in their ability to address a stressor (and less worry) after discussion with peers. In terms of jealousy, study findings are consistent with previous work showing that
sharing an emotional bond with friends is associated with reduced jealousy (Parker, Low, Walker, & Gamm, 2005). Hence, reaching out to peers during times of stress could foster emotional closeness, resulting in lower than average jealousy.

Finally, gender differences found in Study 1 suggested that the peer context was particularly helpful for girls in terms of post-stress sadness, worry and jealousy, and in terms of post-stress happiness for boys. Although intriguing, these findings of gender differences were preliminary given the relatively high proportion of girls sampled in Study 1 (69%). Helpfully, this gender imbalance addressed somewhat in Study 2 and Study 3 with the inclusion of more adolescents into the larger study.

**Is Externalizing Symptomatology Tied to Individual Differences in Emotion Dynamics among Disadvantaged Adolescents?**

Findings collectively provided evidence that externalizing symptoms are indeed associated with individual differences in emotion dynamics, both in terms of emotion reactivity (Study 2) and emotional inertia (Study 3). Informed by theoretical models of externalizing behavior (e.g. Casey, 2015; Ernst & Fudge, 2009; Luciana, 2013), adolescents’ biological vulnerabilities for weak behavioral control were presumed to interact with contexts of high cognitive, social and affective inputs, and result in reduced capacity to control externalizing-type behaviors (i.e. substance use, aggression and risk behaviors). Indeed, several previous empirical investigations provide support for this notion, by showing that adolescents’ make riskier decisions under high-affect conditions (e.g. Rao et al., 2010), showing a relation between real-world stress and risky decision making (e.g. Galván & McGlennan, 2012), and demonstrating positive associations between activation of brain ‘reward’ centers and youthful externalizing symptoms (e.g. Galván, Hare, Henning, Glover, & Casey, 2007).
However, what was missing from this literature was an examination of whether externalizing symptomatology manifests as disrupted emotion dynamics across the course of day-to-day life. Thus, a major contribution of the second and third studies was the finding that adolescents’ externalizing symptoms accounted for individual differences in reactivity and inertia, as investigated ‘in situ’ using ESM. This is important because prior research—both laboratory-based work and studies based on trait measures of emotion regulation—could not speak to the daily vicissitudes of youths’ emotions, and moreover, how these dynamics relate to externalizing symptomology.

More specifically, previous studies had investigated temporal changes in emotion as a function of exposure to a stimulus (i.e. emotion reactivity; e.g. Plattner et al., 2007) within the confines of the laboratory, hence limiting the ecological validity of findings. Hence, there was a need to ‘step outside the lab’ to test youths’ emotion dynamics across situations encountered in daily life, which occur naturally, and place high information processing demands on the emotion-control system. Study 2 addressed this gap by capturing adolescents’ emotion reactivity ‘in-vivo’ across daily life and specifically in response to stressful events. Here, findings support the notion that youthful externalizing is tied to exaggerated emotion reactivity when youth come up against situations that require fast and efficient processing and integration of motivational and affective inputs (i.e. daily stressors).

Study 3 provided additional evidence that adolescents’ externalizing symptoms are associated with disrupted daily emotion dynamics, here in regard to strong inertia for worry and weak inertia for happiness and excitement. These findings are particularly exciting because relatively few studies to date have examined inertia, and no study has examined the link between emotional inertia and externalizing.
Rather, studies that had considered links between psychopathology and emotional inertia had focused on internalizing symptoms (e.g. depression; Koval, Kuppens, Allen, & Sheeber, 2012; van Roekel et al., 2017; 2016; fear of negative evaluation; Koval & Kuppens, 2012; neuroticism, Suls, Green, & Hillis, 1998).

That said, previous studies provided indirect evidence of strong inertia for negative emotions among youths with externalizing symptomatology (e.g. difficulty returning to emotional average; Silk et al., 2003; difficulty matching physiological response to context; Woltering, Lishak, Elliot, Ferraro, & Granic, 2015). Likewise, poor psychological functioning more broadly had been associated with greater instability in positive emotions (Gruber, Kogan, Quoidbach, & Mauss, 2013; Tugade, Fredrickson, & Barret, 2005). Thus, findings from Study 3 were consistent with the broader idea that poor wellbeing may be characterized by a) strong carry-forward of negative emotions and b) weak-carry forward of positive emotions.

Theoretically, weak emotional flexibility should be associated with psychopathology (e.g. Kashdan & Rottenberg, 2010). Specifically, strong inertia has been considered a form of ‘reactive inflexibility’, manifested when emotional systems protractedly respond to changes in environmental demands (Hollenstein, 2015; Koval & Kuppens, 2012). ‘Real-life’ materialization of this inflexibility was evidenced in Study 3 by the carry-forward of worry, tied to higher externalizing symptoms. For these youths, feelings of worry may originate in response to an environmental threat (either real or perceived) but persist when this threat has dissipated (e.g. Chen, Langer, Raphaelson, & Matthews, 2004).

