

**Developmentally Digital: Adolescent Coping in the Digital Age**

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### **Abstract**

Adolescence is a time of increased developmental stress and associated risk for psychopathology. At the same time, today's adolescent is almost constantly digitally connected, and the online space has been largely overlooked by researchers as a context for youthful coping. As a result, the current thesis includes three empirical studies to address critical gaps in our measurement of adolescent coping (online or off), how adolescents look to the digital arena as they navigate day-to-day life, and the short-term influence of online coping on adolescents' emotional well-being.

First, Study 1 sought to characterize how scholars are using technology to measure adolescent coping via ambulatory assessment (AA), and to delineate associated advantages and challenges of varying approaches. Previous published research has remained challenged by how best to conceptualize, measure, and analyse adolescents' coping in situ. Thus, drawing from 60 adolescent AA coping studies, Study 1 called for scholars to revisit coping theory in their study designs to ensure they tap their focal aspect of the adolescent coping process. Study 1 also provided key lessons and recommendations for scholars seeking to deploy AA methods in their pursuit of measuring coping.

Second, Study 2 sought to establish a foundation for adolescent online coping. This study brought together data from adolescent focus groups (Study 1;  $n = 16$ ), experience sampling (Study 2;  $n = 156$ ), and young adult surveys (Supplementary data;  $n = 213$ ). Study findings validated adolescents' online coping as a strategy that youth widely endorse in the face of daily stress. Specifically, in line with common coping facets, and drawing on the communications literature, three online coping strategies emerged: online emotional support seeking, information seeking, and self-distraction. Moreover, findings suggest negative linear effects for these online coping strategies;

when conceived as an individual difference construct, whereby more online coping was associated with worse emotional reactions to stress in daily life.

Third, Study 3 sought to explore the impact of adolescents' online coping using a more fine-grained approach. Specifically, by tying ambulatory assessments of online coping to momentary stress reports, this study allowed for the analyses of the full coping process—stress, coping, response—within an in-situ framework. Moreover, this study capitalized on momentary coping reports in a subset of youth ( $n = 115$ ; 1,241 timepoints) to assess both linear and non-linear associations with short-term emotional well-being. Findings indicated a negative linear impact of momentary online coping, such that more emotional support seeking, information seeking, and distraction online were associated with worse emotional responses. However, testing of non-linear associations indicated better fitting models across the board, and a robust pattern of results. Here, moderate levels of online coping had a clear positive impact on adolescents' emotional recovery from stress.

All told, thesis findings point to the important arena of technology to support adolescents' coping and associated well-being. Thesis studies contribute to the literature in several arenas, including a much-needed scoping review of the existing AA coping literature, and a robust validation of the online coping construct. Further and most importantly, studies make clear that online coping has an effect on adolescents' emotional well-being, and when used in moderation, may be beneficial to their emotional functioning.

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### **Statement of Originality**

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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Megan Duvenage

## Table of Contents

<b>Abstract .....</b>	<b>i</b>
<b>Acknowledgements .....</b>	<b>iii</b>
<b>Statement of Originality .....</b>	<b>v</b>
<b>Table of Contents .....</b>	<b>vi</b>
<b>List of Tables .....</b>	<b>x</b>
<b>List of Figures .....</b>	<b>xi</b>
<b>Acknowledgement of Papers included in this Thesis .....</b>	<b>xii</b>
<b>Conference Presentations Related to this Thesis .....</b>	<b>xv</b>
<b>Other Publications during Candidature .....</b>	<b>xv</b>
<b>Chapter 1: Thesis Overview .....</b>	<b>1</b>
Research Aim 1 .....	2
Research Aim 2 .....	2
Research Aim 3 .....	3
Introduction to Literature Review .....	5
<b>Chapter 2: Adolescent Psychopathology, Stress, and Coping .....</b>	<b>6</b>
Adolescent Psychopathology .....	7
The Importance of Daily Stress in Adolescence .....	9
Socio-Economically Disadvantaged Youth .....	11
Coping in Adolescence .....	12
Outcomes of Coping .....	15
The Process of Coping .....	16
Capturing the Coping Process: The Experience Sampling Method .....	18
Chapter Summary and Remaining Questions .....	20
<b>Chapter 3: Youths' Technology Use and Online Coping .....</b>	<b>22</b>
Introduction to Chapter 3 .....	22
The Technological Generation .....	22
Developmental Tasks and the Internet .....	24
Coping with Stress Online .....	25
Youths' Access to Technology in Disadvantaged Settings .....	28
The Relationship between Technology and Affective Well-being: It's Complicated! .....	29
Theoretical Frameworks for Conceptualising Adolescent Online Behaviour .....	31

What Media does to People: The Media Effects Approach .....	31
Media Effects Model. ....	31
Limitations of the Media Effects Approach .....	32
What People do with Media .....	34
Mood Management Theory. ....	34
Uses and Gratifications Theory. ....	35
Online Coping: Uses and Gratifications that are Motivated by Stress.....	36
Online Information Seeking (Content Gratification) .....	37
Online Self-Distracton (Process Gratification).....	38
Online Emotional Support (Social Gratification) .....	39
Chapter Summary and Remaining Gaps .....	40
References .....	43
<b>Chapter 4: How Do We Measure Adolescent Coping?.....</b>	<b>70</b>
<b>Chapter 5: Ambulatory Assessment of Adolescent Coping: It's a Complicated Process .....</b>	<b>72</b>
Abstract .....	73
Introduction .....	74
Ambulatory Assessment and Adolescents.....	76
Coping Theories and the Importance of Process .....	77
Traditional Trait-Based Study of Coping .....	78
AA Design Considerations .....	80
Time-Based Designs .....	80
Time-based designs: how often?.....	81
Event-Based Designs.....	82
Coping Measurement in Ambulatory Assessment.....	84
Trait, Daily, or Momentary Assessment of Coping .....	85
Trait Coping in Ambulatory Assessment. ....	85
Measuring Daily Coping. ....	86
Measuring Coping in Situ.....	87
The Combination of Trait, Daily or State Measurement. ....	88
The Process of Coping: The Trigger and the Outcome.....	90
What's the Problem? Measuring Stressors .....	90
Finding What Works: Measuring Outcomes of Coping in Ambulatory Assessment .....	92



Moving Toward a More Complete Picture of Coping .....	95
Compliance in AA Coping Research .....	95
Compliance When Stressed: Might It Matter? .....	96
Does Context Affect Compliance?.....	98
Further Compliance Challenges and Potential Solutions .....	99
Parting Thoughts and Recommendations.....	101
Recommendations .....	101
References .....	104
Supplementary Section.....	118
<b>Chapter 6: Describing Adolescent Online Coping.....</b>	<b>132</b>
<b>Chapter 7: Technology can sting when reality bites: Adolescents' frequent online coping is ineffective with momentary stress.....</b>	<b>134</b>
Abstract .....	135
1.0 Introduction.....	136
2.0 Study 1: Focus Groups .....	145
2.1 Method.....	145
2.2 Focus Group Results.....	146
2.3 Discussion .....	149
3.0 Study 2: Experience Sampling Method Study .....	149
3.1 Method.....	149
3.2 ESM Results.....	155
3.3 Discussion .....	167
4.0 General Discussion.....	167
References .....	178
Supplementary Section.....	189
<b>Chapter 8: Momentary Fluctuations in Adolescent Online Coping.....</b>	<b>198</b>
<b>Chapter 9: Adolescents' online coping: when less is more, but none is worse.....</b>	<b>200</b>
Abstract .....	201
Introduction .....	202
Methods .....	205
Results .....	210
Discussion.....	214
References .....	218
Supplementary Section.....	223

**Chapter 10: General Discussion ..... 231**

    Summary of Findings Addressing Aims ..... 231

        Research Aim 1..... 231

        Research Aim 2..... 232

        Research Aim 3..... 235

    Research Implications ..... 237

        Theoretical Implications ..... 237

        Clinical Implications ..... 239

        Practical Implications ..... 241

    Strengths, Limitations and Future Research..... 243

        Methodological Strengths..... 243

        Limitations and Future Research ..... 244

    Conclusion ..... 246

    References ..... 248

**Appendix A: Ethics Permit and Ammendment Approval..... 255**

## List of Tables

### Chapter 5 (Paper 1)

Supplementary Table 1. <i>Summary of Studies Included in Review</i> .....	118
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### Chapter 7 (Paper 2)

Table 1. <i>Focus Group Themes</i> .....	148
Table 2. <i>Descriptives and Correlations</i> .....	157
Table 3. <i>Adjusted Cross-Level Interactions of Online Coping X Negative Event Predicting Emotion</i> .....	164
Supplementary Table 1. <i>Correlations between online and offline coping and well- being in a separate, young adult sample</i> .....	190
Supplementary Table 2. <i>Adjusted multi-level models predicting emotion</i> .....	192

### Chapter 9 (Paper 3)

Table 1. <i>Multilevel models, testing coping contrast codes of momentary online coping predicting emotion change</i> .....	213
Supplementary Table 1. <i>Descriptives and Correlations</i> .....	224
Supplementary Table 2. <i>Multilevel models, adolescent experience sampling reports of momentary online coping predicting emotion change</i> .....	225
Supplementary Table 3. <i>Multilevel models, testing coping contrast codes of momentary online coping predicting emotion change</i> .....	228

List of Figures

Chapter 7 (Paper 2)

*Figure 1A.* High online emotional support seeking is associated with surges in loneliness after a stressor.....160

*Figure 2A.* High online self-distraction is associated with surges in worry after a stressor.....161

*Figure 2B.* High online self-distraction is associated with surges in jealousy after a stressor.....162

*Figure 3A.* High online information seeking is associated with surges in worry after a stressor.....163

*Supplementary Figure 1.* Study design.....191

Chapter 9 (Paper 3)

*Supplementary Figure 1.* Experience Sampling Design.....223

### **Acknowledgement of Papers included in this Thesis**

Section 9.1 of the Griffith University Code for the Responsible Conduct of Research (“Criteria for Authorship”), in accordance with Section 5 of the Australian Code for the Responsible Conduct of Research, states:

To be named as an author, a researcher must have made a substantial scholarly contribution to the creative or scholarly work that constitutes the research output and be able to take public responsibility for at least that part of the work they contributed. Attribution of authorship depends to some extent on the discipline and publisher policies, but in all cases, authorship must be based on substantial contributions in a combination of one or more of:

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- Analysis and interpretation of research data
- Drafting or making significant parts of the creative or scholarly work or critically revising it so as to contribute significantly to the final output.

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- Include in the list of authors only those who have accepted authorship
- Appoint one author to be the executive author to record authorship and manage correspondence about the work with the publisher and other interested parties.
- Acknowledge all those who have contributed to the research, facilities or materials but who do not qualify as authors, such as research assistants, technical staff, and advisors on cultural or community knowledge. Obtain written consent to name individuals.

Included in this thesis are Chapters 5, 7, and 9 which are co-authored with other researchers. At the beginning of each corresponding chapter, my contributions to each paper is listed. The referencing details for these papers (with all authors) are as follows:

**Chapter 5:** Duvenage, M., Uink, B. N., Zimmer-Gembeck, M. J., Barber, B. L., Donovan, C. L., & Modecki, K. L. (2019). Ambulatory assessment of adolescent coping: It's a complicated process. *Journal of Research on Adolescence*, 29(3), 578-594. doi: 10.1111/jora.12468

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(Signed) \_\_\_\_\_ (Date) \_\_\_\_\_

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## **Chapter 1: Thesis Overview**

The online space represents a novel opportunity for reaching youth where they are and helping them navigate day-to-day stressors. However, there are major gaps in our understanding of adolescent coping with daily stress and their use of technology as a resource to cope. First, the literature emphasizes the developmental significance of adolescent coping with stress in relation to psychopathology symptoms (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Skinner, Edge, Altman, & Sherwood, 2003). Further, this work highlights both the importance of understanding the effectiveness of adolescents' coping and the associated challenges with measuring coping with stress in everyday life (Grant, Compas, Stuhlmacher, Thurn, McMahon, & Halpert, 2003). All told, exploring this question calls for a more fine-grained approach to measuring adolescent coping with stress in-vivo (Tennen, Affleck, Armeli, & Carney, 2000). Second, adolescents are nearly always online, and a great deal of scholarly attention has been focused on links between youth technology use and well-being (Odgers, 2018; Steele, Hall, & Christofferson, 2019). However, this work within developmental psychology has been conducted relatively separate from communications and media studies scholarship (Arnett, Larson, & Offer, 1995; Subrahmanyam & Smahel, 2010). Specifically, the communications sphere has been more apt to focus on individual reasons for using media and what users stand to gain. As a result, adolescent developmental research has generally overlooked the underlying motivations behind youths' technology use and, relatedly, how technology use may benefit them (George & Odgers, 2015).

Thus, the overarching aim of the current thesis is to shed light on new opportunities for understanding adolescent well-being in the digital age, by characterizing the state of the adolescent coping field and conducting two empirical

works to begin to unpack these questions. To address these aims, the thesis includes two background chapters, Chapters 2 and 3, which provides a broader review of the research in regard to 1) adolescent coping and psychopathology and 2) adolescent technology use within developmental and clinical psychology and communications literature. The thesis further undertakes three research aims, addressed in Chapters 5, 7, and 9, and detailed below.

### **Research Aim 1**

*The first aim was to characterize how scholars are using technology to measure adolescent coping via ambulatory assessment (AA), and to delineate associated advantages and challenges of various approaches.*

As described in Chapter 2, best practice for assessing adolescent coping processes draw on in-situ methods, which tap stress, coping and emotion within-person. Thus, Study 1 (Chapter 5) provides a scoping of the AA adolescent coping literature. This work provides a thorough overview of a breadth of approaches and associated findings, which have been largely inconsistent. Thus, there is a clear need to better tie theory with methodological approaches, tailor methods to adolescents' needs in daily life, and better capitalize on adolescents' near-constant technology use.

### **Research Aim 2**

*The second aim was to document the phenomenon of adolescent online coping, bridging qualitative and quantitative data to corroborate adolescents' use of technology to cope.*

As characterized in Chapter 3, adolescents widely engage with technology. Often, youths' motives for technology use include seeking to modulate how they feel.

More specifically, drawing on Uses and Gratifications theory, youths' motives for technology use to assist in times of emotional distress include a) finding information b) social support and c) for distraction.

Thus, Study 2 (Chapter 7) includes focus group data from at-risk youth, describing their use of technology to change how they feel. Next, building on these ideas, Study 2 makes use of ambulatory assessment data from a larger project, and explores the relation between online coping and adolescents' emotion reactivity to stress. In this case, stress and emotion were assessed repeatedly throughout the week within a sample of socio-economically disadvantaged youth. Further online coping was assessed using an adapted version of Carver's (1997) Brief-COPE scale, and supplementary data are described to differentiate offline versus online coping.

### **Research Aim 3**

*The third and final aim was to explore the impact of adolescents' online coping using a more fine-grained and precise approach, which allows for exploration of linear and non-linear associations between online coping and emotional well-being.*

Assessing adolescents' online coping within-person represents a significant challenge, in that stressors, emotion, and coping strategies fluctuate over time. Moreover, a growing body of research asserts that links between technology use and health may not be linear (e.g., Bélanger Akre, & Berchtold, 2011). Therefore, Study 3 (Chapter 9) aimed to map within-person variability in stress, emotion, and online coping. In addition, this study made use of effect-codes to compare benefits (or risks) of varying levels of online coping.

Together, Study's 1-3 (Chapters 5, 7, and 9) seek to advance the understanding of adolescent coping in the digital age. Chapters 2 and 3 provide background rationale

for exploring the nexus of adolescents' daily stress and the development of psychopathology, highlighting to the importance of coping for youth, especially for those living in socio-economic disadvantage. These chapters further point to advantages of ambulatory assessment for exploring these arenas and tie the technological sphere to questions of adolescent well-being and coping. Each of these chapters begins with a preface section (Chapters 4, 6 and 8) which serves to link each study to the broader conceptual framework of the thesis. The final chapter (Chapter 10) integrates results from the three studies, and highlights the theoretical, clinical and practical implications of the thesis.

### **Introduction to Literature Review**

The key purpose of the following two chapters is to provide a background to the program of research discussed in the thesis. The first chapter (Chapter 2) outlines adolescence as a developmental period, and touches on the traditional view of adolescence as a time of storm and stress. The chapter then moves to discuss adolescent psychopathology, as well as the role that daily stress plays in the development of adolescents' mental health difficulties. The chapter then progresses to discuss the key role of adolescent coping for long-term development, and outlines many of the challenges implicit in both conceptualizing and measuring coping. In particular, the Chapter 2 underscores a central conundrum, in that coping is not generally conceptualized as a stable construct, but is instead described as a transactional process, and measurement of this process may best be tapped via experience sampling methods.

The next chapter (Chapter 3) emphasizes the overlooked positive role that digital technologies play for youth, particularly in response to daily hassles. The chapter opens with a summary of the significance of digital technology in adolescents' day-to-day life, with a particular focus on the developmental tasks youth now experience within the online space. The potential role that technology can play in response to daily hassles is then explored, and the online coping literature, for both adults and youth, is summarised. Next, the complex relation between technology use and adolescent well-being is highlighted. Chapter 3 draws on theories grounded in the communications arena and seeks to disengage some of the mixed findings that are associated with technology use and well-being. Finally, the chapter links communications theory with online coping, and discusses the literature regarding three specific online coping strategies (information seeking, self-distraction and social support seeking).

## **Chapter 2: Adolescent Psychopathology, Stress, and Coping.**

Adolescence is the phase of gradual transition between childhood and adulthood (Ernst, Pine, & Hardin, 2006). Often, in Western cultures, this is considered synonymous with the teenage years, or the “second decade of life” (Bernat, & Resnick, 2009; Luciana, 2013). As a result, the terms adolescents, youth and teenagers are all used interchangeably within this thesis. Importantly, adolescence has widely been recognised as a particularly turbulent period of development (Compas, Hinden, & Gerhardt, 1995). Indeed, famously coined as a time of “storm and stress” (Hall, 1904), the teenage years are commonly thought of as a time of inherent challenge. Although contemporary scholars have increasingly emphasized that this period does not necessarily guarantee declines in well-being or functioning (e.g., Arnett, 1999; Hollenstein, & Loughheed, 2013), adolescence does pose challenges in terms of the maturational experience of facing and needing to navigate more stressors and novel stressors, relative to earlier (or later) developmental periods (Silk, Steinberg, & Morris, 2003).

Among the most salient aspects of adolescence are the inevitable biological, cognitive and social transitions that youth must face (and in turn, learn to manage). Biologically, the onset of adolescence is coupled with the initiation of pubertal development (Dahl, 2004). Puberty brings with it dramatic changes in body size, composition, and sexual development, as well as vast changes in brain development (Spear, 2000). In turn, these brain-based maturational changes trigger their own set of developments, from increased cognitive abilities (Luciana, 2013), to stark differences in emotional intensity and risk-taking behaviours (Dahl, 2004; Ernst, Pine, & Hardin, 2006). Further, adolescents are simultaneously tasked with navigating these internal changes while also confronting evolving academic, familial, social and romantic

demands (Susman, & Dorn, 2009). Considering these many developmental challenges, it is not surprising that adolescents are particularly vulnerable to the onset of psychopathology (Paus, Keshavan, & Giedd, 2008).

### **Adolescent Psychopathology**

Although many adolescents successfully navigate the challenges of this maturational period and do not inevitably face mental health challenges, turmoil (in some form) is part-and-parcel of adolescence (Cicchetti & Rogosch, 2002). Mood disruptions and increased risk-taking behaviours are not considered atypical during this period (Arnett, 1999), but they are associated with internalizing and externalizing forms of psychopathology. Thus, during adolescence, the boundaries between normative struggle (i.e., mood lability, irritability) and psychopathological symptoms are not always clear (Cicchetti & Rogosch, 2002; Humphreys, Schouboe, Kircanski, Leibenluft, Stringaris, & Gotlib, 2019). What is clear, however, is that the prevalence rates of diagnosed mental health disorders in youth are high (e.g., Collinshaw, 2015).

Adolescence is a known critical period for the development of a range of mental health difficulties (Avenevoli, Knight, Kessler & Merikangas, 2008). Indeed, mental health disorders negatively impact approximately 1 in 5 youth globally (Merikangas et al., 2010). Adolescent psychopathology can in turn be categorised into two broad dimensions, namely, internalising and externalizing disorders. Externalizing disorders are characterised by struggles with impulsivity and hyperactivity. These include problems related to rule-breaking behaviour, conflict with others and delinquency (Sourander & Helstela, 2005; Kazdin, 1995). Although the most typical developmental pathways through adolescence include low or decreasing levels of externalizing behaviour, (Kjeldsen, Janson, Stoolmiller, Torgersen & Mathiesen, 2014), a substantial

number of youth exhibit stable, high scores of externalizing problems (Campbell, Spieker, Vandergrift, Belsky, & Burchinal, 2010; Cote, Vaillancourt, Barder, Nagin & Tremblay, 2007). Further, dimensional and categorical approaches to characterizing externalizing disorders have identified behaviours including engaging in antisocial behaviour, impulsivity, delinquency, noncompliance, aggression, hyperactivity and exhibiting difficulties in self-control and attention (e.g., Bogels, Hoogstad, Lieke van Dun, de Schutter & Restifo, 2008; White & Renk, 2012). Overall, lifetime prevalence rates for externalizing disorders beginning in childhood or adolescence range from 2-7%, and these rates are higher for males (Ehringer, Rhee, Young, Corley & Hewitt, 2006).

In contrast to externalizing disorders, internalising disorders are those in which problems are turned inward and manifest in emotional and cognitive distress, such as depression and anxiety (Sourander & Helstela, 2005). Notably, childhood and adolescence are the core risk phases for the development of anxiety, the severity of which may range from mild symptoms to clinically diagnosed anxiety disorders (Beesdo, Knappe & Pine, 2009). Indeed, anxiety disorders are among the most common psychiatric disorders in adolescence with a lifetime prevalence of 31.9% in youth under 18 years, and 8.3% being characterised as having a severely impairing disorder (Merikangas et al, 2010). Similarly, depressive disorders tend to first appear in adolescence or early adulthood, with one in every five adolescents likely to experience a diagnosable depressive episode by the age of 18 years (Kessler, Berglund, Demler, Merikangas & Walters, 2005; Rutter, Kim-Cohen & Maughan, 2006).

The implications of adolescent psychopathology symptoms can be far-reaching and often have quantifiable negative consequences (Romer, 2010). For instance, risk-taking behaviours in adolescence have been associated with a range of unintended



negative outcomes (e.g., accidental injuries) (Blum & Nelson-Mmari, 2004; Luciana, 2013). Statistically, causes of death among teenagers are predominantly associated with risky and preventable events, with motor vehicle accidents and suicide being among the most common (Blum & Nelson-Mmari, 2004; Minino, 2010; Somerville, Jones, & Casey, 2010). In sum, these statistics reinforce the notion of stress and storm during adolescence, at least in some youth. Thus, prevention efforts aimed at reducing and minimizing negative adolescent outcomes should focus on identifying adaptive ways of managing the tumult of adolescence especially for vulnerable groups of youth.

### **The Importance of Daily Stress in Adolescence**

Adolescence has been considered, by definition, a period of increased experience of and exposure to stress (Spear, 2000; Somerville et al., 2010). In the context of this thesis, stressors can be divided into two categories: major life events, such as parental divorce; and daily stressors, or “hassles”, such as getting a poor grade in school (Mize & Kliwer, 2017; Schneiders, Nicolson, Berkhof, Feron, van Os, & Devries, 2006). Both types of stressors appear to represent distinct sources of strain that contribute independently to adolescent functioning (Sim, 2000).

In the last two decades, scholarship on adolescent stress has shifted its focus from the study of traumatic, major life events, to normative challenges and developmental tasks (Seiffge-Krenke, Aunola & Nurmi, 2009; Skinner & Zimmer-Gembeck, 2007). Indeed, major life events in adolescence can lead to both emotional and behavioural problems and play a significant role in the development of psychopathology (Horesh, Ratner, Laor & Toren, 2008). However, daily stressors, potentially due to their frequent occurrence and chronic nature, can perhaps more thoroughly explain human maladjustment (Compas, Davis, Forsythe, & Wagner, 1987),

and indeed appear to more accurately predict the development of psychological symptoms (Moulds, 2003; Sim, 2000). As a result, research that focuses on adolescent day-to-day stressors has much to tell us about the experiences of youth, particularly those at-risk for psychopathology.

Previous research suggests that minor, daily stressors are associated with elevations in negative affect in adolescents (Uink, Modecki, Barber, & Correia, 2018; Schneiders et al., 2006). Although the experience of intense negative affect alone is not considered to be maladaptive per se, developmental changes that occur during adolescence do make it more difficult for adolescents to regulate these intense emotions (Cole, Luby & Sullivan, 2008; Uink, Modecki & Barber, 2017). Indeed, adolescents have been found to be more emotionally reactive to stressors and have greater mood variability in general when compared to adults and pre-pubescent children (Larson, Moneta, Richards, & Wilson, 2002). The reasons behind this increase in emotion sensitivity and lability are a complex mixture of biological, social and psychological factors (Skinner & Zimmer-Gembeck, 2016). Specifically, puberty entails rapid neuronal growth in an adolescent's appetitive approach systems, which in turn, increases their motivational and emotional inputs, including behaviours such as excitement-seeking and time with peers (Galvan, Hare, Voss, Glover & Casey, 2007; Modecki, 2009; Uink, Modecki & Barber, 2017). However, these same neurophysiological developments increase youths' likelihood of encountering stressors, while simultaneously rendering youth more sensitive to these aversive events, especially those relating to peer evaluation (Dahl & Gunnar, 2009; Luciana, 2013; Somerville, 2013). In other words, adolescents simultaneously deal with an increased desire for emotional rewards, and the subsequent behavioural changes these desires initiate, with a

still under-networked regulatory system. Thus, adolescents arguably have a reduced capacity to regulate the surges in emotion that daily stressors entail.

Given that adolescents with high levels of psychopathology symptoms report a more labile pattern of emotionality, this begs the question, “do adolescents with psychopathology symptoms simply encounter more daily stressors?” Interestingly, Schneiders and colleagues (2006) compared the frequency of self-reported daily hassles in a sample of high and low risk adolescents and found no differences between the two groups. Likewise, Uink and colleagues (2018) assessed relatively serious daily stressors in a sample of over 200 at-risk youth. They found no differences in the number of stressors based on levels of externalizing symptoms, suggesting that psychopathology may not lead to a greater frequency of daily stressors in and of themselves. Empirical studies in this thesis account for daily stressors in statistical models, in terms of both average weekly stressors and fluctuations in stress from moment-to-moment. As a result, study designs take into account this possibility, and likewise provide via correlations some insight into putative links between psychopathology and increased experience of stress.

**Socio-Economically Disadvantaged Youth.** Not only is adolescence a time of increased experience of daily stressors, and risk for psychopathology symptoms, some populations are more susceptible to the risks than others due to structural and societal disadvantage (Chen, Miller, Brody, & Lei, 2015). Indeed, there is a well-established link between chronic exposure to stressors and the risk of developing psychopathology symptoms (Grant, McMahon, Carter, Carleton, Adam, & Chen, 2014). Further, youth living in socio-economic disadvantage are more vulnerable to experiencing a range of stressors (e.g., Evans, Vermeulen, Barash, Lefkowitz, & Hutt, 2009) and are considered to be at higher risk for a range of health outcomes (Chen, Martin, & Matthews, 2006).

Of note, research has found that a key mediator in this socio-economic-health gradient is the way in which youth respond to stressful events (e.g., Grant et al., 2006). Thus, while it is important to investigate the types of stressors youth face, the strategies youth use to cope appears to have especially significant implications for their long-term development (Frydenberg, 2008; Grant et al., 2003; Seiffge-Krenke, Aunola, & Nurmi, 2009).

### **Coping in Adolescence**

Coping has been defined as “conscious, volitional efforts to regulate emotion, cognition, behavior, physiology, and the environment in response to stressful events or circumstances” (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001, p. 89). Here, coping can be thought of as “action regulation under stress”, which refers to “how people mobilize, guide, manage, energize and direct behaviour, emotion, and orientation, or how they fail to do so, under stressful conditions” (Skinner & Zimmer-Gembeck, 2007, p. 122). Thus, coping encompasses cognitive and behavioural efforts utilised by individuals to manage the demands of a person-environment relationship (Frydenberg, 2008). Implicit within these definitions of coping is the overarching construct of regulation. That is, coping refers to the ways in which multiple regulatory subsystems work together when dealing with stress (Skinner & Zimmer-Gembeck, 2007).

Despite the centrality of system regulation to definitions of coping, there remains little consensus on how best to conceptualize, and therefore measure, coping as a construct (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Skinner, Edge, Altman, & Sherwood, 2003). First, scholars have aimed to define and measure individual coping strategies. In the broadest sense, *ways of coping* encompass the basic

descriptions used to define how people respond to stress (Skinner et al., 2003).

However, coping responses are virtually infinite in variety, with a review by Skinner and colleagues (2003) identifying over 400 different coping labels. Naturally, this approach has been deemed too broad for most purposes and a more concise approach to conceptualizing coping has been called for.

Thus, in order to better examine how individuals cope in response to stress, and to identify adaptive ways of doing so, several researchers have proposed methods of categorising coping responses (Carver & Connor-Smith, 2010). Again, however, this has taken place based on a variety of perspectives. For instance, coping response categories have been grouped in terms of approach versus avoidance coping (Krohne, 1993; Roth & Cohen, 1986) or engagement versus disengagement coping (Compas et al., 2001). Here, ways of coping are categorised depending on whether they describe direct management of stressors (e.g., seeking advice), or efforts to disengage from a stressor (e.g., avoidance or distraction) (Eschenbeck, Schmid, Schroder, Wasserfall, & Kohlmann, 2018). Similarly, coping responses have also been categorised in terms of problem- versus emotion-focussed coping (Lazarus & Folkman, 1984). In this case, problem-focussed ways of coping include efforts to manage with the stressors themselves, whereas emotion-focussed coping represent more indirect strategies to emotionally adjust to the stressor (e.g., comfort-seeking) (Zimmer-Gembeck & Skinner, 2011). However, although these broad categories help clarify where various coping strategies may fall, it has also been suggested that these dichotomies may be overly simplistic, as they fail to capture the full range and diversity of coping responses (Carver & Connor-Smith, 2010; Connor-Smith, Compas, Wadsworth, Thomsen & Saltzman, 2000).

Building upon the categorisation of coping strategies, scholars have moved towards conceptualizing and assessing hierarchical models of coping (Skinner & Zimmer-Gembeck, 2007) that use higher-order categories (also referred to as families) to organise multiple lower-order ways of coping (e.g., Ayers, Sandler, West, & Roosa, 1996; Connor-Smith et al., 2000). These higher-order families allow for the categorisation of ways of coping, despite differences in theoretical approaches. Previous theoretical and empirical analyses have generally converged on 12 higher-order families of coping responses (Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007). These families of coping include: Problem-solving, Information-Seeking, Helplessness, Escape, Self-reliance, Support-seeking, Delegation, Social isolation, Accommodation, Negotiation, Submission and Opposition. Here, each coping family represents functionally consistent ways of coping. That is, families of coping group specific coping strategies based on their adaptive function. For example, the coping family of information seeking is comprised of strategies aimed at gathering new information to assist with the management of a stressor. Likewise, specific ways of coping that fall within this family include asking others, researching through reading or social observation (Zimmer-Gembeck & Skinner, 2011).

Of course, the level of engagement in various forms of coping differ depending on developmental stage (Compas et al., 2001). For adolescents in particular, the most commonly endorsed families of coping include: 1) Problem solving (which includes planning and strategizing how to resolve the task at hand), 2) Distraction (mentally or behaviourally engaging in some other task), 3) Support seeking, (using available resources to help resolve the issue) and 4) Escape (mentally or physically withdrawing from the problem at hand ) (Zimmer-Gembeck & Skinner, 2011). Further, developmental factors also influence how these coping strategies are implemented. For

example, support seeking strategies in youth are increasingly focussed on peers, perhaps due to the increased desire of autonomy from parents (Allen & Miga, 2010; Skinner & Zimmer-Gembeck, 2016). Additionally, the developmental resources available to youth would arguably impact upon how youth deploy specific coping strategies. In particular, a central tenet of this thesis is that access to digital technologies provides an uncharted resource for youths' coping repertoire. Thus, the studies that comprise the thesis aim to expand upon current conceptualizations of coping to acknowledge the role of digital technologies in youths' coping.

### **Outcomes of Coping**

Beyond the challenges of conceptualizing and measuring coping as a construct, scholars also face difficulties in identifying “what works” for youth in the face of stress. A general theme within the coping literature is that approach coping can be considered to be adaptive, whereas avoidance coping often leads to poor outcomes (Baker & Berenbaum, 2007). That said, the coping field is also rife with conflicting findings of what constitutes an “adaptive” coping response (Compas et al., 2017). Thus, “what works” likely depends on adolescents' available supports, and overall risk factors (e.g., Kliewer, Parrish, Taylor, Jackson, Walker, & Shivy, 2006).

As one example, focussing on social support seeking as a type of approach coping, Saha and colleagues (2014) demonstrated that social support seeking positively predicts adolescent life satisfaction. However, research has also found that social support seeking can be detrimental for some youth. Specifically, for youth living in economic-disadvantage, seeking support from their peers or adults has been found to be unhelpful (Gaylord-Harden & Cunningham, 2009). Most likely, peers and adults from whom disadvantaged adolescents are seeking support are experiencing high levels of

stress themselves, and thus are limited in their capacity to provide support (Landis, Gaylord-Harden, Malinowski, Grant, Carleton, & Ford, 2007).

Further, self-distraction coping, traditionally viewed as an avoidant form of coping, has also been found to have inconsistent effects. Specifically, Stoeber and Janssen (2011) conducted a daily diary study whereby students reported on their perceived daily failures, ways of coping and level of end-of-day satisfaction. Here, the effectiveness of self-distraction varied depending on whether students reported high levels of perfectionism. Here, students who reported high levels of perfectionism experienced lower end-of-day satisfaction when they used self-distraction coping strategies. Conversely, self-distraction has also been found to protect youth from poor developmental outcomes. Specifically, Burke and colleagues (2016) conducted a two-year longitudinal study investigating cognitive risk and protective factors for suicidal ideation in youth. Here, youths' engagement in self-distraction techniques when coping with negative affect was found to buffer against the risk of developing suicidal ideation. In sum, scholars have generally moved away from initial conceptualizations of coping as a static construct, presumed to have uniform effects on youth (Lazarus, 1993). Indeed, what "works" in the coping sphere varies depending on a range of factors – which in themselves can be dynamic and flexible. Thus, scholars' conceptualizations and approaches to measuring coping need to account for the interactive, and transactional nature of this construct.

### **The Process of Coping**

Coping scholars have long emphasized that coping is, in actuality, a process. Indeed, a core emphasis on process can be found in most theoretical frameworks of coping. Specifically, Lazarus and Folkman (1984) emphasized that stressful experiences



first and foremost need to be cognitively appraised as stressful (primary appraisal). Then, in turn, potential coping responses are cognitively explored based on personal and social resources (secondary appraisal), and penultimately, coping is the behavioural execution of the selected response, which in turn leads to an outcome. Comparatively, Compas and colleagues' (2001) definition of coping places relatively less emphasis on the cognitive appraisal of stressful encounters; rather, they posit that the experience of a stressor itself is the precipitant to voluntary coping responses, which in turn can lead to varying outcomes. Further, Skinner and Zimmer-Gembeck (2016) likewise highlight that coping can be considered as a process on multiple levels. Specifically, coping can be considered as an adaptive process across developmental time that influences health and competence. Further, coping can also be considered as an episodic process that takes into account previous coping experiences social and personal factors. Finally, coping can be viewed as an interactional process that occurs in real-time. Thus, across these and other perspectives of coping, scholars speak to a collection of regulatory processes, which play out across a span of time.

Across conceptualizations, the most basic components of the coping process include the experience of a stressor, the coping response itself, and the outcome (Folkman & Moskowitz, 2004). However, given the many possible variations of each of these three factors, there is inherent richness and complexity to the coping process. Specifically, stress itself is a broad construct, and specific stressors may warrant particular coping strategies (Eschenbeck, Kohlman, & Lohaus, 2007). Additionally, the availability of coping strategies varies depending on developmental factors (i.e., cognitive maturation, as well as personal and social resources (e.g., psychopathology, available social support)) (Compas et al., 2001), which in turn may be influenced by the number and nature of stressors experienced (Matthews & Wells, 1996). Finally, the

outcome, in this case well-being, can also be defined in a multitude of ways, and what is considered to be an adaptive outcome in the short-term, may not necessarily translate to longer-term positive development (Gross & John, 2003). As a common example, short-term emotional relief, while helpful in the moment, does not necessarily lead to better long-term outcomes.

More broadly, when coping is conceptualized as a longitudinal process as with these above frameworks, for accurate measurement and assessment, scholars need to account for both between-person (i.e., age, psychopathology symptoms) factors and repeated assessments of within-person (i.e., type of stressors, average emotion) factors at each stage of the process (e.g., Tennen, Affleck, Armeli, & Carney, 2000). That is, coping scholars need to account for the variations in youths' overall experiences and in day-to-day variations in events and well-being. Given this, one especially useful method for capturing these micro-changes over a span of time is the experience sampling method, which, when combined with static surveys of well-being and experiences, can be used to model the within-person process of coping, while accounting for exploring effects of individual differences .

### **Capturing the Coping Process: The Experience Sampling Method**

The experience sampling method (ESM) (sometimes referred to as ecological momentary assessment- EMA, or self-report digital ambulatory assessment-AA), is a micro-longitudinal self-report method whereby participants repeatedly record their current thoughts, emotions, behaviours in vivo, across various contexts in their daily lives (Scollon, Prieto, & Diener, 2003). As defined by Stone and Shiffman (1994) ESM: a) collects data in real-world contexts; b) focuses on either an individual's current, or very recent states or behaviour; c) depending on the research question, assessments can

be time-based, event-based or randomly prompted; and d) collects multiple assessments over a period of time. Additionally, assessments can be collected using a variety of media including paper diaries, telephones, and more recently, digital devices (Trull & Ebner-Priemer, 2009).

In comparison to traditional cross-sectional survey designs, ESM has multiple methodological benefits that are attractive to coping scholars. First, in part, this methodology was developed in response to the limitations of retrospective recall of experience (Shiffman, Stone, & Hufford, 2008). Indeed, the unreliability of autobiographical memory has been well-established (Robinson & Clore, 2002), and retrospective reports can risk retrospective bias in which responses are coloured by participants' mood at the time of reporting (Gorin & Stone, 2001). Importantly, and in relation to coping, research has found that over-general autobiographical memory (i.e., the inability to recall specific details regarding one's own experiences) is related to increased experience of stress and psychopathology symptoms (Stange, Hamlat, Hamilton, Abramson, & Alloy, 2013). This again highlights the utility of measuring experience as it happens, particularly for individuals under stress, or who are vulnerable to the development of psychopathology.

A second benefit of ESM is that these *in vivo* designs allow for the sampling of the highly dynamic and context-dependent coping process across various social contexts (Trull & Ebner-Priemer, 2009). Thus, scholars can map the within-person coping process across home, school and leisure settings, while simultaneously accounting for between-person factors such as gender, symptomology and the like. More specifically, ESM allows for analytic approaches that use each youth as his or her own control, and so reflect variations from each person's own average, in, for instance, affect or stress. Thus, ESM methods and corresponding within-person analyses can provide a more

accurate picture of fluctuations in stress and in short-term affective well-being (Shiffman, Stone, & Hufford, 2008; Uink, Modecki, & Barber, 2017).

## **Chapter Summary and Remaining Questions**

This chapter provided a conceptual overview of adolescence as a developmental period of increased stress and relatively higher risk for onset of psychopathology symptoms (Collinshaw, 2015). The impact of day-to-day stress, above and beyond serious life events (e.g., parental divorce), can have critical down-stream consequences for youth well-being (Schneiders, et al., 2006). Therefore, research that characterizes the ways that young people cope with challenges in the context of daily life can have important implications for mental health and overall functioning (Grant et al., 2003; Seiffge-Krenke et al., 2009). Thus, a first question arises in terms of how can we best measure adolescent coping, in a manner that aligns with theoretical conceptualizations of coping as a transactional process?

Experience sampling methods provide a useful approach for tapping coping in-vivo and given these methods are comprised of repeated assessments within-person, they allow for analytic methods that can parse between-person (e.g., gender) and within-person (e.g., momentary variations in coping or stress) effects on a given outcome, such as emotion (e.g., Uink et al., 2017). That said, even in their most simple form, coping theories point to at least three core elements of a given coping process—stressor, coping response, outcome—and assessment of even just these elements within an appropriately dynamic framework poses challenges. As a result, this chapter draws attention to one of the central difficulties facing adolescence scholars as they seek to characterize the potential benefits (or risks) associated with forms of coping - how to best measure this process?

