Prosociality through a Multidimensional Perspective: Insights from Psychophysiology and Emotion Regulation

By

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ABSTRACT

Prosociality, which reflects dispositions to allocate attention and energy toward addressing the needs of others, is a hallmark of positive socioaffiliative development in adolescence (Eisenberg et al., 2015; Carlo & Padilla-Walker, 2020). While the propensity to help and support others is evident throughout the lifespan, the increasingly complex social landscape and neurobiological reorganization characteristic of adolescence present greater opportunities for the development of prosocial emotions and behaviors. Effective emotion regulation underlies the ability to shift attention from one's own emotional state to attend to the needs of others (Preston & DeWaal, 2002). Assessments of psychophysiological functioning may provide foundational insight into core psychological capacities and motives that support prosocial engagement. Therefore, this dissertation examines the nuanced interplay among emotion regulation, autonomic nervous system activity, and various forms of prosocial emotions and behaviors. Paper 1 tests the influence of cognitive reappraisal and rumination as regulatory strategies on adolescents' autonomic nervous system (ANS) activity and prosocial responding. Paper 2 investigates the extent to which parasympathetic nervous system (PNS) reactivity to experiences of both thinking and talking about negative emotions are associated with adolescents' prosociality. Paper 3 examines the effect of emotional distress experienced during the COVID-19 pandemic on different forms of helping behaviors during the pandemic, as well as the extent to which cognitive reappraisal and expressive suppression may promote or diminish these forms of prosocial behaviors. Findings from this dissertation begin to address the existing gaps in emotion regulation research by identifying psychophysiological profiles that facilitate greater prosociality across emotional and situational contexts. Taken together, the three papers herein demonstrate

that youths' emotion regulation abilities and strategies contribute to diverse forms of prosocial engagement.

# CHAPTER ONE

# GENERAL INTRODUCTION

As a developmental period, adolescence is characterized by gradual maturation of affective and cognitive functioning, which occur alongside tremendous physiological changes (Fuhrmann et al., 2015; Nelson et al., 2016; Sisk & Foster, 2004). With the onset of puberty, changes in hormonal production and reorganization of neural networks position adolescence as a period of sensitivity to environmental influences on psychosocial development (Fuhrmann et al., 2015). Thus, emotional and behavioral responding in social contexts have important implications for adolescents' adaptive socioemotional development.

The plasticity and continual evolution of normative developmental capacities underscore the critical importance of positive youth development perspectives during adolescence (Lerner, 2009). Prosociality, or the propensity to help others and respond in socially beneficial ways, is a fundamental aspect of positive socioemotional development and proficiency in adolescence (Eisenberg et al., 2015). Prosociality manifests in various forms, ranging from emotional (e.g., empathy, sympathy) to behavioral experiences (e.g., comforting others, sharing personal resources with others; Hastings et al., 2007; Zahn-Waxler et al., 2018).

## Prosociality in Adolescence

Prosociality is a fundamental aspect of positive socioemotional development and proficiency in adolescence (Eisenberg et al., 2015). Greater prosociality has been associated with various aspects of adolescents' healthy and adaptive socioemotional functioning, including improved life satisfaction, well-being, and social bonds with others (Caprara et al., 2014; Carlo & Padilla-Walker, 2020; Eisenberg et al., 2015). Given the characteristic heightened sensitivity to social contexts (Schriber & Guyer, 2016; Steinberg, 2005) and complexity of social

relationships during adolescence (Brizio et al., 2015), investigating the underlying mechanisms that foster positive social engagement responses is central to better understanding how to promote healthy and adaptive developmental trajectories.

Within the developmental literature, prosociality is most often assessed through behaviors which reflect direct attempts to positively impact the well-being of others. While many studies have conceptualized and measured prosocial behaviors as a singular, global construct (Eisenberg et al., 2016; Wentzel et al., 2007), there has been increased attention given to the different forms of prosocial behaviors in which youths may engage (Carlo & Padilla-Walker, 2020; Hodge et al., 2023; Paulus, 2018). Adolescents can also allocate their attention and energy to the needs of others through more internal and emotional forms of responding. For instance, when witnessing another person in need or distress individuals often experience subjective responses to these observations (Batson, 2023; Preston & DeWaal, 2002). One clear example of this includes affective empathy, such that an individual vicariously experiences the emotions of those they are observing (Hastings et al., 2007; Zahn-Waxler et al., 2018). Similarly, experiences of sympathy reflect feelings of compassion and concern directed at another (Eisenberg et al., 2014; Zahn-Waxler et al., 2018). While these internal experiences of adolescents' prosocial responding have not been explored as much as prosocial behaviors, engagement in these emotional forms of prosociality may be just as important in promoting different aspects of positive socioemotional developmental trajectories in adolescence (Van der Graaff et al., 2018; Carlo et al., 2015).

Understanding the nature of adolescents' emotional and behavioral facets of prosociality is important for informing how youths may successfully navigate nuanced social contexts to form meaningful, lasting relationships. While the propensity to help and support others is relevant throughout the lifespan, the increasingly complex social landscape and heightened emotional

salience characteristic of adolescence (Hay, 2019; Steinberg & Morris, 2001) present unique opportunities for the development of prosocial behaviors (Eisenberg et al., 2015). The rapidly developing socioemotional and cognitive capacities during adolescence may suggest the importance of adolescents' learning of how to empathize with and respond to others' emotions and situations (Eisenberg et al., 2015; Steinberg & Morris, 2001).

**Emotion Regulation and Prosociality**

During adolescence, notable enhancements in sensitivity to emotional experiences and social interactions emerge (Bailen et al., 2019; Schriber & Guyer, 2016; Steinberg & Morris, 2001). Observing others in distress frequently triggers prosocial behaviors, as these situations often provoke emotional contagion, where individuals' emotions mirror those of the distressed parties (Eisenberg et al., 2015; Hastings et al., 2014b). Research has identified empathic concern and personal distress as the main emotional reactions to such vicarious experiences. These reactions lead to different types of prosocial responses: empathic concern typically promotes other-oriented feelings like sympathy and compassion, enhancing the likelihood of prosocial actions (Eisenberg et al., 2015; Zahn-Waxler & Radke-Yarrow, 1990). Conversely, personal distress might cause self-focused and withdrawal behaviors, aimed at self-protection, which are linked to reduced prosocial responding (Eisenberg & Eggum, 2009).

Emotion regulation, which refers to processes that change the occurrence, strength, and duration of emotional reactions (Gross, 2015), plays a crucial role in fostering prosocial behaviors instead of withdrawal or self-protective reactions (Preston & De Waal, 2002). Adolescents who are better at managing their feelings and thoughts, particularly for emotions that are negative and vicarious, demonstrate greater capacities to attend to the needs of others (Eisenberg & Eggum, 2009; Eisenberg et al., 2015; Lockwood et al., 2014).

Effective emotion regulation during instances of another's distress is critical for shifting focus from oneself to the needs of others (Preston & De Waal, 2002). Inabilities to control these vicarious emotions often results in overwhelming personal distress, which not only impedes prosocial actions but also leads to withdrawal and self-preservation tactics (Miller, 2018; Miller & Hastings, 2019).

However, within the developmental literature, studies have broadly differed in their conceptual and operational approaches to measuring emotion regulation. The current inconsistencies have hindered abilities to better understand the extent to which emotion regulation fosters prosocial emotions and behaviors in adolescence. First, among the studies exploring the links between emotion regulation and prosociality, emotion regulation has predominantly been assessed through trait-level measures (i.e., the extent to which one tends to be regulated). However, emotion regulation also involves dynamic processes that respond to immediate, situational stimuli (Mendes, 2016). Further investigations into these state-level regulation processes can advance the understanding of how certain responses to challenging stimuli are most conducive to adaptive, prosocial responses. Yet, further complicating this area of study, experimental emotion induction tasks have differed in the protocol (e.g., recalling personal emotions, watching film scenes) as well as the specific emotional stimuli (e.g., sadness, anger) participants are instructed to regulate (Coulombe et al., 2019; Cui et al., 2015; Scrimgeour et al., 2016; Stellar et al., 2015). These factors may be differentially influencing how participants perceive and approach attempts to regulate emotions, and thereby adolescents' capacities to respond prosocially.

In addition to abilities to effectively regulate emotions, there is also a need for further investigation into the effects that different emotion regulation strategies have on youths'

prosocial emotions and behaviors. Most of the extant research has explored these associations within youths' usage of cognitive reappraisal, as an effective form of emotion regulation (Cohen et al., 2014; Garnefski & Kraaij, 2007; Thompson et al., 2019). However, much less is known for the effects of other regulatory strategies on adolescents' capacities for prosocial responding. Moreover, depending on contextual demands, abilities and strategies to regulate one's emotions may influence the forms of prosocial emotions and behaviors in which youths engage. Addressing these inconsistencies within the emotion and developmental literatures could inform the efforts to develop strength-based models of adolescent socioemotional development.