Further too, there is a proposed adaptive function of stable positive emotions. That is, relatively high stability in positive emotion has been considered adaptive for psychological functioning (Fredrickson, 2004; Gruber et al., 2013), perhaps because
individuals choose to savor rather than act to alter positive emotional states (Larsen, 2000). Maintaining high levels of positive affect may also promote psychological functioning, at least in adult samples. For instance, among adults, being able to remain in positive emotional states despite a stressful context is associated with resilience, physiological recovery, and self-control (Daly, Baumeister, Delaney, & MacLachlan, 2014; Tugade et al., 2005). Several studies with youth point more indirectly towards the adaptive nature of sustaining positive emotions (e.g. connection to the community; Froh, Bono, & Emmons, 2010; effective emotion regulation; Yap, Allen, & Ladoucer, 2008). In this vein, emotional inflexibility in terms of positive affect, might better be viewed as the inability to carry-forward pleasurable emotional states, particularly under adverse conditions. In study 3, weaker inertia for positive emotions was found in relation to externalizing symptoms—more symptomatic youth demonstrated weaker (though still positive) carry-forward of happiness and excitement. Thus, Study 3 highlights a nuanced relation between emotional inertia and externalizing symptomatology, showing that individual differences in the strength of inertia depends on the valance of the specific emotion under consideration.

**Theoretical Implications and Significance**

These studies adapted an emotion dynamics framework to better conceptualize youths’ daily emotional functioning. This approach was taken in a bid to overcome two identified limitations of prior research into adolescent emotional functioning, which has been dominated by trait-level investigations of emotion regulation. That is, prior research has relied heavily on one-point-in-time measures of emotion regulation, and as a result, conveyed understandings of how youth modulated emotions, but could only indirectly infer whether emotion change had
occurred. Second, prior emotion research had not yet sought to identify the specific and nuanced aspects of a youths’ emotional experience that change, or remain stable, across time and context.

Speaking to the first limitation, prior work often inferred change from one-point-in-time measures. Though this research helped elucidate the strategies that adolescents use to modulate their emotions, it could not directly detect whether, and under what naturally occurring conditions, changes in youths’ emotions were occurring. By utilizing ESM to capture repeated assessments of adolescents’ emotions, a given adolescent’s propensity toward emotional change/stability could be understood in terms of proximal contextual factors (i.e. daily stressors, social context) and individual differences (i.e. externalizing symptomatology).

Such identification of individual differences in intra-individual variability in emotions is of important because contemporary approaches to emotion seek to examine how affect unfolds as a dynamic and context-dependent experience (e.g. Koval et al., 2010; Hollenstein, Lichtwarck-Aschoff, & Potworowski 2013; Kuppens & Verudyn, 2017; Russell & Odgers, 2016). Importantly too, if processes that occur within-person are assumed to occur equally across individuals, or vice versa, incorrect estimates of individual differences can result (Hamaker, 2012). In the context of the empirical studies presented here, this would be analogous to assuming that all disadvantaged adolescents report similar relations between daily stressors and emotion.

That is, findings from Study 1 implicate the role of social context in informing emotional responses to stress. Study 2 showed that adolescents’ levels of externalizing symptoms accounted for significant between-person differences in emotion reactivity. Likewise, findings from Study 3 suggest individual differences in
emotional inertia based on levels of externalizing. Thus, by capturing repeated assessments of adolescents’ emotions and by including analysis of within-and between-person variability in these emotions, the three studies here overcame the first identified limitation of prior emotion research.

A second limitation of many emotion regulation frameworks is that they fail to identify which specific aspects of a youths’ emotional experience change, or remain stable, across time and context. Here, by drilling into youths’ reports of “in-the-moment” emotions, each empirical study allowed for fine-grained analyses needed to characterize specific indices of youths’ emotion dynamics. For instance, comparing findings across Study 1 and 2 helps to disentangle emotional responding (i.e. change in a given youth’s emotion from their average level), from emotional reactivity (i.e. temporal changes in a youth’s emotion with the advent of a stressor). Additionally, Study 3 included a novel index of temporal dependency in emotion (i.e. emotional inertia) to help better understand adolescents’ daily emotional functioning. Ideally future research will build upon findings from Study 3, by assessing temporal dependency alongside indices of emotional variability in order to provide a truly comprehensive picture of youths’ daily emotion dynamics (Trull et al., 2015).