In actuality, there is no perfect answer to the question of how best to tap the coping process. Experience sampling methods offer many advantages, yet even so, these methods require trade-offs in terms of where to focus ESM's fine-grained lens versus one-time survey measures. Thus, in order to better characterize the benefits and challenges associated with measuring coping in every-day life, including various trade-offs and how these relate to coping theory, Study 1 of the thesis provides a scoping review of the literature. More specifically, Study 1 will categorize 60 published studies tapping adolescent coping with ESM frameworks and point to patterns and themes in terms of research questions, adolescent populations, overall study approach, and resulting data quality including compliance. Thus, Study 1 of the thesis will lay the groundwork for considering different options for assessing adolescent coping, and two of the design options will then be employed in thesis Study 2 and Study 3. The next review chapter further sets the stage for the thesis' empirical studies. It speaks to adolescents' near-constant engagement in technology and what this might mean for their development. More specifically, it outlines key communications theories in relation to media engagement, and underscores conceptual links between theory and specific coping approaches as they are thought to occur in the online space.

### **Chapter 3: Youths' Technology Use and Online Coping**

#### **Introduction to Chapter 3**

As discussed in Chapter 2, intensive longitudinal methods have grown in fashion not only because of their advantages over cross-sectional survey designs, but especially with rapid advances in digital technology (e.g., Heron, Everhart, McHale, & Smyth, 2017; Singer, 2017). Further, a considerable amount of research has been dedicated to the investigation of adolescent coping. Surprisingly, however, scholars have largely overlooked the role of digital devices as a modern-day *resource* for youth in the face of stress. Thus, the next chapter discusses adolescents' digital world and explores its potential for youthful coping. This chapter first highlights technology's prevalence, and the central role of technology in adolescents' day-to-day life. In particular, the chapter underscores that adolescents are undertaking normative developmental tasks online, often to good effect. However, the relationship between technology and well-being in youth is mixed, and there are likely many benefits that youth derive from engaging in the online space. The chapter proceeds with a discussion of theoretical approaches to exploring this important relationship. Finally, the chapter concludes by linking dimensions of online coping to relevant communication theories, and briefly outlines some of the various ways in which youth might use the online space to cope.

#### **The Technological Generation**

Digital technology is central to the life of today's youth. Through computers, tablets, mobile devices and gaming, youth are constantly connected to each other and the online space (Crone & Konijn, 2018; Lenhart, Smith, Anderson, Duggan, & Perrin, 2015; Subrahmanyam & Smahel, 2010). Today's generation of adolescents are arguably

unique in that they were “born digital” – that is, most youth cannot recall a time without access to the internet or mobile devices (Palfrey & Gasser, 2008). Indeed, adolescents are now often referred to as *Digital Natives* (Prensky, 2001), because they have lived their entire lives surrounded by, and immersed within, digital technologies. As a result, they have enhanced digital dexterity and tend to engage with the digital space intuitively (Subrahmanyam & Smahel, 2010). Similarly, adolescents tend to access multiple types of media and use them simultaneously, often on the same device (George & Odgers, 2015). As such, the terms digital technology, digital devices, mobile devices, internet, media and the online context are all used interchangeably in this thesis.

Not only are youth constantly surrounded by technology, adolescent device ownership also begins early. Indeed, in a representative United States sample, 48% of 11-year-olds and 85% of 13-year-olds report owning a mobile phone (Odgers, 2018). Not surprisingly then, adolescent digital engagement is increasing. For example, within a decade, the amount of time youth spend online has more than doubled, increasing from an average of eight hours per week in 2005, to 18.9 hours in 2015 (Ofcom., 2015). Similarly, in a European sample, Tsitsika and colleagues (2014) found that 92% of adolescents aged 14-17 years reported being a member of at least one Social Networking Site, and that 40% spent over two hours daily on those sites. Within Australia, the Australian Communications and Media Authority (ACMA, 2015) reported that in 2015, 82% of adolescents, aged 14-17 years had accessed the internet in the previous four weeks, with 88% of these adolescents going online more than once a day. Further, rates of digital communication have been found to peak during mid-adolescence, with higher overall internet use, text messaging, and social media use by 14-17-year-olds compared with adults aged 18-30 years (Lenhart, Ling, Campbell, & Purcell, 2010). More recently, a growing amount of U.S. teenagers report being online

almost constantly. Specifically, when surveyed in 2014, 24% of youth surveyed reported constant internet use and 56% reported accessing the internet several times daily. In 2018, these proportions shifted toward constant use, with 45% of youth now reporting constant internet use, and 44% of youth reporting checking in online throughout the day (Anderson & Jiang, 2018). Given these high prevalence rates of near-constant online connection, as well as the rapid growth in technology use in children and adolescents, updated theory and associated research is required to better understand the impact of technology use on adolescent development and well-being (George & Odgers, 2015).

### **Developmental Tasks and the Internet**

Why is technology so very enticing to youth? Beyond sheer convenience and entertainment, Subrahmanyam & Smahel (2010) suggest that for adolescents, the Internet serves as a playing ground for important developmental tasks that were traditionally confronted offline, including: explorations of sexuality, identity formation and self-expression, intimacy, and interpersonal connection (Tarrant, Mackenzie, & Hewitt, 2006; Valkenburg & Peter, 2011). Indeed, youth have been found to use the online context to explore their identity (Israelashvili, Kim, & Bukobza, 2012), find information about developmentally-sensitive issues (Valkenburg & Peter, 2009), form close and intimate relationships (Tzavela et al., 2015), and increase their sense of connection through self-disclosure (Utz, 2015).

The online environment also allows youth to explore developmental tasks in a context where they can control their degree of immersion and with the possibility of full anonymity (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005; Gross, 2004). Anonymity may be especially important for youth, who, generally speaking, are learning to manage



developmental tasks while simultaneously experience increased feelings of vulnerability and feelings of self-consciousness (Sebastian, Burnett, & Blakemore, 2008; Somerville, 2013). In particular, youth who are seeking to find information regarding stigmatized issues such as mental health, are able to do so without fear of criticism or exclusion (Elmquist & McLaughlin, 2018). Moreover, as Valkenburg & Peter (2011) emphasize, digital technologies are especially appealing to youth as they grant unlimited access to peers. During a developmental phase where peers are of increased importance, social media and other channels are vital for seeking new, and maintain existing, social connections and support (Shapiro & Margolin, 2014).

### **Coping with Stress Online**

Given that adolescence is a time when youth face increased levels of stress, a key developmental task for youth involves learning how to best manage the vicissitudes of day-to-day stressors (Zimmer-Gembeck & Skinner, 2011). Likewise, given the ubiquitous nature of technology use during adolescence (Odgers, 2018), the technological realm is arguably an ideal, yet under-studied, avenue for youth to learn how to navigate stressors. Importantly, this notion of youth making use of media to cope with stress is not all together new. Illustratively, in an early study, Steele and Brown (1995) found that youth self-reported using traditional media (i.e., television, magazines) to cope with negative emotions and to enhance their moods. Next, in a study conducted in 1999 (on the cusp of the millennium), teens reported using the internet for help-seeking in relation to emotional problems (Gould, Munfakh, Lubell, Kleinmann, Parker, 2002). Somewhat more recently, adolescent focus groups reported that mood management (through entertainment and information seeking) was among their personal motives for media use (Leung, 2006).

With a history of youth looking to media and technology in the face of stress, several scholars have called for updates to traditional coping scales so that they are modified to include items reflecting electronic media use (Leiner, Argus-Calvo, Peinado, Keller, & Blunk, 2014). Very few scholars have answered this call, with two notable exceptions. First, Eschenbeck and colleagues (2006) modified The German Stress and Coping Questionnaire for Children and Adolescents [SSKJ 3-8], a scale requiring youth to identify how much they used media in response to two stressful situations (a social stressor; arguing with a friend, and an academic stressor; homework). The items used within the media subscale included multiple forms of media use including television, video games, mobile phones, internet and stereo/radio (example item: *I watch TV*). Overall, media coping was found to be positively associated with avoidant coping, palliative emotion regulation, and anger-related emotion regulation, further, media coping was negatively correlated with problem-solving (Eschenbeck, Heim-Dreger, Tasdaban, Lohaus, & Kohlmann, 2012).

A second example of scholars seeking to tap adolescents' engagement with technology as a means to cope, Lohaus and colleagues (2005) modified an existing coping scale to include media use among adolescent participants. This study investigated the use of varying types of media (television, audio, print and computer) in relation to the function for which they were used, including: the use of media to cope with stress, to acquire information, and for fun. In this study, adolescents reported that all forms of media were used for fun and coping (with the exception of computer-based coping for boys), and only television and print media were used to gather information. That said, these findings should be interpreted in light of the study time period (data collected 2003), in that adolescents' access to media has dramatically changed since this

time, and thus arguably, information seeking and coping behaviours should now be more prevalent in digital forms media.

Both of these studies, Eschenbeck and colleagues (2018) and Lohaus and colleagues (2005), provide early support for the notion that youth identify with engaging with media to cope with their stress. That said, a notable limitation of both is that they did not investigate specific mechanisms or effects of online coping, and instead focused on measuring youths' views of media as an avenue for coping (Lohaus, Ball, Klein-Hessling, & Wild, 2005). Other work that has explored online coping in relation to specific coping mechanisms falls within the adult literature. Here, one study usefully clarifies adults' use of the internet for specific coping strategies; van Ingen and Utz and Toepoel (2016) explored online coping strategies within a large representative sample in the Netherlands. In this case, the authors adapted seven subscales of a widely used, well-validated coping scale (Brief COPE; Carver, 1997), to reflect the specific coping behaviours executed online (e.g., an item from the Emotional support subscale: *"I got emotional support from others"* was adapted to *"I got emotional support from others through the internet"*). Here, participants were asked to retrospectively report on how much they engaged with these coping strategies (both online and offline) in response to five negative life events (e.g., being divorced or widowed, involuntary job loss). Results clearly indicated that online coping and offline coping were distinct constructs, with online coping being reported by only 57% of study participants, whereas 96% of participants reported some form of offline coping. Further, online and offline coping were significantly, yet differentially, related to indicators of well-being. Specifically, online coping was negatively associated with self-esteem, optimism and life satisfaction, whereas offline coping was positively associated with these constructs.

While van Ingen and colleagues' (2016) work, in particular, lays informative groundwork regarding adolescents' online coping, potential translation to current teenage populations raises several potential points of difference. First, though van Ingen and colleagues' study was highly instructive, this work was conducted with adults, (mean age 50.4 years), who arguably have a lower prevalence of online coping due to less intensive, (or arguably less intuitive) technology use relative to youth (Lenhart et al., 2010; Madden, Lenhart, Duggan, Cortesi & Gasser, 2013). Second, effects of the digital space have actually been found to differ for adults versus adolescents, with youth but not adults experiencing a palliative effect of online communication (e.g., Gross, 2009). Third, while providing a cornerstone for understanding online coping, van Ingen and colleagues' work was only able to assess online coping and well-being retrospectively, and in relation to intense life stressors (i.e., loss of a job or partner). As a result, further research is required to better characterize adolescents' experiences of online coping, how online coping helps youth manage stressors in everyday life, and the immediate or short-term impact of online coping on youth well-being. In particular, adolescents' need to cope with stressors is arguably especially acute in settings with high daily stress and fewer contextual supports-that is, for youth living in the context of disadvantage. For these youth, online coping may be especially germane.

### **Youths' Access to Technology in Disadvantaged Settings**

Although this thesis points to online coping as a key support channel for youth living in disadvantaged settings, it is worth noting a common misconception that a 'digital divide' exists between low and high socioeconomic populations (Kreutzer, 2009; Tondeur, Sinnaeve, van Houtte, & van Braak, 2011). On the contrary, numerous studies with youth have shown that, compared to high socio-economic status (SES) populations, youth from economically disadvantaged backgrounds are more likely to

own a mobile phone (e.g., Byun et al., 2013), access their phones more frequently (Lenhart, 2015), and spend more time on their phones overall (Thomas, Heinrich, Kuhnlein, & Radon, 2010). In fact, smartphone ownership among teenagers has been found to be nearly universal, irrespective of socio-economic background (Anderson & Jiang, 2018). Thus, considering the vulnerabilities that youth living in socio-economic disadvantage face, digital technologies have enormous potential as a channel for prevention and intervention efforts to enhance positive outcomes and reduce risk (Seko, Kidd, Wiljer, & McKenzie, 2014). At the same time, scholars have been slow to study adolescent technology use as a well-being, more broadly (Underwood & Ehrenreich, 2017), and thus research concerning the use of technology to *improve* adolescent well-being is surprisingly sparse. Further, the existing research that has indeed sought to investigate the impact of technology on well-being has a mostly dark history (de Leeuw & Buijzen, 2016), with technology being touted by many (adults) as being detrimental to youth well-being.

### **The Relationship between Technology and Affective Well-being: It's Complicated!**

The emerging scholarship on adolescent technology use has focused predominately on the negative impact of technology use (George & Odgers, 2015). It is worth noting that adult caution over new technologies is far from a new phenomenon. Historically, fears regarding youth well-being and new media have been raised in response to comic books (Thrasher, 1949), television (Stein & Friedrich, 1975), video games (Anderson & Ford, 1986), and more recently, digital technologies (e.g., Twenge, Joiner, Rogers, & Martin, 2018). At the same time, not all of these concerns can be simply relegated to technophobic anxiety. Admittedly, a marked difference between today's digital technologies is that engagement is now far more entrenched and so has, understandably, captured scholarly attention.

That said, fears and concern regarding the potential negative impact of digital technologies on well-being have arguably been prematurely translated via popular media (e.g., Wakefield, 2018) and at times, even by policy makers (Selwyn, 2019). However, adolescent subjective reports of the perceived impact of social media on their well-being are quite mixed. Specifically, Anderson and Jiang (2018) found that 31% of youth surveyed reported a ‘mostly positive’ effect; 24% reported a ‘mostly negative’ effect and 45% reported neither a positive nor negative impact of social media. This ambivalence surrounding the effects of technology use can also be found within the empirical literature (Steele, Hall, & Christofferson, 2019; Seabrook, Kern, & Rickard, 2016). On one hand, scholars have found some evidence for the positive effects of digital technology on well-being. Indeed, evidence has been found for social media decreasing adolescents depressed mood when social support was sought and received (Frison & Eggermont, 2015). Similarly, youth have been found to use social media to strengthen their friendships (Reich et al, 2012) and to compensate for poor offline social supports (Reich, 2016). On the other hand, however, there is also evidence for negative associations between media use and affective health in youth. For instance, Barry and colleagues (2017) found that frequency of social media use was positively related to self-reported loneliness, as well as parent-reported hyperactivity/impulsivity, anxiety and depression symptoms. Similarly, Shensa and colleagues (2017) found associations between adolescent social media use and negative outcomes such as depressed mood, loneliness, reduced well-being and lower quality of life.

Reviews analysing research on a broader scale have also failed to provide a clearer picture of well-being and technology (e.g., Marchant et al., 2017). For instance, Best and colleagues (2014) reported that the majority of research in this area found either mixed or no effects of online communication and/or social media use on

adolescent well-being. However, some studies have found modest positive correlations between social media use and depression in youth (Huang, 2010; McCrae, Gettings, & Purssell, 2017). Notably, study limitations in the field have been widely noted, including an over-reliance on cross-sectional designs, inconsistent measurement of constructs, poorly validated constructs-especially in relation to technology use, and issues of generalizability (Baker & Algorta, 2016; McCrae et al., 2017). Given these mixed findings in the literature, and shortfalls in methodological approaches, it is worth considering how scholars have theoretically conceptualised the relationship between technology and well-being.

### **Theoretical Frameworks for Conceptualising Adolescent Online Behaviour**

Several theoretical frameworks have been put forth for exploring the relationship between digital technology and well-being. Early theoretical approaches, such as the Media Effects Model, while laying important groundwork, were generally uni-directional and so have limitations that arguably make them less relevant for understanding the impact of new and emerging technology on adolescent well-being. In response, the field has grown to acknowledge the role of individual choice in engagement with technology for different reasons or for different purposes as evidenced by both Mood Management Theory and Uses and Gratifications Theory. These variations in theoretical grounding are important, because they shape methods, hypotheses, and conclusions, and hence where the field is travelling in terms of consensus on media's effects.

### **What Media does to People: The Media Effects Approach**

**Media Effects Model.** Among the first approaches scholars used to conceptualize the role of media in human development was the media effects model

(Klapper, 1960; Neuman & Guggenheim, 2011; Subramanyam & Smahel, 2010).

Within this model, the content of media is believed to affect the emotions, thoughts, behaviours and attitudes of the user (Anderson & Dill, 2000; Valkenburg & Peter, 2013; Valkenburg, Peter, & Walther, 2016). Proponents of this model view media as external to the user, with its effects flowing uni-directionally—from the outside in. Although not explicitly stated, the media effects approach views users as passive recipients of media influence, with the inference being that media uniformly impacts adolescents, rather than considering individual differences in the way youth access or utilize content.

Further, within the media effects framework, a proposed mechanism between digital technology use and its effects centres on overall time spent online. The *displacement hypothesis* suggests that time spent online represents not only time spent on the Internet, but also time spent away from other activities (Kraut, Patterson, Lundmark, Kiesler, Mukophadhyay & Scherlis, 1998) such as sleep (e.g., Van den Bulck, 2007), participation in physical activities (Biddle, Gorely, & Stensel, 2004), and meaningful social interactions (Nie, Hillygus & Erbing, 2002).

**Limitations of the Media Effects Approach.** Although useful for conceptualizing time as a limited resource, and the effects (positive or negative) of engaging with technology, a limitation of the media effects model is its failure to acknowledge that the impact of media engagement are not uniform. Moreover, this approach discounts youths' *reasons for use* (Gauntlett, 2006). For instance, with regard to the displacement of meaningful social interactions, much of the time adolescents spend online is used to maintain, or even enhance their existing relationships (e.g., Gross, 2004; Lee, 2009; Valkenburg & Peter, 2007). Further, although many think of online gaming as being a socially isolating activity, research indicates that gaming- usernames are one of the first pieces of identifying information that 38% of adolescent



boys share when they meet someone with whom they would like to be friends (Lenhart, Smith, Anderson, Duggan & Perrin, 2015). Further, research has found that video games are associated with lower anxiety levels among teenage boys (Ohannessian, 2009). As the majority of teenage boys interact with each other while gaming, they tend to likewise experience enhanced social connectedness. (Ohannessian, 2018). This is just one example of how technology use can serve to enhance adolescent well-being through connection and support.

Further, although digital technology may indeed displace activities in certain areas of adolescents' lives (e.g., sleep; Vernon, Modecki, & Barber, 2018), the effects are also likely contingent upon *ways of use*, in that, when used excessively, technology tends to be disruptive. At the same time, it could be argued that excessive engagement in any activity can be associated with poor well-being, and thus technology use is not entirely unique. More importantly, it is unlikely that technology effects are fully causal. Some studies have found that excessive use of digital technology is likewise predicted by poor adolescent functioning. Specifically, Lemmens and colleagues (2011) found that low social competence, low self-esteem and high loneliness were all antecedents of problematic online gaming in youth. In this case, engagement with the online space may be resulting from, or reinforcing existing struggles for these youth, rather than being the origin of their poor functioning. In sum, findings tying adolescent media use to adverse outcomes are generally rooted, to some degree, within a media effects model, which is uni-directional and thus overlooks reasons for engaging with media in the first place. As a result, scholars have moved to acknowledge and explore more nuanced and bi-directional effects of adolescents' active selection of media.

## **What People do with Media**

As noted above, an essential component for considering the role of technology in young people's well-being is to clarify the specific reasons for adolescents' use and how those reasons might translate to adaptive or maladaptive outcomes. Several theoretical models speak to this notion, including Mood Management Theory and Uses and Gratification Theory (UGT).

**Mood Management Theory.** Mood management theory, as the theory's name implies, highlights the various ways in which people employ media based on their current affective experience. Specifically, this theory posits that individuals will select media content that promises to optimise their current mood (Knobloch, 2003). Perhaps the most empirically supported observation in mood management research is that users who are experiencing positive moods will seek positively valenced media to maintain their moods (Dillman Carpentier et al., 2008; Knoblock & Zillman, 2002). However, numerous studies have also observed that media choices often diverge from the hedonistic principles of minimizing pain and maximizing pleasure. Specifically, some studies have found that happy people do not always seek out positive media (e.g., Meadowcroft & Zillman, 1987), and further, people in negative moods have been found to select negatively valenced media rather than searching for uplifting content (Chen, Zhou & Bryant, 2007). Thus, individuals may be seeking media to match their mood (e.g., negative mood seeks out negative media), and this differs from mood management's posting of continually seeking to enhance mood. Interestingly, Dillman Carpentier and colleagues (2008) found that adolescents consistently turn to media when feeling down or less positive, but this did not link to selection of uplifting or positive media. Rather, they report a non-significant relationship between negative mood and the selection of positively valenced media. All told then, adolescents are not

just turning to technology to merely “cheer up”, and a more likely scenario is that adolescents’ use of technology varies depending on their current goals and needs.

**Uses and Gratifications Theory.** Unlike the media effects model, the Uses and Gratifications approach assumes that the consumer has an *active* role in their selection of media, and therefore, potentially plays a part in the effects that media may have on them (Smock, Ellison, Lampe & Wohn, 2011). This distinction is important, as the theory highlights individual differences in relation to the positive and negative well-being outcomes associated with adolescent technology use (Arnett, Larson, & Offer, 1995). More specifically, Uses and Gratifications Theory (UGT) is conceptualized as a means to study how media, including social media, are utilised to fulfil the needs of individual users with different goals (Katz, Blumler & Gurevitch, 1974).

As a result, UGT is grounded in five assumptions: 1) media selection and use is goal-directed, *purposive and motivated*, 2) people take the *initiative in selection* and use media to *satisfy needs or desires*, 3) a host of social and psychological factors mediate people’s communication behaviour, 4) media *compete* with other forms of communication for selection, attention, and use *to gratify needs and wants*, and 5) *people are typically more influential* than media in the relationship (Lometti, Reeves & Bybee, 1977). These theoretical groundings highlight the UGT viewpoint that individuals, including adolescents, are active users of technology; the adaptive function technology plays (at least in the short-term) to perpetuate adolescents’ use; the role of individual differences in conditioning links between technology use and well-being outcomes; and, the fact that online and offline supports may both compete with, and compliment, one-another in helping to sustain adolescent functioning.

Perhaps not surprisingly, given its emphasis on active use and adaptive functions, the UGT model has been used to identify motivations for Internet use, and three main categories of gratification have been identified: 1) *Content gratification*, which includes the need for researching or finding specific information, 2) *Process gratification*, gaining gratification from the process of browsing the internet, either purposefully or randomly, and 3) *Social gratification*, which is based on forming or deepening social ties (Stafford, Stafford & Schkade, 2004). Generally speaking, these gratifications are applicable to various forms of digital technologies, acknowledging that certain forms of media may be used primarily for one gratification. For instance, Johnson and Yang (2009) found that Twitter is used primarily as an information source rather than for addressing other needs. That said, with the current state of technology, different forms of media are all now readily accessible through a single digital device, and youth are able to seamlessly navigate between applications, depending on the type of gratification they are seeking to obtain.

### **Online Coping: Uses and Gratifications that are Motivated by Stress**

Given that UGT asserts that youth seek out different technological contexts depending on their gratification goals, UGT can usefully be drawn upon in conceptualising how individuals seek out the online space in an effort to cope with stressors. The studies in this thesis propose that when specific uses and gratifications of media use are *motivated by the need to manage stress*, these behaviours can be considered to be akin to online coping strategies. Although, as noted earlier, researchers have largely overlooked the digital space as an arena for youth to manage stress, there are several exceptions. Among these, van Ingen and colleagues (2016) define online coping as “thoughts and behaviours that are *facilitated by the internet*, that people use to manage stressful situations” (pg. 512). Thus, the next section briefly outlines the

literature on adolescent online coping behaviours in relation to the three main gratifications for internet use outlined in UGT: Content, Process and Social gratifications.

### **Online Information Seeking (Content Gratification)**

A key reason that youth turn to technology in times of stress is that the online space offers a wealth of information. Indeed, adolescent self-report data suggests that youth are turning to the Internet to research adolescent-specific concerns, particularly those of a sensitive nature that they might not feel comfortable discussing with parents or peers (Skinner, Biscope, Poland & Goldberg, 2003). In fact, much research attests to adolescents' searching for health information online (Gray, Klein, Noyce, Sesselberg & Cantrill, 2005; Harvey, Brown, Crawford, Macfarlane, & McPherson 2007; Selkie, Benson, & Moreno, 2011).

Beyond formal online information sources, the online space is also a key medium where youth seek information and advice from their peers. For instance, a content analysis of online bulletins for adolescents revealed that the most frequently shared health-related concerns were based on the following topics: sexual health, pregnancy/birth control, body image and self-grooming (Suzuki & Calzo, 2003). Additionally, teens seeking advice regarding mental health difficulties are increasingly using online contexts to connect with peers. However, some risks to youth well-being have also been identified in relation to youth information seeking online (Elmqvist, & McLaughlin, 2018). Illustratively, Cavazos-Rehg and colleagues (2016) coded advice shared online through the platform, Tumblr and found that 25% of posts provided potentially harmful advice (e.g., advising how to engage in self-harm or maladaptive behaviours) and that only 13% of posts suggested seeking professional help or therapy

to cope with mental health struggles. Thus, although the online space provides a widely available resource for youth seeking information, it is also likely that youth could benefit from better directions as to where and how to seek relevant and accurate material.

### **Online Self-Distraction (Process Gratification)**

Beyond information, the digital space of course serves as a source of enjoyment, and youth look to online videos, gaming, researching interests and social networking sites for entertainment. These and other online experience provide short-term diversions, and thus the digital world provides ample opportunity for youth to distract themselves from their stressors (Eschenbeck et al., 2018; Knobloch-Westerwick, Hastall & Rossmann, 2009). In fact, such short-term diversion may allow youth to recoup from stress, and in turn, help them manage it more effectively. For example, a commonly scrutinized online activity is online gaming (Przyblyski & Weinstein, 2019), yet research has found that gaming may be used to manage stressors (Przyblyski, Rigby, & Ryan, 2010). Specifically, Reinecke (2009) found that, at least in adults, video and computer games are systematically accessed after exposure to daily stressors, particularly for participants who reported low levels of social support. Thus, online experiences including gaming may play a compensatory role as a coping strategy for youth.

Likewise, social media use, specifically Facebook, has actually been found to be protective against the experience of stress. Specifically, in a laboratory study, Rus and Tiemensma (2018) found that the use of Facebook before the experience of an acute social stressor buffered participants' psychosocial experience of stress, as well as their physiological reactions to stress. Importantly, these results were based on passive

Facebook use, which entails consuming social media content, as opposed to actively messaging and posting online. Thus, this study is among the first to provide evidence that social media use may be used as a buffer against stressors when used as a form of distraction.

That said, when it comes to adolescents, research investigating the potential palliative effects of online self-distraction strategies is lacking. Instead, the field is dominated by studies investigating the potential dangers of using the digital space as a means of escape (Ko, Yen, Chen, & Yen, 2005; Mehroof & Griffiths, 2010). However, the distinction between escape and self-distraction is an important one in the coping literature (Zimmer-Gembeck et al., 2011), as self-distraction can be considered adaptive when engaged in moderately. In contrast, escapism, especially in relation to the online context, has been consistently related to high levels of psychopathology and problematic levels of internet use (Kardefelt-Winther, 2014). Thus, online self-distraction, (as opposed to escapism) and when engaged with at appropriate levels, should not necessarily equate to poor well-being outcomes, and may serve as an adaptive function.

### **Online Emotional Support (Social Gratification)**

Lastly, beyond information seeking and distraction online, adolescent peer relationships are often built and/or sustained online. During adolescence, youth increasingly discuss personal problems with each other (Frison & Eggermont, 2015), and the digital space provides an important area to communicate with and support each other in the face of daily stress. Indeed, adolescents report that they use the Internet predominantly for interpersonal communication (Frison & Eggermont, 2016; Gross, 2004; Lenhart, Madden & Hitlin, 2005). This body of research is a welcome change of

pace for the field more generally, as it attests to the potential benefits of near-constant access to social supports via the internet (e.g., Amichai-Hamburger, Wainapel & Fox, 2002; Valkenburg, Schouten, & Peter, 2005; Wästlund, Norlander, & Archer, 2001). As one example, Instant Messaging services may play a pivotal role for youth, as they enable private, synchronous ways of communication, and have been found to provide emotional relief for youth in particular, when turned to in distress (Dolev-Cohen & Barak, 2013).

In fact, studies have pointed to the potential compensatory benefits online emotional support may serve, especially among vulnerable youth. For example, Selfhout and colleagues (2009) tested longitudinal associations between mental health symptoms and time spent communicating on the internet (versus non-communication purposes). Results showed that, for youth with low levels of offline social support, use of the online space for communication purposes predicted fewer depressive symptoms. Thus, the online space may serve as a supportive respite for youth with fewer offline resources. Similarly, Bonetti, Campbell and Gilmore (2010) found that youth high in social anxiety reported using the internet more often than their less anxious counterparts for the purpose of alleviating feelings of loneliness. Again, it may be that the online world can be especially helpful when offline worlds present as particularly difficult or challenging. However, although these studies point to the online space as a source of connection for youth, none to date have explored the effectiveness of online emotional support seeking as a coping strategy in the face of daily stressors.

### **Chapter Summary and Remaining Gaps**

This chapter introduced the notion of adolescents' digital world as a potentially potent resource for youthful coping. Given technology's prevalence and central role in



adolescents' daily life, it is not surprising that adolescents undertake normative developmental tasks online. Much of this experience is arguably productive and positive. In fact, one explanation for the rather mixed literature on technology's impact on youth well-being may be due, at least in part, to the theoretical underpinnings of early research in the field. In this case, a focus on outcomes of technology use, as opposed to consideration of different motivations for use and the resulting (and often varying) outcomes. This in turn has led to a somewhat myopic picture of technology's risks or failures, as opposed to its opportunities of enhancing well-being. Alternatively, UGT provides a dynamic framework for exploring adolescents' engagement with technology in association with coping motives, including information seeking, support seeking, and distraction.

Although Chapter 3 lays the groundwork by linking relevant communication theory with adolescents' coping motives and behaviour, empirical work is needed to validate the occurrence of these coping motives in everyday adolescent life. Likewise, beyond providing a sense of prevalence of adolescent online coping, research of course needs to explore and understand the degree to which different online coping strategies might be helpful (or harmful) for youth. As a result, research described in Study 2, which characterizes adolescents' qualitative discussions on why and how they use the internet in the face of stress, provides a needed proof of concept. Likewise, empirical data described in the second half of Study 2, linking adolescents' reports of online coping to other youthful characteristics such as technology use, stress, and psychopathology provides a critical validity check. Further, by tying online coping to experience sampling reports of stress and stress responses, Study 2 and Study 3 provide much-needed, novel data for understanding the benefits (and risks) associated with

online coping among adolescents living in under-resourced environments of socio-economic disadvantage.

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#### **Chapter 4: How Do We Measure Adolescent Coping?**

The previous chapters made clear that in order to better understand how adolescents manage stress, a fine-grained approach is required, especially in relation to measuring coping. In particular, intensive longitudinal approaches such as ambulatory assessment are arguably well-poised to capture adolescents' fluctuating experiences of stress, emotion, and coping. However, ambulatory assessment methods also bring with them manifold decisions and associated trade-offs, so that no single best-practice exists.

Thus, Study 1 provides an overview of adolescent coping research that has used ambulatory assessment and explores methodological options in relation to individual study aims, theory, and population considerations. This study is published in *Journal of Research on Adolescence* (Impact Factor 2.071; SCImago ranking Q1). The PhD Candidate is the first author of the paper, the principal supervisor is co-corresponding author, two members of the supervisory team are co-authors. Professor Melanie Zimmer-Gembeck and Dr. Bep Uink were contributors and study-co-authors. Electronic supplementary material to the paper are attached at the end of the of Chapter 5.

#### **STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER**

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The PhD Candidate's contribution to the paper involved co-conceptualizing the study, co-coding of all data and all data synthesis, drafting the manuscript, and revising the manuscript in the publication process. Study co-authors provided feedback and/or comments on the manuscript.

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## **Chapter 5:**

### **Ambulatory Assessment of Adolescent Coping: It's a Complicated Process**

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### **Abstract**

Scholars have long-called for research to treat coping as a process that is measured over an arc of time. Ambulatory assessment (AA) offers an appealing tool for capturing the dynamic process of adolescent coping. However, challenges in capturing the coping process are not altogether circumvented with AA designs. We conducted a scoping review of the AA literature on adolescent coping and draw from 60 studies to provide an overview of the field. We provide critiques of different AA approaches and highlight benefits and costs associated with various types of measurement within AA. We also speak to considerations of participant burden and compliance. We conclude with recommendations for developmental scholars seeking to deploy AA to capture this quintessential process among adolescents.

**Key words:** coping, ambulatory assessment, experience sampling

## **Ambulatory Assessment of Adolescent Coping: It's a Complicated Process.**

### **Introduction**

The transition from childhood to young adulthood is characterized by an upswing in psychosocial vulnerabilities, emotional lability, and stressors and challenges (Larson, Moneta, Richards, & Wilson, 2002; Modecki, 2016). In fact, with its physical and cognitive transformations, evolving family and peer relationships, inexperienced romantic relationships, and educational demands, the adolescent period is sometimes typified as one of “navigating stressors” (Luciana, 2013; Modecki, Zimmer-Gembeck, & Guerra, 2017). Daily hassles represent a salient source of strain for youth, and research suggests that experiencing these and other relatively minor stressors can have significant explanatory power in predicting later maladjustment (Compas, Davis, & Forsythe, 1985; Sim, 2000). As a result, one major developmental task during adolescence is to acquire the skills needed to respond adaptively to stressors across day-to-day life.

Given that youth coping has major implications for symptoms of psychopathology in the short term (Grant et al., 2003; Uink, Modecki, & Barber, 2017) as well as for long-term psychosocial development (Frydenberg, 2008), there is a compelling need to better understand youths’ experience of coping across their days. In part, a lack of understanding of adolescents’ coping capacity is related to legitimate challenges that exist in tapping this process. Illustratively, a widely accepted coping definition highlights that coping is a fine-grained dynamic progression—that is, coping is a “conscious and volitional effort to regulate emotion, cognition, behavior, physiology, and the environment in response to stressful events or circumstances” (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001, p. 89).

Not surprisingly then, coping scholars were among the earliest adopters of Ambulatory Assessment (AA) in an effort to more fully characterize this process (e.g.,

Stone, Neale, & Shiffman, 1993; Larson & Ham, 1993). In fact, more than three decades ago, foundational scholars of coping, Lazarus and Folkman (1984) called for “micro-analytic, process-oriented research” to assess the complex interplay between the individual and her/his environment. Since that time, and especially in the last decade, the field has shown mounting enthusiasm for deployment of AA methods for the study of well-being generally (Modecki & Mazza, 2017) for the study of coping (e.g., Serre, Fatseas, Swendsen, & Auriacombe, 2015) and adolescent development (e.g., Heron, Everhart, McHale, & Smyth, 2017) more specifically. Accordingly, what follows is a scoping review and an informed critique of the literature. To lend a clearer sense of the field, we audited AA research on child and adolescent coping, and considered major themes and approaches.

We searched Web of Science, Psych Info, and Pub Med with a combination of a range of terms which allowed us to identify studies including a searchable item associated with coping (e.g., cope, coping, stress appraisal, emotion response); ambulatory assessment (e.g., experience sampling, daily diary, ecological momentary, momentary assessment, ecological assessment, electronic diary); and youth (e.g., adolescent, pre-adolescent, early adolescent, youth, student), up through mid -2017. After culling studies which did not meet each of these subject criteria, and those which did not include data, we began our focused review with 413 studies. We extracted abstracts and underwent a closer search for studies which could be conceptualized as coping (loosely defined as including the term “coping” or “emotion regulation” in response to stress or hassles). Two hundred and ten were retained for further review and coding. These were evaluated by four study authors for inclusion criteria including population (e.g., children, adolescents or college students) whether any type of coping (or closely related construct in response to stress) was measured, and self-report daily

diary or momentary assessment. Of these, 60 studies were considered relevant for a systematic discussion, and these are listed in Supplementary Table 1 (S1). Notably, because the distinction between coping, emotions, and behaviors is not always clear, an expansive set of studies were included (e.g., Skinner & Zimmer-Gembeck, 2007). We draw on these to first provide a broad overview of the adolescent AA coping literature. We then progress to enumerate the challenges, benefits, costs, and advantages of varied AA study designs that are represented within Table S1. Finally, we conclude our scoping review with a series of scholarly recommendations for the field.

### **Ambulatory Assessment and Adolescents**

As evidenced by this Special Issue, AA methods have grown in fashion in parallel with rapid advances in technology (Singer, 2017). In particular, self-report digital AA (sometimes referred to as ecological momentary assessment-EMA, or experience sampling methodology-ESM) is facilitated by youths' rapid uptake of new mobile technologies, their native dexterity in navigating digital settings, and their ability in making intuitive use of emerging apps and innovations (Subrahmanyam & Smahel, 2010). Moreover, a particular strength of AA designs is that youth are treated as their own "control," thus data provide novel insight into how youth deviate from their average, across time and settings. Specific to our focus on adolescent coping, one of the foremost advantages to AA is that youth are able to report processes unfolding across micro-time periods (e.g., hours, days) as they navigate ordinary life, across varied demands and settings. Thus, with AA, we can gauge, and ideally unpack, the micro-progression of adolescents' coping processes in-vivo. Importantly, the term "process" is highlighted here intentionally, as scholars widely characterize coping as a sequence, but only more recently have researchers studied it as such.

### **Coping Theories and the Importance of Process**

Developmental, clinical and health scientists have a rich tradition of considering coping in children and adolescents, as part of their field's attention on factors that can promote positive outcomes or that can protect against long-term mental and physical difficulties. Coping is of particular interest for scholars assessing youths' exposure to adversity, including challenge in the form of daily stressors (e.g., victimization or exclusion by peers; Zimmer-Gembeck, 2016) or major adverse life events (e.g., poverty or loss of a parent; Cicchetti & Rogosch, 2009; Masten, 2001). Thus, coping is often viewed as a promotive or protective factor (e.g., Modecki et al., 2017). Yet, considering coping as a static "factor" is not very satisfying in developmental science. Instead, coping responses are often described with terms that suggest a process of adaptive regulation, such as descriptions of "managing" or "dealing" with stressors. A major challenge, then, in deploying AA to assess youthful coping is how to extract essential elements of this process of managing real-life stressors in a well-timed, brief, and reliable manner.

Further, as with any research agenda, design is incumbent upon the theoretical framework. Theoretical frameworks of coping are varied, among these include Lazarus and Folkman (1984); Sandler and colleagues (2000); Taylor and Stanton, (2007); Carver, Scheier, & Weintraub (1989); Compas and colleagues (2001); Skinner and Zimmer-Gembeck (2007); and others, however throughout, a core emphasis on *process* remains. Specifically, across these and other varied perspectives on coping, scholars speak to a collection of regulatory processes which play out across a span of time, such as initiating a coping process, mobilizing resources, and coordinating goals and responses. Thus notionally, capturing coping should entail tapping aspects of the wider

process, beginning with stress detection, encapsulating various coping responses, and subsequent outcomes (Folkman & Moskowitz, 2004).

Beyond conceptualizing coping as a micro-longitudinal process, coping is also widely characterized as engaging multiple levels of experience (i.e., including factors which occur within an individual, such as unique circumstances and events, and across individuals, such as health and demographic risks). For instance, Skinner and Zimmer-Gembeck (2016) proposed a multilevel framework that described coping as dynamic, and involving multiple subsystems (e.g., physiological, emotional, attentional). Their model considers coping as occurring at three time-intervals: "on the scale of developmental time; ...as an episodic process across days and months; (and) in real time as an interactive regulatory process" (p. 10)". Thus, this model speaks to multiple between-person and within-person elements which interact to influence how youth cope with stressors across multiple spans of time.

Bearing this in mind, through the lens provided by AA, scholars might characterize between-person factors in terms of trait or dispositional qualities (e.g., psychopathology, developmental stage). These factors, in turn, likely influence within-person variation in appraisals (e.g., process of appraising the stressor as a challenge or a threat) and the subsequent retrieval of possible coping responses. Likewise, within AA, we might expect within-person variation in terms of different stressors (including severity of stressors) and different circumstances. Finally, scholars might tap coping outcomes in terms of short-term relief from stressors within AA or by linking AA response to measures of longer-term well-being.