**Psychophysiological Assessments**

Insights from biopsychosocial perspectives may assist in bridging these gaps in the literature by identifying the underlying mechanisms of arousal regulation during these dynamic processes that lend to greater prosocial responding (Hastings et al., 2023). Many of the discrepancies regarding the conceptualization of prosociality are often partially attributed to reporter or social bias error during self-report or observational assessments of behaviors and motivations (Lanz et al., 2022). Measures of psychophysiological activity allow for more dynamic, state-level assessments of socioemotional factors that foster prosociality (Berntson & Cacioppo, 2007; Carlo et al., 2022; Gunnar & Quevedo, 2007). Furthermore, physiological assessments provide unique opportunities to assess psychological factors that are not otherwise observable through traditional empirical assessments (e.g., self-report, observations). Thus, it is plausible to suggest that adolescents' psychophysiological reactivity to emotional experiences may be a fundamental determinant of prosocial development (Hastings & Miller, 2014).

While various psychophysiological systems are involved in core regulatory processes, activity within the autonomic nervous system (ANS) has been widely used to index acute

physiological responses to emotional stimuli. ANS functioning is coordinated by both the sympathetic (SNS) and parasympathetic (PNS) branches (Berntson & Cacioppo, 2007). Traditional perspectives on ANS regulation position the PNS as responsible for the down-regulation and calming of arousal to maintain homeostasis (i.e., sustained growth and restoration; Smith et al., 2017). The SNS functions, in part, to redistribute metabolic output to peripheral sites (e.g., skeletal muscles, skin, myocardium, brain) in times of perceived threat or challenge to produce physiological changes commonly associated with "fight-or-flight" responses (i.e., excitatory arousal, approach and avoidance behaviors; Dawson, Schell, & Filion, 2007).

According to the polyvagal theory (Porges, 2007, 2011), vagal nerve modulation has evolved as part of the social engagement system, and thus, social factors (affiliation, social engagement), personality factors (optimism, bonding, attachment) and emotional states (positive emotions, compassion) can modulate cardiac vagal responses. Emerging developmental psychophysiological research has begun to recognize that the traditional conceptualization of the SNS and PNS serving as opposing agents of the ANS does not comprehensively consider the influences of individual difference characteristics and contextual demands (Bernston, et al., 2008; Quigley & Moore, 2018). Informed by these perspectives, dynamic ANS activity is conceptualized to manifest in patterns of co-activation, co-inhibition, reciprocal activation, or uncoordinated activation (i.e., only one branch of the ANS responds; Bernston et al., 2008; Quigley & Moore, 2018).

Yet, there is a lack of biopsychosocial research that considers the physiological aspects of adolescent prosocial development compared to other developmental periods (Hastings et al., 2023). Adolescence is a unique developmental period marked by rapid physiological, emotional, and social changes (Steinberg & Morris, 2001), which may uniquely influence how ANS

reactivity to emotions prompts prosocial responding compared to other life stages. Exploring these models during adolescence may provide insights into the strengths and resilience that enable most youths to navigate this developmental period (Miech et al., 2024).

**The Current Studies**

Guided by theories of positive youth development (Carlo & Padilla-Walker, 2020; Eisenberg et al., 2015), processes of emotion reactivity and regulation (Gross, 2016; Preston & de Waal, 2002), and biopsychosocial functioning (Hastings et al., 2023), the three studies herein investigate how adolescents' regulation of negative emotions and vicarious arousal are related to forms of emotional and behavioral prosociality. Paper 1 tests the influence of different emotion regulation strategies (e.g., cognitive reappraisal, rumination) on adolescents' ANS activity during experiences of emotion contagion as well as their prosocial responding. Paper 2 examines the extent to which PNS reactivity to two different emotions (e.g., disappointment and frustration) are associated with adolescents' prosocial emotions and behaviors. Furthermore, Paper 2 explores how youths' PNS reactivity may vary depending on whether these two emotions are processed internally (e.g., thinking) or externally (e.g., talking), and how this relates to their prosocial emotions and behaviors. Paper 3 investigates the direct effect of emotional distress on altruistic and egoistic forms of prosocial behavior during the COVID-19 pandemic. Additionally, Paper 3 assesses the direct and indirect effect of emotion regulation strategies (e.g., cognitive reappraisal and expressive suppression) on these associations within two samples.

The current studies aim to address several gaps within the emotion and positive developmental literatures to advance strength-based models of prosocial development. Each study builds upon theoretical frameworks and previous research findings to provide novel

insights into how emotion regulation processes facilitate greater propensities for prosocial emotions and behaviors.

# CHAPTER TWO

## PAPER 1: THE EFFECT OF EMOTION REGULATION ON AUTONOMIC FUNCTIONING AND ADOLESCENT PROSOCIAL RESPONDING

Adolescence is characterized by marked increases in sensitivity to emotional experiences and social interactions (Bailen et al., 2019; Schriber & Guyer, 2016; Steinberg & Morris, 2001). Prosociality, or the propensity to help others and act in socially beneficial ways, is a fundamental aspect of positive socioemotional development and proficiency in adolescence (Eisenberg et al., 2015). Prosociality manifests in various forms, ranging from emotional (e.g., empathy, sympathy) to behavioral experiences (e.g., comforting others, sharing personal resources with others; Hastings et al., 2007; Zahn-Waxler et al., 2018). During experiences of witnessing others in need or distress, effective regulation of personal distress responses supports capacities for greater prosocial responding (Preston & DeWaal, 2002). Certain strategies, such as cognitive reappraisal, have been found to effectively diminish personal distress responses and support greater prosocial outcomes (Lockwood et al., 2014; Powell, 2018).

Yet, the effects of other cognitive forms of emotion regulation strategies on prosocial responding has received less empirical investigation. Experimental comparisons involving rumination, characterized by persistent attention on the origins and experiences of emotional stimuli, may enhance our understanding of the attentional processes underpinning prosocial responding in social contexts. Moreover, insights from biopsychosocial perspectives may further highlight the underlying mechanisms of arousal regulation during these dynamic processes that lead to greater prosocial responding (Hastings et al., 2023). Therefore, the current study aims to address these gaps by examining the effects of cognitive reappraisal and rumination on autonomic nervous system (ANS) activity during experiences of empathy and adolescents' prosocial responding.

**Adolescent Prosociality**

Prosociality, which reflects dispositions to allocate attention and energy towards addressing the needs of others, is a hallmark of social proficiency during adolescence (Carlo & Padilla-Walker, 2020; Eisenberg et al., 2015). Greater prosociality has been associated with various aspects of adolescents' healthy and adaptive socioemotional development, including improved life satisfaction, well-being, and social bonds with others (Caprara et al., 2014; Carlo & Padilla-Walker, 2020; Eisenberg et al., 2015). Given the characteristic heightened sensitivity to social contexts (Schriber & Guyer, 2016; Steinberg & Morris, 2001) and complexity of social relationships during adolescence (Brizio et al., 2015), investigating the underlying mechanisms that foster positive social engagement responses is crucial to better understand how to promote healthy and adaptive developmental trajectories.

Within the developmental literature, prosociality is most commonly assessed through behaviors that reflect direct attempts to positively impact the well-being of others. While many studies have conceptualized and measured prosocial behaviors as a singular, global construct (Eisenberg et al., 2016; Wentzel et al., 2007), there has been increased attention given to the different forms of prosocial behaviors in which youths may engage (Carlo & Padilla-Walker, 2020; Hodge et al., 2023; Paulus, 2018). One predominant framework considers three dimensions of prosocial behaviors, including comforting others, sharing personal resources, and instrumental helping to improve another's situation (Paulus, 2018). The majority of studies drawing from this perspective have been assessed within early childhood (Drummond et al., 2014; Imuta et al., 2016). Consequently, evidence of how these different behavioral forms of prosociality manifest in adolescence is lacking. The present study aims to address this gap within

the developmental literature by employing two distinct assessments of adolescents' behavioral prosocial responding.

Although prosociality is most commonly modeled through these behavioral forms of responding, individuals may also allocate their attention and energy to the needs of others through more internal and emotional forms of responding. Witnessing another person in need or distress often prompts subjective responses within the observer (Batson, 2023; Preston & DeWaal, 2002). One clear example of this includes affective empathy, such that an individual vicariously experiences the emotions of those they are observing (Hastings et al., 2007; Zahn-Waxler et al., 2018). Similarly, experiences of sympathy reflect feelings of compassion and concern directed at another (Eisenberg et al., 2014; Zahn-Waxler et al., 2018). While these internal experiences of adolescents' prosocial responding have not been explored as much as prosocial behaviors, engagement in these forms of prosociality may be just as important for promoting positive socioemotional developmental trajectories in adolescence (Van der Graaff et al., 2018; Carlo et al., 2015). Therefore, this study aims to bridge the gap between behavioral and emotional forms of prosocial responding by directly assessing adolescents' affective empathy, sympathy, and behavioral prosocial responses.