Contemporary models of emotion further recognize the need to capture individual differences in discrete varieties of emotion dynamics, particularly individual difference in emotional dysregulation based on psychopathology (Koval et al., 2013; Chow et al., 2005; Hollenstein et al., 2013; Trull, Lane, Koval, & Ebner-Priemer 2015). For instance, in their DynAffect model, Kuppens and colleagues (2010) propose that individual susceptibility to psychopathology is driven by two dynamic forces. These are the extent to which external and internal events push an
individual away from their affective set point, and the extent to which their regulatory capacity can pull them back toward this set point. Findings from Study 2 and Study 3 nicely support these ideas. Study 2 shows that adolescents with elevated externalizing symptoms show greater emotion reactivity to daily stress, indicating that this subset of adolescents experience greater “push” away from their affective set point, after an external event (i.e. daily stressor). Likewise, Study 3 finds that this subset of youth experience stronger inertia for worry, indicating that these youths have difficulties in “pulling” back towards their affective set point.

These notions of reactive flexibility (or inflexibility) are also consistent with ideas proposed in the Flex3 model of Socio-emotional Flexibility (Hollenstein, 2015; Hollenstein et al., 2013). That is, once an externalizing youth deviates from his or her emotional set point, they tend to remain in this state for longer, relative to low externalizing youth whom tend to have lower emotional inertia. Relatedly, for the Flex 3 model, the ability to shift between emotional states in-line with changes in environmental demands sits at the cornerstone of healthy psychological functioning. Thus, within Study 3, the strong emotion reactivity and inertia (for negative emotion) found among youth higher in externalizing symptoms, supports the idea that psychopathology is characterized by low emotional flexibility, both in terms of large peaks and valleys in emotions, and in terms of difficulty ‘getting out’ of emotional valleys (Hollenstein, 2015).

That said, these same precepts do not necessarily hold for positive emotions. That is, Study 3 found that maladaptive psychological functioning (i.e. externalizing symptomatology) was associated with relatively weak carry-forward of happiness and excitement, highlighting a potentially different role of emotional inertia for positive emotions in informing psychopathology. Indeed, emotion dynamics research
is only beginning to unpack the specific contribution that change or stability in positive emotions play in relation to discrete forms of adolescent psychopathology (e.g. Gilbert, 2012; Gruber et al, 2013; Morgan et al., 2017; van Rokel et al., 2017).

**Clinical Implications**

Findings from this thesis also provide valuable information about the emotional experiences of disadvantaged youth, which ideally might be translated to inform programs aimed at improved mental health and social emotional functioning. Consistent with understanding of the SES-health gradient (e.g. Chen & Miller, 2012), findings here indicate that disadvantaged youths’ reactivity to stress across day to day life may be an important target for intervention efforts, particularly for youth displaying externalizing symptomology. Indeed, programs aimed at reducing the risk associated with socioeconomic disadvantage tend to conceptualize maladaptive responses to stress as their core targets (Gershoff, Aber, & Raver, 2005). The current findings suggest that teaching youth strategies to respond adaptively to daily stress should be included in these targets.

Here, existing therapeutic approaches for helping youth to temper their emotions might be adapted to address the context of day-to-day stress. For youth already at risk for developing externalizing disorders (i.e. those displaying elevated externalizing symptoms), programs that broadly target social-emotional skills, including problem-solving and impulse control, may be most effective in helping them better cope with dips and peaks in emotion from daily stress, the carry-forward of worry, and the lack of forward momentum for positive emotions. Illustratively, the Life Skills Training program— which aims to prevent substance use and violent behavior in youth- includes an emotion management component that teaches youth to notice internal and external cues as means to identify emotional
states, alongside stress management techniques (Botvin, Griffith, & Nichols, 2006). These skills could be taught with the purpose of helping youth ‘tune into’ environmental demands (or rewards) to enable flexible emotional responding to daily challenges.

Additionally, findings from this thesis highlight that disadvantaged youth, particularly those with externalizing symptoms, struggle to apply these skills ‘in action’, or in-situ, when needed most (Modecki, Guerra, & Zimmer-Gembeck, 2017). Programs that promote mastery of such in-the-moment responses may thus be beneficial. For example, the Coping Power Program – which aims to improve youthful self-regulation - helps youth to identify their emotional states and teaches skills to help reduce arousal in the moment (e.g. relaxation, problem solving; Lochman & Wells, 2002). Participants are also given the opportunity to practice these skills with the benefit of instructor feedback. Thus, this program and those like it might be augmented to promote youths’ understanding of when and how emotion regulation strategies need to be deployed across day-to-day life (for example, in response to daily stressors).

That said, the bulk of these skills-based programs are based within a cognitive-behavioral approach (Modecki et al., 2017). However, it is worth noting that youth who display externalizing symptomatology already carry high information processing loads, and that having to integrate the social, emotional and cognitive demands of daily stressors can further burden their information processing load (Luciana, 2013). Hence, as a pre-cursor to these youths’ implementation of higher-order cognitive-behavioral skills, youth who demonstrate externalizing symptomatology may require additional techniques that serve to lower the cognitive burden of daily situations. For instance, techniques such as mindful awareness of
bodily sensations might help act as a stop-gap between youths’ recognition of their emotion and their behavioral responses (Chambers, Gullone, & Allen, 2009). To the extent that mindful awareness can assist at-risk youth in identifying their emotional markers (e.g. rise in skin temperature and heart beat being a marker for anger), incorporation of bodily awareness training may benefit youth in forming adaptive emotional responses in daily life.