### **Traditional Trait-Based Study of Coping**

Traditionally, scholars have employed retrospective measures in an effort to characterize adolescent stress and coping, soliciting adolescents' own reflections of

their affective well-being and coping responses *in general*, or over a certain period of time (e.g., during the past month) (Folkman & Moskowitz, 2004). In response to such assessments, adolescents must combine remembered affective and behavioral responses into a given global outcome measure (e.g., Adolescent Coping Scale: Frydenberg & Lewis, 1993; Ways of Coping: Folkman & Lazarus, 1980; The COPE Inventory: Carver, Scheier, & Kumari Weintraub, 1989). These methods and measures have provided the essential groundwork for our conceptualizations of youthful coping (e.g., Ayers, Sandler, West, & Roosa, 1996), and offer useful evidence for how youth generally cope with stressful events across given situations. However, these methods do have several shortcomings, many of which AA methods are well-posed to address.

One of the most widely cited drawbacks to retrospective responding using trait psychometric scales is recall biases (e.g., participants tend to recall stressful events which are consistent with their current affective state; Trull & Ebner-Priemer, 2009). AA offers advantages of tapping emotions, motives, events, and behavior on a far shorter time-scale (e.g., over the day, over the last few hours, or even over the last hour) relative to psychometric scales (Scollon, Kim-Prieto, & Diener, 2003) and thus reducing such recall biases. Also problematic is that trait questionnaires of coping risk imprecision and possible inaccuracy because they assess context-dependent constructs (i.e., coping) by querying about *general* tendencies across settings and contexts (O'Toole, Jensen, Fentz, Zachariae, & Hougaard, 2014). Further, trait-based approaches have additionally asked youth to envision how they believe they would cope within a given situation (e.g., use of hypothetical vignettes). However, a critical issue with such methodology is that projections of behavior consistently differs from actual behavior (Dunning, Heath, & Suls 2004). Consequently, trait-based measures, even those based

on past behaviors or hypothetical vignettes, may not accurately tap adolescents' actual experiences or behaviors.

### **AA Design Considerations**

Although AA methods can help minimize or circumvent these drawbacks found in traditional trait-based studies, AA is not without its own challenges. As with any research method, researchers wishing to utilize AA to study youthful coping are confronted with a range of considerations, starting from questions of study design. Likewise, as with any theoretically driven study question, scholars must match their design with the coping process that is being conceptualized. Because AA has primarily been deployed to examine coping as an episodic process, that is, as a process that is initiated by the experience of a stressor, that includes an adolescents' deployment of a coping strategy, and that ends with emotion relief or a behavioral outcome, this lends itself to two main designs. When focused on this micro-process of coping, researchers have elected to tap youthful coping responses by either relying on time-based or event-based designs.

#### **Time-Based Designs**

In time-based AA designs, which include signal- (whenever the device "beeps") and interval (at specific time points)-contingent designs (e.g., Khor et al., 2014) youth report on phenomena of interest at specific, predetermined time points (as opposed to events). Taking the view that coping is a continually unfolding, dynamic and cumulative process (Lazarus & Folkman, 1984), time-based designs represent a strong fit for the assessment of adolescent coping. That is, this design allows for the repeated sampling of stressful events, coping responses, appraisals, emotions, or behavioral reactions, as they unfold. Thus, researchers can glean needed insight into the process of coping. However, the question becomes- how frequently, and for how long, do



adolescents need to report on their stress experiences and coping responses in order to adequately capture this process?

**Time-based designs: how often?** On the one hand, researchers may wish to adopt a sampling schedule that allows for as many repeated assessments as possible. Indeed, more sampling moments across the day or week would be assumed to increase the chance of capturing ‘coping in action’. Further, with greater sampling moments comes the possibility of measuring coping across a larger variety of social contexts which youth inhabit (e.g., the classroom, the family, being with peers). Such contextual information is especially helpful for understanding adolescents' coping responses, given that coping is expected to be differently constrained or supported within different social settings (Mesquita & Boiger, 2014). As an example, Waller and colleagues (2014) phoned depressed and non-depressed adolescents 42 times over three weeks, to assess differences in two coping behaviors – co-rumination and co-problem solving – in two different social contexts, when with peers and when with family. In so doing, the authors were able to compare co-rumination that occurred with peers versus parents and show that contextual effects were dependent on youths’ depression status.

Yet, the need to sample youths’ coping behaviors frequently enough to capture the process unfolding, and across multiple contexts, must be balanced with considerations of participant burden. Thus, scholars must contend with the possibility that sampling too frequently, or not frequently enough, may result in missing out on core elements of the coping process (Ebner-Priemer & Swatitzki, 2007). As outlined in the “Length and Timescale” section within Table S1, within the studies we examined, sampling frequency differed substantially, ranging from once per day (e.g., Hema et al., 2009; Johnson & Swendsen, 2015) to 25 – 30 times per day (e.g., Henker, Whalen, Jamner, & Delfino, 2002), making precise recommendations for the ‘ideal’ number of

sampling moments unclear. What is clear, though, is that the number of sampling moments within time-contingent studies need be approached as a cost-benefit analysis. Indeed, as Nesselroade and Featherman (1994) fittingly convey “choosing an interval for repeated measurements is something like selecting a sieve or a strainer for use; you may lose some pieces you would like to keep because the holes (intervals between measurements) are too large or retain some that you don’t want because the holes are too small” (p. 48).

Whatever the size of one’s scholarly sieve, time-based designs will not always be ideal for capturing coping processes. Specifically, the majority of AA coping studies that utilize time-based designs ask youth to report on whether a stressful event occurred since they were last contacted (e.g., Khor, Melvin, Reid, & Gray, 2014) before asking about coping responses. Yet, in most studies, many adolescents do not report encountering a stressful event on any given day, and thus, do not report coping responses. For example, adolescents in the Johnson and Swendsen (2015) study reported a maximum of one peer, family and school-related stressor across 28 sampling moments, and just under a quarter of adolescents (24%) in Low and colleagues (2013) reported having an argument with their parents at *every* sampling moment (each day, across a 7-day sampling period). Thus, stressful events can be too infrequent for this design. Thus, a possible alternative is to ask youth to initiate the reporting process themselves when they encounter a stressful experience.

### **Event-Based Designs**

Event-based designs (also known as event-contingent designs) offer a potential solution for tailoring AA to more closely monitor when stressful events are perceived, and when coping responses are initiated. Instead of predetermined sampling times, event-based designs ask adolescents to complete AA reports whenever a specific event

occurs. As an example, in examining the link between stressors, negative affect and eating, Kubiak and colleagues (2008) asked obese adolescent girls to make an AA report of negative affect and rumination whenever they experienced a hassle. Likewise, event-based designs can be used to sample specific coping behaviors. For instance, Goldstein and colleagues (2015; 2014) asked late adolescents to report whenever they gambled, and Gorka and colleagues (2017) asked adolescents to report whenever they had smoked or craved a cigarette.

Event-based designs can be particularly useful for measuring relatively low frequency coping behaviors, or those that require a specific context or setting (Piasecki, Richardson, & Smith, 2007). Examples of such (problematic) coping behaviors include non-suicidal self-injury (e.g., Nock, Prinstein, & Sterba, 2009), bingeing and purging (Karr et al., 2013), or drinking alcohol (Hussong, 2007; Hussong, Galloway, & Feagans, 2005). Illustratively, Karr and colleagues (2013), though in a sample including adults, used event-based reports of bingeing and purging to show that women diagnosed with bulimia nervosa plus post-traumatic stress disorder exhibited faster increases in negative affect before a binge/purge episode, as well as faster decreases in negative affect after an episode, compared to women with a sole diagnosis of bulimia nervosa. Arguably, such nuanced data on bingeing and purging as maladaptive coping behavior could be overlooked in time-based designs.

Importantly, among the AA studies of adolescent coping reviewed here, none relied exclusively on event-based designs (e.g., Kubiak, Vögele, Siering, Schiel, & Weber, 2008; Goldstein, Stewart, Hoaken, & Flett, 2014; Gorka, Hedeker, Piasecki, & Mermelstein, 2017). Rather, event-contingent designs were included alongside time-based sampling. Indeed, in Karr and colleagues (2013) study, across 14 days, women reported an additional 1006 episodes of bingeing and purging not picked up within the

time-based prompts. This suggests that time-based designs may not fully capture the frequency of certain coping behaviors, and that for behavioral coping responses, for example, time-based designs may be best paired with event-contingent methods.

### **Coping Measurement in Ambulatory Assessment**

Outside of one's design strategy, one thorny challenge that AA researchers face lies in their measurement of coping. The difficulty here being that coping is a complex and interactive process, and in the context of AA, characterizing "coping" can be nebulous.

The prospect of quantifying a construct characterized as "coping" in situ can lead scholars to seek the more familiar havens of person-level psychometric scales (e.g. at pre-test). Alternatively, some scholars seek to adapt coping measures to a select number of ambulatory items in an effort to adequately account for the time and situation-dependent nature of the coping process. As another option, other scholars elect to operationalize coping through specific behaviors (e.g. smoking, avoidance, self-harm), which can be assessed as both trait and state-level constructs.

Although psychometric scales provide a sound basis for external and internal validity, they are typically too burdensome for multiple repeated assessments in a short time frame. Thus, as described below, psychometric scales tend to be reserved for pre-AA coping assessments. However, those scholars assessing coping at a daily or momentary level have mainly sought to adapt trait self-report scales to their state equivalencies (e.g., Bentall et al., 2011). Yet, approaches have been inconsistent; some scholars have relied on one item per coping response type, whereas others have used multiple items, and still others have combined items from different scales in an attempt to capture a wider range of coping responses (e.g., Massey, Garnefski, Gebhardt, & Van Der Leeden, 2009). As a result, rarely do researchers fully explore the full extent of

possible coping responses in situ, or consider how different stressful events might elicit different coping responses. Hence there is no gold-standard measure, as of yet, for assessing state coping within AA. Below we briefly describe these different approaches to measuring coping, moving from the trait to the momentary level, along with their associated benefits and limitations.

### **Trait, Daily, or Momentary Assessment of Coping**

**Trait Coping in Ambulatory Assessment.** Despite the promise of AA for measuring the coping process, trait-level measurement of coping is still used within these designs, as found in four of the studies (6.7%) included this review. For example, Cleveland and Harris (2010) investigated the moderating role of trait coping strategies, specifically problem-solving and avoidance, between daily negative affect and daily substance cravings in college students in substance abuse recovery. The study found that students who reported trait-level avoidance coping, experienced higher levels of cravings on days where their negative affect was also high. As another example, Low and colleagues (2013) investigated the role of trait coping, stress and inflammation in adolescents. This study measured both daily stressors and negative life events and found trait positive engagement coping, as opposed to disengagement coping, to be a protective factor for youth with high stress. While both studies provide novel insight in tying coping to key aspects of health, they and many others still rely on broad brush-strokes to characterize coping. These broad themes of “avoidance is harmful” and “approach is adaptive” have appeared in the coping literature since the field’s inception. Recall that trait or dispositional reports of coping have been found to correlate only weakly with AA reports of coping (Todd, Tennen, Carny, Armeli, & Affleck, 2004). Thus, despite the use of AA methods, without a measure of coping embedded within the ambulatory design, findings cannot fully clarify ‘what works’ for youth, and when.

**Measuring Daily Coping.** As an alternative, some researchers have begun to tap coping processes on a daily basis. Indeed, one-fifth of studies reviewed in Table S1 fall under this rubric. Daily coping has most often been measured through end-of-day reports (sometimes referred to as daily diaries), whereby youth are asked to reflect upon their day and nominate the degree to which they have engaged in specific cognitive or behavioral coping strategies (e.g., Aldridge-Gerry et al., 2011; Hema et al., 2009). For example, Aldridge-Gerry and colleagues (2011) used a daily-diary design to explore the relations between ethnicity, the experience of daily stress, coping strategies and alcohol consumption. This study is a notable example of a thoughtfully designed AA approach for determining interrelations among focal between- and within-person factors, assessing cognitive and behavioral methods of coping, and how these differ based on one's reported ethnicity.

Daily measures in AA offer the distinct advantage of reducing participant burden while still allowing for the possibility of a more thorough assessment of the coping process. For instance, daily AA measures can still include multiple facets of the coping process (e.g., Hoggard, Byrd, & Sellers, 2012). That said, sampling adolescents' experiences on a daily basis may still not tap the intricacies of the coping process in its entirety. Specifically, as with trait self-report measures, end-of-day reports may be coloured by participants' affect at the time of reporting, and so may not provide a fully accurate recollection of the stressors experienced, the coping responses or even the outcomes of the coping process (Stone, Shiffman, Atienza, & Nebeling, 2007).

Perhaps the most notable limitation of using daily measures within AA is that often the direction of causality cannot be accurately tested, given emotions and behaviors experienced across the day are reported simultaneously (Aldridge-Gerry et al., 2011; Ham & Larson, 1990). However, we note some useful work-arounds in the

literature. For example, Weiss and colleagues (2017) investigated the bi-directional associations between daily emotion regulation strategies and substance use in daily diary design. To do so, they simultaneously enquired about the current day's emotion regulation strategies (e.g., "since waking until the time of the report"), and substance use during the previous evening (e.g., "since completing yesterday's survey"), thus allowing for time-lagged models to test these relations. Although this type of design is still subject to a degree of potential bias from retrospective recall, it does at least allow for the inference of causal effects.

**Measuring Coping in Situ.** As an alternative, a smaller subset of studies (15% in this review) have measured coping on a within-day basis, hence implementing AA designs to their full effect (e.g., Allen et al., 2016; South & Miller, 2014; Tan et al., 2012). These designs vary considerably in the number of sampling moments, ranging from 3 (Ranzenhofer et al., 2014) to a substantial 30 assessments (Henker et al., 2002) within a single day. The benefit of these momentary assessments is that they can help paint a more detailed picture of youths' coping processes, and thus equip scholars with a deeper, more nuanced understanding of what promotes or prevents adaptation in the face of stress. For example, Tan and colleagues (2012) employed an AA design to investigate anxious youths' emotion reactivity and emotion regulation strategies in response to micro- stressors. They found that, compared to a healthy control group, anxious youth did not show greater reliance on maladaptive emotion regulation strategies (e.g., avoidance), or less reliance on adaptive strategies (e.g., acceptance). Rather, the efficacy of certain strategies heavily depended on the severity of the stressor, which specific negative emotion youth were attempting to manage, and how much simultaneous physiological arousal they experienced. Scholars cannot tap this level of detail (i.e., the conditioning effects of stressor severity, discrete emotions, and

level of physiological arousal) and hence uncover this type of nuanced information, without repeated assessments of these constructs across the day.

Thus, momentary coping measures offer the advantage of finer detail, and arguably increased ecological validity of reports. However, AA designs that tap coping at a momentary level can place considerable demands on youthful participants—which may be reflected in high drop-out and/or low compliance rates (McCabe, Mack, & Fleeson, 2012). Indeed, small sample sizes can be an issue with momentary coping approaches (e.g. Kubiak et al., 2008; Pavlickova, Turnbull, Myin-Germeys & Bentall, 2015). As an alternative, by sampling more intensively over the day, or extending the sampling period, which generally run between five (Tan et al., 2012) to fourteen days (Razenhofer et al., 2014), researchers can increase their power to detect effects. Longer time frames also make sense in that the likelihood of capturing the coping process is arguably diminished within shorter sampling frames, at least among normative samples. To address this concern, some AA designs have usefully executed AA assessments across a much longer sampling period (e.g., 30 days O’Hara, Armeli & Tennen, 2016), with the sacrifice here being the likely omission of core aspects of the coping process (e.g. stressors, affect, or other outcomes).

**The Combination of Trait, Daily or State Measurement.** A scoping of the literature makes clear the flexibility of AA methods for capturing coping at different time-levels. Some of these useful possibilities are highlighted within Table S1. Indeed, the vast majority of studies in this review sought to combine either trait and daily measurements (35%) or trait and momentary measurements of coping (23.3%). In several cases, studies have used a combination of trait and daily/AA coping scales, which have helped expand upon cross-sectional findings. For example, Waller and colleagues (2014) compared trait and momentary reports of rumination in youth with



major depressive disorder (MDD) and healthy controls. Consistent with prior research, youth with MDD reported higher levels of trait rumination. However, through AA measurement, it was also found that depressed youth engaged in rumination almost three times more often as controls in vivo.

As another example, and pointing to the immense potential of AA to deepen scholarly understanding of youthful coping, the inclusion of AA measures has helped to debunk long-held beliefs in the coping sphere. For instance, cross-sectional research has widely suggested that suppressing the expression of emotion is maladaptive (Pepping, Duvenage, Cronin, & Lyons, 2016). However, Chapman, Rosenthal, and Leung (2009) measured trait experiential avoidance (e.g., emotional suppression) among late adolescents, and then instructed them to either suppress or observe their negative emotions throughout the day. At the momentary level, youth reported their emotion and urges to engage in impulsive behaviors (e.g., self-injury). Among youth who exhibited features of borderline personality disorder, positive affect was higher and urges to engage in impulsive behaviors were diminished on days where they suppressed their emotions. Thus, this study design provides evidence that expressive suppression may actually be adaptive within specific populations, at least in the short-term.

Further, studies that incorporate both trait and AA measures of coping have made clear that there is often poor correspondence between momentary assessment and trait-coping measures. For instance, Hussong et al., (2005) investigated the association between college students' trait reports of 'drinking to cope' with their actual experience of daily negative affect and alcohol use. They found that students who indicated that they drank alcohol as a means to cope consistently reported daily mood experiences that were not linked to their drinking. These findings could be taken to suggest that using alcohol is an ineffective means to manage negative affect among college students, or

that the assessment of coping motives at the trait level provides imprecise information with regard to the in-situ relation between negative affect and alcohol use.

As another example, in a study of coping motives for smoking cigarettes among late adolescents, Piasecki and colleagues (2007) found that trait-based responses measured pre- AA did not correlate with in vivo reports of coping. In this case, the relative importance of particular coping motives differed by assessment method (retrospective reports vs. daily diary). Retrospective reports of coping motives appeared to measure subjective importance of different smoking to cope outcomes, rather than the probability or incidence of outcomes (Piasecki et al., 2007). These and other studies are suggestive of the idea that momentary assessment and retrospective recall are perhaps assessing different features of experience (Conner & Barrett, 2012).

### **The Process of Coping: The Trigger and the Outcome**

#### **What's the Problem? Measuring Stressors**

Beyond the challenges of operationalizing and measuring coping in a theoretically meaningful way (i.e., whether at a trait, daily, or state level), challenges exist in measuring its triggers - stressful events. There are numerous possibilities for assessing stressors, and thus not surprisingly, the literature is highly variable in regard to how stressful events have been measured. This variability is important, because from a theoretical perspective, the nature of the stressor can arguably be deemed just as important as the coping response itself (Carver & Connor-Smith, 2010). Indeed, scholars have repeatedly argued that that a specific coping strategy might be effective in one situation, but less productive in another (Folkman & Moskowitz, 2004). Further, effectiveness will depend on how well a coping strategy matches the stressor itself (Carver & Connor-Smith, 2010). Thus, facets that might usefully be measured include how severe the youth rates the stressor severity (e.g., Khor et al., 2014) how much a

youth perceives that they have control over the stressor occurrence or resolution (e.g., Allen et al., 2016), whether the youth expected the stressor, (e.g., Ham & Larson, 1990), and the context in which the stressor occurred (e.g., Shrier, Rhoads, Burke, Walls, & Blood, 2014).

In fact, a critical oversight within the AA literature (found in 32% of studies we detailed) has been failure to measure stressful events, let alone the nature of specific stressors. This may be due to a heavy focus on coping behaviors, rather than potential triggers of a coping process. That is, some studies have measured trait-level coping and their subsequent AA-level behaviors (e.g., alcohol or cannabis use) but failed to measure the occurrence of stressors (Kuntsche & Cooper, 2010; O'Hara et al., 2016). Thus, within these designs, it could be argued that coping responses were not actually measured but rather, behaviors which could be attributed to other motivations such as socialising or enhancement of positive emotion.

An interesting alternative to omitting the assessment of stressors entirely, is to provide a checklist of stressors that could arise throughout the day (Ham & Larson, 1990; Reeves, Nicholls, & McKenna, 2011; White & Shih, 2012). As an example, White and Shih (2012) developed an eighteen-item daily stressful events measure in which youth could nominate multiple types of stressors they encountered each day. Yet, although useful for the measurement of typical stressors (e.g., social exclusion, academic stress), this method may limit reporting of less common and more unique experiences. Importantly too, not all stressors need be external. Youth commonly cope with stressors in the form of negative cognitions (regarding the present or the future) or the recollection of past negative experiences. As such, a smaller subset of studies has measured adolescents coping responses to unpleasant internal experiences (Mori,

Takano, & Tanno, 2015; Shahar & Herr, 2011; Weiss, Bold, Sullivan, Armeli, & Tennen, 2017).

Among those coping studies that did include an assessment of stressful events, most (62%) have measured the most salient stressor of the day, or since the last sampling period (e.g., Kubiak et al, 2008; Low, Matthews, & Hall, 2013). Although this method may capture the most varied, and the most naturalistic measurement of stress, it also brings with it increased variability. Put another way, coping responses and their effectiveness will depend in part on the characteristics of the context (Folkman & Moskowitz, 2004). Thus, measuring youths' "biggest stressor" as part of the coping process can mean that scholars are left with a wide array of coping responses, emotional reactions, and behavioral responses from which to detect a coherent pattern. Thus, in order to reduce the "noise" in youths' reports of salient stressors, one useful alternative is to ground coping assessments by tapping only specific stressors (e.g., experience of racially stressful events; Hoggard et al., 2012). Anchoring the coping process to one type of stressor allows for a more tailored (and arguably more accurate) measurement of appraisals and coping responses, though can limit generalisability to other types of stressors or other populations.

### **Finding What Works: Measuring Outcomes of Coping in Ambulatory Assessment**

Yet another challenge scholars face in seeking to measure the coping process is how to establish a meaningful endpoint, or tangible coping outcome (Somerfield & McCrae, 2000). Relatedly, depending on where scholars delineate their coping "outcome," this will necessarily affect what constitutes an adaptive (or maladaptive) coping response. That is, when measuring the coping process on a micro-longitudinal basis, what might be considered to be an adaptive coping outcome (e.g., lower negative affect or emotional recovery), may not be at all adaptive over the long term. As an

example, past empirical evidence suggests that youth use particular coping behaviors (for instance, emotion-focused coping) to attain short-term emotional relief, but that these behaviors can lead to increased distress in the longer-term; whereas problem-focused coping can lead to short-term peaks in distress but longer-term positive outcomes (Gross & John, 2003).

Given challenges in identifying “what works” in relation to adolescent coping more broadly, and in defining coping’s “endpoint” within AA designs more specifically, our scoping review revealed several alternative options. First, some studies are able to circumvent this issue by anchoring the coping process to a tangible, specific experience—such as a headache (Massey et al., 2009), binge eating (Freeman & Gil, 2004) or alcohol craving (Cleveland & Harris, 2010). Thus, these researchers were able to track “outcomes” of coping at one- and two-time intervals later, to assess whether specific ways of coping lead to diminished problematic outcomes. Another option is to track mental health symptoms on the same time scale as stressors. Thus, stress, coping, and well-being can be examined sequentially to better characterize how different ways of coping, with different forms of stress, help to manage mental health difficulties (Hankin, Fraley, & Abela, 2005).

That said, some studies take a different tack and assess affect as an outcome, in which case, assessing “what works” becomes less clear. As noted above, short-term emotional relief does not necessarily equate with an adaptive coping outcome. Although several studies seek to bypass this conundrum by predicting affect at the next adjacent time point (e.g., Pavlickova et al., 2015), moving the time scale one interval beyond the trigger may not be far enough to tap longer term emotional outcomes. Further shifting out the time scale means that any number of external factors may also be influencing mood, thus adding inevitable noise in outcome measurement.

Additionally, a number of studies suggest that coping effectiveness does not solely depend on which coping strategy was enacted, but rather an individual's perception of the efficacy of their coping attempts (Sandler, Tein, Mehta, Wolchick, & Ayers, 2000). Helpfully, some AA research has incorporated this idea into study design. One noteworthy example is a study conducted by Massey and colleagues (2009), in which youth were asked to report on their perceptions of how they believed they managed their emotions and experiences encountered that day, while measuring the occurrence of daily headaches. Results suggested that such coping efficacy beliefs were significantly related to the next days' headache occurrence, regardless of which cognitive coping strategies the youth employed. As another example of how scholars have tapped youths' experience of coping effectiveness, Piasecki and colleagues (2014) asked youth whether their engagement in specific coping strategies resulted in either pleasure or relief, or increased discomfort. These approaches to assessing coping efficacy, and approaches that otherwise provide alternative options for considering coping outcomes, are helpful examples of how scholars might better characterize the successfulness of coping strategies.

That said, although the field made considerable headway toward measuring outcomes of coping within AA, it is also not surprising that some scholars have evaded this challenge altogether by defining their focal outcome in terms of engagement in specific coping strategies (e.g., Aldridge-Gerry et al., 2011; Shahar & Herr, 2011). Specifically, Hema (2009) explored which coping responses among adolescents with Type 1 diabetes were endorsed in the context of daily stressors. Further, Hoggard and colleagues (2012) investigated whether coping appraisals and responses differed depending on the nature of the stressor, in this case, whether the stressor was race-related. While these designs are valuable in helping to describe coping responses within

certain populations or in response to specific stressors, the field stands to benefit from researchers widening their AA lens to encompass the full coping process and to include coping outcomes.

### **Moving Toward a More Complete Picture of Coping**

Given the nature of stress and coping, the coping literature has more commonly focused on the negative aspects of daily life, thus overlooking day-to-day upsides and uplifts. In fact, within our scoping review, only four studies (6.7%) accounted for the impact of momentary positive events during the coping process (Bentall et al., 2011; Klipker, Wrzus, Rauters, & Riediger, 2017; McHale, Clark, & Tramonte, 2015; and Wang et al., 2010). More broadly, there has been an over-reliance on the sole measurement of negative affect in the field (e.g., Armeli, Conner, Cullum & Tennen, 2010; Turner, Wakefield, Gr 2017; White & Shih, 2012). Naturally, positive experiences are not necessarily intuitive when conceptualizing the coping process. However, positive events and affect play a significant, distinct role in this process. Specifically, positive affect has been found to be a substantial buffer against stressors (Gilbert, 2012). Taken a step further, one might argue that the aim of coping research should not be solely to establish ways in which youth can feel *less bad*. Thus, scholars should ideally seek to uncover the ways in which coping processes can bolster, or at least maintain, positive outcomes in youth.

### **Compliance in AA Coping Research**

Traditionally, compliance rates have been considered an Achilles' heel of the in vivo process using self-report data (Wen, Schneider, Stone, & Spruijt-Metz, 2017). That said, in Wen and colleagues 2017 meta-analysis of compliance rates with mobile AA among children and adolescents, the average compliance rate was 78% (amongst 36 studies which reported compliance). Of course, a caveat here is that many studies do not

report compliance. Encouragingly, in terms of the coping specific AA literature, 67% (n = 40) of the 60 studies reviewed here reported some form of compliance to AA protocol. Among these, the average reported rate was 73.6%, suggesting coping studies may not be uniquely susceptible to lower compliance rates relative to the broader AA literature.

However, among the studies that did report compliance within our review, a subset (7%) report lower compliance than what is typically found in AA designs. Illustratively, Kenny and colleagues (2016) report a compliance rate of 18% and Reeves et al., (2011) report a compliance rate of 54%. These studies are unlikely to be exceptions, and studies that fail to report compliance may well suffer from difficulties of low compliance rates. Of course, benchmarks for compliance also vary, and are sometimes set at very low levels. For instance, thresholds have been set as low as 25% (South & Miller, 2014) and 33% (Pavlickova et al., 2015). Additionally, compliance rates do not tell the whole story in terms of rates of missing data. That is, dropped participants with low rates of compliance can artificially inflate the picture of data completeness. Specifically, retained participants will result in reported rate of missed AA reports that is considerably lower than the original sample. While this is not a scenario unique to AA, given its potential burden on participants, difficulties with compliance and susceptibility to missing data, youths' engagement should be monitored and reported, and reasons for potential missingness needs to be considered in study design (Enders, 2013).

### **Compliance When Stressed: Might It Matter?**

Scholars who have attempted to implement AA to assess youthful coping are likely familiar with an added complexity emerging from the intersection of coping and AA methodology – that is, the process being measured may simultaneously interfere



with adolescents' likelihood of completing an AA report. Put simply, youth may be too busy coping, or not coping as the case may be, to report on their experiences.

Specifically, momentary emotions and overall mood profiles have been shown to predict responding rates, though the role of positive versus negative emotions in compliance remains unclear. For example, Sokolovsky and colleagues (2013) found that adolescents who had higher overall negative affect, or who had increased positive affect (relative to their average mood) at the 'moment' level showed lower compliance. These authors posit that mood effects on compliance may be due to various underlying causal factors at play. Specifically, for youth who exhibit consistently high levels of negative affect, lower response rates may be due to a general lack of motivation. Whereas for youth with increased positive affect, low compliance may be due to participants being over-stimulated and subsequently having fewer cognitive resources available to devote to responding. That said, findings tying positive affect and compliance, in particular, are inconsistent. Illustratively, Shiyko and colleagues (2017) found that youth with consistently high, stable positive affect profiles demonstrated higher adherence rates. Further, findings linking emotional experiences to compliance have further implications for AA studies of youth coping, because emotional intensity of negative and positive affect have been found to relate to adolescent psychopathology (Gilbert, 2012; Silk, Steinberg, & Morris, 2003). Thus, for youth with psychopathology, exposure to stressors throughout the day may prompt fluctuations in affect, but such emotional lability may also reduce the likelihood of an adolescent completing an AA report. Hence, it is important to acknowledge that AA methods may still beget an under-representation of coping strategies in adolescent populations, especially those at-risk for psychopathology.

**Does Context Affect Compliance?**

Of course, adolescents experience stressors across a range of contexts, and a major advantage of using AA is the ability to tap coping across these varied settings. Yet contexts themselves may play a role in adolescents' responding to their AA prompts. As one example, social contexts have been linked to adolescents' emotional states (Uink et al., 2017) with peers providing a palliative effect on adolescents' stress responses. Thus, whom youth are spending time with when they are 'beeped' may factor into their affective experiences and thus their reporting. More directly, context in and of itself has been shown to be predictive of youthful compliance with AA protocols (Sokolovsky, Mermelstein, & Hedeker, 2013). Specifically, youth may be less likely to respond to prompts that occur outside of the home compared to prompts that occur inside the home. Similarly, Shiyko and colleagues (2017) showed that youths' compliance rates are higher at the end of the day, arguably because this is when adolescents are most likely to be at home. Yet school-based stressors (e.g., bullying, problems with teachers), are amongst the most common stressors that youth face (Zimmer-Gembeck & Skinner, 2008), which means that developmental scholars should proceed with caution. Specifically, tapping school-based stressors may be particularly challenging as adolescents are often not permitted to use phones during school hours. This has prompted some researchers to avoid signalling participants during school hours altogether (e.g., Ranzenhofer et al., 2014). Further, Henker and colleagues (2002) actively instructed participants to ignore their study protocol during activities that were incompatible with responding, which included being in class. Thus, scholars should pay close attention to potential complications with youthful compliance across the varied social and physical settings adolescents encounter in a given day.

### **Further Compliance Challenges and Potential Solutions**

More broadly, frequent and repeated assessments within AA can represent an imposition for youth. Illustratively, Ebner-Priemer and Swatitzki (2007) show that when prompted too frequently, participant compliance rates decrease overall. As a result, it may be tempting to decrease the frequency of prompts sent to youth in an effort to increase likelihood of compliance. However, reductions in frequency bring two marked disadvantages. First, if time between sampling is too long, youth may be prone to disengage from the device or forget to attend to the study protocol (Sokolovsky et al., 2013), reducing compliance regardless. Second, and arguably more importantly, reducing frequency of prompts results in a loss of detail within the coping processes, which AA methods are well-placed to capture.

Rather than seeking to dramatically diminish the frequency of AA prompts, scholars may be better off seeking to reduce participants' burden. One practical approach is to reimburse youth for their time and effort associated with their participation. Research shows that compliance rates are higher in studies that offer incentives (Dubad, Winsper, Livanou, & Marwaha, 2017). Notably, methods of compensation in the studies we reviewed were wide-ranging, with some studies offering entry into a competition (e.g., McHale et al., 2015; O'Hara et al., 2016) and others offering incentives for baseline and each ambulatory response separately (e.g., Hoggard et al., 2012; Schatz et al., 2015). Providing youth with additional incentives for achieving benchmark levels of compliance also seems to be a promising strategy (Sokolovsky et al., 2013). Illustratively, studies offering bonus incentives for high levels of compliance (e.g., Karr et al., 2013; Turner et al., 2017) reported compliance levels within 90% of responses. That said, some studies report admirable compliance rates even without providing incentives for participation. For instance, Weis and colleagues

(2017) reported an impressive 88% compliance without incentives. However, participants within this study could respond to missed prompts up to three days later, which naturally would have reduced missing data points, but at the cost of reducing the reliability of their responses.

While we fall in favour of compensating youth for their contributions and offer payments for their time and effort wherever possible, it is also the case that researchers may need to adjust their assessments to reduce participant burden. Designs that allow the order of questions to be contingent upon participants' responses are one way to decrease response load. For example, within time-based designs, if a youth responds that they have not experienced a stressor in the current sampling period, then stressor-related questions may be omitted (e.g., Reid et al., 2009; Waller, Silk, Stone, & Dahl, 2014). Of course, the concern then becomes whether youth then opt against reporting within a "cascade"-type question (e.g., that they have experienced a stressor) to avoid further assessment.

Finally, it is worth mentioning potential developmental considerations in regard to compliance in AA. We found that studies have successfully utilised AA methods with individuals as young as ten, with good compliance (Allen et al., 2016; Tan et al., 2012). These studies used phone calls to contact participants, and further, Tan and colleagues offered to recontact participants if timing was inconvenient and attempted to contact multiple times in the event of a missed call. This adjustment in design is a prime example of how researchers can adapt research methods to accommodate youth to increase compliance in AA. Other noteworthy methods of investment in youth compliance include contacting and problem-solving with youth in the event of a missed report (e.g., Schatz et al., 2015), or even asking parents to help remind youth to complete reports (e.g., Hema et al., 2009).

## Parting Thoughts and Recommendations

While we have outlined in considerable detail a number of considerations and challenges associated with AA research on adolescent coping, we do so while continuing to endorse AA's promise for informing developmental understanding. Overall, we recommend that scholars take a cautionary approach to the study of adolescents' coping with AA, and readily acknowledge that "*the weakest ink is more powerful than the strongest memory.*" As momentum for AA coping research with adolescents continues to grow, below we take a parting opportunity to offer practical recommendations

### Recommendations

**1. Treat coping as a process.** One of the more disappointing outcomes of AA coping research is when fine-grained, repeated assessments of stressors, coping strategies and outcomes are, in the end, converted to aggregate measures. Thus, micro-processes are examined through an increasingly macro lens, as scholars collapse across categories in an effort to reduce many data points and many different types of responses into something more manageable. We urge researchers to delve into the nuanced and fine-grained information that AA methods can provide (Modecki & Mazza, 2017), in order to unpack coping process that occur within (and between) adolescents.

**2. Consider including both trait and state measures.** We recommend including both trait and state measures of coping constructs, where possible. When responding to trait-level reports, to some extent we rely on conjecture, hypothesizing what we would *usually* do to cope. Whereas state measures necessarily highlight one or a few possible coping options. Given that trait and state

coping measures likely tap different elements of experience (Conner & Barrett, 2012) we believe that both are important.

**3. Measure the positives.** In order to gather a more complete picture of adolescents' experience, consider the good with the bad and do not exclusively focus on hassles or negative affect. Uplifts and positive affect may play a beneficial role within the coping process, and at the very least need to be accounted for in causal models. Better still, we press the field to move beyond the sole focus on reducing negative affect, and instead, conceptualize beneficial coping as simultaneously increasing positive affect, even in the face of stress.

**4. Be specific.** As we are sampling experience, anchoring the coping process to either a specific type of stressor or a clearly defined outcome will help reduce "noise" in the data. This will come with the potential cost of lack of generalisability but will bring much needed clarification regarding which coping strategies offer more beneficial or adaptive outcomes, in regard to specific types of stress.

**5. Consider reasons for missing data *before* data collection.** Acknowledge that AA coping designs place demands on youth during potential times of stress. Although this recommendation is by no means unique to AA methods, here, missing data are critical because of AA's focus on gathering a representative snapshot of adolescent life. When studying coping, the challenges of missing data can become especially burdensome, given that reasons for non-response can be tied to experiences of stress, turbulence of emotion, and/or deployment of maladaptive coping behaviors (e.g., drinking). With more AA reports completed, scholars can be increasingly confident that they are sampling *life as it is lived*. That said, methods for handling missing AA data are advancing-and use of modern methods (e.g., Full Information Maximum Likelihood) and sensitivity checks help lend

credibility to AA findings. Here, we recommend turning to previous AA studies to identify factors relating to non-compliance (e.g., unstable mood profiles; Sokolovsky et al., 2013). Researchers should be proactive in this regard and seek to include measures that may be related to subsequent missingness (e.g., youths' perceived likelihood of their own compliance, psychopathology symptoms) that can be part of an inclusive strategy for data analysis (Enders, 2013).