**Emotion Regulation and Prosocial Responding**

Emotion regulation, which can be defined as the processes that change the occurrence, strength, and duration of emotional reactions (Gross, 2015), underlies abilities to diminish vicarious arousal to others' distress (Batson, 2023). During experiences of witnessing another person in need or distress, capacities to effectively regulate emotion contagion responses are widely considered essential for enabling an attentional shift from one's own state and toward focusing on others' needs (Preston & DeWaal, 2002). Conversely, one's inability to regulate

vicarious emotional arousal often elicits personal distress responses, leading to an overwhelming emotional state (Van Hulle et al., 2013). These personal distress responses hinder prosocial responding and have been found to elicit self-preservation responses or withdraw from the situation (Miller, 2018; Miller & Hastings, 2019).

Notably, witnessing others in need may elicit different emotional responses depending on the form of emotion regulation being used (Eisenberg, 2000). Research within the developmental and emotion literatures that has directly linked emotion regulation strategies with prosocial outcomes has predominantly focused on cognitive reappraisal and expressive suppression as regulatory strategies (Goldin et al., 2008; Hofmann et al., 2009; Lamm et al., 2007; Lockwood et al., 2014; McRae et al., 2011). These two strategies differ in that cognitive reappraisal targets emotion regulation through changes in cognitive responses (i.e., a reinterpretation of how one thinks about an emotional situation), whereas expressive suppression inhibits outward displays of emotional experiences (Gross, 2015). Greater cognitive reappraisal skills have been repeatedly shown to effectively diminish personal distress responses, and thereby predict greater prosocial outcomes (Hodge et al., 2023; Powell, 2018). Whereas, engaging in expressive suppression has been found to heighten personal distress responses (Goldin et al., 2008; Hofmann et al., 2009). Subsequently, cognitive reappraisal is regarded as an effective emotion regulation strategy, and thus more efficient at diminishing personal distress responses during experiences of empathic emotional arousal.

While prior work has supported cognitive reappraisal as a generally more adaptive strategy than expressive suppression, less attention has been given to comparisons of cognitive reappraisal with other potentially less adaptive cognitive strategies (Cohen et al., 2014; Garnefski & Kraaij, 2007; Thompson et al., 2019). Other cognitive strategies, such as rumination and

avoidance, differ from cognitive reappraisal in that they involve dwelling on distressing thoughts and emotions or actively avoiding them altogether, respectively (De Castella et al., 2018; Cohen et al., 2014). Investigating various cognitive strategies for emotion regulation may advance our understanding of how differences in attention allocation during regulation can facilitate prosocial responding. These distinctions are particularly relevant in processes that shift attentional focus from an individual's emotion contagion response to attending to another person's emotional state.

As an effective emotion regulation strategy, cognitive reappraisal not only adaptively manages personal emotions, but has also been found to foster empathic concern responses, which refer to other-oriented emotional responses that align with the perceived distress of another person (Lockwood et al., 2014; Noar et al., 2020; Powell, 2018; Thompson et al., 2019). In contrast, rumination, which is characterized by a persistent focus on the causes and consequences of emotional stimuli, is widely regarded as a less effective form of cognitive emotion regulation (Nolen-Hoeksema et al., 2008). Engaging in rumination has been shown to exacerbate personal distress and promote self-protective withdrawal responses, rather than positive socioaffiliative responses (da Silva et al., 2017; Eisenberg & Eggum, 2009; Kim & Han, 2018; Smith & Rose, 2011).

Given these dynamics, further empirical work is needed to clarify the distinct impacts of these two cognitive strategies of emotion regulation on adolescents' abilities to respond adaptively and positively to other's emotional states. To not only address these gaps in the literature, but also contribute to a more nuanced understanding of emotion regulation processes in social contexts, this present study aims to experimentally assess the effects of these two strategies on adolescents' prosocial responding.

**Emotion Regulation, Autonomic Regulation, and Prosociality**

Much of what is currently known regarding the associations between emotion regulation strategies and individuals' prosociality has been assessed at the trait-level (Lamm et al., 2007; Moreira et al., 2020; Powell, 2018; Smith & Rose, 2011). In other words, there is a well-established body of literature that demonstrates the extent to which an individual tends to be emotionally well-regulated influences their prosocial outcomes. Yet, the process of regulating emotions is also a dynamic process that occurs in states of experiencing emotions. This dynamic regulation of emotional states can be examined through assessments of psychophysiological functioning (Mendes, 2016). These physiological processes may enhance our understanding of the complex associations between emotion regulation and prosocial behaviors by revealing underlying processes that are not measurable at the behavioral or self-report domains. Indeed, a growing body of research on adolescents' physiological functioning during emotional reactivity and regulation has begun to elucidate the ways in which these underlying processes may promote adolescents' prosociality (Hastings et al., 2023; Miller, 2018).

While there are numerous psychophysiological systems involved in core regulatory processes, activity within the autonomic nervous system (ANS) is central to modulating arousal and stress responses (Mendes, 2016). Coordinated activity within two branches of the ANS, the parasympathetic (PNS) and sympathetic nervous system (SNS), have been used to index acute physiological responses to evocative stimuli. Activity of the PNS is often indexed through respiratory sinus arrhythmia (RSA), which reflects how the vagus nerve coordinates changes in heart rate in sync with breathing. Biopsychosocial perspectives of ANS regulation consider PNS activity responsible for the down-regulation and calming of arousal to maintain states of homeostasis (i.e., sustained growth and restoration). According to the polyvagal theory (Porges,

2007, 2011), it is this ability of the PNS to modulate arousal levels that renders it an essential system for appropriate social engagement and responding. Thus, within perceived safe or non-threatening contexts, greater abilities to diminish personal distress responses and maintain more calm states afford greater capacities to allocate one's attention and energy to positively socially engage with others (Miller, 2018; Porges, 2007, 2011).

The SNS functions, in part, to redistribute metabolic output to peripheral sites (e.g., skeletal muscles, skin, myocardium, brain) in contexts of perceived threat or challenge to produce physiological changes commonly referred to as "fight-or-flight" responses (i.e., excitatory arousal, approach and avoidance behaviors; Gibbons; 2019). SNS activity is often assessed through pre-ejection period (PEP), which refers to the amount of time between the onset of the heartbeat and ejection of blood into the aorta. Activation of the SNS leads to a shortening of the PEP, resulting in a faster heartbeat and heart rate (Gibbons, 2019). Thus, a shortening of PEP indicates greater SNS activity, whereas a lengthening of PEP indicates SNS withdrawal. Additionally, SNS activity has commonly been assessed through electrodermal activity (EDA), which reflect changes in the skins ability to conduct electricity, such that greater SNS activity elicits increased EDA (Mendes, 2016).

Prior work has demonstrated that cognitively reappraising emotions effectively decreases arousal in the ANS (Hofmann et al., 2009; Mauss et al., 2007; vanOyen Witvliet et al., 2010). Whereas, ruminating about emotions has been associated with increased ANS arousal (da Silva et al., 2017; Ottaviani et al., 2009). However, it is noteworthy that many findings in existing literature on cognitive reappraisal and rumination typically indicate a predetermined emotional valence to be achieved through regulation. For instance, to assess cognitive reappraisal, tasks have often provided instructions to participants that they should diminish their emotional

responses, or they should focus on the positive aspects of the emotional stimulus (e.g., considering potential benefits; thinking about a quick resolution; Denny & Ochsner, 2014; Goldin et al., 2008; Hofmann et al., 2009; Mauss et al., 2007; vanOyen Witvliet et al., 2010). On the other hand, rumination tasks often instruct participants to focus on negative aspects of emotional stimuli (e.g., focusing on negative events or thoughts; da Silva et al., 2017; Ottaviani et al., 2009; Smith & Rose, 2011; vanOyen Witvliet et al., 2010). Thus, to an extent, studies have confounded the type of cognitive regulation with the valence of their affective goal state. Yet, at their core, these two emotion regulation strategies do not suggest an intended outcome and either strategy could be used across any situation, whether of negative or positive valence. Thus, experimental designs should avoid including participant demand effects by identifying an intended subjective outcome with emotion regulation tasks.