Importantly, too, existing skills-based programs aimed at reducing externalizing behaviours might also benefit from taking skill development ‘outside the classroom’ to situations where youth can practice them experientially (Modecki et al., 2017). As one example, leveraging adolescents’ digital literacy, interventions delivered through mobile phones would be a promising method for assisting youth with skills “where they are,” to support their emotion regulation efforts in situ. Indeed, a growing body of research supports the use of mobile phone interventions for increasing awareness of emotional states and mood monitoring (Reid et al., 2011; Klasnja & Pratt, 2012; Matthews, Doherty, Sharry, & Fitzpatrick, 2008). Because socioeconomically disadvantaged youth tend to be a particularly dependent on their mobile phone for access to the internet (Madden et al., 2013), using mobile online interventions to reach out to youth has the additional advantage of extending programming to populations whom traditionally face barriers to accessing healthcare (Bonveski et al., 2014; Klasnja & Pratt, 2012).

It is also worth noting that ideally, focusing on disrupted emotion dynamics should not be the sole target of interventions aimed to prevent or reduce youth externalizing behaviours. Indeed, previous work shows that interventions to reduce unhealthy behaviours in adolescents work best when individual emotion regulation skills are taught concurrently with more distal factors, including positive
relationships with parents and schools (e.g. Espalage, van Ryzin, & Holt, 2018; Pisani et al., 2012; Merin, Hong, & Espalage, 2015). As one example of how youths’ broader contexts might be leveraged, within this thesis peer context were shown to be especially helpful for youth after a stressful event. Indeed, because social networks are a salient source of emotional support, and a positive context for building identify and self-worth, there is growing recognition of the possibilities for leveraging youths’ peer networks in prevention and intervention efforts (Cohn et al., 2004; Fredrickson, 2004). Given that adolescents spend a great deal of their time with peers throughout the day- in the classroom, school yard, and ‘hanging out’-the peer context is a readily available milieu in which youth might successfully receive support for coping with stressors. Connecting with peers during times of stress may play a similar protective function, in boosting youths’ psychological wellbeing, as that found in studies of natural mentors (e.g. Hurd & Zimmerman, 2010). Such informal and naturalistic interventions may also be particularly useful for youth, given they tend to be low cost, and tend to be viewed as a less intimidating alternative to formal psychosocial intervention (US Public Health Service, 2002).

**Limitations and Future Research**

The findings in this thesis need to be considered in terms of the socioeconomic and ethnic characteristics of the adolescents examined. First, although these empirical studies provide useful translational information for at-risk youth, findings do not necessarily generalize to youth in more advantaged settings (i.e. higher SES settings). Indeed, previous research supports differences across levels of socioeconomic advantage in youths’ development of emotion regulation skills, goals for emotion regulation, preference for emotion regulation strategies, and coherence of emotional and behavioral responses (Thompson & Calkins, 1996;
Raver, 2004). Thus, it is possible that the dynamics studied here – emotional responding, reactivity, and inertia – may show different (perhaps more exacerbated) relations with psychopathology across levels of SES. Indeed, the current findings that daily stressors and externalizing symptomatology are associated with significant changes in disadvantaged adolescents’ emotion dynamics parallel other work based on youth living in more advantaged settings (e.g. Ham & Larson, 1991; Silk et al., 2003). Hence, it may be the case that adolescents generally experience disrupted emotion dynamics in the context of daily stressors and externalizing symptomatology, but that these disruptions are exacerbated among youth characterized by socioeconomic disadvantage.

Second, the current findings may also be limited in their generalizability to ethnic-minority youth. The majority of participants in these studies reported their ethnicity as Caucasian (75.7% in Study 1 and 73.8% for Study 2 and 3). Hence, although rates of ethnic diversity here are actually higher compared to similar studies in the field (e.g. Evans et al., 2009; Larson & Richards, 1991), they still under-represent youth from diverse cultural backgrounds. This concern is particularly salient within the arena of emotion research, because a large degree of cultural variation exists in what is often considered appropriate in terms of emotional expression and regulation (Mesquita & Fridja, 1992; Saarni, 1998). Further, because emotion socialization practices vary cross-culturally, the processes by which adolescents come to develop strategies which inform their daily emotion dynamics, may also diverge from those identified in research with majority Caucasian samples (Cole & Tamang, 1998; Friedlmeier, Corapci, & Cole, 2011).