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## Supplementary Section

Supplementary Table 1. *Summary of Studies Included in Review*

Name	Population (Age = Years)	Design	AA Method	Length and Time Scale	Coping Measurement	Stress	Affect	Compliance	Compensation
<b>Trait Coping Only</b>									
Cleveland, H. H. and K. S. Harris (2010).	Mage = 22.6 (SD = 5.70) Range: N/A	Daily Diary	Palm Pilots	Daily, average 23.7 days	Trait Coping	Daily negative social experiences (18 item scale)	Daily NA	Unable to calculate	\$50
Connelly, M., et al. (2012).	Mage = 13.2 (SD = 2.7) Range: 8 - 17	Signal	Smart phone	3 times a day, 28 days	Trait Coping	N/A	Momentary, PA and NA	Average completed reports = 69%. (2.06/3 reports per day). Inferential tests of compliance by participant demographics and week of study	Not Listed
Lansing, A. H., et al. (2016).	Mage = 12.87 (SD = 1.53) Range: N/A	Daily Diary	Website URL	End of day, 14 days	Trait Coping	Daily problems Only in response to diabetes	Daily NA only in response to diabetes	Average completed reports = 12.81 days out of a possible 14 days (92%). Benchmark to be included in the analyses and number of participants who met this benchmark	\$4 per diary and \$50 for trait
Low, C. A., et al. (2013).	Mage = N/A (SD = N/A) Range: 14 - 19	Daily Diary	Website URL	End of day, 7 days	Trait Coping	Trait Life events and Daily interpersonal conflict	N/A	N/A	\$100 upon completion
<b>Combined Trait Scale and Momentary Scale</b>									
Bentall, R. P., et al. (2011).	Mage = 22.16 (SD = 4.78) Range: N/A	Signal - Study 3 only	Watch for signal and paper diary	10 times a day, 6 days	Combined Trait and Momentary Scale	Momentary, Pleasant/Unpleasant Event	Momentary, PA and NA	Benchmark number of reports for a participant to be included in study analyses (i.e. have at least 33% reports completed, n = 5 excluded)	20 pounds
Khor, A. S., et al. (2014).	Mage = 14.46 (SD = 1.83) Range: 12 - 18	Signal	Mobiletype program on provided mobile	4 times a day for 14 days	Combined Trait and Momentary Scale	Momentary Stress/Hassle	N/A	N/A	SIM Card with \$20 credit

Klipker, K., et al. (2017).	<i>Mage</i> = 15.36 ( <i>SD</i> = 2.66) Range: 10 - 20	Signal	Mobile Phone	6 times a day, for 3 days, 3 X blocks with 2 days rest between each (9 days total)	Combined Trait and Momentary Scale	Momentary, Hassles & Uplifts	Momentary, PA and NA	N/A	\$96 - \$109 if 80% compliance
Mushquash, A. R. and S. B. Sherry (2013).	Daughters: <i>Mage</i> = 19.99 ( <i>SD</i> = 3.15) Range: N/A Mothers: <i>Mage</i> = 50.06 ( <i>SD</i> = 4.92) Range: N/A	Signal	Email Link	2 times a day for 7 days	Combined Trait and Momentary Scale	Momentary, Mother- specific stressors	Momentary, NA	Total reports completed/total possible reports (98.0%; 2523/2575 reports)	\$ 25 - \$10 and course credit \$25 for baseline, \$15 additional per week, Final \$25 and then a bonus \$25 if compliance over 80%
Quinlan, C. K., et al. (2014).	<i>Mage</i> = 21.85 ( <i>SD</i> = 1.58) Range: 19 - 24	Signal	Personal Data Assistant	3 times a day for 30 days	Combined Trait and Momentary Scale	N/A	N/A	N/A	
Waller, J. M., et al. (2014).	<i>Mage</i> = 14.47 ( <i>SD</i> = 1.79) Range: 11 - 17	Signal	Phone calls	42 calls total, (14 calls over 5 days for 3 weeks)	Combined Trait and Momentary Scale	Momentary, Negative Event	Momentary, PA and NA	Benchmark number of reports (at least 50%) for a participant to be included in study analyses; Inferential test comparing compliance rates between Control vs MDD groups	Not listed
Combined Trait Scale and Daily Scale									
Genet, J. J. and M. Siemer (2012).	<i>Mage</i> = 19.0 ( <i>SD</i> = N/A) Range: N/A	Daily Diary	Website URL	End of day, 6 days	Trait and Daily Scale	Daily events scale & single event item	Daily NA	Total reports completed/total possible reports (89%; 829/ 942 possible reports). Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark; Percent of	Course Credit

								participants who contribute certain numbers of reports.	
Hankin, B. L., et al. (2005).	Mage = 18.7 (SD = .096) Range: 18 - 23	Daily Diary	Pen and Paper	End of day, 35 days	Trait and Daily Scale	Daily negative events	Daily depressive symptoms	Average percent of participants who did not complete an AA report (12%; therefore average completion rate of 88%). Compared compliance rate by study variables and day of study.	Course Credit
Kenny, R., et al. (2016).	Mage = 15.98 (SD = 0.70) Range: 15 - 18	Daily Diary	Mobile Phone App	28 days	Trait and Daily Scale	Daily, negative events	Daily, PA and NA	Average number of days with completed reports (5/28 possible days; 18%).	Not Offered
McHale, N., et al. (2015).	Mage = 20.54 (SD = 5.04) Range: N/A	Daily Diary	Online Diary	End of day, 7 days	Trait and Daily Scale	Daily, sad experience and positive experience	Daily, PA and NA	Total completed reports/total possible reports (789/1127 possible reports; 70%). Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark	Entry into a draw for \$50 if 7 days completed
Mori, M., et al. (2015).	Mage = 20.5 (SD = 2.50) Range: N/A	Daily Diary	Pen and Paper	End of day, 7 days	Trait and Daily Scale	Daily, most bothersome (including internal experience)	Daily, PA and NA	Total completed reports/total possible reports (264/273 possible reports; 97%)	Not Listed
O'Toole, M. S., et al. (2014).	Low Social Anxiety Mage = 23.4 (SD = 7.0) Range: N/A  High Social Anxiety Mage = 21.6 (SD = 4.5 ) Range: N/A	Daily Diary	Online Survey	End of day, 11 days	Trait and Daily Scale	N/A	Daily, PA and NA	Total completed reports/total possible reports (50%). Number of participants who had completed at least 1 AA report; Number of participants who completed at least 3 AA reports (n = 114 out of 261 participants). Benchmark to be included in the analyses and number of participants who met this benchmark.	Not Listed
Roesch, S. C., et al. (2010).	Mage = 15.5 (SD = 1.0 ) Range: 14 - 18	Daily Diary	Pen and Paper	End of day, 5 days	Trait and Daily Scale	Daily, Most negative event	N/A	Total completed reports/total possible reports (548/630 possible reports; 89%). Average of	Not Listed



								4.35 reports per participants (out of a possible 5).	
	ASD Group: <i>M</i> age = 12.66 ( <i>SD</i> = 3.32) Range: 8 - 20							Unable to compute compliance rate as total amount of possible AA reports is unclear. Average amount broken down by diagnostic group; Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark.	Not Listed
Samson, A. C., et al. (2015).	Typically Developing: <i>M</i> age = 12.58 ( <i>SD</i> = 2.86) Range: 8 - 20	Daily Diary	Email Link	End of day, 10 days	Trait and Daily Scale	N/A	Daily, PA and NA		
								Average number of completed reports per participant (18.22/21 possible reports per participant; 87%) Percent of participants who completed at least 15 AA reports (90%); Inferential tests of compliance rates by study variables.	Course Credit
Shahar, B. and N. R. Herr (2011).	<i>M</i> age = 18.99 ( <i>SD</i> = N/A) Range: N/A	Daily Diary	Email Link	End of day, 21 days	Trait and Daily Scale	N/A	Daily NA		
								Average amount of completed reports/total possible reports per person, by each group (NSSI: 12.04/14 = 86%; non-NSSI = 13.02/14 = 93%). Inferential test of differences in compliance rate between groups; Percent of participants who completed at least 12 AA reports.	Paid \$60 for baseline, \$45 if completed 5/7 days or \$60 for 7/7, maximum compensation of \$240
Turner, B. J., et al. (2017).	<i>M</i> age = 23.50 ( <i>SD</i> = 4.66) Range: 18 - 35	Daily Diary	Email Link	End of day, 14 days	Trait and Daily Scale	Daily negative events and interpersonal interactions	Daily NA		
Wang, S. W., et al. (2010).	<i>M</i> age = 19.21 ( <i>SD</i> = 1.27) Range: N/A	Daily Diary	Email Link	End of day, 10 days	Trait and Daily Scale	Daily, stress and positive events	N/A	Unclear.	Course credit / monetary compensation
White, M. E. and J. H. Shih (2012).	<i>M</i> age = N/A ( <i>SD</i> = N/A) Range: 18 - 25	Daily Diary (Copin	Email Link	Twice a day, 7 days	Trait and Daily Scale	Daily, stressful events checklist	Daily, NA	N/A	Course credit

g end of day only)									
Momentary Scale Only									
Allen, K. B., et al. (2016).	<i>Mage</i> = 11.03 ( <i>SD</i> = 1.46) Range: 9 - 14	Signal	Phone Calls	14 calls over 5 days (Thurs - Monday)	Momentary Scale	Momentary, Negative event	Momentary, NA	N/A but authors refer to other studies from their lab for further details.	Not Listed
Kubiak, T., et al. (2008).	<i>Mage</i> = 15.5 ( <i>SD</i> = 1.4) Range: 14 - 17	Signal + Event	Hand-Held Computer provided	Signal (4 times a day), Event (hassle), 7 days	Momentary Scale	Momentary, Negative event	Momentary, NA	Total completed reports/total possible reports (381/448 total possible reports; 85%). Average completed reports per participant (23.8/28). Average number of reports provided via event- contingent sampling	CD Vouchers
Pavlickova, H., et al. (2015).	Index Offspring: <i>Mage</i> = 16.04 ( <i>SD</i> = 1.79) Range: 13 - 19  Control Offspring: <i>Mage</i> = 16.18 ( <i>SD</i> = 1.97) Range: 13 - 19	Signal	Watch for signal and paper diary	10 times a day 6 days	Momentary Scale	N/A	Momentary, PA and NA	Benchmark number of completed reports (at least 33%) for a participant to be included in the analyses and number of participants who met this benchmark.	Not Listed
South, S. C. and M. L. Miller (2014).	<i>Mage</i> = 20.8 ( <i>SD</i> = 2.23) Range: 18- 32	Signal	Palm Pilots	5 times a day, 7 days	Momentary Scale	Momentary Stressor	Momentary, PA and NA	Benchmark number of completed reports (at least 25 %) for a participant to be included in the analyses and number of participants who met this benchmark; Number of participants whose data was lost due to equipment malfunction	\$30 and go into a draw for a gift card if 75% compliance

Tan, P. Z., et al. (2012).	Anxious Group: <i>Mage</i> = 10.90 ( <i>SD</i> = 1.43) Range: 9 - 13  Control Group: <i>Mage</i> = 10.41 ( <i>SD</i> = 1.30) Range: 9 - 13	Signal	Phone calls	14 calls over 5 days (Thurs - Monday)	Momentary Scale	Momentary, Negative event	Momentary, PA and NA	Average amount of completed reports/total possible reports per person, by each group (Anxious youth = 13.02/14; 93%; Healthy youth = 12.79/14; 91%). Inferential tests comparing anxious vs. healthy participants compliance rates.	Not Listed
Daily Scale Only									
Ham, M. and R. Larson (1990).	<i>Mage</i> = 13.0 ( <i>SD</i> = N/A) Range: 10.0 - 15.9	Daily Diary	Pen and Paper	End of Day, 7 days	Daily Scale	Daily scale	Daily, PA and NA	N/A	Not Listed
Hema, D. A., et al. (2009).	<i>Mage</i> = 13.02 ( <i>SD</i> = 2.66) Range: 8 - 18	Daily Diary	Pen and Paper	daily, 14 - 21 days	Daily Scale	Daily diabetes related	N/A	Unable to calculate compliance rate because number of possible AA reports unclear.	Not Listed
Hoggard, L. S., et al. (2012).	<i>Mage</i> = 19.08 ( <i>SD</i> = 0.98) Range: 18-21	Daily Diary	Online Survey	End of Day, 20 days	Daily Scale	Daily - racial vs non-racial	N/A	N/A	\$15 for baseline and \$3 per response, max \$60
Massey, E. K., et al. (2009).	<i>Mage</i> = 15.8 ( <i>SD</i> = 1.30) Range: 13 - 21	Daily Diary	Online Diary	End of Day, 21 days	Daily Coping and coping efficacy	Daily Frustration	Daily, NA	Total completed reports/total possible reports (1062/1089 possible reports; 57%)	Prize draw if completed 15 entries, and weekly raffle if 6/7 per week
Massey, E. K., et al. (2011).	<i>Mage</i> = 15.8 ( <i>SD</i> = 1.30) Range: 13 - 21	Daily Diary	Online Diary	End of Day, 21 days	Daily Coping and coping efficacy	Daily Goal Frustration	Daily, PA and NA	Same as Massey et al., 2009	Prize draw if completed 15 entries, and weekly raffle if 6/7 per week
Reeves, C. W., et al. (2011).	<i>Mage</i> = 14.48 ( <i>SD</i> = 1.98) Range: 12 - 18	Daily Diary	Pen and Paper	4 phases of 8 daily diaries only on competing days (not rest days)	Daily Scale	Daily stressor checklist and open-ended	N/A	Total completed reports/total possible reports (538/992 possible reports; 54%). Compliance broken down by age bracket	Not Listed

Roesch, S. C., et al. (2009).	<i>Mage</i> = 15.40 ( <i>SD</i> = 1.02) Range: 14 - 18	Daily Diary	Pen and Paper	End of Day, for 3/4/5 consecutive days	Daily Scale	Daily, Most negative event	Daily, PA and NA	Total completed reports = 312. Unable to calculate compliance rate as total number of possible reports is unclear.	Not Listed
Weinstein, N., et al. (2009).	<i>Mage</i> = 20.0 ( <i>SD</i> = 1.84) Range: 18 - 40	Signal	Study 3 only: Pagers and Pen and Paper	3 times a day for 7 days	Daily Scale	Momentary Stressor	Momentary, PA and NA	N/A	Not Listed
<b>Combined Trait Scale and Momentary Behavior</b>									
Goldstein, A. L., et al. (2014).	<i>Mage</i> = 21.67 ( <i>SD</i> = 1.65) Range: 19- 24	Signal + Event	Smartphone provided	3 times a day for 30 day and event triggered	Combined trait scale and momentary behavior	N/A	Momentary, PA and NA	Total completed reports/total possible reports (6783/9024 possible reports; 75.2%)	\$25 for 80% compliance, \$15 for each weekly check in (4 ) and a final \$25 for overall study
Goldstein, A. L., et al. (2016).	<i>Mage</i> = 21.67 ( <i>SD</i> = 1.63) Range: 19 - 24	Signal + Event	Palm Pilots	3 times a day for 30 day and event triggered	Combined trait scale and momentary behavior	N/A	Momentary, PA and NA	Same as Goldstein et al., 2014	Online Gift cards
Time of enrolment: <i>Mage</i> = 15.6 ( <i>SD</i> = 0.60) Range: N/A									
Gorka, S. M., et al. (2017).	Follow up <i>Mage</i> = 22.1 ( <i>SD</i> = 1.80) Range: N/A	Signal + Event	Hand held computers	5 times a day for 7 days and event triggered	Combined trait scale and momentary behavior	N/A	Momentary, PA and NA	N/A	Not listed
Hussong, A. M., et al. (2005).	<i>Mage</i> = 18.10 ( <i>SD</i> = N/A) Range: 18 - 20	Signal	Pager and invisible ink pen and paper	3 times a day for 28 days	Combined trait scale and momentary behavior	N/A	Momentary, NA and Attentiveness	N/A	Paid for completion of study
Linnemann, A., et al. (2015).	<i>Mage</i> = 23.20 ( <i>SD</i> = 3.11) Range: 18 -31	Signal	iPod Touch provided	6 times a day for 5 days	Combined trait scale and momentary behavior	Momentary stressor	N/A	N/A	50 Euro or Course credit

Otsuki, M., et al. (2008).	Mage = 19.41 (SD = 1.42) Range: 18 - 24	Signal	Palmtop Computer	5 times a day for 7 days	Combined trait scale and momentary behavior	N/A	N/A	Total completed reports/total possible reports (1164/2232 possible reports; 52%). Rate of compliance across the day. Rate of compliance based on whether participant was prompted to respond or not prompted to respond	\$25 or Course credit
Combined Trait Scale and Daily Behavior									
Armeli, S., et al. (2010).	Mage = 18.76 (SD = 1.09) Range: N/A	Daily Diary	Website	Daily Diary, 30 days, Yearly for up to 4 years	Combined trait scale and daily behavior (alcohol use)	N/A	daily NA	Authors report “compliance for daily diary reporting across all years was 83.8%” although unclear how rate was calculated. Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark	Not listed
Hersh, M. A. and A. M. Hussong (2009).	Adolescents: Mage = 13.9 (SD = N/A) Range: N/A  Parents: Mage = 43.0 (SD = N/A) Range: N/A	Signal	Watch and pen and paper	4 times daily for 21 days	Combined trait scale and daily behavior (substance use)	Trait laboratory stress task	Momentary, NA	Total completed reports/total possible reports (1116/1365 possible reports; 82%). Average number reports per participant = 17/21; 81%. Percent of participants who met criteria for a certain level of compliance.	\$15 for baseline, \$1 per entry and a draw for \$30 each time adolescents submitted data
Hussong, A. M. (2007).	Mage = N/A (SD = N/A) Range: 18 - 20	Signal	Pager and pen and paper	4 times a day for 28 days	Combined trait scale and daily behavior (alcohol use)	Trait Alcohol related consequences	Momentary, PA and NA	Says compliance was assessed weekly by the researchers but no data reported	Incentive offered no details provided
Kuntsche, E. and M. L. Cooper (2010).	Mage = 22.7 (SD = 1.90) Range: N/A	Daily Diary	SMS Daily behavior	Daily diary, weekends only, total 4 days	Combined trait scale and daily behavior (alcohol use)	N/A	N/A	Unable to calculate compliance rate based on information provided; Average amount of completed reports. Percent of participants who	Draw for movie tickets

								answered all AA reports (84%); Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark	
O'Hara, R. E., et al. (2016).	Mage = 19.2 (SD = 1.2) Range: N/A	Daily Diary	Website	Daily, 30 days	Combined trait scale and daily behavior (alcohol and cannabis use)	N/A	N/A	Total completed reports/total possible reports (22557/26280 possible reports; 86%). Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark.	Paid and provided with credit if applicable
Shrier, L. A., et al. (2014).	Mage = 19.2 (SD = N/A) Range: 15 - 24	Signal Intervention	MOMENT program SMS	4 - 6 times a day for 7 days	Combined trait scale and daily behavior (cannabis craving and use)	Substance cravings and social context (triggers)	Momentary, PA and NA	Total number of reports completed during each phase of the study, for momentary and daily reports, but total number of possible reports unclear. Authors state response rate ranges for momentary = 50-65% and daily = 44-48%	Up to \$280 depending on compliance
Tortella-Feliu, M., et al. (2012).	Mage = 22.58 (SD = 4.38) Range: N/A	Daily Diary	Online Diary	Daily, 50 days	Combined trait scale and daily behavior (avoidance)	N/A	Trait and Daily NA	N/A	Not Listed
<b>Daily Coping Scale and Daily Behavior</b>									
Aldridge - Gerry, A. A., et al. (2011).	Mage = 20.1 (SD = 2.10) Range: 17 - 25	Daily Diary	Website	End of Day, 5 days	Daily Scale and daily behavior - drinking	Daily, stressful event	N/A	Total completed reports/total possible reports (1760/1825 possible reports; 96%). Average completed reports per participant = 4.82 out of 5 possible reports.	\$25
Freeman, L. M. and K. M. Gil (2004).	Mage = 19.6 (SD = 4.6) Range: 17 - 39	Daily Diary	Pen and paper	End of day, 30 days	Daily Scale and daily	Daily, stressful event	Daily, NA	Total completed reports/total possible	Not listed

					behavior (binge eating)			reports (1282/1450 possible reports; 88%)	
Giacobbi, P. R., et al. (2007).	<i>Mage</i> = 21.56 ( <i>SD</i> = 1.94) Range: 18 -28	Daily Diary	Email	End of day, 14 days	Daily Scale and Behavior (Exercise)	Daily, academic stressors	Daily, PA and NA	N/A	Not listed
Weiss, N. H., et al. (2017).	<i>Mage</i> = 19.2 ( <i>SD</i> = 1.4) Range: N/A	Daily Diary	Website	End of day, 30 days	Daily Scale and Behaviour (Substance Use)	N/A	N/A	Total completed reports/total possible reports (42 409/49 200 possible reports; 98%). Inferential statistics comparing group differences in compliance.	Not listed
<b>Combined Momentary Coping Scale and Momentary Behavior</b>									
Karr, T. M., et al. (2013).	<i>Mage</i> = 24.98 ( <i>SD</i> = 7.42) Range: 18 -55	Signal, Event & Interval	Handheld computer	6 times a day for 14 days	Combined momentary scale, and momentary behavior (Binge and Purge)	N/A	Momentary, PA and NA	Total completed reports/total possible reports (Momentary: 9927/9996 = 99%; End of day: 1454/1666 = 87%). Total reports from event- contingent sampling.	\$100 per week and \$50 bonus for 85% compliance
<b>Momentary Behaviour Only</b>									
Henker, B., et al. (2002).	<i>Mage</i> = 14.5 ( <i>SD</i> = N/A) Range: 12.9 - 15.8	Signal, 2 blocks, 6 months apart	Handheld computer	25-30 times day for 4 days, 8 days total	Momentary behavior	Momentary, hassles	Momentary, PA and NA	Authors report "daily reports were made on approximately 80% of possible occasions" although unclear how they compliance calculated this figure	\$20 baseline, and up to additional \$5 per day, maximum \$100
Ranzenhofer, L. M., et al. (2014).	<i>Mage</i> = 14.92 ( <i>SD</i> = 1.54) Range: 12.25 - 17.35	Signal + Event	Palmtop Computer	3 - 5 times a day for 14 days, and event	Momentary behavior	Momentary, interpersonal stress	Momentary, NA	Average amount of days per participant where a report was completed (12.79/14; 91%). Average of 2.3 signal contingent reports completed per participant, although total possible reports unclear. Benchmark number of reports for a participant to be included in study analyses number of participants who met this benchmark; Inferential	Not listed

									tests response rate by time of day and day of study.
Swendsen, J. D. and S. Norman (1998).	Mage = 19.0 (SD = 1.1) Range: N/A	Signal	Pager and pen and paper	5 times daily for 7 days	Momentary behavior	Daily negative events, Trait impact of life stressor	Momentary, NA	Authors refer to another study from their laboratory for compliance information.	Not listed
<b>Combined Trait Coping, Daily Scale and Daily Behaviour</b>									
Piasecki, T. M., et al. (2007).	Mage = 18.5 (SD = N/A) Range: 18 - 21	Signal + Event	Personal Digital Assistant	Signal not listed, 14 days	Combined trait and momentary Behaviour and Scale (both event and signal)	Momentary, stressors	Momentary, PA and NA	Average amount of days where reports were completed (12.7/14 days; 91%)	Course credit and \$75
Schatz, J., et al. (2015).	Mage = 13.04 (SD = 2.5) Range: 8 - 21	Daily + Activity record	Smartphone provided	Daily, 5 days	Trait scale and momentary scale and behavior	Trait, experience of pain	N/A	Total completed reports/total possible reports (1547/2530 possible reports; 61%)	\$10 for baseline and \$1 for each pain diary
<b>Combined Trait Coping, Momentary Scale and Momentary Behaviour</b>									
Chapman, A. L., et al. (2009).	Mage = 21.19 (SD = 3.18) Range: N/A	Signal + Daily Intervention for ER strategy	Personal Digital Assistant	8 times a day for four days	combined trait and Daily experimental and momentary impulsive behavior	N/A	Momentary, PA and NA	Average completed reports per person (24.16/32 possible reports; 76%). Mean response time to signals	\$40 for study
Piasecki, T. M., et al. (2014).	Mage = 23.3 (SD = 7.2) Range: 18 - 70, 74.8% between 18 - 23	Signal + event	Personal Digital Assistant	Signal 5 times a day, Event when drinking, 21 days	Combined trait scale and momentary behavior	N/A	N/A	Total completed reports although unclear how many total possible reports were expected.	Can earn up to \$150 for completion

Note. N/A = Not Available. Mage = Mean Age. SD = Standard Deviation of Ages. NA = Negative Affect, PA = Positive Affect.



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## Chapter 6:

### Describing Adolescent Online Coping

Chapter 5 (Study 1) demonstrated the varied options associated with assessing adolescents' coping in-situ. Here, Study 1 highlighted clear implications and trade-offs of specific study designs for understanding the coping process. Although Study 1 characterized the published adolescent ambulatory assessment coping literature, none of the coping methods were explicitly online, and no research to date has explored adolescents' online coping.

Thus, Study 2 provides a first exploration of adolescent online coping. This study draws on three independent sets of data to paint a fuller picture of online coping. These data sets speak to how and when adolescents turn to the online space, the potential emotional effects associated with online coping, and suggestive differences between online and offline coping. This study is published in *Computers in Human Behavior* (Impact Factor 4.306; SCImago ranking Q1). The PhD Candidate is the first author of the paper, the principal supervisor is corresponding author, and two members of the supervisory team are co-authors. Dr. Helen Correia and Dr. Bep Uink were project contributors and study-co-authors. Electronic supplementary material to the paper are attached at the end of Chapter 7. Further, original ethics approval #2012/203 for the study "How do you feel? Adolescent Behaviour, Emotion, and Technology Use" was granted by the University Ethics Committee (Murdoch University) and Department of Education (see Appendix A).

### **STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER**

This chapter includes a co-authored paper. The referencing details of the co-authored paper including all authors are:

Duvenage, M., Correia, H., Uink, B. N., Barber, B. L., Donovan, C. L., & Modecki, K.

L (2020). Technology can sting when reality bites: Adolescents' frequent online coping is ineffective with momentary stress. *Computers in Human Behavior*, 102, 248-259. <https://doi.org/10.1016/j.chb.2019.08.024>

The PhD Candidate's contribution to the paper involved co-conceptualizing the triangulation of focus group, ambulatory assessment, and young adult survey data. The candidate also oversaw data collection of young adult data. Further, the candidate analyzed and interpreted quantitative data analyses, drafted the study manuscript, and revised the manuscript in the publication process. Study co-authors provided feedback and/or comments on the manuscript.

(Signed)\_\_\_\_\_ (Date)\_\_\_\_\_

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## **Chapter 7:**

### **Technology can sting when reality bites:**

**Adolescents' frequent online coping is ineffective with momentary stress.**

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### Abstract

The fact that youth widely engage with the online space in order to improve their emotional health has been lost amongst the debate surrounding adolescents' technology use and associated well-being. Two studies focused on adolescents' use of technology to cope with stressors in daily life. Focus groups (Study 1;  $n = 16$ ) indicated that youth readily identify using technology to cope and perceive it as helpful for emotional relief. Experience sampling participants (Study 2;  $n = 156$ ) completed a baseline assessment of online coping and mental health, and one week of reports, five times daily, on their technology use, stress, and emotions. Multilevel regression results indicated that across their daily lives, youth who widely endorsed using online strategies to cope responded more negatively to stressors and displayed difficulties in recovering from worry and jealousy. Results held even controlling for use of technology, typical number of stressors, and mental health. Findings highlight the potential shortcomings and comorbid vulnerabilities for youth who frequently turn to the online environment to seek support, information, or distraction.

**Keywords:** online coping, mixed method, adolescent, emotion reactivity, Experience Sampling Method

**Study is based on sensitive and confidential data from minors. Please contact corresponding author for requests for final codes for qualitative data, Mplus syntax, or outputs for final models.**

### Highlights.

- Adolescents widely endorse going online to cope
- No relation was found between momentary technology use and subsequent emotion.
- Youth who frequently use online coping had poorer recovery from worry and jealousy

**Technology can sting when reality bites: adolescents' frequent online coping is ineffective with momentary stress.**

## **1.0 Introduction**

Mobile technologies are an essential part of adolescents' daily lives (Crone & Konijn, 2018; Odgers, 2018). Adolescents are constantly connected, affording them the opportunity to engage with the online world 24/7 (Lenhart, 2015). This constant connection means that adolescents can make use of the digital space to connect with peers, learn about their world, and to escape the everyday pressures adolescence entails (Seo, Houston, Knight, Kennedy, & English, 2014; Subrahmanyam & Smahel, 2010; Wartella, Rideout, Montague, Beaudoin-Ryan, & Lauricella, 2016). Yet, we know surprisingly little about these activities impact emotional well-being (Underwood & Ehrenreich, 2017).

The importance of emotional well-being is widely recognised across the life span, but during adolescence, it is especially significant. Adolescence is a developmental period characterized by increased stress and emotional lability (Silk, Steinberg, & Morris, 2003). Hence, adolescents are seeking to cope with daily challenges, and the affective upheavals they bring (Crone & Dahl, 2012; Uink, Modecki & Barber, 2017). Given the focal role of the online space in adolescent life, this is a key arena where teens seek to mitigate problems (Gould, Munfakh, Lubell, Kleinman, & Parker, 2002).

In the current study, we aim to characterize how youth are making use of the online space in the service of their well-being, namely in the face of day-to-day stressors. First, we explore focus group reports of why and how adolescents use technology to cope with negative experiences. Second, in a separate sample, we employ detailed experience sampling data to investigate the potential usefulness of online



coping strategies for dampening the affective impact of moment-to-moment stress, after accounting for critical confounds.

### **1.1 The mixed role of technology in youth well-being**

Historically, the combination of technology and adolescent well-being has been controversial, with some areas of research highlighting its potential dangers (e.g., Twenge, Joiner, Rogers, & Martin, 2018; Wartella & Robb, 2008), and fewer studies calling attention to its promises (e.g., George & Odgers, 2015; Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005; Mills, 2016). Indeed, evidence suggests that technology use may serve to fulfil certain developmental needs (Borca, Bina, Keller, Gilbert, & Begotti, 2015). For instance, youth employ technology in an effort to develop close and meaningful relationships (Reich, Subrahmanyam, & Espionza, 2012; Valkenburg & Peter, 2011), explore their identity (Subrahmanyam, Smahel, & Greenfield, 2006), and find information about developmentally sensitive issues (Valkenburg & Peter, 2011).

Alternatively, other studies report that adolescents' technology use can sometimes be linked to problems (Twenge, Cooper, Joiner, Duffy, & Binau, 2019). Specifically, in a study of older adolescents' retrospective daily estimates of time use, more technology use was associated with poorer academic performance (Jacobsen & Forste, 2011). Likewise, heavy internet use has been linked to poorer body image among adolescent girls (Tiggermann & Slater, 2013) and among teenagers more broadly, engagement with various types of technology has been associated with poorer physical and psychological health (Rosen et al., 2014). Indeed, Twenge and colleagues (2018) investigated social-media use and mental health among adolescents using two large-scale, nationally representative U.S. samples ( $N=506, 820$ ). Results indicated that social media use, depressive symptoms, and rates of suicide were positively linked, especially in adolescent females. The authors concluded that social media use may

perhaps be driving increases in poorer mental health outcomes among youth. That said, although the relation between media use and mental health may indeed be negative, at least in relation to very high levels of use (Przybylski & Weinstein, 2017), the direction of effect is yet to be determined, and may even be bi-directional, or be due to a third confounding factor that underlies both (Heffer, Good, Daly, Macdonnell & Willoughby, 2019; Orben & Przybylski, 2019). For instance, research has highlighted that the link between adolescents' technology use and overall maladaptation may be explained by other offline issues (e.g., poor sleep; Vernon, Modecki, & Barber, 2017), suggesting that the effects of technology use may be dependent, in part, on individual differences.

Moreover, to date, most quantitative research with adolescents has been based on either retrospective reporting (e.g., over the last six months), or focused explicitly on negative outcomes (e.g., cyberbullying, body image). A notable exception is recent research by George and colleagues (2018), who made use of daily reports of technology use and daily mental health symptoms in a noteworthy attempt to tease apart these relations. Findings were mixed, in that adolescents' self-estimated daily engagement with technology was positively linked with certain Attention Deficit Hyperactivity Disorder (ADHD) and Conduct Disorder symptoms. However, youth estimates of daily technology use were also linked to lower same-day anxiety symptoms. Importantly, when longitudinal (e.g., next-day) effects of technology were explored, only one of these relations held, greater estimated technology use predicted increased ADHD symptoms the following day. Thus, longitudinal findings have not yet clarified whether adolescents' technology use facilitates better or worse functioning.

Across studies, mixed findings regarding technology and youth well-being allude to several key considerations for the next phase of youth-technology research. First, given the complex interplay between technology use and mental health, questions

regarding youths' technology use and their affective states are best explored longitudinally, such that concurrent technology use, on-going real-life experiences, and later emotional functioning are taken into account. Second, considering the fluid nature of youth emotions, contexts, and technology engagement, better understanding of these complex relations calls for a fine-tuned approach. That is, a moment-to-moment perspective (rather than daily reports) provides a more informative picture of how and where youth are spending their time and how they are managing the challenges they face. Third, these mixed results suggest that these relations may depend, at least in part, on *why* youth are engaging with their technology. Youth likely experience different affective outcomes depending on their needs and motivations for technology use. Hence, exploring youth technology use in relation to certain purposes or needs, including how they utilize technology in the service of their- well-being, is a needed next step to progress the field.

## **1.2 Theoretical background: what motivates technology use?**

Uses and Gratifications Theory (UGT) remains a cornerstone theory to help understand individual differences in what motivates technology use (Coyne, Padilla-Walker, & Howard, 2015; Elhai, Levine, Dvorak, & Hall, 2017). UGT highlights that individuals play an active role in their selection of media in an effort to fulfil specific needs or goals (Katz, Haas, & Gurevitch, 1973). For instance, Coyne and colleagues (2015) emphasize that young people are active and self-selecting agents and select technology for the purpose of building autonomy, intimacy, and developing their identity. Moreover, research has found that these needs can include entertainment and boredom relief (Rokito, Choi, Taylor, & Bazarova, 2019), to seek self-status (Park, Kee & Valenzuela, 2009), and critically in the context of adolescence, such needs sometimes pertain to management of stressors (Leung, 2007).

More recently, the UGT framework has been applied to identify different motivations for Internet use. Here, three main categories of gratification have been identified: 1) *Content gratification*, which includes the need for researching or finding specific information, 2) *Process gratification*, gaining gratification from the process of browsing the internet, either purposefully or randomly, and 3) *Social gratification*, which is based on forming or deepening social ties (Stafford, Stafford, & Schkade, 2004).

That said, while UGT underscores several purposes for which youth can engage with the online environment, these gratifications provide little clarification as to whether such technology use serves to help or hinder their affective well-being. Further, dealing with stressors is arguably a key need which drives adolescents to engage with technology. Thus, research is needed to clarify whether youth themselves identify with using technology in this way; and if so, does it help them feel better?

### **1.3 Adolescent stress and online coping**

A critical need that adolescents seek to fulfill is effective management of their day- to-day stressors. During adolescence, youth are confronted by a range of challenges, including physical and cognitive changes, evolving family and peer relationships, new romantic ties, and increasing educational demands (Markova & Nikitskaya, 2013). Although minor in nature, the experience of these types of daily stressors, or ‘hassles’, is a salient source of emotional upheaval (Modecki, Zimmer-Gembeck, & Guerra, 2017; Silk, Steinberg & Morris, 2003). In fact, research shows that relative to major life events, these types of daily hassles can better explain human maladjustment (Compas et al., 1985), and more accurately predict psychological symptoms (Sim, 2000). That said, what has not yet been adequately explored is how

youth engage with the online environment as they seek to manage (whether effectively or not) these day-to-day difficulties.

Online coping has been defined by van Ingen and Utz and Toepoel (2016) as “thoughts and behaviors that are *facilitated by the Internet* that people use to manage stressful situations” (p. 512). Indeed, scholars have established that adults report using the online space to cope with events, though this work is cross-sectional and based on retrospective reports. For instance, van Ingen and colleagues (2016) used an adapted online coping measure from Carver with more than 5,000 Dutch adults ( *Mage* = 50 years) and showed that online and offline coping strategies are significantly and positively correlated. However, online coping was associated with negative markers of well-being, including lower levels of optimism, life satisfaction, and self-esteem.

Specific to adolescents, a growing body of research attests to youths’ use of technology in manners akin to coping (Eschenbeck, Schmid, Schröder, Wasserfall, & Kohlman, 2018; Leiner, Argus-Calvo, Peinado, Keller, & Blunk, 2014; Lohaus, Ball, Klein-Heßling, & Wild, 2005). Indeed, Leung (2007) found that adolescents reported motives for internet use that were significantly linked to major life stressors (e.g., parental separation, illness). Specifically, youth identified with using the internet to either manage negative emotions (e.g., seeking information for stress reduction), or for social compensation (e.g., relationship maintenance). More recently, Eschenbeck and colleagues (2018) found that media use as a coping strategy increases as youth enter adolescence.

#### **1.4 Motivated by stress: linking UGT and online coping**

Youth and their technology use have become so entwined (Subrahmanyam & Smahel, 2010) that in the course of managing the day-to-day bustle of adolescence, the online space is an ever-ready avenue for seeking emotional relief from daily challenges

(Eschenbeck et al., 2018). More specifically, tentative empirical evidence indicates that youth access the online environment for three key reasons, for emotional support seeking (e.g., Valkenburg & Peter, 2011), self-distraction (e.g., Kuss & Griffiths, 2012; Snodgrass et al., 2014) and for information seeking (e.g., Skinner, Biscope, Poland, & Goldberg, 2003) in response to stress. These coping strategies can be usefully conceptualized in relation to UGT in that emotional support seeking falls within needs for social gratification, self-distraction within process gratification, and information seeking might be encapsulated within content gratification needs. That said, we know little about whether youth themselves identify with using these strategies or whether employment of these strategies can buffer against the impact of day-to-day stress, at least in the short term.

Importantly, a body of research supports the value of coping for adolescents, at least in the offline context. Over the last few decades, adolescence research has sought to identify patterns of coping that are tied to well-being—in particular, emotional support seeking, informational support seeking, and self-distraction (Zimmer-Gembeck & Skinner, 2011). On the one hand, this work suggests that coping is a fundamental skill that youth attempt to master during adolescence (Modecki et al., 2017). On the other hand, not all offline coping strategies are considered equally healthy. For example, approach-oriented coping strategies such as support seeking and information seeking tend to be associated with more adaptive functioning. Whereas self-distraction, at least when considered over the long-term, tends to be tied to poorer well-being (e.g., Carver & Connor-Smith, 2010). That is, although it may feel good in the short term, the cumulative effects of problem-avoidance over time do not necessarily contribute to successful stress navigation.

### **1.5 Remaining questions**

Thus far, research has largely focussed on characterizing technology's link with maladaptation (e.g., poor sleep). Yet, ties between adolescent technology use and its effects arguably depend upon individual differences (e.g., in well-being, in methods of access). Research has largely overlooked the impact of specific reasons for access on well-being, in this case, using technology to cope. By exploring motivations for technology use, scholars can better decipher the ways in which technology might be harmful (or indeed helpful). This question is especially relevant considering adolescents are highly vulnerable to stress and have unprecedented access to digital technologies. Thus, it stands to reason that youth are navigating this context intuitively (Subrahmanyam & Smahel, 2010). In fact, while scholars have been quick to explore risks in relation to adolescents' use of technology (e.g., Wartella & Jennings, 2000), increasingly, calls have been made to highlight opportunities that naturally exist for youth in the online space (Odgers, 2018). Yet, relatively little research has explored avenues through which youth, in particular, might benefit.

### **1.6 The current studies**

The current studies fill these critical gaps, leveraging detailed information from adolescents living in the context of stressful circumstances, specifically, socio-economic disadvantage. Importantly, economically disadvantaged adolescents report high rates of exposure to daily stressors (Evans, Vermeulen, Brassh, Lefkowitz, & Hutt, 2009), and many are subject to poor emotional functioning in response to moment-to-moment stressors (Uink, Modecki, Barber, & Correia, 2018). As a result, given our focus on youth coping, sampling within these circumstances not only provides adequate variability in stressors encountered and salient contexts for assessing efficacy of coping online, it also provides a much-needed picture of youth who could most benefit from

services online. Moreover, using an ambulatory assessment design (Study 2) offers the advantage of each youth serving as his or her own control. Thus, this study marries a high likelihood of encountering stress with the ability to characterize emotion-change relative to each youths' own average (Modecki & Mazza, 2017).

Notably, there is a common misconception that a digital divide exists between low and high socioeconomic populations (Kreutzer, 2009). On the contrary, studies with youth have shown that when compared to high socio-economic status (SES) populations, youth from economically disadvantaged backgrounds are *more likely* to own a mobile phone (e.g., Byun et al., 2013), access their phones more frequently (Lenhart, 2015), and spend more time on their phones overall (Thomas, Heinrich, Kuhnlein, & Radon, 2010). Thus, the combination of increased exposure to stressors and higher infiltration of mobile technologies in day-to-day life makes this sample especially pertinent.

In Study 1, we use qualitative (focus-group) data to describe adolescents' identified motivations and experiences engaging with their online environments to manage their emotions and stress. In Study 2, we employ an online coping measure to assess how different technology-based coping strategies (informational support, emotional support, self-distraction) relate to youths' effectiveness in mitigating negative emotional responses to stress. Together, these studies aim to validate adolescents' use of technology to cope with day-to-day problems and in turn, test the utility of technology-based coping.

H1: Adolescents will uniformly report using the online space in response to negative experiences (Study 1)

H2: Technology use will have short-term effects on negative emotion (but direction of effects is exploratory) (Study 2)



H3: Adolescents' online coping strategies will buffer against short-term negative affective responses to stress, and so will be experienced as temporarily useful (Study 2)

## **2.0 Study 1: Focus Groups**

### **2.1 Method**

**2.1.1 Participants and procedure.** Original ethics approval #2012/203 for the study "How do you feel? Adolescent Behaviour, Emotion, and Technology Use" was granted by the University Ethics Committee and Department of Education, to conduct pilot research at a low-SES metropolitan public high school. Participants/guardians granted consent following distribution of information about the study to sixty students. Sixteen participants (seven girls, nine boys) consented to participate in one of two single-gendered focus group discussions, which aimed to explore experiences and phenomena relating to technology use and mood. Two facilitators used a discussion schedule to generate and facilitate discussion regarding experience of emotion in relation to technology use (e.g., How do you feel when you are talking with your friends on the phone? Texting? Posting on social networking sites? Privately through email?). Emotion probe cards were used to facilitate identification and selection of a range of different emotions.

Research team members explored qualitative themes in relation to adolescent technology use for managing moods and coping with problems. Given the exploratory nature of the data, thematic analysis using a six-stage process (Braun & Clarke, 2006) was conducted to generate themes from the content of the focus groups. This included becoming familiar with the data through repeated reading, generating initial codes and searching for themes, reviewing and refining themes, and defining themes to produce final analysis.

## **2.2 Focus Group Results**

**2.2.1 Using technology in response to offline experiences (internal and interpersonal).** Adolescents reported engaging with technology in response to different types of offline experiences, as described in Table 1 under Theme 1. Specifically, youth described feelings such as boredom and anger, which they attempted to manage by engaging with technology, typically through social sites like Facebook, or Skype, or online games. Another key theme reported was that often, these emotional experiences and the desire to use technology were initiated in the context of interpersonal interactions, such as with friends or family. Key examples for this are also provided under Theme 1 in Table 1.