Burgeoning research that has examined activity within both branches of the ANS, has demonstrated somewhat inconsistent findings for the ways in which PNS and SNS activity during emotion inductions are related to youths' prosociality (Miller, 2018). Among these recent studies, associations with prosociality have been found for PNS activity only (Coulombe et al., 2019; McQuade & Breaux, 2017), whereas others have identified links to SNS activity (Kalvin et al., 2016). Psychophysiological measures reflect abilities to modulate arousal levels, which have critical implications for subsequent emotional states and behavioral decisions (Porges, 2007, 2011).

Moreover, research examining the relationships between ANS activity and prosociality has not concurrently evaluated the diverse forms of prosocial experiences that youths may encounter. This oversight may restrict the capacity to comprehensively identify the role of the ANS in these processes. Different profiles of ANS functioning may be required to facilitate

youths' engagement with other-oriented attention and action (Miller, 2018). Additionally, the extant research exploring these associations has been conducted in samples of young children, and thus are lacking adolescent developmental perspectives. Adolescence as a developmental period features rapid physiological changes that align with the onset of puberty and gradual maturation of emotional cognitive abilities (Steinberg & Morris, 2001), that coincide with ever increasingly complex social contexts (Schriber & Guyer, 2016). These developmental phenomena suggest that adolescence may be an opportune time in the life course to assess the associations among these factors. Therefore, this study assessed the associations among ANS activity and affective empathy, sympathy, and prosocial behaviors as different dimensions of adolescent prosocial responding.

To our knowledge there are currently no experimental designs that directly test the effect of different emotion regulation strategies on the associations among ANS activity and prosocial responding. Therefore, to begin to address this gap in the literature, the present study aims to explore how adolescents' use of cognitive reappraisal or rumination during emotional contagion experiences alters patterns of ANS activity related to immediate prosocial responding.

**The Current Study**

To better understand the direct effects of emotion regulation on adolescents' psychophysiological functioning and prosocial responding, we examined how engaging in cognitive reappraisal or rumination influenced ANS activity (e.g., RSA, PEP, SCR) while watching a film depicting sadness and loss, as well as youths' responses of affective empathy, sympathy, altruistic helping behaviors, and altruistic donation behaviors. This study is explicitly designed to bridge gaps within the positive development literature, by extending existing models of how the regulation of emotion contagion promotes youths' prosociality across several

dimensions of emotional and behavioral responding within adolescence. The findings from this study are also intended to extend existing emotion psychophysiological theoretical frameworks by identifying how youths' engagement in different emotion regulation strategies promotes more healthy and adaptive biopsychosocial functioning and socioaffiliative responding. Furthermore, by experimentally examining the effects of a more effective emotion regulation strategy (e.g., cognitive reappraisal) with a less effective regulation strategy (e.g., rumination), findings from this study may better distinguish which patterns of ANS activity foster prosocial responding.

We tested several hypotheses in the present study. First, we predicted that H1a) youths engaging in cognitive reappraisal would respond most prosocially, whereas H1b) youths engaging in rumination would respond least prosocially. Youths' engagement in these two emotion regulation strategies were also expected to affect ANS activity during their experiences of emotion induction. Specifically, we predicted that H2a) youths engaging in cognitive reappraisal would evince greater PNS activity and less SNS activity while watching the sad film scene, whereas H2b) youths engaging in rumination would evince less PNS activity and greater SNS activity. *A priori* hypotheses were not put forward for the effects of cognitive reappraisal and rumination on the relations among ANS activity and youths' prosocial responding, as this is the first study we are aware of to explore these associations.

## Method

### Participants

Participants in this study included 120 adolescents ($M_{age}$ = 13.18 years, $SD$ = 1.46) recruited from Northern California. The sample consisted of 50.8% females and 49.2% males based on sex assigned at birth; 43.4% of participants identified as girls, 49.2% as boys, and 3.3% as non-binary or genderqueer (3 participants declined to report their gender). There were 74

participants who identified as White, 17 who identified as Asian, 1 who identified as Black, 1 who identified as Native American, and 23 participants who identified as biracial or multiracial; 1 participant did not report their race. In addition, 21.7% of the sample identified as Hispanic or Latinx ethnicity. Within the sample, 15.8% of the participants lived in households with an annual income between $35,000 and $74,999, 31.7% of participants lived in households with income between $75,000 and $149,000, and 52.5% lived in households with annual income above $150,000. Exclusionary criteria included hypertension, having a pacemaker, taking cardiac medications, or being pregnant.

**Procedure**

All procedures were approved by the Institutional Review Board of the researchers' university. Participants were recruited through various methods including online parent and family groups (e.g., Facebook), and community events (e.g., farmers' markets), and posting of advertisements in public spaces (e.g., cafes, parks, community centers). For all participants, the experimental procedure was conducted in 1-hour home visits. Upon the experimenter's arrival, informed consent was obtained from the participant's parent or guardian, and informed assent was obtained from the participant. Adhesive electrodes and an ambulatory monitor were then attached to the participant for the collection of autonomic physiology data. Participants responded to questionnaires for around 10 minutes to acclimate to having electrodes attached. A baseline measure of autonomic activity was then recorded while participants watched a neutral film scene for 3 minutes. Participants then watched an emotion film scene for 2.5 minutes; data collected during this first film task were not pertinent to the hypotheses being tested in the current manuscript and are not reported herein. To minimize potential carry-over effects of

physiological response to the first emotion induction, participants then watched an instructional video for 3 minutes describing a game that they were informed they would play later in the visit.

Participants were then randomly assigned to one of three emotion regulation conditions: cognitive reappraisal ($N = 40$), rumination ($N = 41$), control ($N = 39$). Participants were instructed to engage in their assigned emotion regulation strategy during the following film scene, described in a following section. After watching this 2.5-minute emotion induction video, participants rated their subjective emotional experiences while watching the film. As described below, participants then played a costly sharing game, followed by an altruistic donation task. Then, participants completed additional questionnaires. Participants were then debriefed on the experimental procedures and compensated monetarily for their participation.

**Measures**

***Emotion Regulation Experimental Manipulation***

To measure the effects of different emotion regulation strategies on ANS activity and prosocial responding, participants were randomly assigned to one of three groups, and were instructed to engage in this emotion regulation strategy while watching an emotion film scene. Participants randomly assigned to the control condition were provided the following instructions, "*Please watch the following film clip carefully. Do you have any questions?*"

Participants randomly assigned to the *cognitive reappraisal* condition were provided the following instructions, "*For the next video, imagine that you are in the main character's situation. Pay close attention to how this makes you feel. Everyone tries to manage their emotions on some occasions. One way we can regulate our emotions is by changing the way we think about the situation we are experiencing. While you watch the next video, try to manage*

*your emotions by* ***changing the way you are thinking about the character's situation****. Do you have any questions?*"

Participants randomly assigned to the rumination condition were provided the following instructions, "*For the next video, imagine that you are in the main character's situation. Pay close attention to how this makes you feel. Everyone tries to manage their emotions on some occasions. One way we can regulate our emotions is by thinking about the emotions we are experiencing. While you watch the next video, try to manage your emotions by* ***reminding yourself how this situation makes you feel and by thinking about why you are feeling this way****. Do you have any questions?*"

To allow for a more ecologically valid examination of emotion regulation strategies, the instructions we used in this study intentionally did not indicate a targeted affective valence to achieve through regulation. By not specifying a desired emotional outcome, we aimed to observe how participants naturally interpret and respond to any emotion induction without imposing a preconceived notion of what emotions they should feel or regulate toward.

***Emotion Induction Materials***

Two emotion induction film scenes (2.5 minutes) were used from age-appropriate feature films: *The Champ* and *My Girl*. Both film scenes depicted children mourning the death of a loved one. These two scenes were selected for their similarity in content and because they were previously identified by a pilot study to produce the strongest ratings of induced emotions from a larger set of age-appropriate film scenes. Early in the visit, participants first watched one of these film scenes without receiving instructions on how to respond. Then participants watched the second film scene after the experimental manipulation. Only participants' responses to this second film presentation were used in this study. The order of video presentation was counterbalanced to

reduce order effects. Moreover, video presentation order was included as a covariate in the current analyses to account for any residual differences in the two scenes' effects.

***Affective Empathy and Sympathy***

Following the emotion induction, participants were asked to rate on a 5-point Likert scale (1 = *Not at all*, 3 = *Some*, 5 = *Extremely*) the degree to which they experienced 15 different emotions during the film clip. The emotion terms were presented in a random order across participants. Given that sadness was the primary emotion depicted in the emotion induction film scenes, we aggregated ratings of participants' reports of feeling sad, down, and gloomy as a measure of affective empathy ($\alpha = .88$). To measure sympathy, we aggregated participants' reports of feeling sympathy and compassion ($\alpha = .67$).