Beyond characteristics of the adolescents’ examined here, because of their focus on the day-to-day patterning of youths’ emotional responding, reactivity and
inertia, the current studies did not seek to identify actual processes associated with each of these dynamics. For instance, findings from Study 1 suggest a palliative effect of peers on post-stressor emotions, but the question remains as to what it about the peer context is that underscores this relation. Based on prior evidence, peers might dampen adolescents’ emotional responses to daily stressors via the provision of social support (e.g. Kingery et al., 2011). Alternatively, peers may assist youth in their coping by offering distraction (Skinner & Zimmer-Gembeck, 2007). Future studies examining whether disadvantaged adolescents deliberately seek out peers in times of stress, their motives for doing so (e.g. support, distraction), or whether they avoid contexts (e.g. family members), will help elucidate the processes underlying Study 1 findings.

Likewise, Study 2 and Study 3 also raise additional questions regarding underlying processes that drive individual differences in emotion dynamics, here in relation to reactivity and emotional inertia. Illustratively, future studies would benefit from testing the mechanisms that underscore the relation between adolescents’ externalizing symptoms and emotional inertia, identified in Study 3. Emotional inertia is hypothesized to be driven by a decoupling of emotion from changing environmental demands (Koval & Kuppens, 2012). Although Study 3 demonstrated that externalizing symptomatology was characterized by strong inertia for worry, it did not examine whether this relation was due to decoupling of worry from context. Here, lab-based designs where emotional inertia is measured before and after a change in context (e.g. via the introduction of an affective stimulus) might be one way to test for such decoupling (Koval & Kuppens, 2012; Kuppens, Allen, & Sheeber, 2010).
Fourth, future studies would benefit from combining the ecological validity of the ESM used here, with lab-based experimental design to help triangulate results. For instance, carefully controlled lab-based studies that manipulate the executive load of tasks could be used in concert with in-vivo examinations of adolescents’ reactivity to daily events. As one example of the beneficial integration of lab-based and experience sampling methods, Galván and McGlennen (2012) used ESM to monitor adolescents’ daily stress, and had participants complete a lab-based decision-making task on high and low stress days. Consistent with findings here, adolescents made riskier decisions on high versus low stress days. Additionally, in this thesis, it was theorized that disadvantaged youth with elevated externalizing symptoms would show exaggerated emotion reactivity, due to this context conferring risk for already burdened physiological stress response systems (i.e. allostatic overload; Chen & Miller, 2012). Future studies could leverage biological sampling, alongside self-report, to collect information on biomarkers of allostatic load (e.g. Almeida, McGonagle, & King, 2009; Matthews, Salomon, Kenyon & Zhou; 2005).

Fifth, an additional consideration for future research, raised by each of the studies presented here, is the need to incorporate youths’ goals for emotion regulation when deciding whether disrupted emotion dynamics signal maladaptive functioning. Emotion goals refer to desired changes in emotional states from regulatory actions (Tamir, 2006). An assumption underscoring each study here was that adolescents carried hedonic emotion goals, that is, the desire to move toward more pleasurable emotional states. Yet, there are several other goals for emotion regulation including instrumental, social, and eudemonic goals. By assessing youths’ goals in relation to placing parameters on their emotions, scholars can better assess
whether deviations in the specific dynamics tested here (i.e. emotional responding, reactivity, and inertia) are well and truly maladaptive.

Sixth and finally, although the three empirical studies in this thesis focused on the subjective component of emotion as measured by adolescents’ self-report, simultaneously investigating physiological and behavioral components of emotion dynamics would be especially informative (e.g. Hollenstein et al., 2004; Koval et al., 2015). Indeed, emotions are multi-faceted, and their behavioral, physiological, and subjective components do not necessarily map onto each other (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Thus, future studies would benefit from including physiological (e.g. respiratory sinus arrhythmia; Cui, Morris, Harrist, Larzelere, & Criss, 2015) and/or behavioral measures (e.g. observer-coded ratings of behavioral rigidity; Hollenstein et al., 2004), to provide a fuller picture of daily emotional functioning among disadvantaged youth.

**Looking Forward**

The studies within this thesis provide a compelling case for continued examinations of disadvantaged youths daily emotional functioning through the lens of an emotion dynamics framework. By adopting this framework, each study uniquely demonstrated how contextual- and individual-level factors inform youth’s daily emotional landscapes. In doing so, findings provide promising directions for future research and useful translational information which may help serve at-risk youth.