**2.2.2 Using technology to manage mood and emotions.** In response to queries about how technology was used to manage emotions, participants acknowledged a range of ways in which technology could alter or maintain a particular emotion, including through social interaction and support as well as seeking experiences online that might produce positive emotional experiences. Several representative responses in relation to this theme are provided under Theme 2 (Table 1). What was apparent from youths' responses was that technology, most notably social networking sites such as Facebook, were often used as an emotion-focused strategy to reduce perceived negative emotions or to maintain positive emotions.

**2.2.3 Technology as a source of negative emotional stimuli.** Importantly, however, participants also discussed a range of situations that occurred online, which subsequently evoked negative emotional experiences. Here, participants recognized that although they often went online to feel better, being online could lead to further experiences of negative affect. Some of these experiences were relational, in that they perceived social networking sites as being used by others to provoke their emotions

(e.g., engaging in actions to embarrass, provoke jealousy). In other cases, youth acknowledged that these experiences were simply a product of being online (e.g., social comparison). Illustrative examples are again provided in Table 1, under Theme 3.

Table 1. *Focus Group Themes.*

<i>Participant (Gender)</i>	<b>Theme</b>
<b>1. Using technology in response to offline experience (internal and interpersonal)</b>	
<b>1A. Examples in relation to moods</b>	
AM (F)	<i>Aah probably when I'm feeling bored, probably in the middle of the day or something</i>
SH (F)	<i>Na I just hop on it cause it's fun and on the weekend got on it 'cause we were bored and we were playing Minecraft with my cousin and we wanted to play with some of his mates...</i>
MA (M)	<i>yeah, I play Minecraft to get my mind off everything</i>
DA (M)	<i>When I'm bored I go on it, and then get bored on it anyway [laughs]</i>
<b>1B. Examples in relation to interpersonal experiences</b>	
SH (F)	<i>If my mum, my dad or my brother are annoying me I just go on Facebook and talk to people and it makes me feel calm instead of listening to them</i>
DA (M)	<i>I just get annoyed from my brothers, and sit in my room, pinch mums laptop for a couple of hours</i>
LE (M)	<i>When I get in trouble for things I didn't do [Facilitator: From your parents? Ok, so what do you do then?] Ah, I go on the computer and play games and that [Facilitator: Aah and how does that help?] Umm, It just makes you feel calmer</i>
<b>2. Using technology to manage mood and emotions</b>	
TA (F)	<i>Yeah, cause instead of being home and bored or something, when I'm in like a sad mood or something I can talk to my friends, or family that lives somewhere else. It makes me feel happier.</i>
TY (M)	<i>I watch YouTube videos [to manage unpleasant mood]</i>
JA (M)	<i>I watch YouTube videos, or play on the x-box when I feel crap [Facilitator: Oh ok, so you feel crap and it pops into your head, or?] JA (M): Yeah, and then I just try and, get my mind off it</i>
<b>3. Technology as a source of potential negative emotional stimuli</b>	
SH (F)	<i>When..ahh.. at the start of the year and all of my friends were commenting on this photo from when we were at the youth centre and they kept doing dots just to annoy people and then they ended up having an argument 'cause they were getting so much notifications and they didn't really like it</i>
CA (F)	<i>Uuuuum. It was between two of my friends. They were fighting over umm, that one of my friends should share me, and then another girl said yes and then everyone else started butting in... Yeah I got annoyed</i>
DA (M)	<i>When something makes me really, really angry. When you're talking to someone and then they screen check your conversation and then they post it to everyone. That just makes me [frustrated face].</i>

## 2.3 Discussion

Results revealed that youth identified with using technology in response to negative experiences. Indeed, youth reported using the online space as an emotion-focussed coping strategy (e.g., steering away from anger or unpleasant offline experiences). That is, adolescents identified turning to the online space to alleviate negative experiences rather than coping with the trigger itself. This suggests that adolescents are cognizant of accessing the online space to deal with stressors, though they did not spontaneously volunteer preferred strategies. Youth also reported that the online environment can be a salient source of discomfort, either through a negative social interaction, or exposure to content that triggers negative reactions. All told, our first hypothesis positing that adolescents would widely endorse using the online space to cope with negative experiences was generally supported. Thus, study 2 empirically explored the utility of adolescents' online coping efforts in the face of day-to-day stressors.

## 3.0 Study 2: Experience Sampling Method Study

### 3.1 Method

**3.1.1 Participants and procedure.** Participants in the second study, using experience sampling study methods (ESM), were 213 adolescents from two additional low-SES public schools in a metropolitan area. Schools were recruited based on their designation as relatively low SES, as ranked on a national Index of Community Socio-Educational Advantage (Australian Curriculum, Assessment & Reporting Authority, 2013), which is determined based on a range of indicators, including parental education, household income, and single-parent status household. Five participants withdrew consent from the study, and two participants completed the pre-ESM survey but did not commence the ESM phase. Further, participants who were deemed non-compliant with

the study protocol (see Results section) were excluded from study analyses. Thus, the final sample consisted of 156 adolescents ( $M_{\text{age}} = 14.7$  years ( $SD = 1.3$ ), 13-16 years; girls = 66%). The majority of study participants reported their ethnicity as Caucasian (74.4%). Other ethnicities were Maori (3.8%) African (2.6%) Asian (1.3%) Aboriginal or Torres Strait Islander (8.3%) and “other” (5.1%). 4.5% of participants did not report their ethnicity.

Ethics approval for “How do you feel? Adolescent behaviour, emotion, and technology use over time” project was obtained from the University Human Ethics Research Committee to extend the original project #2013/141, and continued approval was obtained from the State Department of Education (Project # D13/0537672)<sup>1</sup>. Participants and parents/guardians gave written consent prior to participation. Participants received no financial remuneration for participation but instead were given unlimited use of a recent model iPhone with phone and data credits to enhance engagement. Data were collected in groups of 20-25 youth per week between late 2013-mid 2016 in two school cohorts. Groups were staggered to allow sufficient resource allocation (e.g., smartphones and research team attention; Modecki et al., 2019). Prior to beginning the ESM phase, participants completed a computerized baseline survey (pre-ESM survey) which included items tapping demographics and a range of constructs, including adapted online coping questions, psychopathology, life-stressors, and well-being.

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<sup>1</sup> These data were part of the larger project, “How do you feel? Adolescent behaviour, emotion, and technology use over time”, which focuses on day-to-day life among youth living in the context of low SES settings. This is the first project paper to report on youth technology use and is the second paper to publish from the final sample. See Modecki, Uink, & Barber, 2018; Uink, Modecki & Barber, 2017; Uink, Modecki, Barber, & Correia, 2018.

For the ESM study phase, participants were loaned a recent model iPhone for seven days, provided by the research team with a pre-paid plan. Five times throughout each study day participants were sent an SMS link to a web-based ESM survey at random intervals, within pre-specified time blocks. Surveys were sent each morning (07:30—08:00 (09:00 – 09:30 weekends)), Lunch (13:15 only, due to school lunch break), Afternoon (15:30 – 16:00), Dinner (18:30 – 19:00) and Night (21:00 – 22:00). Each survey was closed to responses within an hour of being sent. Survey times were successfully piloted in a separate sample of adolescents. The research team was also onsite at school each sampling day from early morning to after school to enhance compliance and were contactable by phone outside of school hours to troubleshoot any technical issues (see Figure S1 for a diagram of study design).

### **3.1.2 Momentary-level measures.**

**3.1.2.1 Momentary Emotion.** Adolescents' emotions across the day were assessed by asking, "*Right now, how are you feeling?*" at each sampling moment. Because we were specifically interested in youths' problematic responding, in this study, we concentrated exclusively on negative affect (worry, anger, jealousy, loneliness, sadness). Participants rated how lonely, worried, angry, jealous, and sad they were feeling (1 = Not at all, 5 = Very much). Because we were interested in how youths' emotional states fluctuated with their technology use, the primary outcome variable in study analyses was emotional change, rather than level of each emotion. We tested for this emotion change by assessing a youth's emotion at the current sampling moment ( $t=0$ ) while controlling for emotion at the previous time point ( $t-1$ ). Thus, analyses characterize *changes* in emotion as a result of predictors.

**3.1.2.2 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?”* (Schneiders et al., 2006; Uink, Modecki, & Barber, 2017). The question format ensured that participants reported on recent stressors, occurring within the last 2-5 hours. A dummy variable was created for momentary stressors (0 = no bad event since last messaged, 1 = bad event since last messaged).

**3.1.2.3 Momentary Technology Use.** Ninety-four percent of youth within the sample reported accessing a mobile phone on a more or less daily basis. Adolescents’ momentary technology use was assessed by asking, *“Since the last message, have you”* followed by six variations of technology use (including: *“Used text messaging/Instant messaging”*, *“Watched YouTube videos”* or *“Used social networking sites”* *“Done any gaming”* *“Made or received phone calls”* *“Watched TV or movies.”*) A dummy variable was created (0 = no technology use, 1 = technology use).

**3.1.2.4 Momentary Positive Events.** Analyses also controlled for momentary positive events as a level-1 covariate. At each sampling moment, adolescents were asked: *“Since the last message, has anything good happened to you?”* A dummy variable was created for momentary positive events (0 = no good event since last messaged, 1 = good event since last messaged).

### **3.1.3 Person-level Measures.**

**3.1.3.1 Adapted Brief-COPE.** To assess online coping, three subscales from the brief-COPE (Carver, 1997) scale were adapted to assess online coping behaviours. Previous research has shown a similar but slightly longer version of this scale to be valid among adults (van Ingen & Wright, 2016). Notably, Van Ingen and Wright’s (2016) work shows only moderate correlations between online and offline coping ( $r = .36$ ) and reported generally positive correlations between well-being and offline coping, but negative correlations between online coping and self-esteem and connectedness.



Supplementary Table 1 reports our parallel work with young adults (ages 17-25,  $M_{\text{age}} = 20.03$ ) which provides a fairly similar pattern of findings. That is, offline strategies were generally negatively associated with problems, with the exception of self-distraction. Whereas online strategies were associated with more problems and maladaptive affect regulation.

Table 2 presents means and correlations between youths' scores on the adapted Brief-COPE subscales and other study variables. Participants were asked: *"Please rate how much you do the following things when you experience stressful events."* Responses were recorded on a 4-point Likert scale (1 = I haven't been doing this at all, to 4 = I've been doing this a lot). Subscales included Emotional Support (2 items; e.g., To get emotional support from others, I use technology like Facebook, Instant Messaging and SMS,  $\alpha = .78$ ; 17% reported not doing this at all, 6% reported doing this a lot); Seeking Information (e.g., To get advice from other people I use technology like Facebook YouTube and Google (1 item; 22% had not done this at all, 11% reported doing this a lot); and Self-Distraction (2 items; e.g., To take my mind off things, I turn to technology like Facebook, YouTube and Streaming Music,  $\alpha = .64$ ; 6% had not done this at all. 13% reported doing this a lot).

**3.1.3.2 Person-Level Covariates.** A number of person-level controls were included in the analyses, including gender (0 = male, 1 = female), depression symptoms, social anxiety symptoms, and externalizing behaviours (see Supplementary Section). Additional controls included average engagement with technology over the week, average stressors encountered over the week, and average level of each emotion experienced across the week (see Planned Analysis). Specifically, gender, psychopathology, and weekly averages were regressed onto the intercept at level-2 to control for between-person differences in these factors (Ebner-Priemer, Eid,

Kleindienst, Stabenow, & Trull, 2009). Hence, analyses provide an estimate of emotion change separate from overall mean level of technology use, stressors experienced, and dispositional emotion (Bolger & Laurenceau, 2013).

**3.1.4 Planned Analyses.** Analyses used multilevel modelling (MLM) (Hox, 2010) to account for repeated measures of stressors, technology use, and emotion nested within-person. MLM accounts for non-independence in the variables that were measured at each sampling moment (e.g., technology use, stressors, emotions) and also allows within-person and between-person variance in outcomes to be estimated separately (Hox, 2010). Within-person (i.e., repeated measures) variables are modelled at level-1 of the models, and between-person variables are modelled at level-2 of the models. Notably, these are conservative tests in that we re-introduced the means of technology use, emotion, and stress at level 2 so that models report independent micro- (level 1) and macro-level (level 2) contributions of these predictors. Level-1 variables were group-mean centered (e.g., centered on each adolescents' average for the week) and level-2 variables were grand-mean centered (e.g., on the sample's average) (Enders & Tofighi, 2007). Separate models were estimated for each emotion and each coping subscale.

Models first examined whether momentary stressors, technology use, and online coping strategy predicted emotion change (i.e., fixed effect models). Next, a cross-level interaction was added to the models to assess the focal hypothesis, in which online coping strategy conditioned the relation between experiencing a stressor and change in emotion. To test the cross-level interaction, the slope of emotion was regressed on stress and was allowed to vary across adolescents. The three online coping variables were (separately) then regressed onto the random slope. Adding this cross-level interaction

allowed us to test whether coping strategy explained variance in slopes (between stressor and subsequent emotion) across adolescents.

MLM was run using Mplus version 8 (Hox, 2010; Muthén & Muthén, 2017). Missing data were estimated using Full Information Likelihood Method (FIML), which provides model estimates based on all observed data, in line with best practice (Enders, 2010)<sup>2</sup>. Models were estimated using robust standard errors to account for variable non-normality. Notably, in all multilevel models (e.g., main effect and cross-level interaction models) Benjamini-Hochberg family wise corrections were applied across coping strategy ( $n = 3$ ), thus accounting for increased type 1 error due to exploration of three different types of coping for each emotion.

## 3.2 ESM Results

**3.2.1 Data preparation and participant compliance.** The final sampling moment of the ESM study was excluded as it was not temporally linked to change in emotion, resulting in 34 assessable time points per participant. Further, less than 1% (.8%) of sampling moments were incomplete due to a technical error or a school scheduling conflict. Compliance rates were based upon the completed number of momentary reports of emotion. Consistent with past ESM studies focused on momentary emotion change (e.g., Brans, Koval, Verduyn, Lim & Kuppens, 2013) participants who completed less than 40% (i.e., less than 14 reports,  $n = 50$ ) of emotion reports were deemed non-compliant and were excluded from current analyses. The median response among included participants in this study was 24, which translates to a median response rate of 71% (i.e., 24/34 possible reports per participant).

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<sup>2</sup> To inform FIML estimation, and make use of all relevant information, construct variances at level 2 and level 1 were brought into each model. In instances where these failed to converge, level 1 variances were individually excluded.

**3.2.2 Correlations.** As described in Table 2, average level of technology use was positively associated with all online coping strategies. Further, social anxiety symptoms and externalizing were also positively associated with all online coping strategies (trend for social anxiety and self-distraction). Additionally, depression symptoms were positively associated with online emotional support and information seeking. Emotional support seeking was positively related to average levels of all emotions (trend for worry). Finally, online information seeking was positively associated with average levels of loneliness and at trend, sadness and worry.

Table 2. *Descriptives and Correlations*

	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Mean Negative Events	.12(.14)														
2. Online Emotional Support Seeking	2.16(.88)	.14+													
3. Online Information Seeking	2.23(.95)	.07	.60***												
4. Online Self-Distraction	2.58(.87)	.05	.57***	.50***											
5. Gender	.68(.49)	.12	.01	-.05	-.14										
6. Depression	5.75(1.49)	.22**	.32***	.21*	.09	.26**									
7. Social Anxiety	4.76(1.72)	.13	.33***	.21*	.16+	.30***	.69***								
8. Externalizing	2.55(.29)	.16+	.31***	.26**	.18*	-.13	.23**	.23**							
9. Mean Lonely	1.61(.77)	.26**	.24**	.20*	.10	.04	.49***	.39***	.24**						
10. Mean Worry	1.60(.71)	.36***	.15+	.16+	-.04	.11	.58***	.41***	.23**	.65***					
11. Mean Anger	1.48(.57)	.36***	.19*	.09	-.01	.05	.50***	.33***	.21*	.68***	.71***				
12. Mean Jealous	1.36(.64)	.25**	.16*	.10	-.02	.08	.47***	.33***	.26**	.72***	.71***	.76***			
13. Mean Sad	1.60(.77)	.31***	.20*	.15+	-.03	.19*	.56***	.40***	.15	.77***	.87***	.72***	.68***		
14. Mean Tech Use	.91(.12)	.09	.21*	.17*	.30***	.10	.00	.11	.24**	.03	.03	-.03	-.01	.05	
15. Mean Positive Events	.30(.26)	.17*	.02	.00	.12	-.13	-.23**	-.09	-.05	-.15+	-.14+	-.17*	-.17*	-.14+	.12

Notes: + $p < .10$  \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .  $n = 156$ . Gender male = 0.

### **3.2.3 Does adolescents' online coping, stress, and technology use predict emotion change?**

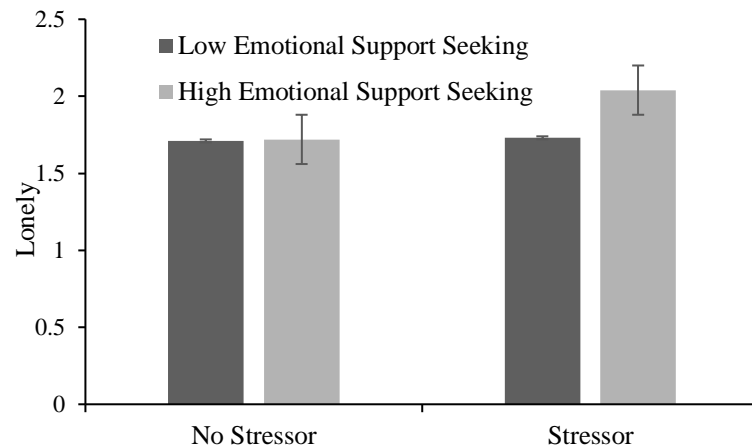
**3.2.3.1 Main effects predicting emotions.** In the two-level fixed effects models, there were significant main effects at level 1 and level 2 for each emotion. Across all three of the coping models, and as shown under the level 1 section of Supplementary Table 2, recent stressors were associated with significant increases in each emotion, except jealousy. Further, recent positive events were associated with significant decreases in each emotion (trend for jealousy). Likewise, previous emotion positively predicted subsequent emotion. Notably, however, momentary technology use was not associated with emotion change in any of the models.

As shown under the level 2 section of Supplementary Table 2, average emotion across the week was positively associated with the corresponding emotion outcome in each model. Further, there was a trend-level association with gender and jealousy across all models; girls experienced more change in jealousy across the week than boys. Social anxiety symptoms were also related to less change in jealousy across all models. Further, externalizing symptoms were associated with less change in momentary loneliness (trend for emotional support and information seeking) and less change in momentary jealousy (trend). Adolescents with higher average technology use across the week experienced less change in anger and sadness. Regarding specific online coping strategies, going online to seek information was significantly associated with greater change in worry. It is worth noting that these models are predicting within-person change in emotion, as opposed to emotional well-being across the week (for between-level averages, see correlations in Table 2).

### **3.2.4 Do adolescents' emotional responses to stress depend on their online coping strategy?**

Outlined in section 3.2.3.1, recent stressful events were associated with increases in negative emotion. The following cross-level interactions tested whether this relation between stressor and emotion was conditioned by participants' online coping style.

**3.2.4.1 Online Emotional Support Seeking.** As described in Table 3, for emotional support, there was a significant Stressor X Online Coping interaction predicting loneliness. Plotting and probing of simple slopes at high and low levels of support seeking ( $SD+1$ ,  $SD-1$ ), indicated that when youth were not experiencing a stressor, both groups of youth reported similar moment-to-moment change in loneliness (left side of Figure 1A). However, youth reporting high levels of online emotional support seeking (light grey bar, right side of Figure 1A) reported significant increases in loneliness ( $b = .32(.12)$ ;  $p = .006$ ) after experiencing a stressor. Youth at low levels of online emotional support only reported slight increases in loneliness after a stressor, and this relation was non-significant ( $b = .02(.08)$ ;  $p = .776$ ).



*Figure 1A. High online emotional support seeking is associated with surges in loneliness after a stressor. Change after a) no stressor and b) a stressor, for low and high online emotional support seekers. Error bars represent standard errors.*

Additionally, there was a trend-level interaction for Stressor X Online Coping predicting worry. Given we were conservative in our application of a Benjamini-Hochberg correction to multi-level effects, we explored this interaction via probing and plotting of simple slopes. The pattern of results was similar to those for lonely. Results indicated that when youth were not experiencing a stressor, both groups of youth reported fairly similar moment-to-moment change in worry. However, after experiencing a stressor, youth endorsing high levels of emotional support seeking reported significant increases in worry ( $b = .46 (.11)$ ;  $p < .001$ ). Youth endorsing low levels of emotional support seeking also reported slight upticks in worry pre- to post-stressor, but this association was weaker ( $b = .20(.12)$ ;  $p = .093$ ).

Finally, there was a significant Stressor X Online Coping interaction predicting jealousy. Plotting and probing of simple slopes at high and low levels of emotional support seeking ( $SD+1$ ,  $SD-1$ ), indicated that when youth were not experiencing a stressor, both groups of youth reported relatively similar moment-to-moment change in



jealousy. However, youth reporting high levels of online emotional support seeking reported increases in jealousy, ( $b = .05(.04)$ ;  $p = .201$ ) after experiencing a stressor, although this relation was non-significant. Youth at low levels of online emotional support reported slight decreases in jealousy after a stressor, although again this relation was non-significant ( $b = -.06(.05)$ ;  $p = .197$ ).

**3.2.4.2 Online Self-Distraction.** For self-distraction, there was a significant Stressor X Online Coping interaction predicting worry. This interaction is characterized in Figure 2A. Specifically, after experiencing a stressor, youth at high levels of self-distraction reported significant increases in worry ( $b = .49(.09)$ ;  $p < .001$ ), as did youth with low levels of self-distraction ( $b = .19(.06)$ ;  $p = .002$ ). Again, this association was weaker at low levels of self-distraction.



*Figure 2A. High online self-distraction is associated with surges in worry after a stressor. Worry change after a) no stressor and b) a stressor, for low and high online self-distractors. Error bars represent standard errors.*

Additionally, there was a significant Stressor X Online Coping interaction predicting jealousy. Youth high in self-distraction experienced significant increases in jealousy after a stressor ( $b = .13(.03)$ ;  $p < .001$ ) whereas youth low on self-distraction

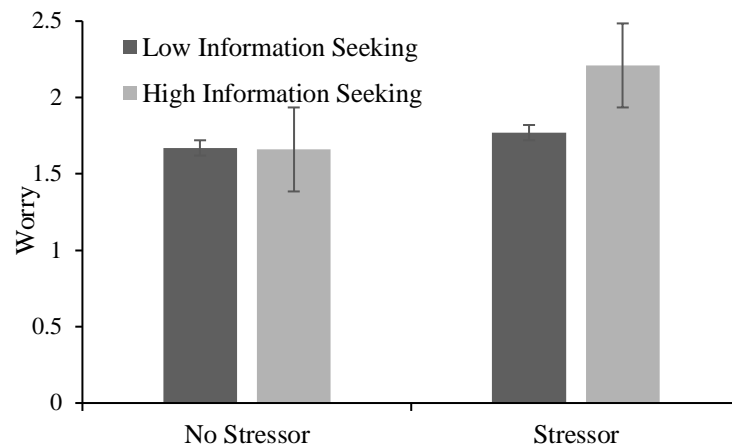
experienced significant decreases in jealousy after a stressor ( $b = -.14(.04)$ ;  $p = .001$ ).

These relations are characterized in Figure 2B.



*Figure 2B. High online self-distraction is associated with surges in jealousy after a stressor. Jealousy change after a) no stressor and b) a stressor for low and high online self-distractors. Error bars represent standard errors.*

**3.2.4.3 Online Information Seeking.** For information seeking, there was a significant Stressor X Online Coping interaction predicting worry. Youth at high levels of information seeking reported significant increases in worry after a stressor ( $b = .55(.09)$ ;  $p < .001$ ). Youth at low levels of information seeking also reported increased worry after experiencing a stressor, but this relation was weaker, and the simple slope was non-significant ( $b = .10(.06)$ ;  $p = .125$ ). These relations are characterized in Figure 3A.



*Figure 3A. High online information seeking is associated with surges in worry after a stressor. Worry change after a) a stressor and b) no stressor for low and high online information seekers. Error bars represent standard errors.*

Finally, there was a significant Stressor X Online Coping interaction predicting jealousy. Plotting and probing of simple slopes at high and low levels of information seeking ( $SD+1$ ,  $SD-1$ ) indicated a pattern similar that found for self-distraction (Figure 2B). When not experiencing a stressor, both groups of youth reported relatively similar moment-to-moment change in jealousy. However, when experiencing a stressor, those at high levels of online information seeking experienced increases in jealousy, although this relation was non-significant ( $b = .06(.04)$ ;  $p = .156$ ). Further, those at low levels of online emotional support seeking reported slight decreases in jealousy after a stressor; however, this relation was again non-significant ( $b = -.06(.05)$ ;  $p = .257$ ).

Table 3. *Adjusted Cross-Level Interactions of Online Coping X Negative Event Predicting Emotion*

Online Coping - Emotional Support					
Random Intercept and Slope Model	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
<b>Level 1 Covariates</b>					
Negative Event	.17(.06)** [.05 – .30]	.33(.07)** [.19 – .47]	.65(.08)** [.49 – .81]	.01(.05) [-.10 – .09]	.60(.08)** [.44 – .75]
Positive Event	-.20(.04)** [-.27 – -.12]	-.10(.04)** [-.19 – -.02]	-.19(.04)** [-.27 – -.11]	-.05(.03)+ [-.10 – .00]	-.22(.04)** [-.30 – -.15]
Technology Use	.07(.05) [-.01 – .16]	.00(.05) [-.10 – .11]	-.04(.04) [-.12 – .05]	.08(.04)+ [-.16 – .00]	-.05(.05) [-.15 – .06]
Previous Emotion	.07(.03)** [.02 – .13]	.27(.04)** [.20 – .34]	.11(.04)** [.04 – .17]	.30(.05)** [.19 – .40]	.19(.04)** [.13 – .26]
<b>Level 2 Covariates</b>					
Cross-Level Interaction	.17(.07)* [.04 – .30]	.15(.08)+ [-.01 – .30]	.15(.09) [-.04 – .33]	.06(.03)* [.00 – .12]	.07(.08) [-.09 – .22]
Gender	-.19(.07)* [-.32 – -.05]	-.10(.14) [-.38 – .18]	-.01(.12) [-.25 – .22]	-.34(.34) [-.10 – .32]	-.07(.04) [-.16 – .02]
Average Emotion	.82(.06)** [.70 – .94]	.85(.06)** [.73 – .97]	.91(.03)** [.85 – .98]	.76(.04)** [.68 – .84]	.87(.05)** [.77 – .96]
Depression	.01(.02) [-.02 – .05]	.01(.02) [-.03 – .05]	.00(.01) [-.03 – .03]	.01(.02) [-.04 – .05]	.02(.02) [-.02 – .06]
Social Anxiety	.03(.01)* [.01 – .04]	.01(.01) [-.01 – .03]	-.01(.01) [-.03 – .01]	.04(.03) [-.29 – .11]	-.01(.01) [-.02 – .01]
Externalizing	-.06(.06) [-.18 – .05]	-.02(.03) [-.08 – .05]	.08(.03)* [.02 – .13]	-.02(.15) [-.30 – .27]	-.04(.04) [-.02 – .04]
Average Technology Use	-.03(.11) [-.26 – .19]	-.08(.15) [-.38 – .22]	-.03(.15) [-.32 – .25]	-.03(.19) [-.42 – .35]	-.11(.08) [-.27 – .04]
Average Negative Events	.02(.10) [-.18 – .22]	.17(.18) [-.18 – .52]	.14(.21) [-.26 – .54]	.23(.20) [-.16 – .62]	.10(.09) [-.08 – .28]
Emotional Support	.01(.03) [-.05 – .06]	.02(.02) [-.02 – .05]	-.02(.01) [-.04 – .01]	-.01(.03) [-.08 – .05]	.05(.02) [.02 – .09]

Online Coping – Self-Distraction					
Random Intercept and Slope Model	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
<b>Level 1 Covariates</b>					
Negative Event	.18(.06)** [.06 – .31]	.34(.06)** [.22 – .46]	.66(.08)** [.51 – .81]	.00(.04) [-.08 – .07]	.59(.08)** [.44 – .74]
Positive Event	-.20(.04)** [-.28 – -.13]	-.10(.04)* [-.18 – -.03]	-.19(.04)** [-.26 – -.11]	-.05(.03)+ [-.10 – .01]	-.22(.04)** [-.30 – .14]
Technology Use	.07(.05) [-.02 – .16]	.00(.05) [-.10 – .10]	-.04(.04) [-.12 – .05]	-.08(.04)+ [-.16 – .00]	-.05(.05) [-.15 – .06]
Previous Emotion	.07(.03)** [.02 – .12]	.27(.04)** [.20 – .34]	.11(.04)** [.04 – .17]	.30(.05)** [.19 – .40]	.20(.04)** [.13 – .26]
<b>Level 2 Covariates</b>					
Cross-Level Interaction	.10(.09) [-.07 – .27]	.17(.07)* [.03 – .31]	.12(.10) [-.08 – .31]	.16(.04)** [.08 – .24]	.21(.10) [.01 – .40]
Gender	-.15(.08)+ [-.29 – .00]	-.11(.05)+ [-.21 – -.01]	-.02(.21) [-.43 – .39]	-.35(.35) [-1.04 – .33]	-.07(.06) [-.19 – .05]
Average Emotion	.84(.06)** [.72 – .97]	.85(.03)** [.78 – .92]	.90(.03)** [.85 – .95]	.75(.04)** [.67 – .84]	.87(.06)** [.76 – .98]
Depression	.01(.01) [-.02 – .03]	.01(.01) [-.01 – .03]	.00(.01) [-.03 – .03]	.01(.02) [-.04 – .05]	.03(.02) [-.02 – .07]
Social Anxiety	.02(.01)+ [.00 – .04]	.01(.01) [.00 – .03]	-.01(.01) [-.02 – .01]	.04(.03) [-.03 – .11]	.00(.01) [-.03 – .02]
Externalizing	-.04(.05) [-.14 – .07]	-.01(.03) [-.07 – .05]	.07(.05) [-.03 – .18]	-.01(.14) [-.29 – .27]	-.02(.04) [-.09 – .06]
Average Technology Use	-.09(.10) [-.30 – .11]	-.09(.09) [-.25 – .09]	-.02(.30) [-.61 – .57]	.03(.22) [-.14 – .62]	-.09(.07) [-.23 – .05]
Average Negative Events	.04(.13) [-.22 – .31]	.18(.08)+ [.02 – .34]	.18(.07)* [-.04 – .32]	.24(.19) [-.14 – .62]	.12(.11) [-.09 – .33]
Self-Distraction	.02(.01) [-.01 – .05]	.01(.01) [-.02 – .03]	-.02(.01) [-.03 – .00]	-.05(.05) [-.14 – .05]	.01(.02) [-.02 – .05]

Online Coping –Information Seeking					
Random Intercept and Slope Model	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
<b>Level 1 Covariates</b>					
Negative Event	.19(.07)** [.06 – .31]	.33(.06)** [.05 – .30]	.66(.08)** [.50 – .82]	.00(.05) [-.10 – .10]	.59(.08)** [.44 – .75]
Positive Event	-.20(.04)** [-.28 – -.13]	-.10(.04)* [-.18 – -.03]	-.19(.04)** [-.27 – -.11]	-.05(.03)+ [-.10 – .00]	-.22(.04)** [-.30 – -.15]
Technology Use	.07(.05) [.02 – .16]	.00(.05) [-.09 – .10]	-.04(.04) [-.12 – .05]	-.08(.04)+ [-.16 – .00]	-.04(.05) [-.15 – .06]
Previous Emotion	.07(.03)** [.02 – .12]	.27(.04)** [.20 – .34]	.11(.04)** [.04 – .17]	.30(.05)** [.19 – .40]	.19(.04)** [.13 – .26]
<b>Level 2 Covariates</b>					
Cross-Level Interaction	.09(.05) [-.01 – .20]	.24(.06)** [.12 – .37]	.09(.09) [-.07 – .26]	.06(.03)* [.00 – .12]	.13(.08) [-.03 – .29]
Gender	-.15(.08)+ [-.31 – .00]	-.11(.05)+ [-.21 – .00]	.01(.22) [-.45 – .43]	-.34(.36) [-1.05 – .36]	-.08(.06) [-.18 – .03]
Average Emotion	.85(.07)** [.72 – .98]	.85(.04)** [.78 – .92]	.91(.03)** [.85 – .97]	.76(.05)** [.67 – .85]	.87(.05)** [.77 – .97]
Depression	.01(.01) [-.01 – .03]	.01(.01) [-.01 – .03]	.00(.02) [-.05 – .05]	.01(.02) [-.04 – .05]	.03(.02) [-.02 – .07]
Social Anxiety	.02(.01)+ [.00 – .04]	.01(.01) [.01 – .03]	-.01(.01) [-.03 – .01]	.04(.04) [-.03 – .11]	.00(.01) [-.02 – .02]
Externalizing	.00(.05) [-.13 – .06]	-.01(.03) [-.07 – .05]	.08(.04)+ [.00 – .16]	-.01(.16) [-.31 – .30]	-.03(.04) [-.10 – .05]
Average Technology Use	-.05(.10) [-.24 – .14]	-.07(.08) [-.23 – .10]	-.03(.21) [-.44 – .39]	-.03(.20) [-.42 – .37]	-.08(.07) [-.22 – .06]
Average Negative Events	.05(.14) [-.22 – .32]	.18(.08)+ [.03 – .33]	.14(.17) [-.18 – .47]	.22(.20) [-.17 – .61]	.12(.10) [-.08 – .33]
Information Seeking	-.01(.01) [-.03 – .02]	.00(.01) [-.02 – .02]	-.02(.02) [-.05 – .01]	-.03(.02) [-.08 – .02]	.02(.01) [-.01 – .04]

Note. + $p \leq .10$ , \* $p < .05$ , \*\* $p \leq .01$ , gender male = 0. All  $p$  values adjusted using the Benjamini-Hochberg family wise correction.

### **3.3 Discussion**

Study 2 sought to build on findings of Study 1 (suggesting that youth make use of online spaces to cope) and investigated whether adolescents' use of online coping strategies mitigated affective upheavals in the face of actual daily stress. Two hypotheses were tested. First, technology use across the day was a key covariate in the models and as an exploratory research aim, we sought to investigate whether moment-to-moment use of technology led to short-term change in emotion. Surprisingly, we found no effects of recent technology use on subsequent emotion. Second, we hypothesized that the types of online coping style that adolescents endorsed would each dampen emotional reactivity to stress. However, this hypothesis was not supported for any of the investigated online coping styles. In fact, adolescents' frequent use of online coping in any form was tied to poorer "bounce back" from stress. Regardless of whether youth reported high levels of seeking emotional support, self-distraction, or looking for information when experiencing stressful events, their emotion change (relative to the previous time point, T-1) was more overtly negative—mainly in relation to worry and jealousy, with one effect for loneliness—relative to youth who endorsed lower levels. This suggests that using the online space as a general means of dealing with stress may not be helpful when employed frequently, as adolescents' habitual approach to feeling better.

### **4.0 General Discussion**

Teens are almost always online; yet surprisingly, little research has sought to understand the ways in which youth are connecting with technology to benefit their emotional well-being (e.g., Wartella & Jennings, 2000). Here we have sought to validate and characterize adolescents' online coping in conjunction with their emotional health, drawing on Uses and Gratification Theory (UGT) (Katz et al., 1973). First, our

focus group findings re-affirm that in the face of day-to-day challenges, adolescents are turning to technology in order to feel better. According to their own accounts, this strategy tends to be perceived as effective, though not without its challenges (e.g., other stressors encountered online). Second, we examined whether, in everyday life, youthful online coping is protective in response to stressors. Contrary to adolescents' beliefs and our original hypothesis, frequent online coping was associated with poorer bouncing back when problems arose, mainly in relation to worry and jealousy. Hence, adolescents who regularly engage in online coping do not appear to benefit from short-term emotional relief.

#### **4.1 Validity of adolescent online coping**

This study is the first, to our knowledge, to explicitly assess online coping with adolescents within a theoretically informed framework. We triangulated methods, using focus groups followed by ESM to substantiate adolescents' use of technology as part of their coping repertoire. Within focus group discussions, youth spontaneously shared engaging with technology solely for the purpose of coping with their affective states and emotional upheavals. Motivated by these accounts, we worked to adapt a theoretically informed, widely-used measure of coping constructs to the online space. Similar to recent research with adults (e.g., van Ingen & Wright, 2016), our updated online coping constructs exhibited excellent validity with adolescents. When asked how often they engaged with online strategies in response to stress, 84% reported seeking emotional support online; 78% endorsed findings information online; and 94% reported engaging in self-distraction, at least in some way. Notably, endorsement of online coping was significantly associated with average technology engagement across the week, indicating that the more time spent online, the more likely youth were to engage in these strategies.



#### 4.2 Does adolescents' online coping work?

Two considerations underpinned our selection of coping strategies thought to be especially pertinent for adolescents online. First, adolescent coping research points to three common forms of coping used among this age group—emotional support seeking, informational support seeking, and self-distraction (Zimmer-Gembeck & Skinner, 2011). Second, each of these strategies, in turn, is inherently linked to the application of UGT to motivations for internet use (Stafford et al., 2004). Adolescent emotional support seeking parallels seeking *social gratification*, in that using the Internet may be a way to emotionally connect. Youths' information support seeking aligns with their *content gratification*, or searching for helpful information, and adolescent self-distraction mirrors *their process gratification* (enjoying the experience of browsing itself). As a result, theoretically, these strategies were an appropriate selection for investigation in youth.

Contrary to our hypothesis, however, high reliance on these online strategies was equally ineffective in providing adolescents with short-term emotional relief. Based on empirical analyses of moment-to-moment change in stress and emotions, we found that youth who endorsed engaging in online coping more frequently had worse outcomes following a stressful experience. Conversely, those who were less inclined to engage in technology in this way displayed more adaptive recovery from a stressor. Notably, these findings emerged in a conservative test that controlled for adolescents' experience of positive events, technology use, and psychopathology and deployed a family-wise error rate to diminish chances of false-discovery.

More specifically, when examined relative to each emotion, adolescents who recurrently engaged in online coping strategies were particularly ineffective in

managing their worry. Adolescents who tended to rely heavily on any one of the online strategies (only trend for emotional support) exhibited greater surges in worry post-stress, relative to their previous emotional state. We posit that these strategies are especially ineffective in relation to worry because this emotion encompasses an intolerance of uncertainty (Laugesen, Dugas, & Bukowski, 2003), and so can be particularly difficult to address without credible reassurance or solutions. Illustratively, in a previous cross-sectional survey study of adolescents, roughly 20% of Internet help-seekers reported dissatisfaction with the help they received for emotional problems online (Gould et al., 2002).

Also discernible was a link between high use of online coping and lack of effectiveness in controlling jealousy. Across emotional support seeking, self-distraction, and information seeking, high engagement in online coping was associated with increased jealousy after a stressful experience. Potentially, adolescents may be going online to divert their attention, but subsequently expose themselves to unrealistic content tailored to impress or instil envy (Lennarz, Lichtwarck-Aschoff, Finkenauer, & Granic, 2017). Indeed, youth who reported only engaging in self-distracting behaviours less frequently or not at all recovered especially well after stress. We posit that these youth are showing particular adaptation and may be using more productive strategies offline, which are more problem-focused and actively support their sense of control (Compas, Conner-Smith, Saltzman, Thomsen, & Wadsworth, 2001).

Although findings were mainly in relation to worry and jealousy, frequent seeking of emotional support online was also problematic in relation to loneliness. In contrast, some previous research has found that adolescents' support-seeking online can be beneficial in relation to challenges such as mental health struggles (e.g., Gray et al., 2005), or by increasing general feelings of "belongingness" and self-esteem (e.g., Best,

Manktelow, & Taylor, 2014). Thus, it may be that our findings of poorer outcomes tied to frequent support seeking online may reflect a general vulnerability within these youth. That is, those who struggle with regulating their loneliness also tend to commonly seek support online. Indeed, higher support seeking was positively correlated with youths' depression scores and reported overall loneliness across the week.

All told, it is quite possible that frequent online coping may be linked to poorer adaption because youth who actively endorse online strategies tend to be the most challenged. That is, youth who are especially at-risk also tend to seek to cope online more frequently. As a result, the difficulties recovering from stress seen here are more indicative of youths' vulnerabilities, rather than due to the online environment itself. For instance, emotional support seeking, self-distraction, and online information seeking all showed associative patterns indicative of poorer well-being. Higher use of each was tied to increased levels of psychopathology, and with the exception of self-distraction, increased average negative affect.