***Autonomic Nervous System Activity***

ANS activity was concurrently assessed using a MindWare ambulatory monitor, capable of simultaneous recording of electrocardiography (ECG), impedance cardiography (ICG) and electrodermal activity (EDA). To measure ECG, three electrodes were attached to the participant's chest and abdomen with a 7% chloride wet gel. To measure ICG, two electrodes with a 7% chloride wet gel were attached to the ventral (chest) side of the child's torso, and two were attached to the dorsal (back) side. To measure EDA, two electrodes were placed bilaterally on the palmar surface of participants' non-dominant hand with leads taped across the wrist. Baseline ANS activity was first collected while participants sat still and watched a neutral film scene for 3 minutes. To assess for ANS activity during the experimental manipulation, participants watched a 2.5-minute film clip intending to elicit emotion contagion. All measures of ANS activity were inspected and cleaned for artifacts by at least two trained researchers, such

that any segments that did not have a .9 correlation of reliability between researchers was reviewed and edited collectively by the research team.

**Respiratory Sinus Arrhythmia.** Parasympathetic nervous system (PNS) activity was assessed through respiratory sinus arrhythmia (RSA). RSA was recorded in 30-second epochs that contained both a) at least 15 seconds of clean, continuous data, and b) less than 10% of R-peak estimation (e.g., using the mid-beat function) during data editing. From these 30 second epochs, RSA was then averaged within each task to assess baseline activity and activity during the experimental manipulation. RSA data was not missing for any participants.

**Pre-ejection Period.** Pre-ejection period (PEP) was used as a marker of sympathetic nervous system (SNS) activity, wherein shorter PEP reflects greater SNS modulation of cardiac activity. Mindware IMP software was used to clean raw ECG and ICG data and compute PEP. The impedance signal was used to derive d$Z$/d$t$, the first derivative of the change in thoracic impedance. PEP was defined as the duration in milliseconds between the Q-wave of the ECG signal and the B-notch of the d$Z$/d$t$ signal. After cleaning data within segments, trained researchers located the B-Notch as 2 milliseconds after the inflection point in the ensemble averages for each epoch. When the B-notch was not visibly identifiable ($N$ = 12), the average B-notch range for the participants' activity within the task was calculated. Researchers then assessed the ensemble averages for the point of least change within a 6-millisecond range above and below the average range for the task. Two participants were missing PEP data for one or more tasks due to technical malfunction or having less than 30 seconds of clean data available.

**Electrodermal Activity.** Skin conductance responses (SCR) was used as an additional marker of SNS activity. EDA responses were indexed by skin conductance responses (SCR) during the baseline and the experimental manipulation task. A SCR was defined as sudden

changes in signal amplitude exceeding 0.05 μS. Four participants were missing SCR data for one or more tasks due to impedance cardiogram technical malfunction.

***Altruistic Helping Behavior***

A modified version of the Zurich Prosocial Game (ZPG) was used to assess youths' prosociality through altruistic helping (Leiberg et al., 2011). Within a virtual game setting, participants were tasked with navigating their virtual character through a maze, the paths of which could get blocked by gates, and acquiring treasure in a limited amount of time. Participants were told that they would earn an extra $0.50 for every treasure chest successfully obtained. Participants were informed there would be a total of 10 rounds of the games, which would offer them the opportunity to earn an extra $5 by the end of the experiment. Additionally, participants were told they would be playing the game online with another player (computer confederate).

Earlier in the visit, participants watched a short video describing the rules and conditions of the game. Participants also played one trial round to familiarize themselves with the game mechanics before starting the trial rounds. During each trial, participants were able see how many gates were still going to fall in the round, how many and which colors of keys both players possess, as well as how much time was left in the round.

During the game, both players move their virtual character through the maze, while red and blue gates fall on the paths that can block the participant and the co-player. Each of the two players is equipped with red and blue keys with which they can open the corresponding gates. The confederate co-player was programmed to run out of all keys of a certain color for each round. Participants were able to share one of their own keys with the co-player to open their gate. Although, to reduce demand effects, participants were never told that the purpose of the game

was to help the co-player. Moreover, the two players did not share the same paths in the maze and did not compete for the same treasure, thereby allowing participants to play the game while completely ignoring the co-player. Participants were not able to delay their decisions to help as both players lose the round after 5 seconds of inactivity at one of the gates. Unbeknownst to the participants, sufficient keys were always provided to unlock their own gates. Altruistic prosocial helping was operationalized as the number of times a participant provided a key to the other player.

***Altruistic Donation***

Following completion the ZPG, participants were shown a screen with the following text, "*Congratulations! You did great in that game! We are going to award you the full $5. If you want, you can take the full $5 or you can share any portion of it that you would like with a fundraiser that we are contributing to at St. Jude's Children's Hospital. If you would like to donate, we will deduct that amount from the extra $5 that you are being awarded for your participation in the game at the end of the visit.*" Participants were presented with six options for donation amounts, ranging from $0 to $5. To minimize demand effects a few steps were taken to make participants' decisions as anonymous as possible. First, the donation task was completed on the participants' laptop and out of view of the experimenter. Second, at the end of the game, the experimenter began engaging in other tasks, visibly shifting their attention from the participant. Participants' altruistic donation behavior was operationalized by the amount of dollars they decided to donate.

**Analytic Approach**

A Missing Values Analysis using Little's Missing Completely at Random (MCAR) test demonstrated that data were missing completely at random, $\chi^2_{(74)} = 89.17$, $p = .110$. Seven

outliers (+/- 3 *SD* from the mean) were identified for baseline and task activity for measures of PEP and SCR and winsorized prior to analysis.

A between-subjects Multivariate Analysis of Variance (MANOVA) was conducted to assess the effect of the emotion regulation manipulation on youths' prosocial responding. Participants' age, sex, and video presentation order were included as covariates in this analysis.

Three between-subjects Analyses of Variance (ANOVA) were then conducted to test the effect of the emotion regulation manipulation on measures of ANS activity (e.g., RSA, PEP, EDA) during the emotion induction. Participants' age and sex, as well as video presentation order and baseline activity were included as covariates in these analyses.

Three path analyses were then conducted to explore the extent to which RSA, PEP, and SCR activity during the emotion induction were associated with youths' prosocial responding. Age, sex, video order presentation, and baseline activity were included as covariates in these models. Additionally, participants' experience playing video games was included as a covariate for altruistic helping in the costly sharing game. Household income was also included as a covariate for prosocial responses of altruistic helping and donation behaviors, which had monetary implications. Path analyses were conducted in Mplus 8.8 using maximum likelihood with robust standard errors (MLR). Model fit was considered good if the comparative fit index (CFI) was greater than or equal to .95 (.90 for adequate fit), the root mean square error of approximation (RMSEA) was less than or equal to .06 (.08 for adequate fit), and the standardized root mean square residual (SRMR) was less than or equal to .08 (.10 for adequate fit).

Last, multiple-group analyses were then conducted for each path analysis to explore the extent to which the emotion regulation manipulation influenced the associations among ANS activity and youths' prosocial responding. A fully constrained model was compared to a model of

freely estimated pathways for the associations among ANS activity during the task and prosocial responses. Group differences were examined if model fit significantly improved upon releasing pathway constraints.

## Results

### Preliminary Analyses

Table 1.1 presents the means, standard deviations, and zero-order correlations among target variables and demographic characteristics. Youths responding with more affective empathy also responded with more sympathy. Similarly, youths' altruistic helping behaviors were positively associated with altruistic donations. Neither affective empathy nor sympathy was significantly correlated with the two prosocial behaviors. Baseline RSA was positively associated with RSA during emotion film. Baseline PEP was positively associated with PEP and negatively associated with SCR activity during emotion film. Baseline SCR activity was positively associated with SCR activity during emotion film. There were no significant correlations between the four prosocial measures and the six physiology measures. Older youths displayed longer PEP at baseline and during the emotion induction, and fewer SCR during emotion film, reflecting less SNS activity. Females displayed shorter PEP at baseline and during the emotion film, and donated more than boys. Last, participants with greater household income donated more.

### Effect of Emotion Regulation on Prosocial Responding

Contrary to Hypothesis 1, there were no multivariate effects for emotion regulation strategy on participants' prosocial responding, Wilk's $\Lambda = .90$, $F$ (2, 119) = 1.59, $p$ =.128 (Table 1.2). As reflected by the values in Table 1.3, youths in the three emotion regulation conditions evinced comparable levels of affective empathy, sympathy, helping and sharing.