In reality, the examinations presented here only begin to ‘scratch the surface’ in terms of mapping youths’ daily emotional landscapes. Research that further seeks to disentangle the distinct varieties of emotion dynamics that become disrupted among disadvantaged youth, and how these relates to specific psychopathologies,
will help fill large gaps in an important area of inquiry. Though some scholars have argued that the distinct dynamics examined here (i.e. responding, reactivity, and inertia) represent “cornerstone” parameters for understanding emotion dynamics (e.g. Davidson, 2000; Hollenstein, 2015; Trull et al., 2015), there are a multitude of other parameters (e.g. time until peak affect, emotional recovery), that youth place around their emotional experiences. These, too, may well inform, maintain, and distinguish specific levels of functioning (Kuppens & Verudyn; 2015; Kuppens, Stouten, & Mesquita, 2009; Thompson, 1994). Indeed, recent work suggests that adolescents in particular may struggle to differentiate between discrete negative emotions, and that such difficulty is linked with higher intensity of negative emotions and lower wellbeing (Erbas, Ceulemans, Pe, Koval, & Kuppens, 2014; Lennarz, Lichtwark-Aschoff, Timmerman, & Granic, 2018; Nook, Sasse, Lambert, McLaughlin, & Somerville, 2018). This inability to differentiate between negative emotional states in ‘real-time’ – sometimes referred to as emotional granularity – might explain why adolescents with elevated externalizing symptoms in the current studies experienced greater intensity over a range of negative emotions. Furthermore, although a necessary first step in understanding links between disadvantaged youths’ psychopathology and emotional responsivity, reactivity and inertia was to investigate these dynamics separately, a helpful next step in research will be to investigate the extent to which these indices of emotion dynamics co-vary, or contribute uniquely to, youths’ externalizing symptomatology. Thus, future work that continues to explore these parameters and how discrete parameters may interact to inform psychopathology will help improve our understanding of adolescents’ nuances in daily emotional functioning.
Moreover, resolving some conceptual tension around definitions and operationalizations of specific indices of emotion dynamics is also needed to better uncover youths’ distinct emotional landscapes. Some of this tension was touched on in the Discussion section of the separate studies and will require some effort in order to resolve. Specifically, there remains a conceptual tension between the constructs of emotion reactivity and emotional inertia or recovery, particularly in relation to youths’ externalizing symptomatology. Illustratively, findings from Study 2 suggest that youthful externalizing symptomatology is characterized by strong peaks in negative emotion (and dips in positive emotion), in responses to external stimuli. Such emotion reactivity indicates frequent movement of these youth from their ‘emotional set-point’ (Koval et al., 2010). However, findings from Study 3 suggest these youths also show greater stability, and thus less movement, in negative emotion (i.e. worry). How can this be?

How is it that youth with externalizing symptoms can be characterized as both reactive and inert in negative emotions? One explanation could be that, the specific dynamic that becomes disrupted among youth with elevated externalizing symptomatology, depends upon the discrete emotion under examination. That is, whereas externalizing was related to greater reactivity in sadness, anger, jealousy and loneliness, it was related to greater inertia for worry. That said, in terms of positive emotions, youth with higher externalizing symptoms were more reactive and less inert in positive emotion (excitement). Clearly, there is a need for future work to further delineate the vicissitudes of positive versus negative emotions and how these relate to youth psychopathology.
Conclusion

The primary aim of this thesis was to identify distinct aspects of youths’ emotional experience with which they struggle on a day-to-day basis, with a focus on youth living in the context of socio-economic disadvantage. By utilizing ESM to track disadvantaged youths’ emotional landscapes, the three studies presented here provide novel insights into the daily emotional functioning of these youths. They also highlight that adopting an emotion dynamics perspective may be a fruitful way to better understanding adolescents’ daily emotional functioning.

In linking emotion responses to daily stress with youths’ social context, this thesis identified a proximal context (i.e. the peer context) that could be leveraged to lessen the emotional impact of such stressors (Study 1). Further, by demonstrating the association between disadvantaged youths’ externalizing symptomatology and emotion reactivity and emotional inertia, specific components of emotional responding that might be targeted in future prevention and intervention efforts were identified (Study 2 and 3). All told, these findings build upon and echo prior scholarly positions that teaching youth to overcome minor disruptions to daily life, via promoting robust emotion regulation skills, is central to building youthful resilience and adaptive functioning (e.g. Bai & Reppetti, 2017; Modecki et al., 2017; Luther & Eisenberg, 2017).

These findings provide a nuanced picture of the daily emotional lives of disadvantaged adolescents, capturing their emotional responding, reactivity and inertia in life "as it is lived." Continued examination of these and other emotion dynamics that are potentially disrupting for youth, especially those struggling with symptoms of psychopathology, is sorely needed, as scholars seek to gain a more accurate picture of youths’ daily emotional landscapes.
References


http://www.jstor.org/stable/3696638


Dodge, K.A. (2006). Translational science in action: hostile attributional style and
the development of aggressive behavior problems. *Developmental Psychopathology, 18*(3), 791–814. doi:

http://dx.doi.org/10.1017/S0954579406060391


Eisenberg, N., Spinrad, T.L., & Eggum, N.D. (2010). Emotion-related self-

https://doi.org/10.1146/annurev.clinpsy.121208.131208


https://doi.org/10.1111/j.1467-8721.2008.00571.x


doi:10.1016/j.jadohealth.2006.10.006


Garnefski, N., Legerstee, J., Kraaij, V., van den Kommer, T., & Teerds, J. (2002). Cognitive coping strategies and symptoms of depression and anxiety: A


Gruber, J., Kogan, A., Quoidbach, J., & Mauss, I.B. (2013). Happiness is best kept


http://www.springer.com/medicine/journal/10865


https://doi.org/10.1016/j.cpr.2010.03.001

depression: The role of discontinuities in life course and social support. 