Alternatively, a non-competing explanation is that adolescents' frequent online coping as they are currently inclined, is problematic, and may do more harm than good. Considering that analyses controlled for psychopathology, experience of stressors, and mean levels of affect, it is unlikely that our findings are wholly attributable to these factors. Thus, adolescents' recurrent online coping may be dicey at best. For instance, one possibility is that online coping may be useful up until a certain point, as seems to be the case in relation to adolescent media use more generally (Przybylski & Weinstein, 2017). However, when relied on habitually, these coping endeavours, in their current form, may reflect efforts in vain.

### 4.3 How does this relate to offline coping?

Although the current study focused solely on youth online coping behaviour, a natural extension of this question is whether this pattern is unique to the online context. That is, would a similar pattern of negative functioning be found in relation to adolescents' offline coping? One line of thinking in relation to UGT, suggests that those who are going online (especially those venturing online to cope) may do so in order to compensate for poor resources offline (e.g., Elhai, Levine, Dvorak, & Hall, 2017). Accordingly, we would expect that youth engaging in heavy online coping, in tandem with low levels of offline coping, might be especially vulnerable, and hence less resilient in the face of stress. In fact, in a previous between-person analysis of offline and online coping and well-being among adults, findings corroborated this idea, whereby offline coping was associated with decreased depressive symptoms more broadly, and online coping was linked to higher loneliness, with moderate correlations between the two (van Ingen & Wright, 2016).

Notably, in our own supplementary data with young adults (Supplementary Table 1), in which we also employed online and offline coping measures in association with well-being, a similar pattern arose. Namely, online emotion support-seeking and online information seeking were linked to more stress and internalizing symptoms; whereas their offline counterparts showed a reverse relation to well-being (e.g., depression, emotion regulation strategies). Only self-distraction strategies appeared to be unhealthy, regardless of context (online or offline). Again, within both van Ingen and Wright's (2016) and our data, correlations between online and offline coping were small to moderate, indicating modest overlap. Thus, these behaviours should indeed be considered separately.

#### **4.4 Why do youth continue to cope online if it sometimes makes them feel worse?**

With such negative outcomes associated with routine online coping, the question arises as to why youth continue to cope online? Indeed, in Study 1, youth widely reported coping online, and were under the impression that it made them feel better. In Study 2, youth again reported coping online. However, when online coping was endorsed at high levels, it was related to feeling worse (whether due to ineffective coping or simply individual differences in reactivity, remains to be seen). Here, we discuss three possible explanations for this discrepancy. First, youth who cope less frequently using the online space seem to reap benefits. Thus, it is arguably over-reliance on these strategies that is the culprit. Second, drawing from UGT, a key element of continuing use is the balance between the gratifications sought online versus actual gratifications obtained. In fact, recent research emphasizes the role of gratification discrepancies. Individuals who are either extremely under- or over-gratified, that is, their needs are under- or over- met online, tend to return to the online space more frequently than individuals who have a more balanced experience (Rokito, Choi, Taylor, & Bazarova, 2019). In this case, gratification discrepancies may mean that youth are engaging online to cope in very high amounts due to under-gratification. Third and finally, it is well-established that adults and youth alike are poor affective forecasters (Wilson & Gilbert, 2005). We tend to expect that experiences such as Facebook will make us feel better, even though empirically, these efforts tend to make us feel worse (Sagioglou & Greitemeyer, 2014).

#### **4.5 No effects of technology use on emotion**

A novel secondary contribution of this study was our inclusion of youths' moment-to-moment reports of their technology involvement across the week. Thus, we were able to control for each adolescents' technology engagement on average, enabling

us to parse-out effects of their online coping rather than simply their time online.

Further, as part of our exploration of online coping, we controlled for any momentary effects of technology, in case this precipitated subsequent changes in affect.

Somewhat surprisingly, we found no such effect of adolescents' recent technology use on their emotion. Although our focus groups indicated that the online environment could sometimes leave them feeling embarrassed, left out, or not measuring up, we found no evidence of these problematic effects. Likewise, previous survey research has pointed to relations between youths' poor well-being and their technology use (Rosen et al., 2014; Twenge et al., 2019), and associations between technology use and within-person variation in low emotional and behavioral control (George et al., 2018). Our findings of no significant effects of technology use on emotion suggest that this relation may instead depend on the various ways in which youth choose to engage with the online environment. For instance, texting a friend versus exposure to upsetting content.

Another possible explanation specific to our study design is that youth reported almost always being engaged with technology. In our data, across momentary samples, 90% of youths' responses reported having engaged with at least some form of technology since their last report. As a result, there may have been a lack of predictive capacity due to low variation and thus imprecise estimates.

In tandem with within-person relations between momentary technology engagement and momentary emotion change, we also reported between-person relations among average weekly technology engagement and average levels of each emotion across the week. Our correlations indicated no significant person-level ties. This lack of association at the between-person level again highlights the importance of investigating

reasons for engagement when assessing ties between youth technology use and well-being.

#### **4.6 Study implications**

In order to better understand the potential benefits and risks afforded by technology, scholars would do well to acknowledge why youth are choosing to go online in the first place (Coyne et al., 2015). Are youth seeking entertainment? Connection? Assistance with their problems? Each of these motivations should arguably result in different outcomes, and here we focused on the latter. That is, when triggered by a stressor, how is online coping related to emotional well-being? Our findings highlight several points. First, we provide strong evidence that youth are widely engaging with the online space to cope. Further, findings point to the need to direct youth towards more effective online spaces, which are appropriately tailored to meet their needs (e.g., evidenced-based support sites). Additionally, our data indicate a need for parents, teachers, and practitioners to encourage youth to broaden their coping repertoire more generally, thus allowing them to flexibly employ a range of strategies in response to stress, as opposed to over-reliance on one (Zimmer-Gembeck et al., 2019). Finally, youth who frequently seek out the online space to cope with stress are clearly in need of better options than those they are typically encountering. Providing better resources which are attractive to youth and easily available to them is a practical next step.

#### **4.7 Study limitations**

Study findings also need to be considered in light of study limitations. Included among these is the drawback of a coping measure that was assessed at the person-level, as opposed to the momentary-level. While this is consistent with how coping and technology has been assessed thus far (also without the benefit of experience sampling),

ideally, future research will include repeated assessments of adolescent coping, at a micro-level (Duvenage, Uink, Zimmer-Gembeck, Barber, Donovan, & Modecki, 2019). A second limitation is our use of a broadly defined technology use measure. Although effects of technology may, in theory, be determined by type of technology use, research has shown that youth often multitask (e.g., van Der Schuur, Baumgartner, Sumter, & Valkenburg, 2015), making it challenging to explore effects of specific types of technology in real-time. Similar research exploring technology use at a day-level has also relied on a global measure of time-spent online using digital technologies (George et al., 2018). Third, as typical within the wider coping literature, we focused exclusively on negative emotions, and examining dips in positive emotions as a function of stress and coping would be a useful next step (e.g., Duvenage et al. 2019). Fourth, although we report correlations between online and offline coping from a young adult sample to address whether these are distinct, future research should seek to clarify how these may differ among youth. Finally, our participants include youth already at-risk for problems, given our recruitment from low SES settings. Although our strategy means that participants were likely to experience stressors on a more frequent basis (Uink, Modecki, & Barber, 2017), results need to be replicated in broadly representative samples of youth.

#### **4.8 Conclusion**

The fact that youth widely engage with the online space in order to improve their emotional health has been lost amongst the debate surrounding how adolescents' technology use affects their well-being. Adolescent focus groups described engaging in technology in different ways, often in response to certain emotional and social experiences, in order to regulate their negative emotions. In a quantitative experience sampling study, youth likewise endorsed engaging in theoretically relevant coping



strategies in the online space. Unfortunately, those adolescents who most frequently engaged in such online coping also tended to exhibit poorer outcomes after a stressor. In particular, increases in worry and jealousy tended to be more extreme among youth endorsing high levels of information seeking, emotional support seeking, or self-distraction online. Enhanced opportunities for coping online are now needed for adolescents to access and better manage stressors.

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## Supplementary Section

### Study 2. Psychopathology Measures

**Reynold's Adolescent Depression Scale.** We assessed depression using the Reynold's Adolescent Depression Scale 2<sup>nd</sup> edition (RADS-2; Reynold's 2002;  $\alpha = .82$ ). The RADS-2 assesses risk of a diagnosis of clinical depression by measuring dysphoric mood, anhedonia, negative self-evaluation and somatic symptoms. Participants rated on a 4-point Likert scale (1 = Almost never to 4 = Most of the time), how often they feel certain emotions; for example, "I feel that no-one cares about me."

**Social Anxiety.** We assessed social anxiety using the Social Anxiety Scale for Adolescents (SAS-A; LaGreca, 1998;  $\alpha = .96$ ). Youth responded to each item on a 5-point Likert scale (1 = Not at all to 5 = All the time) regarding how often certain feelings and experiences applied to them; for example, "I'm afraid others will not like me."

**Externalizing behaviour.** Externalizing behaviour was assessed with 15 items that asked participants to rate how often they had engaged in delinquent, aggressive, deceitful and risky behaviours in the last 6 months ( $\alpha = .85$ ) (Fredricks & Eccles, 2006). Participants responded on an 8-point Likert scale how often they engaged in a risky behaviour (0 = none, 7 = 31 or more times). Both the full scale and behavioral subscales have been shown to have good validity across a range of adolescent samples (McCabe, Modecki, & Barber, 2016; Modecki, Barber, & Vernon, 2013). An example item includes: "About how often in the last 6 months have you gotten in a physical fight with another person?"

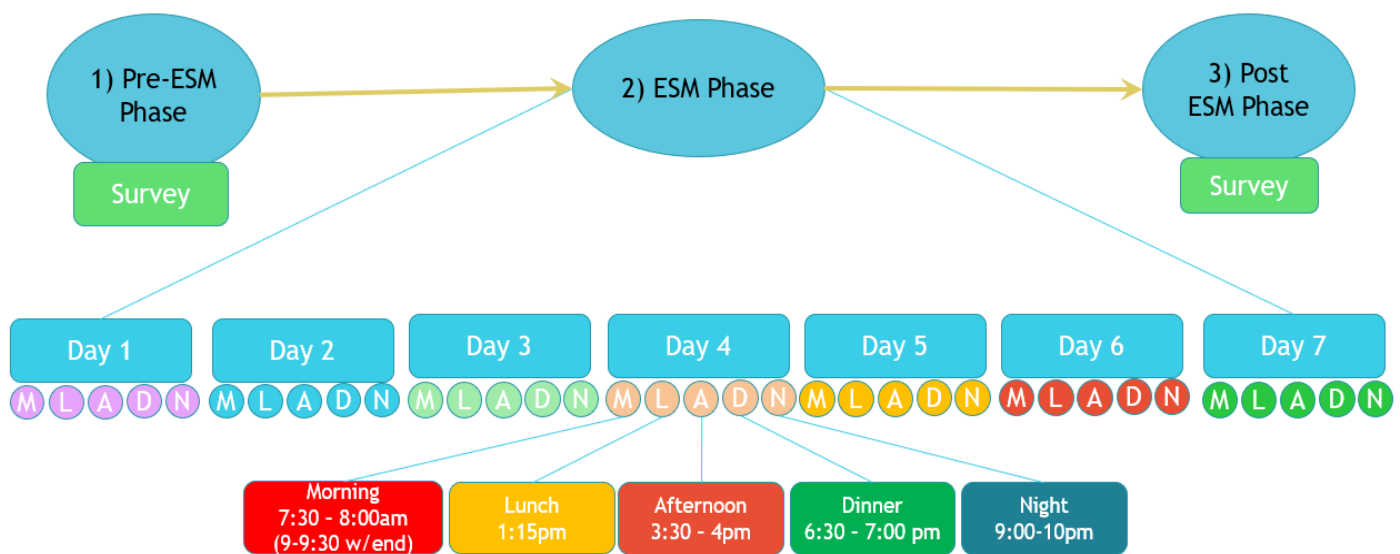
Supplementary Table 1. *Correlations between online and offline coping and well-being in a separate, young adult sample.*

	<b>Online</b>			<b>Offline</b>		
	Emotional Support	Self Distraction	Information Seeking	Emotional Support	Self Distraction	Information Seeking
Stress (DASS-21)	.183**	.261**	.188**	-.077	.168*	-.090
Anxiety (DASS-21)	.150*	.262**	.204**	-.069	.155	-.033
Depression (DASS-21)	.059	.296**	.156*	-.210**	.177*	-.222**
Emotional Symptoms (SDQ)	.145*	.266**	.159*	-.081	.132	-.161*
Conduct Problems (SDQ)	.222**	.213**	.136	-.023	.129	-.038
Nonacceptance of Emotions (DERS)	.069	.325**	.204**	-.097	.265**	-.142**
Lack of Regulation Strategies (DERS)	.061	.325**	.159*	-.153*	.149*	-.231**
Lack of Goals (DERS)	.103	.374**	.188**	.056	.141*	-.039

Note.  $N = 213$ , ages 17-25,  $M_{\text{age}} = 20.03$ , 64% female. \*\* $p < .01$ ; \* $p = .05$ .

Offline and online coping correlations: Emotion Support Seeking  $r = .41^{**}$ ; Self-Distraction  $r = .29^{**}$ ; and Information Seeking,  $r = .30^{**}$ .

Red indicates significant associations with maladaptive functioning; blue indicates significant associations with adaptive functioning. As shown on the left-hand side of the table, online coping was positively associated with indicators of poor well-being. Further, offline emotional support seeking was negatively associated with depression, and negatively associated with a lack of access to a wide array of emotion regulation strategies. Moreover, offline information seeking was negatively associated with depression, internalizing symptoms, and non-acceptance of emotion, and negatively associated with a lack of access to regulation strategies.

*Supplementary Figure 1. Study design.*

*Note.* “How do you feel? Adolescent behaviour, emotion, and technology use over time;” study design, illustrating the three phases of the study: (1) a Baseline Assessment (2) an Experience Sampling Method (ESM) Study of the adolescents via mobile devices for 7 consecutive days, and (3) a second Baseline Assessment.

One key element of the study was our commitment to youth participation and engagement. Research team members were available on site at each school, every day the study ran. This approach ensured regular opportunities to gain rapport with students, to encourage consistent and honest reporting, and make clear the importance of accuracy of results. In addition, research team members were on hand to troubleshoot any technical issues, and this meant availability before the start of each school day and past school closing. Further, a researcher cell-phone was monitored each day (weekends) and night (all days) of the study, in the event of any technical issues, or if there was a need to connect to additional psychological support (a psychologist was on call in the event of any issues in relation to reporting stressors).

Supplementary Table 2. *Adjusted multi-level models predicting emotion.*

Online Coping - Emotional Support					
Random Intercept and Slope Model	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
<b>Level 1 Covariates</b>					
Negative Event	.24(.08)** [.09 – .39]	.35(.07)** [.21 – .49]	.59(.08)** [.43 – .75]	.05(.04) [-.03 – .12]	.62(.08)** [.47 – .78]
Positive Event	-.22(.04)** [-.30 – .13]	-.15(.05)** [-.24 – -.06]	-.23(.05)** [-.32 – -.13]	-.05(.03)+ [-.10 – .00]	-.26(.04)** [-.34 – -.17]
Technology Use	.02(.06) [-.10 – .14]	.01(.07) [-.13 – .15]	.01(.06) [-.11 – .13]	-.07(.06) [-.19 – .04]	-.03(.08) [-.19 – .12]
Previous Emotion	.07(.03)** [.02 – .12]	.26(.04)** [.19 – .34]	.10(.04)** [.03 – .16]	-.25(.05)** [-.17 – .34]	.19(.04)** [.12 – .26]
<b>Level 2 Covariates</b>					
Gender	.01(.01) [-.02 – .04]	-.01(.02) [-.04 – .02]	.00(.02) [-.03 – .03]	.02(.01)+ [.00 – .04]	.01(.01) [-.02 – .03]
Average Emotion	1.05 (.00)** [1.05 – 1.05]	1.03(.07)** [.89 – 1.16]	1.03(.02)** [1.00 – 1.06]	1.02(.01)** [1.00 – 1.04]	1.03(.01)** [1.01 – 1.04]
Depression	-.01(.01) [-.03 – .00]	.00(.02) [-.04 – .04]	-.01(.01) [-.02 – .01]	.01(.00) [.00 – .01]	-.01(.01) [-.02 – .00]
Social Anxiety	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .01]	.00(.01) [-.02 – .01]	-.01(.00)* [-.02 – .00]	.00(.01) [-.01 – .01]
Externalizing	-.06(.01)** [-.08 – -.05]	.01(.03) [-.05 – .07]	.03(.03) [-.03 – .08]	-.04(.02)+ [-.08 – .00]	.01(.03) [-.06 – .08]
Average Technology Use	.05(.05) [-.05 – .14]	-.02(.05) [-.12 – .07]	-.12(.05)* [-.21 – -.02]	.04(.04) [-.04 – .12]	-.09(.04)* [-.17 – -.01]
Average Negative Events	-.02(.05) [-.12 – .08]	.00(.10) [-.20 – .20]	.04(.07) [-.09 – .18]	-.01(.04) [-.08 – .07]	.03(.05) [-.08 – .13]
Emotional Support	.00(.01) [-.02 – .02]	.01(.01) [-.01 – .03]	.00(.01) [-.02 – .03]	-.01(.01) [-.02 – .00]	.00(.01) [-.02 – .02]



Online Coping – Self-Distraction					
Random Intercept and Slope Model Level 1 Covariates	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
Negative Event	.24(.08)** [.09 – .39]	.35(.07)** [.21 – .49]	.59(.08)** [.43 – .75]	.05(.04) [-.03 – .12]	.62(.08)** [.47 – .78]
Positive Event	-.22(.04)** [-.30 – -.13]	-.15(.05)** [-.24 – -.06]	-.23(.05)** [-.32 – -.13]	-.05(.03)+ [-.10 – .00]	-.26(.04)** [-.34 – -.17]
Technology Use	.02(.06) [-.10 – .14]	.01(.07) [-.13 – .15]	.01(.06) [-.11 – .13]	-.07(.06) [-.19 – .04]	-.03(.08) [-.19 – .12]
Previous Emotion	.07(.03)** [.02 – .12]	.26(.04)** [.19 – .34]	.10(.04)** [.03 – .13]	.26(.05)** [.17 – .34]	.19(.04)** [.12 – .26]
<b>Level 2 Covariates</b>					
Gender	.01(.02) [-.02 – .04]	-.01(.01) [-.04 – .02]	-.01(.02) [-.04 – .02]	.02(.01)+ [.00 – .04]	.01(.01) [-.02 – .03]
Average Emotion	1.05(.02)** [1.02 – 1.08]	1.03(.01)** [1.01 – 1.05]	1.03(.02)** [.99 – 1.06]	1.02(.01)** [1.00 – 1.05]	1.03(.01)** [1.01 – 1.04]
Depression	-.01(.01) [-.02 – .00]	.00(.01) [-.01 – .01]	-.01(.01) [-.02 – .01]	.00(.00) [.00 – .01]	-.01(.01) [-.02 – .00]
Social Anxiety	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .01]	-.01(.00)* [-.02 – .00]	.00(.01) [-.01 – .01]
Externalizing	-.06(.04)+ [-.13 – .01]	.02(.03) [-.04 – .07]	.03(.03) [-.03 – .08]	-.04(.02)+ [-.09 – .00]	.01(.03) [-.06 – .08]
Average Technology Use	.05(.05) [-.05 – .14]	-.02(.05) [-.11 – .06]	-.10(.05)* [-.19 – .01]	.03(.04) [-.04 – .10]	-.10(.04)* [-.18 – -.02]
Average Negative Events	-.02(.05) [-.12 – .08]	.00(.06) [-.12 – .12]	.05(.07) [-.08 – .18]	-.01(.04) [-.09 – .07]	.02(.05) [-.08 – .13]
Self-Distraction	.00(.01) [-.01 – .01]	.01(.01) [-.01 – .02]	-.01(.01) [-.03 – .01]	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .02]

Random Intercept and Slope Model	Online Coping –Information Seeking				
	Lonely <i>b</i> (SE) [95% CI]	Worry <i>b</i> (SE) [95% CI]	Anger <i>b</i> (SE) [95% CI]	Jealous <i>b</i> (SE) [95% CI]	Sad <i>b</i> (SE) [95% CI]
<b>Level 1 Covariates</b>					
Negative Event	.24(.08)** [.09 – .39]	.35(.07)** [.21 – .49]	.59(.08)** [.43 – .75]	.05(.04) [-.03 – .12]	.62(.08)** [.47 – .78]
Positive Event	-.22(.04)** [-.30 – -.13]	-.15(.05)** [-.24 – -.06]	-.23(.05)** [-.32 – -.13]	-.05(.03)+ [-.10 – .00]	-.26(.04)** [-.34 – -.17]
Technology Use	.02(.06) [-.10 – .14]	.01(.07) [-.13 – .15]	.01(.06) [-.11 – .13]	-.07(.06) [-.19 – .04]	-.03(.08) [-.19 – .12]
Previous Emotion	.07(.03)** [.02 – .12]	.26(.04)** [.19 – .34]	.01(.04)** [.03 – .16]	.26(.05)** [.17 – .34]	.19(.04)** [.12 – .26]
<b>Level 2 Covariates</b>					
Gender	.01(.02) [-.02 – .04]	-.01(.01) [-.03 – .02]	.00(.02) [-.03 – .03]	.02(.01)+ [.00 – .04]	.01(.01) [-.02 – .03]
Average Emotion	1.05(.02)** [1.02 – 1.08]	1.02(.01)** [1.00 – 1.04]	1.03(.02)** [.99 – 1.06]	1.03(.01)** [1.00 – 1.05]	1.02(.01)** [1.01 – 1.04]
Depression	-.01(.01) [-.02 – .00]	.00(.01) [-.01 – .01]	-.01(.01) [-.02 – .01]	.00(.00) [.00 – .01]	-.01(.01) [-.02 – .00]
Social Anxiety	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .01]	.00(.01) [-.01 – .01]	-.01(.00)* [-.02 – .00]	.00(.01) [-.01 – .01]
Externalizing	-.07(.04)+ [-.14 – .01]	.01(.03) [-.05 – .06]	.03(.03) [-.03 – .09]	-.05(.02)+ [-.09 – .00]	.01(.03) [-.06 – .07]
Average Technology Use	.04(.05) [-.05 – .14]	-.03(.05) [-.12 – .07]	-.11(.05)* [-.20 – -.02]	.03(.04) [-.04 – .09]	-.10(.04)* [-.18 – .02]
Average Negative Events	-.02(.05) [-.11 – .08]	.01(.06) [-.11 – .12]	.05(.07) [-.09 – .18]	-.01(.04) [-.09 – .06]	.03(.05) [-.08 – .13]
Information Seeking	-.01(.01) [-.01 – .02]	.02(.01)* [.01 – .04]	.00(.01) [-.02 – .01]	.01(.01) [-.01 – .02]	.01(.02) [-.01 – .02]

Note. + $p \leq .10$ , \* $p < .05$ , \*\* $p \leq .01$ , gender male = 0. All  $p$  values adjusted using the Benjamini-Hochberg family wise correction.

**References for Measures in Supplementary Table 1:****Depression, Anxiety and Stress Scale (DASS-21):**

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**Difficulties in Emotion Regulation Scale (DERS):**

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment*, 26(1), 41-54.

**Strengths and Difficulties Questionnaire (SDQ):**

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**Coping (brief-COPE):**

Offline:

Carver, C. S. (1997). You want to measure coping but your protocol's too long: Consider the brief cope. *International Journal of Behavioral Medicine*, 4(1), 92.

Online: To assess online coping, three subscales from the brief-COPE scale were adapted to assess online coping behaviors. Previous research has shown a similar but slightly longer version of this scale to be valid among adults (van Ingen & Wright, 2016).

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## **Chapter 8:**

### **Momentary Fluctuations in Adolescent Online Coping**

Study 2 (Chapter 7) made a case for broadening our conceptualizations of adolescent coping to include the online space. Although adolescents widely endorsed going online to feel better in the face of stress, ambulatory assessment findings indicated a negative linear relationship. Specifically, more online coping was related to poorer momentary emotional responses to stress. However, although emotion and stress were assessed in-vivo, online coping was assessed via a stable, individual-difference construct. Arguably, the level of youths' engagement in specific coping strategies may fluctuate across time and contexts. Thus, in order to better understand the impact of these coping behaviours, a more fine-tuned approach was called for.

Therefore, Study 3 explored the impact of fluctuations in online coping across an adolescent's week, making use of time-varying reports of online coping. The benefit of this approach is that coping, stress, and emotion were all assessed as within-person constructs, thus allowing for the full coping process to be captured in-situ. In doing so, Study 3 was also positioned to test the increasingly asserted hypothesis that technology's impact on adolescent well-being may not be linear. As a result, Study 3 tested both linear effects of online coping as well as non-linear effects in which the impact of some online coping could be compared to none or a lot.

This study is under peer review in *Clinical Psychological Science* (Impact Factor 3.0; SCImago ranking Q1). The PhD Candidate is the first author of the paper, the principal supervisor is corresponding author, and two members of the supervisory team are co-authors. Dr. Bep Uink was a project contributor and study-co-author.

**STATEMENT OF CONTRIBUTION TO CO-AUTHORED PUBLISHED PAPER**

This chapter includes a co-authored paper. The referencing details of the co-authored paper including all authors are:

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The PhD Candidate's contribution to the paper involved co-conceptualizing the linking of end-of-day online coping to momentary reports and completing methods associated with updating this coping framework. The candidate also co-conceptualized recoding data for non-linear purposes. The candidate independently created new data sets and analyzed resulting data. The candidate co-interpreted findings drafted and revised the study manuscript for submission. Study co-authors provided feedback and comments on the manuscript.

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## **Chapter 9:**

### **Adolescents' online coping: when less is more, but none is worse.**

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### **Abstract**

With each new technology wave, media and families over-emphasize risks to youth well-being, to the detriment of recognizing potential advantages. Mobile technologies are omnipresent across adolescent life and require better characterization of their potential benefits. Moreover, adolescents experience high rates of daily stress, and investigating their stress-responses using technology is of practical import. We employed experience sampling data from a subset of 115 youth ( $n = 1,241$  timepoints) who reported their technology-based coping and assessed how these related to momentary emotion change, controlling for stress, technology use, trait coping, and other key covariates. Linear dose-response relations indicated negative within-person effects for online coping. However, models testing benefits of moderate use (relative to no or heavy use; Goldilocks effect) better fit the data and showed a clear pattern of positive effects of moderate coping online. Moderate coping was relatively adaptive and led to mitigated declines in negative emotion.

## Introduction

On any given day, we are bombarded with overwhelmingly negative messages regarding the impact of technology on young people's well-being (Odgers, 2018). These messages tend to fixate on technology's alleged mental health risks, while overlooking its many promises (Hiniker, Radesky, Livingstone, & Blum-Ross, 2019). Indeed, arguments have been made for technology's causal role in depression, suicidal ideation, and risk (Twenge, Joiner, Rogers, & Martin, 2018). In response, scholars have called for a more measured discussion of youth's online risks and opportunities (Heffer, Good, Daly, MacDonnell, & Willoughby, 2019; Orben, Dienlin, & Przyblyski, 2019). In a connected world, adolescents benefit from technology across their day, and online contexts serve as an important arena for companionship, learning, and leisure (Tsitsika et al., 2014). Arguably, the online space provides a key resource for adolescents to help manage developmental complexities of everyday life (Dillman Carpentier et al., 2008)

Biological and psychosocial changes of puberty, novel social contexts, and new role demands mean that adolescents face stressors across multiple domains (Dahl, 2004; Uink, Modecki, & Barber, 2017). In fact, these daily stressors may more accurately predict psychological adjustment than major life events (Sim, 2000). Not surprisingly then, in an effort to successfully manage stress, youth seek respite and support in arenas where they naturally spend their time (Frison & Eggermont, 2015).

Ninety-five percent of adolescents regularly access a mobile phone (Anderson & Jiang, 2018), and the online space is a focal point of adolescent life (George & Odgers, 2015). Adolescents are online at school, for homework, and to communicate with home and friendship networks. Given their constant connection and developmental upticks in

stressors (Uink et al., 2017), why then, has so little attention been directed towards understanding adolescents' use of the online space to cope?

Here, we draw on the communication literature which explores how individuals interact with media to fulfil their needs (Katz, Blumler & Gurevitch, 1974).

Illustratively, Uses and Gratifications Theory (UGT) underscores that media is actively selected depending on specific motives and needs. In this case, seeking gratification through specific content (researching or finding information), the process of engaging with technology itself (browsing the internet, either purposefully or randomly), or for social needs (forming or deepening social ties) are core motives for engaging with the internet (Stafford, Stafford & Lawrence, 2004). We assert these motivations can also be triggered by the need to manage stress.

More specifically, young people's motivations for going online includes seeking to cope with day-to-day stressors. The online space offers teenagers a resource for support, seeking information, and distraction from their daily concerns, and online coping has been conceptualized as thoughts and behaviours that are facilitated by the Internet, which people use to manage stressful situations (van Ingen, Utz & Toepoel, 2016). Indeed, in previous work adolescents widely endorsed going online to engage in coping behaviors (author cite removed). Our research suggests that adolescents who are characterized as high on online coping, in general, report greater distress after a momentary stressor. However, to date, online coping has been operationalized only as a trait-like construct. Yet, coping strategies fluctuate across time and stressors, and thus these findings cannot speak to whether online coping helps (or hurts) in relation to day-to-day problems.

An additional challenge is that coping is inherently tied to stressful experiences (Duvenage, Uink, Zimmer-Gembeck, Barber, Donovan & Modecki, 2019). This makes it difficult to disentangle potential positive effects of online coping versus related experiences of emotional distress and potential malfunctioning. By controlling for stress and considering non-linear coping responses, scholars can edge closer to unpacking more productive ways for adolescents to cope.

In fact, a growing body of research suggests that, when used in moderation, engaging with technology can have positive implications for youth well-being. Coined as the “Goldilocks Hypothesis,” research shows that moderate levels of technology use can be advantageous (Przybylski & Weinstein, 2017). That is, being too removed from the online space may place youth at a disadvantage (Kim, 2012). Likewise, too much engagement may disrupt opportunities for skill building in other arenas (e.g., after school activities, family engagement; Romer, Bagdasarov, & More, 2013).

The current study characterizes adolescents’ online coping within an ecologically valid, experience sampling framework, assessing online support seeking, information seeking and self-distraction as dampening emotion surges in response to moment-to-moment stressors. Online coping, stress, emotion, and technology use are assessed repeatedly throughout adolescents’ week, allowing for fluctuations within-person. Moreover, given that the impact of online coping may not necessarily be linear (that is, more may not always be better), we assess its influence in two ways. First, as a linear, dose response, such that more online coping leads to enhanced (or diminished) emotional recovery. Second, we explore a “Goldilocks” or middle-road hypothesis. In this case, engaging in some coping online, as opposed to none or a lot, leads to enhanced outcomes.

## Methods

**Participants and procedure.** Original study participants were ( $n = 206$ ) adolescents from two low-SES metropolitan public schools, determined by a national index. For the current study, we extracted youth who provided at least one day's response to an end-of-day query regarding online coping (i.e. "Thinking about the bad things that happened today, how much did you..."). We then screened their data to ensure they had reported at least one stressor on that day. Next, we attached the end-of-day coping response to each stressor reported that day. Thus, our final sample consists of 115 adolescents with at least one day's valid data for online coping (e.g. 10.79 sampling moments). Recent power recommendations within multi-level frameworks point to the utility of level one sample sizes beyond low single figures; this and other established work further highlight that samples of 100 at level two are nominally biased. With more than 1,200 data points, our design meets simulation-based recommendations for testing small to moderate effect sizes (Arend & Schäfer, 2019; Maas & Hox, 2005).

On average, youth were 14.57 years old ( $SD = .88$ ), 13-16 years and 73% female. Most youth reported Caucasian (79.4%); Maori (3.7%) or Aboriginal or Torres Strait Islander (5.7%) ethnicity. University Research Committee (#2013/141) and State Department of Education (Project # D13/0537672) provided ethics approval. Participants and guardians gave prior written consent. There was no financial remuneration for participation, but youth were provided with a recent model iPhone for unlimited use. Data were collected during late 2013 to mid-2016. Prior to beginning and upon completion of the ESM phase participants completed a computerized survey measuring demographics, online coping, psychopathology, and related constructs. Supplementary Figure 1 includes study design and engagement strategies.

## Measures

### Within-Person Variables

**Momentary emotion.** Across analyses, the outcome variable was momentary change in emotion. At each sampling moment, adolescents were asked “*Right now, how are you feeling?*” Participants rated how happy, sad, lonely, worried, angry, and jealous they were feeling (1 = Not at all, 5 = Very much). To assess how momentary online coping affected *changes* in emotion, models estimated each youth’s emotion at the current sampling moment ( $T = 0$ ), controlling for emotion at the previous time point ( $T - 1$ ).

**Momentary emotion at T-1.** Each model included a lagged emotion score (i.e. emotion change as the outcome). To ensure there were no between-day emotion lags (our only lagged construct), we replaced the corresponding T-1 value for each morning with a missing value (e.g., de Haan-Rietdijk, Voelkle, Keijsers, & Hamaker, 2017). This ensured all stressors and coping strategies were included in the models, and that emotion change did not occur across multiple days.

**Momentary stressors and good events.** Adolescents’ experiences of stress was measured by asking “*Since you were last messaged, has anything bad happened to you?*” (Schneiders et al., 2006). This format ensured that participants reported on recent stressors. A dummy variable was created for momentary stressors (0 = no bad event, 1 = bad event since last messaged). Likewise, at each sampling moment adolescents were asked “*Since the last message, has anything good happened to you?*” A dummy variable was created for momentary positive events (0 = no good event, 1 = good event since last messaged). During our sampling frame, youth reported stressors (32.95%) and good events (34.16%) of all moments.

**Momentary technology use.** Adolescents' technology use was assessed with the question "*Since the last message, have you...*" followed by six types of use ("*Used social networking sites,*" "*Used text messaging/Instant messaging,*" "*Watched YouTube videos,*" "*Done any gaming,*" "*Made or received phone calls,*" or "*Watched TV or movies?*"). During our sampling frame, youth reported technology use during 91.75% of captured moments, including SNS (78.17%), Texting (64.68%), YouTube (31.32%), Gaming (29.44%), Phone Calls (31.57%), and TV/movies (44.76%). We used a dummy control variable (0 = no technology use, 1 = technology use).

**Momentary online coping.** Participants were asked at the end of each day, "*Thinking about the bad things that happened today, how much did you use technology like Facebook, YouTube or Music downloads to make you feel better about it (self-distraction), search for information to help you by Googling it, going to websites, forums or blogs (information seeking) and use technology like Facebook, Instant messaging and Text Messaging to get support from someone*" (emotional support). Response options ranged from 1 = have not used this at all; to 5 = very much.

In order to model fluctuating emotion-change in response to stress and coping, we attached each end-of-day coping response to its appropriate time point. Momentary online coping variables (i.e., momentary self-distraction, momentary information seeking, and momentary emotional support) ranged from 0 to 5, such that 0 = no stressor reported (assigned to timepoints where absent a stressor), 1 = moments where a stressor occurred but online coping scores were 0, and 2-5 = moments where a stressor had occurred and with the youth's end of day coping score ranged between 2-5 (some – very much). Thus, a score of '0' on momentary online coping reflected absence of a recent stressor, '1' reflected a recent stressor but not engaging in online coping, and 2 or above indicated experience of a stressor and engaging in online coping. If more than

one stressor was reported on a given day, online coping reports were linked to each moment where a stressor was reported, because end of day items were based on reflections regarding “the bad events” that occurred that day. Momentary coping design effects were small (emotional support seeking DEFF = 2.21; self-distraction DEF = 1.92; and information seeking DEFF = 2.25) and constructs showed good validity (Supplementary Table 1).

**Momentary coping contrast codes.** To assess the Goldilocks hypothesis in which moderate online coping is beneficial but extreme use or non-use is not, we created a series of contrast codes. We created orthogonal polynomial contrast codes for each type of online coping such that the main contrast of interest compared moderate coping to no/high coping (i.e.,  $G_1$ ). Thus, “not at all” (i.e., no online coping; 1) and “very much” (i.e., high online coping; 5) responses were coded  $-1/2$ , and responses indicating “some” (2-4) online coping were coded  $1/2$ . Absence of a stressor was coded as 0. The remaining contrast,  $G_2$ , was created such that absence of a stressor was coded  $-2/3$  and no/high and moderate coping were both coded  $2/3$ .

### **Person level Covariates**

#### **Trait Online Coping**

Three subscales from the brief-COPE (Carver, 1997) were adapted to reflect online coping behaviours. Previous research with adults shows good validity in a similar version of this scale (van Ingen & Wright, 2016). Importantly, Van Ingen and Wright’s (2016) report only moderate correlations between online and offline coping ( $r = .36$ ); and our data with young adults likewise show small significant correlations with offline coping ( $r$ ’s =  $.12 - .23$ ). Further, Van Ingen and Wright report positive correlations



between offline coping and well-being, but negative correlations between online coping and social connectedness.

### **Depression**

We assessed depression using the Reynold's Adolescent Depression Scale 2<sup>nd</sup> edition (RADS-2; Reynold's 2002;  $\alpha = .82$ ). The RADS-2 assesses risk of a diagnosis of clinical depression by measuring dysphoric mood, anhedonia, negative self-evaluation and somatic symptoms. Participants rated on a 4-point Likert scale (1 = Almost never to 4 = Most of the time), how often they felt for example, "...that no-one cares about me."

### **Social Anxiety**

We assessed social anxiety using the Social Anxiety Scale for Adolescents (SAS-A; LaGreca, 1998;  $\alpha = .96$ ). Youth responded on a 5-point Likert scale (1 = Not at all to 5 = All the time) how often certain phrases applied to them; for example, "I'm afraid others will not like me."

### **Externalizing**

Externalizing behaviour was assessed with 15 items asking how often participants engaged in delinquent, aggressive, deceitful and risky behaviours in the last 6 months ( $\alpha = .85$ ) (Fredricks & Eccles, 2006). Participants responded on an 8-point Likert scale (0 = none, 7 = 31 or more times). An example item includes: "About how often in the last 6 months have you gotten in a physical fight with another person?"

**Additional person-level covariates.** At level 2, we included gender (0 = male, 1 = female), adolescents' average (across the week) technology use, stressors, and level of each emotion. Importantly, analyses further controlled for person-level online coping constructs. That is, momentary online coping explored within-person fluctuations independent of between-person individual differences (e.g., Jensen et al., 2019).

### **Analytic strategy**

In previous research (author cite removed) we demonstrated negative effects of trait online coping. Here, we sought to better test coping outcomes within a more precise framework, using repeated measures of coping within-person. Although this approach was not formally registered before analyses, it was internally vetted within our team. In this case, first and corresponding authors proposed tying daily coping reports to corresponding momentary stressors and assessing whether moderate levels of online coping improved emotional reactivity (e.g., Durkin & Barber, 2002). Thus, our two key questions and associated analytic methods were internally reviewed within the team. In addition to findings described here, to address our non-linear hypothesis, we initially sought to also test a model in which momentary online coping variables were squared. However, first attempts at this approach would yield no effect and we soon realized that this model was still (e.g. similar to linear model) contaminated by the effects of not experiencing a stressor. Thus, we opted against further testing and proceeded with the alternative coding strategy (Cohen, West, & Aiken, 2014).

We used multilevel analyses with FIML in *Mplus* 8.0, to test effects at two levels of analysis. At level one, we explored adolescents' change in emotion following moments of online coping after a stressor, net of stressors, uplifts, technology use, and previous emotion. At level two, we explored whether trait level coping exerted an effect on changes in momentary emotion, net of psychopathology, gender, average stressors, emotion and technology use.

## **Results**

### **Does momentary coping predict emotion change?**

**Emotional Support.** Described in Supplementary Table 2, at level 1, adolescents reported decreases in happiness ( $b = -.09(.04)$ ,  $p = .036$ ) following higher levels of online emotional support-seeking. Adolescents also reported increases in sadness ( $b = .09(.04)$ ,  $p = .021$ ), jealousy ( $b = .06(.03)$ ,  $p = .043$ ), and a trend towards increases in anger ( $b = .08(.05)$ ,  $p = .077$ ). Notably, there were no main effects of momentary technology use, indicating no differences in emotion following youth engaging in technology. At level 2, there was one trend-level effect for trait online emotional support seeking; youth with higher levels of trait coping experienced decreases in worry ( $b = -.06(.03)$ ,  $p = .050$ ).