**Table 1.1.**
Descriptive Statistics and Intercorrelations Among Demographics, RSA Change, and Prosocial Responding

| | *M* | *SD* | Sex | Age | Inc | BL RSA | BL PEP | BL SCR | RSA Exp | PEP Exp | SCR Exp | Aff Emp | Sym | Help |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | 13.18 | 1.46 | -.09 | | | | | | | | | | | |
| Inc | 7.51 | 1.54 | .05 | .05 | | | | | | | | | | |
| BL RSA | 6.67 | 1.01 | .10 | -.11 | .00 | | | | | | | | | |
| BL PEP | 92.17 | 12.48 | **-.19*** | **.19*** | -.05 | -.03 | | | | | | | | |
| BL SCR | 3.58 | 1.82 | -.09 | -.12 | -.10 | -.09 | -.12 | | | | | | | |
| RSA Exp | 6.53 | 1.01 | -.04 | -.11 | -.09 | **.22*** | .17 | -.13 | | | | | | |
| PEP Exp | 91.94 | 14.03 | **-.21*** | **.25**** | -.08 | -.03 | **.91***** | -.05 | .17 | | | | | |
| SCR Exp | 3.94 | 2.04 | .03 | **-.23*** | -.08 | -.08 | **-.26**** | **.59***** | -.15 | **-.23*** | | | | |
| Aff Emp | 2.91 | 1.38 | .08 | -.11 | .07 | -.05 | -.06 | .02 | -.05 | -.04 | .12 | | | |
| Sym | 2.99 | 1.16 | .11 | .01 | .17 | -.02 | -.05 | .12 | -.12 | -.02 | .17 | **.60***** | | |
| Help | 4.93 | 3.65 | .05 | .03 | .17 | -.15 | .09 | .04 | -.02 | .07 | .08 | .01 | .14 | |
| Donation | 3.54 | 2.00 | **-.20*** | .08 | **.19*** | -.17 | -.05 | .02 | .04 | -.07 | -.02 | .15 | .14 | **.23**** |

*Note.* Sex, 0 = female and 1 = male; Abbreviations: Inc, Income; BL, baseline; Exp, emotional film clip; RSA, respiratory sinus arrhythmia; PEP, pre-ejection period; SCR, skin conductance responses; Aff Emp, affective empathy; Sym, Sympathy; Help, prosocial helping; Donation, prosocial donation.
*$p < .05$, **$p < .01$, ***$p < .001$

**Table 1.2.**
Results of between-subjects MANOVA assessing the effect of the emotion regulation condition on adolescents' prosocial responding, while controlling for participant age and sex

| | *Λ* | *F* | *p* |
|---|---|---|---|
| Age | .97 | .86 | .489 |
| Sex | .93 | 2.02 | .096 |
| Experimental Condition | .90 | 1.59 | .128 |

*Note. Λ = Wilk's lambda.*

**Table 1.3**
Descriptive statistics for dimensions of prosocial responding within each condition group

| | Affective Empathy | | Sympathy | | Altruistic Helping | | Altruistic Donation | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Control | 2.67 | 1.24 | 2.74 | 1.22 | 5.49 | 3.58 | 3.03 | 1.86 |
| Cognitive Reappraisal | 3.16 | 1.16 | 3.13 | 1.16 | 4.25 | 3.74 | 3.68 | 2.03 |
| Rumination | 2.89 | 1.06 | 3.09 | 1.09 | 5.05 | 3.63 | 3.90 | 2.06 |

**Effect of Emotion Regulation on ANS Activity**

Three between-subjects ANOVA analyses were conducted to examine the effect of the experimental conditions on RSA, PEP, and SCR activity, while controlling for participant age, sex, stimulus video presentation order, and baseline activity (Table 1.4). Contrary to Hypothesis 2, the analysis revealed no significant differences in RSA activity between the experimental conditions, $F(2, 119) = .72$, $p = 487$. Baseline RSA was found to significantly predict RSA activity during the emotion video, such that higher baseline RSA was correlated with higher task RSA ($r = .22$, $p < .05$). As reflected by the values in Table 1.5, youths in the three emotion regulation conditions evinced comparable RSA activity.

**Table 1.4.**
Results of between-subjects ANOVA assessing the effect of the emotion regulation condition on adolescents' RSA activity, while controlling for participant age, sex, video order, and baseline activity

| | *df* | *F* | *p* |
|---|---|---|---|
| Age | 1 | 1.42 | .236 |
| Sex | 1 | .82 | .367 |
| Video Order | 1 | 1.10 | .296 |
| Baseline RSA | 1 | 5.09 | .026 |
| Experimental Condition | 2 | .72 | .487 |

*Note*. $N = 120$.

**Table 1.5**
Descriptive statistics for ANS activity within each condition group

| | RSA | | PEP | | SCR | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Control | 6.59 | .88 | 95.55 | 11.98 | 3.72 | 1.60 |
| Cognitive Reappraisal | 6.63 | 1.06 | 89.58 | 13.19 | 4.41 | 2.11 |
| Rumination | 6.38 | 1.09 | 90.81 | 16.13 | 3.71 | 2.30 |

Contrary to Hypothesis 2, the ANOVA analysis revealed no significant differences in PEP activity between the experimental conditions, $F(2, 119) = .43$, $p = 654$. As seen in Table 1.6, baseline PEP was found to significantly predict PEP activity during the emotion induction video, such that longer baseline PEP was correlated with longer task PEP ($r = .91$, $p < .001$). Age was also found to significantly predict task PEP, such that older participants displayed longer PEP ($r = .25$, $p < .001$).

**Table 1.6**
Results of between-subjects ANOVA assessing the effect of the emotion regulation condition on adolescents' PEP activity, while controlling for participant age, sex, video order, and baseline activity

| | *df* | *F* | *p* |
|---|---|---|---|
| Age | 1 | 4.34 | .039 |
| Sex | 1 | 1.14 | .288 |
| Video Order | 1 | .67 | .416 |
| Baseline PEP | 1 | 517.03 | .001 |
| Experimental Condition | 2 | .43 | .654 |

*Note.* $N = 120$.

Contrary to Hypothesis 2, the ANOVA analysis revealed no significant differences in SCR activity between the experimental conditions, $F(2, 114) = .79$, $p = 455$. As seen in Table 1.7, baseline SCR was found to significantly predict SCR activity during the emotion induction, such that participants with more baseline SCR displayed more SCR during the film ($r = .59$, $p < .001$).

**Table 1.7**
Results of between-subjects ANOVA assessing the effect of the emotion regulation condition on adolescents' SCR activity, while controlling for participant age, sex, video order, and baseline activity

| | *df* | *F* | *p* |
|---|---|---|---|
| Age | 1 | 3.40 | .068 |
| Sex | 1 | 1.93 | .168 |
| Video Order | 1 | 4.08 | .046 |
| Baseline SCR | 1 | 58.34 | .001 |
| Experimental Condition | 2 | .79 | .455 |

*Note.* $N = 120$.

**ANS Activity during Emotion Regulation Predicting Prosocial Responding**

***RSA Predicting Prosocial Responding***

Table 1.8 presents the model testing the associations between youths' RSA during the emotion film and their prosocial responding. The model demonstrated good fit, $\chi^2$ (21) = 26.24, $p = .198$, CFI = .96, RMSEA = .08 (.00 - .16), $p = .300$, SRMR = .06. RSA during the emotion film was not significantly associated with any prosocial outcomes.

***PEP Predicting Prosocial Responding***

Table 1.9 presents the model testing the associations between youths' PEP during the emotion film and their prosocial responding. The model demonstrated good fit, $\chi^2$ (21) = 25.57, $p = .224$, CFI = .99, RMSEA = .07 (.00 - .16), $p = .331$, SRMR = .05. Adolescents who evinced longer PEP during the emotion film, indicative of less SNS activity, rated themselves as feeling more affective empathy and sympathy.

**Table 1.8**
Direct Effects of RSA activity on Adolescent's Prosocial Responding

| | RSA Exp | | | Affective Empathy | | | Sympathy | | | Altruistic Helping | | | Altruistic Donation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* |
| Age | .00 | .09 | .998 | -.12 | .09 | .196 | .01 | .09 | .885 | .01 | .09 | .911 | .03 | .09 | .703 |
| Sex | -.01 | .09 | .889 | .06 | .09 | .627 | .10 | .09 | .276 | -.05 | .10 | .593 | **-.20** | **.09** | **.022** |
| Order | -.02 | .09 | .807 | -.12 | .09 | .171 | -.08 | .09 | .385 | | | | | | |
| BL RSA | **.22** | **.09** | **.012** | -.08 | .09 | .390 | -.03 | .09 | .790 | -.13 | .09 | .142 | **-.18** | **.09** | **.040** |
| Income | - | - | - | - | - | - | - | - | - | .13 | .09 | .138 | **.20** | **.09** | **.018** |
| Game | - | - | - | - | - | - | - | - | - | **.23** | **.09** | **.011** | - | - | - |
| RSA Exp | - | - | - | .03 | .09 | .736 | -.04 | .09 | .701 | -.03 | .09 | .780 | .16 | .087 | .064 |

*Note*. Significant effects are in bold. For sex, 0 = female, 1 = male. Abbreviations: Order, video presentation order; Video, experience playing video games; BL RSA, baseline RSA activity; RSA Exp, RSA activity during emotion contagion video.