*Journal of Affective Disorders, 64*(2-3), 155-166. 

https://doi.org/10.1016/S0165-0327(00)00233-0


adolescence: Differences in sex, age, and problem status. Social Development, 16(2), 326-342. doi: 10.1111/j.1467-9507.2007.00387.x


http://dx.doi.org/10.1080/02699931.2012.667392


http://www.jstor.org/stable/351787


https://doi.org/10.1017/S0954579410000222


Orobio de Castro, B., Merk, W., Koops, W., Veerman, J.W., & Bosch, J.D. (2005). Emotions in social information processing and their relations with reactive and proactive aggression in referred aggressive boys. *Journal of Clinical*


Pisani, A.R., Wyman, P.A., Petrova, M., Schmeelk-Cone, K., Goldston, D.B., Xia,


Santiago, C., Wadsworth, M.E., & Stump, J.B. (2011). Socioeconomic status,


215


doi:10.1037/a0012532


http://dx.doi.org/10.1037/a0012532


Uink, B., Modecki, K.L., & Barber, B.L. (2017). Disadvantaged youth report less
negative emotion to minor stressors when with peers: An experience sampling study. *International Journal of Behavioral Development, 41*(1), 41-51. doi: http://dx.doi.org/10.1177/0165025415626516


Wadsworth, M.E., & Achenbach, T.M. (2005). Explaining the link between low


http://dx.doi.org/10.1037/a0028015


APPENDIX A

Experience Sampling Survey Questions

Q1) Who is with you? (Pick all that are correct)
   - Nobody
   - A friend
   - A number of friends
   - Family
   - Boyfriend/Girlfriend
   - A Teacher
   - With friends who are online
   - Other______________________

Q2) How are you feeling right now? (Pick a number for each feeling).

<table>
<thead>
<tr>
<th>Feeling</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Bored</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Angry</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Excited</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sad</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Jealous</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lonely</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Worried</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Q3) Since the last message, did something good happen to you?
   - Yes
   - No

Q4) What was the good thing that happened to you?______________________

Q5) How good was it?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sort of Good</td>
<td>Very Good</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q6) Since the last message, did something bad happen to you?

- Yes
- No

Q7) What was the bad thing that happened to you? __________________

Q8) How bad was it?

1 2 3 4 5

Sort of bad  Very Bad
APPENDIX B

Pre- and post-ESM survey items used in this thesis

ID Number ________________________________

Date of Birth (dd/mm/yy) __________________ / __________ / __________

What is your gender? ________________________________

Externalizing:

The following questions ask you about behaviours that may be considered risky, if you are uncomfortable answering any of the questions feel free to leave them blank. (Circle one answer)

**About how often in the last 6 months have you drunk alcohol?**

<table>
<thead>
<tr>
<th>Option</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>7-10 times</th>
<th>11-20 times</th>
<th>21-30 times</th>
<th>31 or more times</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
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<tr>
<td>once</td>
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<td>never</td>
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</tbody>
</table>

**About how often in the last 6 months have you had more than 5 standard alcoholic drinks on one occasion? (1 standard drink = 1 middy of full-strength beer, or a 100ml glass of wine, or a nip of spirits)**

<table>
<thead>
<tr>
<th>Option</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>7-10 times</th>
<th>11-20 times</th>
<th>21-30 times</th>
<th>31 or more times</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
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<td>once</td>
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<td>never</td>
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<td></td>
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</tr>
</tbody>
</table>

**About how often in the last 6 months have you been drunk?**

<table>
<thead>
<tr>
<th>Option</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>7-10 times</th>
<th>11-20 times</th>
<th>21-30 times</th>
<th>31 or more times</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
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<td></td>
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<tr>
<td>once</td>
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<td>never</td>
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</tr>
</tbody>
</table>

**About how often in the last 6 months have you had alcohol combined with an energy drink (such as 'Red Bull') or a pre-mixed alcohol-energy drink (such as 'Pulse')?**

<table>
<thead>
<tr>
<th>Option</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>7-10 times</th>
<th>11-20 times</th>
<th>21-30 times</th>
<th>31 or more times</th>
</tr>
</thead>
<tbody>
<tr>
<td>never</td>
<td></td>
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<tr>
<td>once</td>
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</tbody>
</table>