**Self-Distraction.** On level 1, higher online self-distraction was associated with decreases in momentary happiness ( $b = -.10(.04)$ ,  $p = .019$ ). Likewise, youth reported increases in sadness ( $b = .08(.04)$ ,  $p = .020$ ) and anger ( $b = .11(.04)$ ,  $p = .004$ ). Further, at level 2, youth who reported engaging in more technology use across the week experienced higher jealousy on average ( $b = .35(.18)$ ,  $p = .048$ ). There were no significant individual differences in emotion changes based on trait self-distraction.

**Information Seeking.** Again, on level 1, moments in which youth reported higher online information seeking were associated with subsequent reductions in happiness ( $b = -.12(.06)$ ,  $p = .045$ ). Additionally, more online information seeking was associated with increases in sadness ( $b = .13(.06)$ ,  $p = .038$ ), and a trend-level increase in anger ( $b = .13(.07)$ ,  $p = .082$ ). There were no significant between-person effects for trait online information seeking.

Thus, our first set of results supported the hypothesis of a linear, dose-response relation between online coping and emotional reactivity.

**Is some online coping better than a lot or none?**

Table 1 details analyses assessing contrast codes for the Goldilocks Hypothesis. Notably, overall model fit (AIC, BIC) for these models were approximately 15% lower compared to those testing linear effects, pointing to superiority of our second approach.

***Emotional Support.*** Moments in which adolescents reported moderate emotional support seeking were associated with decreased sadness ( $G_1, b = -.18(.09), p = .047$ ). Likewise, following moments of moderate emotional support seeking, youth reported decreases in loneliness ( $G_1, b = -.24(.10), p = .020$ ). Finally, there was a trend-level increase in happiness ( $G_1, b = .26(.14), p = .058$ ) following reports of emotional support seeking at moderate levels. There were no significant effects for the contrast comparing no stressful event versus online coping, generally (i.e.  $G_2$ ).

Table 1. *Multilevel models, testing coping contrast codes of momentary online coping predicting emotion change.*

	Emotion Outcome					
	Happy <i>b</i> (SE), <i>p</i> , [95% CI]	Sad <i>b</i> (SE), <i>p</i> , [95% CI]	Lonely <i>b</i> (SE), <i>p</i> , [95% CI]	Angry <i>b</i> (SE), <i>p</i> , [95% CI]	Worried <i>b</i> (SE), <i>p</i> , [95% CI]	Jealous <i>b</i> (SE), <i>p</i> , [95% CI]
<u>Emotional Support</u>						
Level 1						
G1 (no/high vs. moderate)	.26(.14) <i>p</i> =.058 [-.01 – .53]	-.18(.09) <i>p</i> =.047 [-.35 – .00]	-.24(.10) <i>p</i> =.020 [-.44 – .04]	-.12(.10) <i>p</i> =.208 [-.31 – .07]	-.15(.11) <i>p</i> =.147 [-.36 – .05]	-.02(.25) <i>p</i> =.943 [-.50 – .46]
G2 (no stress vs. all coping)	.08(.08) <i>p</i> =.267 [-.06 – .23]	.00(.06) <i>p</i> =.977 [-.13 – .13]	.04(.06) <i>p</i> =.584 [-.09 – .16]	.02(.06) <i>p</i> =.807 [-.10 – .13]	.03(.08) <i>p</i> =.751 [-.13 – .18]	.12(.11) <i>p</i> =.912 [-.22 – .20]
Level 2						
Av. Tech Use	.07(.28) <i>p</i> =.793 [-.48 – .63]	.02(.22) <i>p</i> =.939 [-.42 – .45]	-.11(.22) <i>p</i> =.610 [-.54 – .32]	.21(.25) <i>p</i> =.399 [-.28 – .71]	.27(.21) <i>p</i> =.203 [-.15 – .69]	.38(.20) <i>p</i> =.056 [-.01 – .77]
Emotion Support Trait	.05(.04) <i>p</i> =.110 [-.02 – .13]	-.03(.03) <i>p</i> =.284 [-.09 – .03]	-.01(.03) <i>p</i> =.621 [-.06 – .04]	-.01(.03) <i>p</i> =.764 [-.07 – .05]	.06(.03) <i>p</i> =.066 [-.12 – .00]	-.01(.06) <i>p</i> =.904 [-.12 – .11]
<u>Self-Distraction</u>						
Level 1						
G1 (no/high vs. moderate)	.19(.14) <i>p</i> =.190 [-.09 – .47]	-.16(.10) <i>p</i> =.097 [-.34 – .03]	-.08(.10) <i>p</i> =.450 [-.28 – .13]	-.17(.10) <i>p</i> =.078 [-.37 – .02]	-.24(.11) <i>p</i> =.037 [-.046 – -.02]	-.28(.12) <i>p</i> =.024 [-.52 – -.04]
G2 (no stress vs. all coping)	.06(.07) <i>p</i> =.461 [-.09 – .20]	.01(.07) <i>p</i> =.837 [-.12 – .15]	.08(.07) <i>p</i> =.230 [-.05 – .21]	.03(.06) <i>p</i> =.580 [-.09 – .15]	.04(.08) <i>p</i> =.648 [-.11 – .18]	.00(.06) <i>p</i> =.995 [-.13 – .12]
Level 2						
Av. Tech Use	.18(.29) <i>p</i> =.534 [-.39 – .75]	-.11(.22) <i>p</i> =.623 [-.54 – .32]	-.21(.21) <i>p</i> =.264 [-.70 – .17]	.13(.21) <i>p</i> =.549 [-.29 – .54]	.10(.19) <i>p</i> =.600 [-.27 – .46]	.39(.17) <i>p</i> =.018 [-.07 – .72]
Self-Distraction Trait	.02(.03) <i>p</i> =.481 [-.04 – .09]	.00(.04) <i>p</i> =.935 [-.07 – .08]	.03(.03) <i>p</i> =.384 [-.03 – .08]	.04(.04) <i>p</i> =.237 [-.03 – .11]	.01(.03) <i>p</i> =.687 [-.04 – -.06]	.01(.02) <i>p</i> =.771 [-.03 – .04]
<u>Information Seeking</u>						
Level 1						
G1 (no/high vs. moderate)	.06(.13) <i>p</i> =.639 [-.19 – .31]	-.19(.10) <i>p</i> =.042 [-.38 – -.01]	-.03(.11) <i>p</i> =.778 [-.25 – .19]	-.06(.11) <i>p</i> =.588 [-.26 – .15]	-.12(.11) <i>p</i> =.298 [-.34 – .11]	.01(.12) <i>p</i> =.971 [-.24 – .25]
G2 (no stress vs. all coping)	.06(.08) <i>p</i> =.409 [-.09 – .22]	-.01(.06) <i>p</i> =.870 [-.14 – .11]	.07(.07) <i>p</i> =.310 [-.06 – .20]	.01(.06) <i>p</i> =.877 [-.11 – .13]	-.02(.08) <i>p</i> =.766 [-.12 – .17]	.01(.09) <i>p</i> =.941 [-.17 – .19]
Level 2						
Av. Tech Use	.18(.30) <i>p</i> =.554 [-.41 – .76]	-.10(.22) <i>p</i> =.638 [-.53 – .32]	-.22(.21) <i>p</i> =.297 [-.63 – .19]	.11(.23) <i>p</i> =.616 [-.33 – .56]	.09(.20) <i>p</i> =.663 [-.30 – .47]	.35(.23) <i>p</i> =.127 [-.10 – .80]
Information Seek Trait	.03(.03) <i>p</i> =.311 [-.03 – .09]	.01(.03) <i>p</i> =.655 [-.04 – .06]	.01(.02) <i>p</i> =.717 [-.03 – .05]	.03(.03) <i>p</i> =.329 [-.03 – .08]	.02(.04) <i>p</i> =.587 [-.06 – .10]	.01(.03) <i>p</i> =.651 [-.04 – .06]

*Notes.* In addition, all models control for average emotion, average weekly stressors, gender, externalizing, depression, and social anxiety at level 2. All models also control for prior emotion, good events, momentary technology use and stressors at level 1.

***Self-Distraction.*** Comparing moderate levels of online self-distraction, to high amounts, or no self-distraction, indicated that moderate use was associated with subsequent decreases in worry ( $G_1, b = -.24(.11), p = .037$ ) and jealousy ( $G_1, b = -.28(.12), p = .024$ ). Moreover, there were trend level effects on anger and sadness, such that moderate self-distraction was linked to decreases in anger ( $G_1, b = -.17(.10), p = .078$ ) and sadness ( $G_1, b = -.16(.10), p = .097$ ). There were no significant effects for the contrast comparing no stressor versus online coping, generally (i.e.  $G_2$ ).

***Information Seeking.*** Finally, there was also a Goldilocks effect for online information seeking. Moments with moderate levels of information seeking were associated with subsequent decreases in sadness ( $G_1, b = -.19(.10), p = .042$ ). Once again, no effects were found when contrasting no stressor versus any online coping (i.e.  $G_2$ ). Thus, findings better supported our second hypothesis (i.e. Goldilocks) hypothesis.

## Discussion

Parents and policy makers often express anxiety around adolescents' immersion in the online space (Bell, Bishop, & Przyblyski, 2015). However, surprisingly absent in this discussion is the positive ways in which youth are using technology (George & Odgers, 2015). Additionally, scholars have increasingly argued that moderate amounts of technology use may be more beneficial than not, and that lack of scholarly precision and nuance have clouded this picture (Orben et al., 2019; Jensen et al., 2019). Here, we assert that the online space is an unequalled resource for adolescents to reach out for support, find information about what is troubling them, and seek short-term distraction.

Our adolescent experience sampling data clearly point to beneficial effects of moderate use of technology to cope. In the moments following a stressor, moderate levels of online coping led to enhanced emotional responses. However, in early testing

for linear effects of momentary online coping, the picture that emerged was that coping led to dips in happiness and surges in negative affect. Yet contrast codes testing effects of moderate coping fit the data better, and study findings provide a concrete example of the benefits of characterizing non-linear effects related to health and well-being (Kim, 2012).

A primary benefit of employing experience sampling data was that we were able to assess the impact of fluctuations in online coping on emotion reactivity within-person (i.e. Hamaker, 2012). Our approach was conservative as we controlled for momentary technology use, positive and negative events, and previous emotion. At the person-level, we controlled for trait psychopathology, weekly averages for technology use, stress, emotion, and trait online coping. We also ran sensitivity checks with stressor severity (albeit with missing data) and results were robust. As a result, here we were able to disentangle the effect of variations in online coping from moment-to-moment versus the effects of overall likelihood of experiencing stress or general coping engagement.

First, we examined whether *more* online coping was helpful in the face of daily stressors. Dose-response findings indicated that greater use of online emotional support seeking led to dips in youths' happiness, and surges in sadness, jealousy, worry and anger (trend). Likewise, more frequent use of online self-distraction and information seeking were linked with decreases in happiness and increases in sadness and anger (trend for information seeking). Based on these findings, we might assume that online coping, in and of itself, is harmful in the short-term. Indeed, this approach suggests a negative dose-response, whereby more online coping leads to poorer emotional responses. We controlled for momentary stressful events and average stress across the week, and in (more robust) sensitivity analyses stressor severity.

To test an alternate hypothesis regarding beneficial effects of moderate amounts of online engagement (Przybylski & Weinstein, 2017), we conducted a second set of analyses. Here, we tested the Goldilocks effect, whether moderate levels of coping might provide better outcomes than no coping or coping at high amounts. Previous research on youth and technology (e.g., Kim, 2012) has shown that optimum outcomes are derived from a middle ground, neither non-engagement nor excessive engagement. Our findings parallel this notion of an optimal middle-ground.

In this case, online emotional support-seeking and self-distraction appeared to be especially efficacious, with information seeking less so. Specifically, moderate amounts of online emotional support seeking led to decreased sadness and loneliness, and increased happiness (trend). Likewise, moderate amounts of self-distraction led to decreases in worry and jealousy, and at trend, sadness and anger. Although moderate levels of online self-distraction were found to be beneficial, this strategy is likely only effective in the short-term. Broadly, self-distraction tends to be characterized as avoidant coping and maladaptive over the longer-term. Finally, moderate amounts of online information seeking alleviated sadness, and thus was the least effective of the three. This may in part be due the relevance of information available online.

## **Limitations**

Although this work offers new insight into the online world and adolescents' well-being, there were several limitations. First, while we were able to link end-of-day reports of online coping to within-day stress, future research would benefit from capturing coping on a momentary basis. Second, although we successfully sampled from more than one hundred youth, with roughly 1,240 timepoints, future studies should seek to follow youth over a longer period of time, to capture a wider variety of



experiences (i.e., Dillman Carpentier et al., 2008). Third, more remains to be understood about how online and offline coping intersect, building on findings that these may be orthogonally different constructs (Duvenage et al., 2020).

## **Conclusion**

One of the more pervasive tropes in today's media environment is that new technologies pose a danger to adolescents' well-being (George & Odgers, 2015). What this argument is missing is technology's underlying potential for good outcomes. Youth stand to benefit from the discovery of accurate information, connection with support systems and even taking a break from the everyday stress of adolescent life. The current study reframes technology's effects, and uses experience sampling data to demonstrate short-term, in vivo effects of online coping. When explored as a strictly linear association, more coping was tied to worse outcomes. However, delineating effects of moderate amounts of online coping (with better model fit), we found substantive support for benefits of coping online. When adolescents engaged in emotional support seeking, self-distraction, or information seeking online in a moderate capacity, they experienced better short-term stress relief. Thus, in the case of online coping, less is more, but none may be worse.

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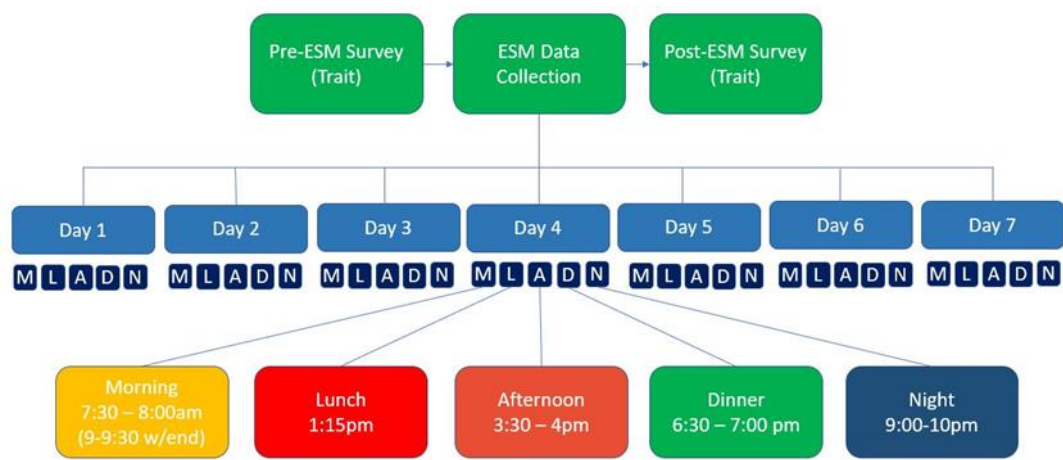
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Supplementary Section

Supplementary Figure 1. Experience Sampling Design



Note. Three study phases: (a) Baseline Assessment (b) Experience Sampling Method (ESM) Study of adolescents via iPhones for 7 consecutive days, and (c) second Baseline Assessment. During the ESM phase, participants were loaned an iPhone for seven days. Five times per day participants were sent a SMS link to a web-based ESM survey at random intervals, within set pre-specified time blocks. Surveys were closed to responses within an hour of being sent. Further, we successfully piloted survey prompt times in a separate sample of adolescents (author cite removed).

The study centered on a participatory commitment to adolescent engagement. Researchers created a youth “hang out” space as each school and were available on site each day of the study. Team members were also on site and available before the start of each school day and past school closing. A researcher cell-phone was monitored each day (weekends) and night (all days) of the study. Staffing thus minimized any technical issues, provided ready connection to additional psychological support (a psychologist was on call in the event of any issues in relation to reporting stressors), and enhanced rapport with students. Regular contact allowed the team to further encourage consistent and honest reporting and make clear the importance of accuracy of results.

Supplementary Table 1. *Descriptives and Correlations*

	<i>M</i> ( <i>SD</i> )	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Momentary Emotion Support	.75 (.48)	1.00												
2. Momentary Self-Distracton	.83 (.42)	0.76***	1.00											
3. Momentary Information Seek	.57 (.32)	0.68***	0.58***	1.00										
4. Mean Stressors	.18 (.14)	0.74***	0.74***	0.59***	1.00									
5. Mean Good Events	.31 (.24)	-0.04	-0.03	0.08	0.22*	1.00								
6. Mean Technology Use	.90 (.11)	0.34***	0.33***	0.11	0.14	0.04	1.00							
7. Trait Emotion Support	2.20 (.90)	0.32***	0.33***	0.13	0.17+	0.08	0.29**	1.00						
8. Trait Self-Distracton	2.68 (.86)	0.07	0.20*	-0.10	0.08	0.22*	0.31**	0.48***	1.00					
9. Trait Information Seek	2.33 (.92)	0.21*	0.17+	0.20*	0.03	0.01	0.27**	0.53***	0.50***	1.00				
10. Gender	.72 (.47)	0.17+	0.16	0.07	0.17+	-0.11	-0.03	0.03	-0.17+	-0.05	1.00			
11. Depression	6.06 (1.57)	-0.02	0.09	0.10	0.04	-0.21*	-0.08	0.23*	0.05	0.20*	0.17+	1.00		
12. Externalizing	2.18 (.29)	0.33***	0.41***	0.28**	0.20*	-0.09	0.23*	0.34***	0.17+	0.17+	-.20*	0.21*	1.00	
13. Social Anxiety	4.99 (1.73)	-0.03	0.10	-0.06	0.01	-0.11	-0.02	0.30**	0.13	0.27**	0.21*	0.67***	0.21*	1.00

Notes: + $p < .10$  \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .  $n = 115$ . Gender male = 0.



Supplementary Table 2. *Multilevel models, adolescent experience sampling reports of momentary online coping predicting emotion change.*

	Emotion Outcome					
	Happy <i>b</i> (SE), <i>p</i> , [95% CI]	Sad <i>b</i> (SE), <i>p</i> , [95% CI]	Lonely <i>b</i> (SE), <i>p</i> , [95% CI]	Angry <i>b</i> (SE), <i>p</i> , [95% CI]	Worried <i>b</i> (SE), <i>p</i> , [95% CI]	Jealous <i>b</i> (SE), <i>p</i> , [95% CI]
<b>Emotional Support</b>						
Level 1						
Emotion Support	-.09(.04) <i>p</i> = .036 [-.17 – .01]	.09(.04) <i>p</i> = .021 [.01 – .16]	.02(.04) <i>p</i> = .641 [-.06 – .10]	.08(.05) <i>p</i> = .077 [-.01 – .21]	.11(.04) <i>p</i> = .011 [.03 – .19]	.03(.03) <i>p</i> = .043 [.00 – .12]
Stressor	-.24(.12) <i>p</i> = .049 [-.48 – -.00]	.10(.13) <i>p</i> = .450 [-.16 – .36]	.03(.10) <i>p</i> = .786 [-.17 – .22]	.24(.14) <i>p</i> = .090 [-.04 – .60]	-.11(.14) <i>p</i> = .442 [-.38 – .17]	-.16(.06) <i>p</i> = .012 [-.29 – -.03]
Emotion at T-1	.02(.04) <i>p</i> = .609 [-.06 – .10]	.07(.08) <i>p</i> = .435 [-.10 – .23]	-.03(.06) <i>p</i> = .661 [-.14 – .09]	.01(.06) <i>p</i> = .867 [-.11 – .17]	.11(.06) <i>p</i> = .088 [-.02 – .23]	.18(.11) <i>p</i> = .087 [-.03 – .38]
Good Event	.78(.08) <i>p</i> < .001 [.63 – .93]	-.31(.07) <i>p</i> < .001 [-.45 – -.16]	-.29(.07) <i>p</i> < .001 [-.42 – -.16]	-.22(.08) <i>p</i> = .005 [-.38 – -.07]	-.09(.08) <i>p</i> = .244 [-.25 – .06]	-.04(.04) <i>p</i> = .330 [-.11 – .04]
Technology use	-.22(.13) <i>p</i> = .089 [-.48 – .03]	-.17(.13) <i>p</i> = .192 [-.43 – .09]	-.07(.11) <i>p</i> = .539 [-.29 – .15]	-.22(.13) <i>p</i> = .075 [-.47 – .02]	-.01(.11) <i>p</i> = .908 [-.23 – .20]	-.12(.08) <i>p</i> = .117 [-.27 – .03]
Level 2						
Gender	-.16(.09) <i>p</i> = .063 [-.33 – .01]	-.07(.05) <i>p</i> = .221 [-.04 – .17]	.08(.06) <i>p</i> = .146 [-.03 – .20]	-.03(.09) <i>p</i> = .751 [-.21 – .15]	.07(.05) <i>p</i> = .177 [-.03 – .17]	.02(.05) <i>p</i> = .661 [-.13 – .08]
Externalizing	.01(.11) <i>p</i> = .948 [-.20 – .21]	.01(.13) <i>p</i> = .995 [-.25 – .27]	-.08(.11) <i>p</i> = .491 [-.30 – .15]	-.12(.22) <i>p</i> = .590 [-.54 – .31]	.03(.15) <i>p</i> = .857 [-.27 – .32]	-.25(.25) <i>p</i> = .306 [-.74 – .23]
Depression	.00(.03) <i>p</i> = .909 [-.06 – .06]	.00(.02) <i>p</i> = .898 [-.04 – .05]	-.01(.02) <i>p</i> = .648 [-.06 – .04]	-.01(.03) <i>p</i> = .769 [-.06 – .04]	-.03(.02) <i>p</i> = .308 [-.07 – .02]	.00(.02) <i>p</i> = .803 [-.03 – .04]
Social Anxiety	-.01(.02) <i>p</i> = .766 [-.05 – .03]	.00(.03) <i>p</i> = .893 [-.05 – .05]	.01(.02) <i>p</i> = .646 [-.02 – .04]	.01(.03) <i>p</i> = .358 [-.01 – .04]	.02(.03) <i>p</i> = .378 [-.03 – .08]	-.01(.01) <i>p</i> = .527 [-.03 – .02]
Emotion Support Trait	.05(.04) <i>p</i> = .191 [-.02 – .12]	-.03(.03) <i>p</i> = .319 [-.09 – .03]	-.01(.03) <i>p</i> = .566 [-.06 – .03]	-.01(.03) <i>p</i> = .777 [-.07 – .05]	-.06(.03) <i>p</i> = .050 [-.12 – .00]	-.01(.04) <i>p</i> = .869 [-.08 – .07]
Av. Tech Use	.16(.28) <i>p</i> = .572 [-.39 – .72]	-.04(.24) <i>p</i> = .858 [-.52 – .43]	-.19(.20) <i>p</i> = .346 [-.58 – .20]	.17(.27) <i>p</i> = .525 [-.65 – .69]	.22(.21) <i>p</i> = .290 [-.19 – .63]	.37(.20) <i>p</i> = .057 [-.01 – .76]
Av. Stressors	-.22(.15) <i>p</i> = .140 [-.51 – .07]	-.06(.15) <i>p</i> = .688 [-.35 – .23]	.06(.10) <i>p</i> = .522 [-.13 – .26]	-.15(.12) <i>p</i> = .190 [-.38 – .08]	-.04(.23) <i>p</i> = .848 [-.50 – .41]	.12(.09) <i>p</i> = .205 [-.06 – .29]
Av. Emotion	1.00(.06) <i>p</i> < .001 [.83 – 1.12]	1.05(.03) <i>p</i> < .001 [.98 – 1.15]	1.08(.04) <i>p</i> < .001 [1.00 – 1.16]	1.06(.04) <i>p</i> < .001 [.97 – 1.14]	1.00(.05) <i>p</i> < .001 [.92 – 1.09]	1.08(.03) <i>p</i> < .001 [1.01 – 1.14]

<b>Self-Distraction</b>	<b>Happy</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Sad</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Lonely</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Angry</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Worried</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Jealous</b> <i>b</i> (SE), <i>p</i> , [95% CI]
Level 1						
Self-Distraction	-.10(.04) <i>p</i> = .019 [-.18 – .02]	.08(.04) <i>p</i> = .020 [.01 – .16]	.04(.04) <i>p</i> = .361 [-.04 – .12]	.11(.04) <i>p</i> = .004 [.04 – .19]	.07(.04) <i>p</i> = .103 [-.01 – .18]	.03(.03) <i>p</i> = .293 [-.03 – .09]
Stressor	-.20(.13) <i>p</i> = .114 [-.45 – .05]	.09(.14) <i>p</i> = .538 [-.19 – .37]	-.02(.11) <i>p</i> = .871 [-.23 – .19]	.15(.12) <i>p</i> = .181 [-.07 – .38]	-.03(.14) <i>p</i> = .830 [-.31 – .34]	-.10(.08) <i>p</i> = .163 [-.25 – .04]
Emotion at T-1	.02(.04) <i>p</i> = .628 [-.06 – .10]	.07(.08) <i>p</i> = .432 [-.10 – .23]	-.03(.06) <i>p</i> = .672 [-.14 – .09]	.01(.06) <i>p</i> = .896 [-.11 – .12]	.11(.06) <i>p</i> = .072 [-.01 – .28]	.18(.11) <i>p</i> = .082 [-.02 – .39]
Good Event	.78(.08) <i>p</i> < .001 [.63 – .93]	-.21(.07) <i>p</i> < .001 [-.45 – -.17]	-.29(.07) <i>p</i> < .001 [-.42 – -.16]	-.23(.07) <i>p</i> = .004 [-.38 – -.07]	-.10(.08) <i>p</i> = .225 [-.26 – .11]	-.04(.04) <i>p</i> = .310 [-.11 – .04]
Technology use	-.22(.13) <i>p</i> = .089 [-.48 – .03]	-.17(.13) <i>p</i> = .137 [-.43 – .09]	-.07(.11) <i>p</i> = .532 [-.29 – .15]	-.23(.13) <i>p</i> = .069 [-.47 – .02]	-.01(.11) <i>p</i> = .937 [-.22 – .27]	-.12(.08) <i>p</i> = .146 [-.28 – .04]
Level 2						
Gender	-.15(.08) <i>p</i> = .066 [-.32 – .01]	.07(.05) <i>p</i> = .193 [-.04 – .18]	-.09(.05) <i>p</i> = .088 [-.01 – .10]	-.01(.08) <i>p</i> = .901 [-.18 – .16]	.07(.05) <i>p</i> = .156 [-.03 – .17]	-.02(.07) <i>p</i> = .762 [-.15 – .11]
Externalizing	.04(.10) <i>p</i> = .693 [-.16 – .24]	-.02(.12) <i>p</i> = .898 [-.25 – .22]	-.09(.11) <i>p</i> = .398 [-.31 – .12]	-.13(.23) <i>p</i> = .568 [-.57 – .31]	-.02(.12) <i>p</i> = .886 [-.26 – .23]	-.26(.32) <i>p</i> = .416 [-.89 – .37]
Depression	.01(.03) <i>p</i> = .749 [-.05 – .07]	.00(.02) <i>p</i> = .916 [-.04 – .05]	-.01(.02) <i>p</i> = .702 [-.06 – .04]	-.01(.03) <i>p</i> = .845 [-.06 – .05]	-.03(.03) <i>p</i> = .521 [-.08 – .02]	.00(.02) <i>p</i> = .813 [-.03 – .04]
Social Anxiety	.00(.02) <i>p</i> = .842 [-.04 – .04]	.00(.03) <i>p</i> = .965 [-.05 – .05]	.00(.02) <i>p</i> = .846 [-.03 – .04]	.01(.02) <i>p</i> = .652 [-.02 – .04]	.02(.03) <i>p</i> = .546 [-.04 – .07]	-.01(.02) <i>p</i> = .584 [-.04 – .02]
Self-Distraction Trait	.02(.03) <i>p</i> = .546 [-.05 – .09]	.00(.03) <i>p</i> = .909 [-.06 – .07]	.02(.03) <i>p</i> = .411 [-.03 – .08]	.04(.04) <i>p</i> = .253 [-.03 – .11]	.01(.02) <i>p</i> = .806 [-.04 – .05]	.01(.02) <i>p</i> = .688 [-.03 – .05]
Av. Tech Use	.22(.29) <i>p</i> = .460 [-.36 – .79]	-.11(.21) <i>p</i> = .611 [-.51 – .30]	-.25(.20) <i>p</i> = .218 [-.64 – .15]	.09(.23) <i>p</i> = .700 [-.36 – .53]	.10(.19) <i>p</i> = .601 [-.27 – .47]	.35(.18) <i>p</i> = .048 [.00 – .70]
Av. Stressors	-.21(.14) <i>p</i> = .140 [-.50 – .07]	-.07(.14) <i>p</i> = .612 [-.35 – .21]	.06(.10) <i>p</i> = .574 [-.14 – .25]	-.17(.12) <i>p</i> = .179 [-.41 – .08]	-.07(.20) <i>p</i> = .729 [-.47 – .33]	.11(.09) <i>p</i> = .244 [-.07 – .29]
Av. Emotion	1.01(.06) <i>p</i> < .001 [.89 – 1.13]	1.05(.04) <i>p</i> < .001 [.98 – 1.12]	1.08(.04) <i>p</i> < .001 [.99 – 1.16]	1.06(.04) <i>p</i> < .001 [.97 – 1.14]	1.01(.04) <i>p</i> < .001 [.94 – 1.09]	1.08(.03) <i>p</i> < .001 [1.01 – 1.14]

<b>Information Seek</b>	<b>Happy</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Sad</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Lonely</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Angry</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Worried</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Jealous</b> <i>b</i> (SE), <i>p</i> , [95% CI]
<b>Level 1</b>						
Info Seek	-.12(.06) <i>p</i> = .045 [-.23 – .03]	.13(.06) <i>p</i> = .038 [.01 – .25]	-.15(.07) <i>p</i> = .821 [-.15 – .12]	.13(.07) <i>p</i> = .082 [-.02 – .27]	.03(.07) <i>p</i> = .668 [-.10 – .16]	.04(.06) <i>p</i> = .479 [-.07 – .16]
Stressor	-.26(.12) <i>p</i> = .033 [-.50 – .05]	.09(.13) <i>p</i> = .509 [-.17 – .35]	.09(.11) <i>p</i> = .392 [-.12 – .31]	.22(.14) <i>p</i> = .108 [-.05 – .49]	-.09(.13) <i>p</i> = .496 [-.17 – .35]	-.09(.09) <i>p</i> = .289 [-.27 – .08]
Emotion at T-1	.02(.04) <i>p</i> = .596 [-.06 – .12]	.07(.09) <i>p</i> = .441 [-.10 – .24]	-.03(.06) <i>p</i> = .678 [-.14 – .09]	.01(.06) <i>p</i> = .941 [-.12 – .13]	.13(.07) <i>p</i> = .056 [.00 – .25]	.19(.11) <i>p</i> = .086 [-.03 – .04]
Good Event	.72(.08) <i>p</i> < .001 [.63 – .98]	-.32(.07) <i>p</i> < .001 [-.46 – -.18]	-.29(.06) <i>p</i> < .001 [-.42 – -.17]	-.23(.08) <i>p</i> = .003 [-.39 – -.08]	-.10(.08) <i>p</i> = .213 [-.26 – .06]	-.04(.04) <i>p</i> = .260 [-.12 – .03]
Technology use	-.23(.13) <i>p</i> = .078 [-.48 – .11]	-.17(.13) <i>p</i> = .205 [-.42 – .09]	-.07(.11) <i>p</i> = .550 [-.29 – .15]	-.22(.12) <i>p</i> = .073 [-.46 – .02]	.00(.11) <i>p</i> = .977 [-.22 – .21]	-.12(.08) <i>p</i> = .153 [-.27 – .04]
<b>Level 2</b>						
Gender	-.15(.09) <i>p</i> = .078 [-.33 – .02]	.07(.05) <i>p</i> = .170 [-.03 – .18]	.09(.06) <i>p</i> = .141 [-.03 – .20]	-.02(.09) <i>p</i> = .810 [-.20 – .21]	.08(.05) <i>p</i> = .159 [-.03 – .18]	-.02(.07) <i>p</i> = .756 [-.16 – .11]
Externalizing	.04(.10) <i>p</i> = .707 [-.16 – .24]	-.01(.11) <i>p</i> = .902 [-.23 – .20]	-.09(.11) <i>p</i> = .412 [-.03 – .12]	-.13(.22) <i>p</i> = .564 [-.54 – .44]	-.02(.12) <i>p</i> = .866 [-.26 – .22]	-.26(.35) <i>p</i> = .447 [-.94 – .41]
Depression	.01(.03) <i>p</i> = .751 [-.05 – .07]	.01(.02) <i>p</i> = .761 [-.04 – .05]	-.01(.02) <i>p</i> = .666 [-.06 – .04]	-.01(.03) <i>p</i> = .887 [-.06 – .07]	-.03(.03) <i>p</i> = .333 [-.08 – .03]	.01(.02) <i>p</i> = .796 [-.03 – .04]
Social Anxiety	-.01(.02) <i>p</i> = .681 [-.05 – .03]	-.01(.03) <i>p</i> = .834 [-.05 – .04]	.00(.02) <i>p</i> = .817 [-.06 – .04]	.01(.02) <i>p</i> = .825 [-.03 – .05]	.01(.03) <i>p</i> = .734 [-.05 – .07]	-.01(.01) <i>p</i> = .470 [-.04 – .02]
Information Seek Trait	.03(.03) <i>p</i> = .355 [-.03 – .09]	.01(.03) <i>p</i> = .577 [-.04 – .06]	.01(.02) <i>p</i> = .761 [-.04 – .05]	.03(.03) <i>p</i> = .322 [-.03 – .10]	.02(.04) <i>p</i> = .575 [-.06 – .10]	.01(.03) <i>p</i> = .704 [-.04 – .06]
Av. Tech Use	.19(.30) <i>p</i> = .530 [-.40 – .77]	-.12(.23) <i>p</i> = .596 [-.57 – .33]	.23(.21) <i>p</i> = .272 [-.63 – .18]	.10(.24) <i>p</i> = .671 [-.37 – .72]	.08(.20) <i>p</i> = .698 [-.31 – .46]	.34(.20) <i>p</i> = .082 [-.04 – .73]
Av. Stressors	-.22(.15) <i>p</i> = .146 [-.51 – .08]	-.07(.14) <i>p</i> = .590 [-.34 – .20]	.06(.10) <i>p</i> = .556 [-.14 – .25]	-.16(.12) <i>p</i> = .200 [-.39 – .08]	-.07(.20) <i>p</i> = .732 [-.47 – .33]	.11(.09) <i>p</i> = .229 [-.07 – .29]
Av. Emotion	1.00(.06) <i>p</i> < .001 [.88 – 1.12]	1.04(.04) <i>p</i> < .001 [.97 – 1.11]	1.08(.04) <i>p</i> < .001 [.99 – 1.16]	1.05(.04) <i>p</i> < .001 [.97 – 1.14]	1.01(.04) <i>p</i> < .001 [.94 – 1.08]	1.08(.03) <i>p</i> < .001 [1.01 – 1.14]

Supplementary Table 3. *Multilevel models, testing coping contrast codes of momentary online coping predicting emotion change.*

	Emotion Outcome					
	Happy <i>b</i> (SE), <i>p</i> , [95% CI]	Sad <i>b</i> (SE), <i>p</i> , [95% CI]	Lonely <i>b</i> (SE), <i>p</i> , [95% CI]	Angry <i>b</i> (SE), <i>p</i> , [95% CI]	Worried <i>b</i> (SE), <i>p</i> , [95% CI]	Jealous <i>b</i> (SE), <i>p</i> , [95% CI]
<b>Emotional Support</b>						
Level 1						
G1 (no/high vs. moderate)	.26(.14) <i>p</i> = .058 [-.01 – .53]	-.18(.09) <i>p</i> = .047 [-.35 – .00]	-.24(.10) <i>p</i> = .020 [-.44 – .04]	-.12(.10) <i>p</i> = .208 [-.31 – .07]	-.15(.11) <i>p</i> = .147 [-.36 – .05]	-.02(.25) <i>p</i> = .943 [-.50 – .46]
G2 (no stress vs. all coping)	.08(.08) <i>p</i> = .267 [-.06 – .23]	.00(.06) <i>p</i> = .977 [-.13 – .13]	.04(.06) <i>p</i> = .584 [-.09 – .16]	.02(.06) <i>p</i> = .807 [-.10 – .13]	.03(.08) <i>p</i> = .751 [-.13 – .18]	.12(.11) <i>p</i> = .912 [-.22 – .20]
Emotion at T-1	.02(.04) <i>p</i> = .628 [-.06 – .10]	.06(.09) <i>p</i> = .465 [-.11 – .23]	-.03(.06) <i>p</i> = .619 [-.15 – .09]	-.01(.06) <i>p</i> = .895 [-.12 – .11]	.12(.05) <i>p</i> = .059 [-.01 – .24]	.19(.11) <i>p</i> = .075 [-.02 – .40]
Stressor	-.56(.07) <i>p</i> < .001 [-.71 – -.42]	.49(.08) <i>p</i> < .001 [.33 – .65]	.14(.08) <i>p</i> = .071 [-.01 – .29]	.56(.09) <i>p</i> < .001 [.40 – .73]	.27(.08) <i>p</i> = .001 [.10 – .43]	.01(.04) <i>p</i> = .805 [-.08 – .10]
Good Event	.76(.07) <i>p</i> < .001 [.62 – .91]	-.30(.07) <i>p</i> < .001 [-.43 – -.17]	-.28(.06) <i>p</i> < .001 [-.41 – -.16]	-.21(.08) <i>p</i> = .007 [-.36 – -.06]	-.09(.08) <i>p</i> = .248 [-.25 – .07]	-.04(.04) <i>p</i> = .305 [-.12 – .04]
Technology use	-.23(.13) <i>p</i> = .078 [-.48 – .03]	-.17(.13) <i>p</i> = .197 [-.43 – .09]	-.07(.11) <i>p</i> = .508 [-.29 – .15]	-.22(.13) <i>p</i> = .087 [-.48 – .03]	-.01(.11) <i>p</i> = .926 [-.22 – .20]	-.12(.08) <i>p</i> = .154 [-.27 – .04]
Level 2						
Gender	-.16(.09) <i>p</i> = .065 [-.33 – .01]	.07(.05) <i>p</i> = .211 [-.04 – .17]	.08(.06) <i>p</i> = .189 [-.04 – .02]	-.03(.09) <i>p</i> = .744 [-.20 – .15]	.07(.05) <i>p</i> = .176 [-.03 – .17]	-.02(.08) <i>p</i> = .736 [-.17 – .12]
Externalizing	.01(.11) <i>p</i> = .942 [-.20 – .22]	.01(.12) <i>p</i> = .948 [-.23 – .25]	-.08(.13) <i>p</i> = .548 [-.32 – .17]	-.11(.20) <i>p</i> = .587 [-.50 – .28]	.03(.15) <i>p</i> = .839 [-.26 – .32]	-.26(.35) <i>p</i> = .460 [-.93 – .42]
Depression	.00(.03) <i>p</i> = .989 [-.06 – .06]	.01(.02) <i>p</i> = .845 [-.04 – .05]	-.01(.02) <i>p</i> = .748 [-.05 – .04]	.00(.03) <i>p</i> = .868 [-.06 – .05]	-.02(.03) <i>p</i> = .336 [-.07 – .03]	.01(.02) <i>p</i> = .844 [-.04 – .05]
Social Anxiety	.00(.02) <i>p</i> = .837 [-.04 – .03]	.00(.02) <i>p</i> = .923 [-.04 – .05]	.01(.02) <i>p</i> = .694 [-.02 – .04]	.01(.01) <i>p</i> = .385 [-.02 – .04]	.02(.03) <i>p</i> = .375 [-.03 – .07]	-.01(.01) <i>p</i> = .521 [-.03 – .01]
Emotion Support Trait	.05(.04) <i>p</i> = .110 [-.02 – .13]	-.03(.03) <i>p</i> = .284 [-.09 – .03]	-.01(.03) <i>p</i> = .621 [-.06 – .04]	-.01(.03) <i>p</i> = .764 [-.07 – .05]	.06(.03) <i>p</i> = .066 [-.12 – .00]	-.01(.06) <i>p</i> = .904 [.12 – .11]
Av. Tech Use	.07(.28) <i>p</i> = .793 [-.48 – .63]	.02(.22) <i>p</i> = .939 [-.42 – .45]	-.11(.22) <i>p</i> = .610 [-.54 – .32]	.21(.25) <i>p</i> = .399 [-.28 – .71]	.27(.21) <i>p</i> = .203 [-.15 – .69]	.38(.20) <i>p</i> = .056 [-.01 – .77]
Av. Stressors	-.27(.15) <i>p</i> = .060 [-.56 – .01]	-.06(.46) <i>p</i> = .711 [-.37 – .25]	.07(.13) <i>p</i> = .605 [-.19 – .32]	-.15(.13) <i>p</i> = .228 [-.40 – .10]	-.05(.27) <i>p</i> = .843 [-.59 – .48]	.12(.13) <i>p</i> = .350 [-.13 – .37]
Av. Emotion	1.00(.06) <i>p</i> < .001 [.88 – 1.12]	1.05(.04) <i>p</i> < .001 [.98 – 1.11]	1.07(.04) <i>p</i> < .001 [.99 – 1.15]	1.04(.04) <i>p</i> < .001 [.94 – 1.13]	1.00(.05) <i>p</i> < .001 [.91 – 1.10]	1.08(.03) <i>p</i> < .001 [.10 – 1.14]