**Table 1.9**
Direct Effects of PEP activity on Adolescent's Prosocial Responding

| | PEP Exp | | | Affective Empathy | | | Sympathy | | | Altruistic Helping | | | Altruistic Donation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* |
| Age | .08 | .04 | .055 | -.15 | .09 | .119 | -.02 | .08 | .791 | .01 | .09 | .941 | .08 | .09 | .394 |
| Sex | -.04 | .03 | .211 | .07 | .10 | .475 | .12 | .09 | .213 | -.05 | .10 | .583 | **-.23** | **.90** | **.010** |
| Order | -.03 | .03 | .412 | -.11 | .09 | .218 | -.07 | .09 | .461 | -.07 | .09 | .461 | -.04 | .09 | .623 |
| BL PEP | **.90** | **.04** | **.001** | **-.42** | **.19** | **.029** | -.43 | .24 | .069 | .12 | .15 | .435 | .11 | .18 | .535 |
| Income | - | - | - | - | - | - | - | - | - | .14 | .09 | .118 | .16 | .09 | .056 |
| Game | - | - | - | - | - | - | - | - | - | **.26** | **.08** | **.002** | - | - | - |
| PEP Exp | - | - | - | **.46** | **.19** | **.017** | **.47** | **.24** | **.048** | .00 | .16 | .989 | -.22 | .20 | .259 |

*Note*. Significant effects are in bold. For sex, 0 = female, 1 = male. Abbreviations: Order, video presentation order; Game, experience playing video games; BL PEP, baseline PEP activity; PEP Exp, PEP activity during emotion contagion video.

### *SCR Predicting Prosocial Responding*

Table 1.10 presents the model testing the associations between youths' SCR during the emotion film and their prosocial responding. The model demonstrated good fit, $\chi^2$ (21) = 24.22, $p$ = .959, CFI = .98, RMSEA = .06 (.00 - .16), $p$ = .394, SRMR = .05. SCR during the emotion film was not significantly associated with any prosocial outcomes.

## Effect of Emotion Regulation on ANS Activity and Prosocial Responding

Table 1.11 presents the multi-group analyses for differences of emotion regulation condition on the associations among ANS activity and adolescents' prosocial responding. As indexed by Chi Square Difference Tests, model fit significantly improved for all three models when removing constraints on pathways for ANS activity on prosocial responding.

As seen in Table 1.12, participants in the control group who evinced higher RSA and longer PEP during the emotion film responded to the film by reporting more affective empathy. Moreover, control group participants with longer PEP and fewer SCR responded with more sympathy. For participants engaging in cognitive reappraisal, lower RSA and more SCR during the emotion film were associated with higher ratings of affective empathy. Additionally, longer PEP, more SCR, and lower RSA were associated with feeling more sympathy. In the associations with the behavioral measures, youths in the reappraisal group who had shorter PEP during the emotion film engaged in more altruistic helping and made larger altruistic donations. Finally, for youths in the rumination group, longer PEP during the emotion film was associated with more affective empathy, whereas more SCR was associated with more sympathy.

**Table 1.10**

Direct Effects of SCR activity on Adolescent's Prosocial Responding

| | SCR Exp | | | Affective Empathy | | | Sympathy | | | Altruistic Helping | | | Altruistic Donation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* |
| Age | -.12 | .07 | .097 | -.10 | .10 | .325 | .03 | .09 | .734 | .09 | .09 | .292 | .02 | .09 | .825 |
| Sex | .13 | .07 | .091 | .02 | .10 | .807 | .13 | .09 | .173 | -.05 | .10 | .619 | **-.19** | **.09** | **.045** |
| Order | **.17** | **.07** | **.016** | -.17 | .09 | .078 | -.09 | .09 | .345 | -.11 | .09 | .260 | -.03 | .10 | .759 |
| BL SCR | **.62** | **.07** | **.001** | -.08 | .11 | .435 | .03 | .11 | .817 | -.01 | .12 | .946 | .07 | .14 | .594 |
| Income | - | - | - | - | - | - | - | - | - | .12 | .09 | .186 | **.22** | **.09** | **.013** |
| Video | - | - | - | - | - | - | - | - | - | **.26** | **.09** | **.004** | - | - | - |
| SCR Exp | - | - | - | .14 | .11 | .194 | .16 | .12 | .189 | .08 | .13 | .550 | -.07 | .13 | .585 |

*Note*. Significant effects are in bold. For sex, 0 = female, 1 = male. Abbreviations: Order, video presentation order; Game, experience playing video games; BL SCR, baseline SCR activity; SCR Exp, SCR activity during emotion induction

**Table 1.11**

Multiple-group analyses for emotion regulation condition on the associations among ANS activity and prosocial responding

| | RSA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | *df* | Scaling | CFI | SRMR | RMSEA | $\Delta\chi^2$ | $\Delta df$ | *p* |
| Fully Constrained Model | 156.095 | 93 | .9448 | .53 | .15 | .13 | - | - | - |
| Unconstrained Pathways of Interest | 137.160 | 85 | .9709 | .61 | .14 | .12 | 21.44 | 8 | .006 |
| | PEP | | | | | | | | |
| | $\chi^2$ | *df* | Scaling | CFI | SRMR | RMSEA | $\Delta\chi^2$ | $\Delta df$ | *p* |
| Fully Constrained Model | 162.051 | 93 | .9124 | .82 | .14 | .14 | - | - | - |
| Unconstrained Pathways of Interest | 145.551 | 85 | .9285 | .84 | .12 | .13 | 17.15 | 8 | .029 |
| | SCR | | | | | | | | |
| | $\chi^2$ | *df* | Scaling | CFI | SRMR | RMSEA | $\Delta\chi^2$ | $\Delta df$ | *p* |
| Fully Constrained Model | 173.323 | 93 | .9631 | .56 | .16 | .15 | - | - | - |
| Unconstrained Pathways of Interest | 155.264 | 85 | .9668 | .62 | .15 | .15 | 18.21 | 8 | .020 |

*Note*. $N = 120$. Scaling factor used to interpret MLR estimator results.

**Table 1.12**
Group Differences for effects of emotion regulation on ANS activity and prosocial responding

| | Affective Empathy | | | Sympathy | | | Altruistic Helping | | | Altruistic Donation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RSA | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* | *β* | *SE* | *p* |
| Control | **.24** | **.11** | **.031** | .14 | .11 | .213 | -.20 | .12 | .083 | .05 | .14 | .688 |
| CR | **-.36** | **.14** | **.009** | **-.39** | **.12** | **.002** | -.11 | .14 | .418 | -.04 | .15 | .778 |
| RUM | .06 | .15 | .693 | .05 | .16 | .778 | .17 | .16 | .292 | .27 | .15 | .068 |
| PEP | | | | | | | | | | | | |
| Control | **.66** | **.23** | **.005** | **.69** | **.23** | **.003** | -.12 | .21 | .555 | -.11 | .23 | .642 |
| CR | .45 | .25 | .067 | **.69** | **.23** | **.002** | **-.42** | **.20** | **.040** | **-.46** | **.23** | **.048** |
| RUM | **.45** | **.20** | **.020** | .38 | .24 | .106 | -.22 | .20 | .281 | -.29 | .20 | .153 |
| SCR | | | | | | | | | | | | |
| Control | -.24 | .15 | .110 | **-.40** | **.15** | **.007** | .11 | .16 | .494 | -.12 | .17 | .497 |
| CR | **.26** | **.15** | **.017** | **.36** | **.15** | **.017** | .05 | .16 | .772 | -.15 | .16 | .376 |
| RUM | .19 | .11 | .079 | **.24** | **.11** | **.034** | -.09 | .22 | .661 | -.14 | .19 | .474 |

*Note*. Significant effects are in bold. Control, control condition group; CR, cognitive reappraisal condition group; RUM, rumination condition group

## Discussion

Understanding the influence of emotion regulation strategies on ANS functioning and prosocial responding is important for developing strength-based models of positive socioemotional developmental trajectories in adolescence. While burgeoning research has increasingly identified the role of the ANS in regulating experiences of emotion contagion, findings remain inconsistent in demonstrating how patterns of ANS support prosocial responding (Hastings et al., 2023; Miller, 2018). The current study aimed to address these gaps and extend the existing biopsychosocial literatures of emotion regulation by assessing ANS activity through multiple indices during active engagement in cognitive reappraisal and rumination. Furthermore, in an attempt to better understand adolescents' nuanced social engagement processes, this study examined positive socioemotional responding across four dimensions of prosocial emotional and behavioral facets.