**About how often in the last 6 months have you used drugs?**

<table>
<thead>
<tr>
<th>Option</th>
<th>2-3 times</th>
<th>4-6 times</th>
<th>7-10 times</th>
<th>11-20 times</th>
<th>21-30 times</th>
<th>31 or more times</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
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<tr>
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</tr>
<tr>
<td>Question</td>
<td>None</td>
<td>Once</td>
<td>2-3 times</td>
<td>4-6 times</td>
<td>7-10 times</td>
<td>11-20 times</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>About how often in the last 6 months have you skipped school without parent permission?</td>
<td></td>
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</tr>
<tr>
<td>About how often in the last 6 months have you used put-downs or told lies about your peers using the Internet (email, instant messaging, text messaging, or websites)?</td>
<td></td>
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</tr>
<tr>
<td>About how often in the last 6 months have you done something you knew was dangerous just for the thrill of it?</td>
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</tr>
<tr>
<td>About how often in the last 6 months have you ridden with a friend who was drunk?</td>
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<tr>
<td>About how often in the last 6 months have you had contact with police for something you did or something they thought you did?</td>
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</tr>
<tr>
<td>About how often in the last 6 months have you done some pretty risky things because you thought it was a kick?</td>
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</tr>
<tr>
<td>About how often in the last 6 months have you gotten in a physical fight with another person?</td>
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</tr>
<tr>
<td>About how often in the last 6 months have you cheated on an exam, or copied someone else’s homework?</td>
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<td></td>
</tr>
<tr>
<td>About how often in the last 6 months have you made fun of or told lies about your peers using the Internet (email, instant messaging, text messaging, or websites)?</td>
<td></td>
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</tr>
<tr>
<td>About how often in the last 6 months have you not used your seatbelt in a car?</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Social Anxiety:

How often are the following statements true for you?

I'm afraid others will not like me.
Not at all 1 2 3 4 All the time 5

I worry about what others think of me.
Not at all 1 2 3 4 All the time 5

I worry about what others say about me.
Not at all 1 2 3 4 All the time 5

I worry that others don't like me.
Not at all 1 2 3 4 All the time 5
I worry about being teased.

Not at all 1 2 3 All the time 4 5

I feel that others are making fun of me.

Not at all 1 2 3 All the time 4 5

I feel that peers talk about me behind my back.

Not at all 1 2 3 All the time 4 5

If I get into an argument, I worry that the other person will not like me.

Not at all 1 2 3 All the time 4 5

I get nervous when I talk to peers I don’t know very well.

Not at all 1 2 3 All the time 4 5

I feel shy around people I don’t know.

Not at all 1 2 3 All the time 4 5

I get nervous when I meet new people.

Not at all 1 2 3 All the time 4 5

I feel nervous when I’m around certain people.

Not at all 1 2 3 All the time 4 5

I worry about doing something new in front of others.

Not at all 1 2 3 All the time 4 5
I only talk to people I know really well.
Not at all 2 3 4 All the time
1 2 3 4 5

It’s hard for me to ask others to do things with me.
Not at all 2 3 4 All the time
1 2 3 4 5

I’m afraid to invite others to do things with me because they might say no.
Not at all 2 3 4 All the time
1 2 3 4 5

I’m quiet when I’m with a group of people.
Not at all 2 3 4 All the time
1 2 3 4 5

I feel shy even with peers I know very well.
Not at all 2 3 4 All the time
1 2 3 4 5

*RADS-2 not included due to copyright.
APPENDIX C

Ethics Permit

Friday, 06 September 2013

Dr Kathryn Modecki
School of Psychology and Exercise Science
Murdoch University

Dear Kathryn,

Project No. 2013/141
Project Title How do you feel? Adolescent Behaviour, Emotion, and Technology Use Over Time

AMENDMENT: Inclusion of additional measure regarding peer and family support
Inclusion of additional measure regarding major and chronic stressors
Amend the longitudinal parent information and consent letter
Inclusion of additional measure of cyber-aggression

Your application for an amendment to the above project, received on 29 August 2013 was reviewed by the Murdoch University Research Ethics Office and was:

APPROVED

Approval is granted on the understanding that research will be conducted according the standards of the National Statement on Ethical Conduct in Human Research (2007), the Australian Code for the Responsible Conduct of Research (2007) and Murdoch University policies at all times. You must also abide by the Human Research Ethics Committee’s standard conditions of approval (see attached). All reporting forms are available on the Research Ethics web-site.

I wish you every success for your research.

Please quote your ethics permit number in all correspondence.

Kind Regards,

Dr. Erich von Dietze
Manager of Research Ethics

cc: Prof Bonnie Barber, Corey Neira, Karen Rowe and Bep Uink
APPENDIX D

Copy of Publications