<b>Self-Distraction</b>	<b>Happy</b> <i>b(SE), p, [95% CI]</i>	<b>Sad</b> <i>b(SE), p, [95% CI]</i>	<b>Lonely</b> <i>b(SE), p, [95% CI]</i>	<b>Angry</b> <i>b(SE), p, [95% CI]</i>	<b>Worried</b> <i>b(SE), p, [95% CI]</i>	<b>Jealous</b> <i>b(SE), p, [95% CI]</i>
<b>Level 1</b>						
G1 (no/high vs. moderate)	.19(.14) <i>p</i> =.190 [-.09 – .47]	-.16(.10) <i>p</i> =.097 [-.34 – .03]	-.08(.10) <i>p</i> =.450 [-.28 – .13]	-.17(.10) <i>p</i> =.078 [-.37 – .02]	-.24(.11) <i>p</i> =.037 [-.046 – -.02]	-.28(.12) <i>p</i> =.024 [-.52 – -.04]
G2 (no stress vs. all coping)	.06(.07) <i>p</i> =.461 [-.09 – .20]	.01(.07) <i>p</i> =.837 [-.12 – .15]	.08(.07) <i>p</i> =.230 [-.05 – .21]	.03(.06) <i>p</i> =.580 [-.09 – .15]	.04(.08) <i>p</i> =.648 [-.11 – .18]	.00(.06) <i>p</i> =.995 [-.13 – .12]
Emotion at T-1	.02(.04) <i>p</i> =.607 [-.06 – .10]	.07(.09) <i>p</i> =.437 [-.10 – .23]	-.02(.06) <i>p</i> =.697 [-.14 – .09]	-.01(.06) <i>p</i> =.878 [-.12 – .11]	.11(.06) <i>p</i> =.070 [-.01 – .24]	.18(.10) <i>p</i> =.077 [-.02 – .39]
Stressor	-.56(.07) <i>p</i> <.001 [-.71 – -.42]	.51(.09) <i>p</i> <.001 [.34 – .67]	.14(.08) <i>p</i> =.071 [-.01 – .29]	.56(.09) <i>p</i> <.001 [.40 – .73]	.26(.09) <i>p</i> =.002 [.09 – .43]	.01(.04) <i>p</i> =.806 [-.08 – .10]
Good Event	.76(.07) <i>p</i> <.001 [.62 – .90]	-.31(.07) <i>p</i> <.001 [-.44 – -.17]	-.29(.06) <i>p</i> <.001 [-.41 – -.16]	-.21(.08) <i>p</i> =.007 [-.36 – -.06]	-.09(.08) <i>p</i> =.260 [-.25 – .07]	-.03(.04) <i>p</i> =.416 [-.11 – .04]
Technology use	-.23(.13) <i>p</i> =.073 [-.48 – .02]	-.20(.13) <i>p</i> =.137 [-.46 – .06]	-.08(.11) <i>p</i> =.498 [-.29 – .14]	-.22(.13) <i>p</i> =.082 [-.47 – .03]	-.01(.11) <i>p</i> =.962 [-.21 – .20]	-.11(.08) <i>p</i> =.142 [-.26 – .04]
<b>Level 2</b>						
Gender	-.15(.08) <i>p</i> =.070 [-.32 – .01]	.09(.06) <i>p</i> =.142 [-.03 – .20]	.09(.06) <i>p</i> =.094 [-.02 – .02]	-.01(.08) <i>p</i> =.893 [-.17 – .15]	.09(.06) <i>p</i> =.125 [-.03 – .21]	-.02(.06) <i>p</i> =.751 [-.14 – .10]
Externalizing	.05(.10) <i>p</i> =.661 [-.16 – .25]	.01(.12) <i>p</i> =.921 [-.22 – .25]	-.09(.11) <i>p</i> =.419 [-.31 – .13]	-.13(.21) <i>p</i> =.547 [-.53 – .28]	.02(.12) <i>p</i> =.889 [-.22 – .26]	-.26(.24) <i>p</i> =.274 [-.73 – .21]
Depression	.01(.03) <i>p</i> =.793 [-.05 – .07]	.01(.03) <i>p</i> =.674 [-.04 – .06]	-.01(.02) <i>p</i> =.758 [-.06 – .04]	.00(.03) <i>p</i> =.988 [-.05 – .05]	-.03(.03) <i>p</i> =.239 [-.08 – .02]	.01(.02) <i>p</i> =.563 [-.02 – .04]
Social Anxiety	.00(.02) <i>p</i> =.894 [-.04 – .04]	.00(.03) <i>p</i> =.895 [-.06 – .05]	.00(.02) <i>p</i> =.853 [-.03 – .04]	.01(.02) <i>p</i> =.710 [-.03 – .04]	.01(.03) <i>p</i> =.741 [-.05 – .07]	-.01(.01) <i>p</i> =.339 [-.03 – .01]
Self-Distraction Trait	.02(.03) <i>p</i> =.481 [-.04 – .09]	.00(.04) <i>p</i> =.935 [-.07 – .08]	.03(.03) <i>p</i> =.384 [-.03 – .08]	.04(.04) <i>p</i> =.237 [-.03 – .11]	.01(.03) <i>p</i> =.687 [-.04 – -.06]	.01(.02) <i>p</i> =.771 [-.03 – .04]
Av. Tech Use	.18(.29) <i>p</i> =.534 [-.39 – .75]	-.11(.22) <i>p</i> =.623 [-.54 – .32]	-.21(.21) <i>p</i> =.264 [-.70 – .17]	.13(.21) <i>p</i> =.549 [-.29 – .54]	.10(.19) <i>p</i> =.600 [-.27 – .46]	.39(.17) <i>p</i> =.018 [.07 – .72]
Av. Stressors	-.25(.15) <i>p</i> =.090 [-.53 – .04]	-.08(.16) <i>p</i> =.610 [-.39 – .23]	.02(.11) <i>p</i> =.842 [-.20 – .24]	-.18(.13) <i>p</i> =.186 [-.44 – .09]	-.09(.28) <i>p</i> =.738 [-.64 – .45]	.12(.12) <i>p</i> =.229 [-.11 – .36]
Av. Emotion	1.01(.06) <i>p</i> <.001 [.89 – 1.13]	1.04(.04) <i>p</i> <.001 [.97 – 1.12]	1.07(.04) <i>p</i> <.001 [.99 – 1.15]	1.05(.04) <i>p</i> <.001 [.96 – 1.13]	1.02(.05) <i>p</i> <.001 [.92 – 1.13]	1.07(.03) <i>p</i> <.001 [1.01 – 1.13]

<b>Information Seek</b>	<b>Happy</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Sad</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Lonely</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Angry</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Worried</b> <i>b</i> (SE), <i>p</i> , [95% CI]	<b>Jealous</b> <i>b</i> (SE), <i>p</i> , [95% CI]
<b>Level 1</b>						
G1 (no/high vs. moderate)	.06(.13) <i>p</i> =.639 [-.19 – .31]	-.19(.10) <i>p</i> =.042 [-.38 – .01]	-.03(.11) <i>p</i> =.778 [-.25 – .19]	-.06(.11) <i>p</i> =.588 [-.26 – .15]	-.12(.11) <i>p</i> =.298 [-.34 – .11]	.01(.12) <i>p</i> =.971 [-.24 – .25]
G2 (no stress vs. all coping)	.06(.08) <i>p</i> =.409 [-.09 – .22]	-.01(.06) <i>p</i> =.870 [-.14 – .11]	.07(.07) <i>p</i> =.310 [-.06 – .20]	.01(.06) <i>p</i> =.877 [-.11 – .13]	-.02(.08) <i>p</i> =.766 [-.12 – .17]	.01(.09) <i>p</i> =.941 [-.17 – .19]
Emotion at T-1	.03(.04) <i>p</i> =.548 [-.06 – .11]	.07(.09) <i>p</i> =.444 [-.10 – .23]	-.02(.06) <i>p</i> =.720 [-.14 – .10]	.00(.06) <i>p</i> =.946 [-.12 – .11]	.12(.07) <i>p</i> =.068 [-.01 – .25]	.19(.11) <i>p</i> =.082 [-.02 – .41]
Stressor	-.56(.07) <i>p</i> <.001 [-.71 – .42]	.49(.08) <i>p</i> <.001 [.33 – .65]	.14(.08) <i>p</i> =.072 [-.01 – .29]	.56(.09) <i>p</i> <.001 [.39 – .73]	.27(.08) <i>p</i> =.001 [.10 – .43]	.01(.05) <i>p</i> =.835 [-.08 – .10]
Good Event	.76(.07) <i>p</i> <.001 [.62 – .91]	-.29(.07) <i>p</i> <.001 [-.43 – .16]	-.29(.07) <i>p</i> <.001 [-.41 – .16]	-.21(.08) <i>p</i> =.007 [-.36 – .06]	-.09(.08) <i>p</i> =.260 [-.25 – .07]	-.04(.04) <i>p</i> =.338 [-.11 – .04]
Technology use	-.23(.13) <i>p</i> =.075 [-.48 – .02]	-.17(.13) <i>p</i> =.201 [-.43 – .09]	-.07(.11) <i>p</i> =.504 [-.30 – .14]	-.22(.13) <i>p</i> =.086 [-.48 – .03]	-.01(.11) <i>p</i> =.955 [-.22 – .21]	-.12(.09) <i>p</i> =.169 [-.28 – .05]
<b>Level 2</b>						
Gender	-.15(.09) <i>p</i> =.085 [-.32 – .02]	.07(.05) <i>p</i> =.220 [-.04 – .17]	.08(.06) <i>p</i> =.149 [-.03 – .20]	-.02(.09) <i>p</i> =.780 [-.19 – .14]	.07(.05) <i>p</i> =.197 [-.04 – .17]	-.02(.10) <i>p</i> =.831 [-.22 – .18]
Externalizing	.04(.11) <i>p</i> =.729 [-.17 – .25]	-.01(.11) <i>p</i> =.952 [-.23 – .22]	-.09(.11) <i>p</i> =.435 [-.30 – .13]	-.12(.21) <i>p</i> =.560 [-.53 – .29]	-.01(.13) <i>p</i> =.915 [-.26 – .23]	-.27(.50) <i>p</i> =.595 [-1.25 – .072]
Depression	.01(.03) <i>p</i> =.787 [-.05 – .07]	.01(.03) <i>p</i> =.792 [-.04 – .06]	-.01(.03) <i>p</i> =.684 [-.06 – .04]	.00(.03) <i>p</i> =.879 [-.06 – .05]	-.03(.03) <i>p</i> =.350 [-.08 – .03]	.00(.01) <i>p</i> =.805 [-.03 – .03]
Social Anxiety	-.01(.02) <i>p</i> =.688 [-.05 – .03]	.00(.02) <i>p</i> =.925 [-.05 – .04]	.01(.02) <i>p</i> =.793 [-.03 – .04]	.01(.02) <i>p</i> =.761 [-.03 – .04]	-.01(.03) <i>p</i> =.697 [-.05 – .07]	-.01(.01) <i>p</i> =.459 [-.03 – .01]
Information Seek Trait	.03(.03) <i>p</i> =.311 [-.03 – .09]	.01(.03) <i>p</i> =.655 [-.04 – .06]	.01(.02) <i>p</i> =.717 [-.03 – .05]	.03(.03) <i>p</i> =.329 [-.03 – .08]	.02(.04) <i>p</i> =.587 [-.06 – .10]	.01(.03) <i>p</i> =.651 [-.04 – .06]
Av. Tech Use	.18(.30) <i>p</i> =.554 [-.41 – .76]	-.10(.22) <i>p</i> =.638 [.53 – .32]	-.22(.21) <i>p</i> =.297 [-.63 – .19]	.11(.23) <i>p</i> =.616 [-.33 – .56]	.09(.20) <i>p</i> =.663 [-.30 – .47]	.35(.23) <i>p</i> =.127 [-.10 – .80]
Av. Stressors	-.23(.15) <i>p</i> =.127 [-.53 – .07]	-.09(.14) <i>p</i> =.521 [-.37 – .19]	.02(.11) <i>p</i> =.821 [-.19 – .23]	-.17(.13) <i>p</i> =.180 [-.42 – .08]	-.09(.21) <i>p</i> =.666 [-.51 – .33]	.11(.11) <i>p</i> =.302 [-.10 – .33]
Av. Emotion	1.00(.06) <i>p</i> <.001 [.88 – 1.12]	1.04(.04) <i>p</i> <.001 [.97 – 1.11]	1.07(.04) <i>p</i> <.001 [.99 – 1.16]	1.05(.04) <i>p</i> <.001 [.97 – 1.13]	1.01(.04) <i>p</i> <.001 [.94 – 1.08]	1.09(.05) <i>p</i> <.001 [1.00 – 1.19]

## **Chapter 10:**

### **General Discussion**

In the final chapter of the thesis, broad aims of the dissertation are revisited in relation to study findings. Next, building on these findings, the chapter provides an overview of the theoretical, clinical, and practical implications of this work. Further, the strengths and limitations of the thesis and recommendations for future research are discussed.

#### **Summary of Findings Addressing Aims**

**Research Aim 1.** The aim of the first study (Chapter 5) was to address advantages, challenges and divergence in measurement approaches to adolescent coping using Ambulatory Assessment (AA). Here, Study 1 provided a detailed characterization and synthesis of the adolescent AA coping literature ( $n = 60$  studies). Indeed, more than three decades ago, foundational scholars of coping Lazarus and Folkman (1984) called for “micro-analytic, process-oriented research” to more accurately assess the complex interplay between the individual and their environment, and to help parse out what constitutes as adaptive coping. Thus, coping scholars have been among the earliest, and most enthusiastic, adopters of ambulatory assessment (Modecki & Mazza, 2017). Moreover, in the last decade especially, the advances in mobile technologies have further enticed scholars towards these methods (Heron, Everhart, McHale, & Smyth, 2017).

Overall, Study 1 makes a significant contribution to new knowledge in providing a broad integration of existing work to date. In turn, Study 1 helps delineate and critique how AA methods have been deployed to measure coping and extrapolate on its impacts, including methodological considerations such as design decisions and

associated participant compliance. Drawing on the study's broad scope, in tandem with close recording of study details, Study 1 also distilled down key lessons and practical recommendations as researchers continue to undertake the challenge of AA adolescent coping research.

In sum, Study 1 recommends that coping scholars pause and balance their enthusiasm for AA methods with a realistic appreciation of what these methods entail. Likewise, scholars should ensure these methods truly make sense for their planned study questions. That is, researchers might first revisit the commonality among the various coping theoretical frameworks (e.g., Lazarus & Folkman, 1984; Compas, Connor-Smith, Saltzman, Thomsen & Wadsworth, 2001; Skinner & Zimmer-Gembeck, 2007), in that coping is a *process* (i.e., the stressor, the coping response, and the outcome). As such, ideally, measurement and assessment of coping requires that *each stage* of the process be considered (e.g., approximately one third of studies reviewed failed to measure stressors overall). While it is certainly possible to contribute to the field when assessing only one or two pieces of the process “in-vivo,” trade-offs regarding which stage is most important to capture within AA should be well-considered. Relatedly, Study 1 highlights the need to better delineate coping process from coping outcomes. That is, to establish a meaningful “endpoint” of the coping process, scholars must consider the limits of their designated timelines (e.g., capturing a full recovery versus the immediate aftermath of a stressor). Finally, Study 1 identified potential solutions for tailoring AA designs to adolescents' needs, including: reducing participant burden, utilising parental support, and contacting youth to help problem-solve compliance related issues.

**Research Aim 2.** The second aim of thesis was to better characterize and measure the construct of adolescent online coping. Thus, Study 2 explored the role of



technology in adolescents' management of daily stressors. Given that the experience of daily stressors is an especially salient source of distress among youth, the possibility of effective stress-management via the already-accessible resource of technology was an especially promising prospect.

Not surprisingly, then, a growing body of scholars had called for traditional coping scales to be modified to include electronic media to better reflect current coping behaviours in youth (e.g., Leiner, Argus-Calvo, Peinado, Keller, & Blunk, 2014). Indeed, the digital context has become so intertwined with how we picture the modern-day adolescent, it is surprising that so few scholars had sought to explore the intersection of technology and youths' stress management. Thus, Study 2 addressed this gap in two ways. First, adolescent focus groups spoke to youths' own descriptions of the precipitants to, and the emotional consequences of, their technology use. Second, Study 2 then measured and validated the efficacy of three types of adolescent online coping: namely, emotional support seeking, information seeking and self-distraction.

First, focus group findings provided qualitative evidence that the digital context is a familiar (albeit imperfect) arena that youth turn to when managing stressful, or emotionally unpleasant experiences. Thus, the experience sampling (ESM) portion of Study 2 then empirically explored the utility of these online coping efforts to manage everyday stressors. Three adapted subscales from Carver's (1997) widely employed Brief-COPE were used to assess the following constructs: online emotional support seeking, information seeking and self-distraction. Notably, youth widely endorsed using these strategies, with 84% reporting seeking emotional support online; 78% endorsing finding information online; and 94% reporting that they engaged in online self-distraction. Further, these online coping behaviours were tied to technology use,

psychopathology and negative emotions among socio-economically disadvantaged adolescents.

A major contribution of Study 2 was its employment of trait-level online coping strategies to test the buffering effect of online coping in relation to in-vivo emotion reactivity to momentary stressors. Somewhat surprisingly, however, youth who endorsed more frequent use of these strategies overall, had worse emotional outcomes following a stressful encounter. More specifically, online coping strategies were particularly ineffective in relation to worry, jealousy and loneliness. Thus, online coping, at least when explored as a trait construct, and as a linear effect, appeared to be ineffective for managing stress.

Notably, in addressing the aim of characterizing the nature of online coping, Study 2 also usefully differentiated between online and offline coping, supporting that these are distinct constructs. Specifically, Study 2 provided supplementary data from young adults, which allowed for comparing relations between offline and online coping and young people's well-being. Importantly and consistent with prior research (e.g., van Ingen & Wright, 2016), online coping strategies were positively associated with indicators of poor well-being. Specifically, all online coping strategies were significantly and positively related to anxiety, stress, and (with the exception of online emotion support-seeking), depressive symptoms. Conversely, offline coping was not uniformly related to indicators of poor well-being. Here, offline emotional support seeking, and information seeking were both negatively associated with depression. However, offline self-distraction was positively associated with anxiety and depression levels, indicating that high levels of self-distraction (online or off), is associated with poor levels of functioning.

Additionally, the correlations among online and offline coping strategies were only moderate, indicating some degree of overlap between online and offline strategies, but also demonstrating that conceptually and empirically, these strategies are indeed distinct. Further, as the causal direction of these relations cannot be determined, it is possible that youth are navigating to the online space due to a lack of effective offline resources. All told, Study 2 was the first study, to our knowledge, to explicitly assess online coping among adolescents, and to do so within a communications-based framework.

**Research Aim 3.** In order to explore the impact of adolescents' online coping using a more precise approach (including the potential for non-linear effects), the final study assessed online coping as a momentary construct, as opposed to stable trait. In tandem, Study 3 examined whether varying levels of use (e.g., moderate levels of online coping) were especially efficacious for adolescents in response to stress. Overall, Study 3 explored momentary coping from two perspectives.

First, Study 3 explored momentary online coping from a *dose-response* perspective. That is, the study tested whether *more* coping was effective (or ineffective) in the face of stress. Here, findings indicated that online coping was associated with subsequent dips in positive affect, and surges in negative affect. This pattern of results was consistent across all online coping strategies. Thus, based on this first approach, one might assume that online coping reflects efforts in vain, or worse, that these behaviours are harmful for adolescents in the short-term.

That said, conceptually, *more* coping is not necessarily an indicator of positive development. That is, a consideration that is often mentioned (but not often addressed) within the coping sphere, is the intertwined nature of stress and coping. Specifically,

studies have long shown that higher levels of coping are inherently tied to greater experiences of stress (e.g., Coyne & Racioppo, 2000). Considered through this lens, *more* coping does not necessarily equate to *better* well-being. Furthermore, the effects of technology use and well-being can vary depending on the level of use (e.g., studies have explored the effects of some use versus no use in relation to videogames, Durkin & Barber, 2002). More specifically, health research has increasingly pointed to the nature of treatments and context on health. Here, very low or very high dosages may be problematic, whereas moderate use might be positive or protective, or vice-versa (e.g., May & Bigelow, 2005). This type effect is not captured within a linear examination of online coping, and thus the effectiveness of online coping was also explored via a non-linear approach. In the case, the *Goldilocks Hypothesis* was tested (Przyblyski & Weinstein, 2017) whereby the effects of extreme levels of coping (including no coping at all, and high amounts of coping) were compared to the effects of moderate levels of use.

Thus, a second element of Study 3 tested the Goldilocks hypothesis, and in so doing, a very different picture of online coping effects emerged. Specifically, online coping, when engaged with at moderate levels of use, was found to be protective against the impact of momentary stress. That is, moderate levels of emotional support seeking were associated with decreases in sadness and loneliness, and trend-level increases in happiness. Further, moderate levels of self-distraction were associated with decreases in worry and jealousy, and at trend level, decreases in in sadness and anger. Finally, moderate levels of information seeking were associated with subsequent decreases in sadness. Not only was this protective pattern of moderate coping fairly robust across online strategies and emotions, these models also provided a better fit to the data relative to linear models. Given that public health scholars continue to articulate the

need to conceptualize and model non-linear impacts on health, and, likewise, given the consistent pattern of findings pointing to a Goldilocks effect of online coping, all together Study 3 shows clearly that moderate amounts of online coping is a productive option for youth to recover from momentary stressors. Thus, the online space is arguably a promising channel for adolescents to readily access emotional support, useful information, and easily accessible distraction from daily stressors, at least in the short-term

### **Research Implications**

Addressing these three aims speak to a number of theoretical, clinical, and practical implications. These are each discussed in turn. Following implications, thesis strengths, limitations, and future directions are discussed.

### **Theoretical Implications**

The studies presented in this thesis have several theoretical implications. First, the findings of Study 2 and 3 point to the importance of considering the online context as a potential resource for adolescents in their management of daily stressors. Although researchers have previously called for online coping to be explored (e.g., Leiner et al., 2014), developmental scholars have been seemingly hesitant to delve into the potential positive effects of the online space (Underwood & Ehrenreich, 2017). The field is rife with the potential risks of technology use on adolescent well-being (e.g., Meier & Gray, 2014; Twenge, Joiner, Rogers, & Martin, 2018); however, scholars have also championed the digital space as a platform where youth gain mastery over specific developmental tasks (Subramanyam & Smahel, 2010). Considering that learning to successfully cope with a range of stressors is a key developmental task of adolescence, it is surprising that the investigation of youths' online coping has been mostly

overlooked. As a result, this thesis underscores the relevance of online coping strategies to adolescents' day-to-day life, as well as their potential utility. At the same time, thesis findings corroborate prior research with adults indicating that online coping should be considered as a separate construct to those enacted in the offline context (van Ingen & Wright, 2016). Additionally, online coping is arguably particularly relevant to adolescents, as most youth within these studies reported engaging with technology to cope, at least in some way.

Further, findings pertaining to the impact of online coping on emotional well-being have significant implications for the wider field of developmental research. Specifically, the present thesis reinforces the importance of considering individual difference factors in *how* technology is used when investigating its potential impact on well-being. Here, concurrent technology use was found to have no impact on subsequent emotional well-being. Further, and consistent with prior research (Bélanger Akre, & Berchtold, 2011; Kim, 2012; Moreno, Jelenchick, Koff, & Eickhoff, 2012), the effects of technology use were shown to differ depending on reasons for use, as well as levels of use. Thus, the age-old question of whether "technology is helpful or harmful" should move beyond broad strokes and consider motivations for use, as well as modelling varying levels of use over time, within-person.

Finally, it is worth revisiting a clear take home from Study 1, in that one explanation for why adolescents' online coping has not been a focus of most work may be due the fact that coping itself is challenging to measure. Traditionally, scholars have relied on retrospective trait-level coping measures to define and validate specific coping strategies (e.g., Folkman & Moskowitz, 2004). This has been important and useful in establishing a sound theoretical foundation for coping in general. Indeed, within this thesis, adapting a well-known trait measure (Carver, 1997), allowed for the validation of

a novel type of coping in youth. However, this approach to measuring coping does bring limitations. Specifically, trait-level coping questionnaires risk imprecision as they measure context-specific behaviours through the recollection of *general* tendencies across situations and stressors (O'Toole, Jensen, Fentz, Zachariae, & Hougaard, 2014). Further, research has found that trait-level coping measures can be poor predictors of momentary coping behaviours, and vice versa (Schwartz, Neale, Marco, Shiffman, & Arthur, 1999). The findings within the present thesis were not a great exception to these discrepancies. Specifically, in Study 3, the correlations between trait and momentary measures of online coping fell within the weak ( $r = .20$ ; information seeking and self-distraction) to moderate range ( $r = .32$ ; emotional support seeking) (Cohen, 1992). Thus, online coping assessed at a trait level and within an ambulatory assessment framework are significantly associated and predict adolescents' emotion reactivity to stress. At the same time, the thesis points to the benefit of measuring coping as a dynamic factor, rather than a stable trait.

### **Clinical Implications**

The foremost clinical implication of the findings from the thesis is the identification of how an already-accessible resource can be harnessed to assist youth in times of stress. This implication is particularly relevant for youth living in socio-economic disadvantage. Specifically, a wide body of research attests to the presence of a SES-health gradient (Chiang, Bower, Almeida, Irwin, Seeman & Fuligni, 2015). When compared to more affluent populations, youth from socio-economic disadvantage are at an increased risk for poor health outcomes, including the development of mental health symptoms (Chen, Miller, Brody, & Lei, 2015). Importantly, research has shown that youth in low SES settings experience more frequent exposure to daily stressors (Evans, Vermeylen, Barash, Lefkowitz & Hutt, 2009), and in turn, this increased

exposure has been related to the development of mental health symptoms (Charles, Piazza, Mogle, Sliwinski & Almeida, 2013).

Considering the vulnerabilities that socio-economically disadvantaged youth face, the identification of ways in which they can more readily find support and information, in particular, has tangible benefits. Indeed, an interesting contrast to the SES-health gradient is the relationship between socio-economic background and access to technology. Specifically, the concept of a “digital divide” between low and high economic populations is a common misconception. In fact, numerous studies have shown that youth from economically disadvantaged backgrounds have better access to mobile phones (Byun et al., 2013), and spend more time engaging with technology overall (Thomas, Heinrich, Kuhnlein, & Radon, 2010).

While the potential to harness technology to improve youth mental health prospects has been widely espoused by scholars (Hollis et al., 2015), at present, this potential remains largely unfulfilled. One major barrier is the lack of knowledge about how youth prefer to use technology to manage their moods. This thesis starts to unpack the ways in which youth naturally engage with the online space under stress, and the carry-on effects of emotion from coping in the online space. As a result, the implications of these findings are potentially far-reaching as they can help guide research, intervention, and clinical decisions on how to best tailor the digital context to suit youths’ needs.

An important take-way from the thesis is that the online space already provides a multitude of ways for youth to receive intervention and support for mental health difficulties. The availability of online mental health programs and health mobile applications, or apps, are growing in number (Grist, Porter, & Stallard, 2017). Further,



in some cases, these mobile interventions have been found to be effective for youth (Seko, Kidd, Wiljer, & McKenzie, 2014). However, app-adherence and program drop-out are a significant hurdle to virtually all technology-based treatment programs (Christensen, Griffiths & Farrer, 2009). A common pattern is that youth tend to initially display high levels of engagement, which then proves to be unsustainable and is followed by a marked decrease within four to seven weeks (Grist, Porter, & Stallard, 2017; Lee et al., 2018). As a result, knowledge about the ways in which youth naturally prefer to cope online allows for scholars and clinicians alike to “meet them” in the online space. Here, existing avenues for coping could be tailored to youths’ needs, rather than flooding youth with new apps that may not stand the test of time.

As one example, Study 3 found that online information seeking was the least useful online coping strategy. This may be attributable to a number of factors. First, it is possible that youth lack the research skills to locate relevant and useful information online. However, it may also be the case that quality information is either not as readily available, or in its current form is not especially palatable to the adolescent population. As a result, a two-pronged strategy would be advised, whereby youth are taught to navigate to, and be able to identify, quality information online, while simultaneously, more readily available adolescent-relevant online spaces are made accessible for youth.

### **Practical Implications**

Finally, the findings within the present thesis have a number of practical implications. First, while not claiming to be a *how-to guide*, Study 1 provides key lessons from 60 adolescent AA coping studies. Further, Study 1 provides practical recommendations for researchers seeking to deploy AA in the pursuit of finding “what works” for youth in the face of stress. Study 1 cautioned researchers to not blindly dive into AA research without a sound theoretical foundation. Indeed, the promise of AA is

enticing, but without theory to guide design-based decisions, researchers face the risk of producing an expensive final data set that may fail to address their initial research questions.

For coping scholars in particular, the confounding nature of managing stress, or feeling low in general, and adherence to study protocol was highlighted. The key practical implication here is for scholars to acknowledge this potential confound and to tailor their protocol to ensure minimal burden for participants. However, the competing nature of coping and AA reporting also means that methods of managing missing data are still needed (Larson, 2019). Finally, Study 1 emphasised the importance of tailoring AA designs to adolescent's needs – that is, consider compliance in varying contexts, and when possible, include ways of encouraging adolescents to respond to study prompts (e.g., financial compensation).

Additionally, as touched on early within the *theoretical implications* section, measuring coping as a dynamic, changing construct has proven to be a common hurdle in the coping field. Thus, the majority of AA studies reviewed in Study 1 opted to measure coping using end-of-day reports. Specifically, 20% of studies were found to solely rely on end-of-day reports, and 35% opted to combine trait and end-of-day reports. Although momentary reports of coping are ideal, this poses a challenge in terms of time and specificity and the field is yet to identify well-validated ways of measuring coping in-situ. Thus, Study 3 provides a useful middle-ground approach, combining end-of-day reports with momentary stress responses. Although this process can indeed be laborious, and comes with its own limitations, it does allow for the proximal (and arguably more accurate) measurement of coping in situ.

## **Strengths, Limitations and Future Research**

### **Methodological Strengths**

Before discussing limitations, it is worth noting that the studies presented in this thesis have a number of methodological strengths, which should be considered in relation to findings. Two key strengths are worth noting in relation to multilevel models assessing online coping. First, a major strength in this research was the conservative approach to empirical analyses. In all models, potentially confounding variables were included and tested as covariates. At the within-person level, this included momentary technology use, momentary positive events and previous emotion. At the person-level, gender, trait psychopathology, weekly averages for technology use, stress and emotion (and in Study 3, trait coping) were also included. Thus, findings related to online coping were above and beyond these other characteristics.

Second, another notable empirical strength of these studies is the high level of participant compliance in both Study 2 and 3. Ambulatory assessment research with adolescents is a challenging endeavour, and adherence among youth living in disadvantaged contexts is especially hard to address. The supplementary section of Study 2 articulates some of the wider strategies that went into the larger project, which were pulled from prevention science best practice, experiential education expertise with at-risk youth, and clinical experience (Uink, 2018). More specifically, within Study 2 and consistent with prior research (e.g., Brans, Kopal, Verduyn, Lim & Kuppens, 2013) a median response rate of 71% was generated among compliant participants who were included in analyses.

## **Limitations and Future Research**

There are also several limitations that need to be acknowledged and could advance future research agendas. First, the method of measurement of daily stressors in this study, although consistent with prior ESM studies (e.g., Schneiders, Nicolson, Berkhof, Feron, van Os, & Devries, 2006), did not allow for inclusion of specific details of the stressor. Some previous research has found that specific stressor type (e.g., academic or relational friends or family) is associated with varying outcomes (Mize & Kliever, 2017). Illustratively, Sim (2000) found that stressors from parents and school, but not friends, were positively associated with antisocial behaviours. Although arguably, increasing the number of questions pertaining to the nature of the stressor would lead to higher participant burden, the trade-off of this approach has been a lack of insight as to when and where online coping may be particularly effective. Indeed, research has found that the nature of the stressor often effects how useful particular coping strategies will be (Carver & Connor-Smith, 2010). Thus, future research should ideally endeavour to clarify specific types of stressors for which online coping may assist.

Second, the present thesis investigated only three ways in which youth can cope online. Research with adults (van Ingen, Utz, & Toepoel, 2016) points to additional coping strategies that can be carried out in the online space, including emotional venting, planning and positive reinterpretation. Future research could aim to validate these additional online coping strategies with youth, as well as investigate their effectiveness in the face of stress. A useful starting point may be to investigate the utility of adolescents' online emotional venting. Indeed, Vermeulen and colleagues (2018) conducted in-depth interviews with 22 youth and found that adolescents often turn to social media in order to express their emotions, as well as to vent about the daily

stressors they have encountered. However, questions pertaining to whether this coping strategy is helpful (including for whom, or when) remain to be explored.

Third, there are limitations in the ways in which coping as measured in this thesis. First, although the adaptation of Carver's (1997) brief-COPE allowed for the validation of these online coping strategies, the reliance on this trait-measure in Study 2 did not allow for the assessment of coping at the micro-level. This limitation was addressed in Study 3, whereby end-of-day coping reports were "attached" to momentary stressors. However, this approach still brought its own limitations. Thus, the field would benefit from future research that endeavours to develop and validate momentary-coping scales. Worth considering is the balance between measurement of momentary coping and repeatedly measuring coping without interfering with it, or guiding youth in their coping processes. Specifically, delivery of momentary prompts that provide youth with a range of coping options in the face of stressors may eventually result to be a list of suggestions for the next stressor. Here, a workaround might be to ground momentary measures to a small number of specific coping strategies.

Fourth, Study 2 and 3 solely focussed on short-term adaptation in that they only explored momentary emotional relief. As emphasised in Study 1, although coping strategies have been found to be effective in the short-term, these patterns may not necessarily equate to positive long-term functioning (Gross & John, 2003). Considering the intensity in which youth are choosing to engage with this space, future research should aim to capture the longer-term effects of coping via technology.

Finally, Study 3 highlighted that the effects of technology use on well-being should be considered from a non-linear perspective. That is, the wisdom of *everything in moderation* applies within the digital context. A key limitation here is that the

boundaries of what constitutes moderate use remain unclear. Research is already beginning to explore the limits of “healthy” levels of technology use. For instance, Przybylski and colleagues (2019) found that caregiver estimates of moderate use fell between 1-2 hours a day, and that this moderate use was associated with positive functioning. Further, levels of heavier use were associated with subjective declines in psychosocial functioning. In this case, moderate use was determined via visualizing of data plots, as opposed to a priori. This approach, or conceptual approaches to moderation, provide an encouraging start to the study of how much technology is too much.

### **Conclusion**

Adolescence is often described as a particularly challenging period of life. The teenage years bring with them an increased exposure to daily stressors, often followed by waves of emotional upheaval. These daily “knocks” can steer adolescents off-course and are a salient source of strain on youths’ emotional health. For developmental scholars, the task of enhancing healthy outcomes for youth by promoting positive coping strategies requires a deeper understanding of how already accessible resources can be used to their full-effect (Modecki, Zimmer-Gembeck, & Guerra, 2017). This thesis has argued that the digital space has been an overlooked arena that can be mobilized to assist youth for coping in times of stress.

Overall, this series studies focused on intensive longitudinal designs to help capture the coping process. First, coping scholars have long called for these designs to be at the forefront of coping research (Lazarus & Folkman, 1984), and enthusiasm for these methods are increasingly more evident in the field. Thus, this thesis took stock of the various approaches taken to measure coping in daily life and highlighted important

lessons and practical recommendations for scholars. Second, the thesis characterizes how youth engage with the online space to cope with daily stressors. Three online coping strategies (emotional support seeking, self-distraction and information seeking) were empirically validated, and shown to be distinct from offline counterparts. Further, adolescents widely endorsed using these strategies. Finally, although linear explorations suggested higher online coping was associated with poorer emotional recovery from stress, a more specific and nuanced approach (contrast codes exploring the impact of moderate amounts of momentary online coping vs none and a lot), demonstrated clear benefits of online coping when relied upon at moderate levels. Overall, technology can indeed be beneficial for youth, and most critically, holds promise as a *naturally occurring* setting for prevention and intervention. When employed to address the experiences of stress, technology stands to both enhance our understanding of the coping process, as well as provide an already-accessible tool to help foster well-being in youth.

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**Appendix A: Ethics Permit and Amendment Approval**[www.murdoch.edu.au](http://www.murdoch.edu.au)**Research Ethics Office**  
Division of Research and Development

Monday, 19 August 2013

Dr Kathryn Modecki  
School of Psychology and Exercise Science  
Murdoch UniversityChancellery Building  
South Street  
MURDOCH WA 6150  
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[www.research.murdoch.edu.au/ethics](http://www.research.murdoch.edu.au/ethics)

Dear Kathryn,

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

Thank you for addressing the conditions placed on the above application to the Murdoch University Human Research Ethics Committee. On behalf of the Committee, I am pleased to advise the application now has:

**OUTRIGHT APPROVAL**

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 project 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

### Human Research Ethics Committee: Standard Conditions of Approval

- a) The project must be conducted in accordance with the approved application, including any conditions and amendments that have been approved. You must comply with all of the conditions imposed by the HREC, and any subsequent conditions that the HREC may require.
- b) You must report immediately anything which might affect ethical acceptance of your project, including:
  - *Adverse effects on participants*
  - *Significant unforeseen events*
  - *Other matters that might affect continued ethical acceptability of the project.*
- c) Where approval has been given pending copies of documents such as letters of support / consent from other organisations or approvals from third parties, these must be provided to the Research Ethics Office before the research may commence at each relevant location.
- d) Proposed changes or amendments to the research must be applied for, using an Amendment Application form, and approved by the HREC before these may be implemented.
- e) An annual Report must be provided by the due date specified each year (usually the anniversary of approval) for the project to have continuing approval.
- f) A closure report must be provided at the conclusion of the project.
- g) If, for any reason, the project does not proceed or is discontinued, you must advise the committee in writing, using a Closure Report form.
- h) If an extension is required beyond the approved end date of the project, an extension application should be made allowing sufficient time for its consideration by the committee. Extensions cannot be granted retrospectively.
- i) You must advise the HREC immediately, in writing, if any complaint is made about the conduct of the project.
- j) Any equipment used must meet current safety standards. Purpose built equipment must be tested and certified by independent experts for compliance with safety standards.
- k) Higher degree students must have both Candidacy and Program of Study approved prior to commencing data collection.
- l) You must notify the Research Ethics Office of any changes in contact details including address, phone number and email address.
- m) The HREC may conduct random audits and / or require additional reports concerning the research project.

**Failure to comply with the National Statement on Ethical Conduct in Human Research (2007) and with the conditions of approval may result in the suspension or withdrawal of approval for the project.**

*The HREC seeks to support researchers in achieving strong results and positive outcomes.*

*The HREC promotes a research culture in which ethics is considered and discussed at all stages of the research.*

*If you have any issues you wish to raise, please contact the Research Ethics Office in the first instance.*





Friday, 06 November 2015

Division of Research & Development  
Research Ethics and Integrity

Dr Kathryn Modecki  
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Dear Kathryn,

[www.murdoch.edu.au](http://www.murdoch.edu.au)

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

**AMENDMENT:** Addition of Research Assistants to attend to data collection.

Your application for an amendment to the above project, received on 29/10/2015 was reviewed by the Murdoch University Human Research Ethics Committee 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**. All reporting forms are available on the Research Ethics and Integrity web-site.

I wish you every success for your research.

Please quote your ethics project number in all correspondence.

Kind Regards,

Dr. Erich von Dietze  
Manager  
Research Ethics and Integrity

cc: Prof Bonnie Barber, Dr Bree Abbott, Dr Helen Correia, Bep Uink, Cathy Drane and Megan Duvenage