In line with previous research, we hypothesized that engaging in cognitive reappraisal, as a more effective emotion regulation strategy in reducing vicarious emotional arousal, would elicit greater PNS and less SNS activity (Hofmann et al., 2009; Mauss et al., 2007; vanOyen Witvliet et al., 2010). In contrast, ruminating during the emotion induction was expected to elicit less PNS and greater SNS, as it has been suggested as an inefficient strategy to reduce personal distress and arousal (da Silva et al., 2017; Ottaviani et al., 2009). Subsequently, we also expected youth engaging in cognitive reappraisal to respond the most prosocially, whereas youths engaging in rumination would respond the least prosocially. However, contrary to these hypotheses, we found that youths' engagement in these emotion regulation strategies during the emotion induction did not differ in their ANS activity or their prosocial responding.

These null findings challenge the prevailing assumption that certain emotion regulation strategies inherently promote prosocial responding in adolescents. There is a substantial body of research that demonstrates cognitive reappraisal as an effective strategy to reduce personal distress responses and facilitate greater other-oriented social engagement (Lockwood et al., 2014; Noar et al., 2020; Powell, 2018; Thompson et al., 2019), yet less attention has been given to the links with rumination. Rather, cognitive reappraisal is often compared to engagement in expressive suppression as a maladaptive strategy (Goldin et al., 2008; Hofmann et al., 2009; Lamm et al., 2007; Lockwood et al., 2014; McRae et al., 2011). While engagement in rumination and expressive suppression have both been shown to be associated with greater personal distress and negative emotional states (da Silva et al., 2017; Eisenberg & Eggum, 2009; Goldin et al., 2008; Hofmann et al., 2009; Kim & Han, 2018; Smith & Rose, 2011), these two emotion regulation strategies differ in the way individuals engage in these processes. As an emotion regulation strategy, expressive suppression requires the diminishing of behavioral or outward

indicators of one's personal emotional states in social contexts (Gross, 2015). Consequently, this manner in which expressive suppression manifests may have implications on propensities to then extend one's attention and energy outward toward others' situations. Within these social contexts that elicit experiences of emotion contagion, suppressing one's emotions reflects a withdrawal and self-preservation response, which may hinder youths' abilities to respond in ways that require them to focus their attention and energy for another person's situation.

On the other hand, as a cognitive form of emotion regulation, the process of regulating emotions through rumination may more closely align with that of cognitive reappraisal. Engaging in rumination involves repeatedly recognizing one's emotional states as well as the events that led up to these states (Nolen-Hoeksema et al., 2008). Depending on how an individual is interpreting the situation and their emotional states, engaging in rumination may not necessarily diminish one's abilities to orient to others' needs. Within the current study's experimental manipulation, we intentionally did not identify a targeted valence of emotions (e.g., positive or negative) for participants to try to achieve. In doing so, participants may have interpreted the emotion induction in a variety of ways, which would potentially elicit differential prosocial responding within each emotion regulation condition. For instance, for some individuals, thinking about the other person's situation differently (e.g., cognitive reappraisal) may have led to them thinking of justifications that reduce the severity of the situation, and thus, limit their propensities to respond prosocially. Similarly, ruminating about one's emotions may have led to more empathizing with the character in the video by emphasizing their ability to relate to the other person, thereby increasing prosocial responses.

Furthermore, our hypotheses were formed from research that has predominantly explored these associations through trait-level assessments of emotion regulation (Lamm et al., 2007;

Moreira et al., 2020; Powell, 2018; Smith & Rose, 2011). It follows that individuals who tend to be more regulated would typically tend to display greater prosocial emotions and behaviors. However, less attention has been given to how dynamic regulation from acute experimental stimuli may replicate these patterns. It is possible that within the moment, individuals' strategies of rumination and cognitive reappraisal may not differentially affect abilities to respond prosocially.

Assessing youths' ANS activity during these experiences of regulation may provide insight into how individuals interpret these emotion regulation strategies, thereby revealing profiles that predict greater prosocial responding. In line with this reasoning, an exploratory goal for this study was to test the effect that these two emotion regulation strategies have on the associations among psychophysiological functioning and prosocial responding, relative to youths who did not receive any guidance about emotion regulation. Our findings suggest that youths' engagement in cognitive reappraisal and rumination did significantly alter the extent to which ANS activity was associated with different forms of prosocial responding.

First, we found that youths' engagement in cognitive reappraisal and rumination influenced how their ANS activity during the emotion induction was related to their experiences of affective empathy. As an emotional facet of prosociality, affective empathy refers to sharing of others' emotional states (Zahn-Waxler et al., 2018). For adolescents who were not provided instructions on how to regulate (i.e., control group) during the emotion induction, evincing both higher RSA and longer PEP predicted greater affective empathy. This pattern of ANS activity reflects activation of the PNS alongside a withdrawal of the SNS, thereby indicating a down-regulation of arousal. This finding aligns with a large body of research suggesting that PNS

dominance confers calmer states that support more adaptive and positive social engagement (Porges, 2007, 2011).

However, for adolescents actively engaging in cognitive reappraisal, affective empathy responses were supported rather by SNS dominance, as indexed by less RSA activity and greater SCR activity. In other words, for youths engaging in cognitive reappraisal, an allowance of greater physiological arousal during the emotion induction facilitated greater affective empathy responses. To experience affective empathy, one must observe and interpret the events and state of the other person in need (Healey & Grossman, 2018). Therefore, while attempting to reinterpret others' distress through cognitive reappraisal, patterns of SNS dominance may reflect a mobilization of internal resources that are required to actively attend to this process (Mauss et al., 2007). Whereas, for rumination, greater physiological arousal may indicate personal distress responses as one repeatedly thinks about their experience of sharing negative emotions with others (Ottaviani et al., 2009). Indeed, similar to what was observed for the control group, our findings suggest that less SNS activity (i.e., longer PEP) for those ruminating predicted greater affective empathy responses. Therefore, less physiological arousal while ruminating on one's emotions may facilitate greater affective empathy by allowing for deep emotional resonance without overwhelming emotional reactions.

Compared to affective empathy, there were both similarities and differences in how the emotion regulation manipulation affected associations between ANS measures and sympathy. Experiencing sympathy goes further than the emotional resonance indicated by affective empathy, as sympathy reflects feelings of concern and compassion for another person in need or distress (Zahn-Waxler et al., 2018). For youths in the control condition group who did not receive instructions to regulate, similar to what was observed for affective empathy, patterns of

SNS withdrawal (e.g., longer PEP, fewer SCR) during the emotion film were found to predict greater sympathy responses. This may suggest that youths with abilities to not become aroused by their emotional experiences were able to feel compassion and concern on behalf of the other person in distress.

Yet, for youths who were guided to ruminate, increased arousal (e.g., more SCR) was associated with greater sympathy responses, contrasting to what was observed for affective empathy. As an emotion regulation strategy, rumination has been suggested to draw attention inwardly, toward oneself (Nolen-Hoeksema et al., 2008). Potentially, greater SNS arousal during rumination may have occurred for youths who followed the instruction to "*think about why you are feeling this way*" by focusing on the precipitating event in the film clip that led to the character's sadness and distress, specifically, the death of a loved one. This heightened attentional to the cause of the emotion may have fostered greater feelings of concern for those in need. It is intriguing that for youths in the rumination condition, less SNS activity predicted affective empathy (feeling sad, down) whereas more SNS activity predicted sympathy (feeling compassionate). This could be seen as paralleling the motivational drives of the two emotions experiences, as sympathy involves more outwardly-directed and engaged emotional arousal than affective empathy (Eisenberg et al., 2014; Yavus et al., 2024). For those engaging in cognitive reappraisal, adolescents who evinced a lower RSA, longer PEP, and more SCR responded with the most sympathy. These findings parallel the associations predicting affective empathy responses for those who engaged in cognitive reappraisal, such that less PNS and greater SNS (e.g., lower RSA, more SCR) predicted greater sympathy responses. Yet, unlike affective empathy responding, youths' displays of shorter PEP were also associated with sympathy responses. This profile of ANS activity suggests a degree of co-inhibition between the PNS and

SNS, resulting in minimal fluctuations in heart rate (Bernston et al., 2008). Partial attenuation of SNS influence may facilitate the likelihood of an adolescent to use cognitive reappraisal to surpass experiences of just affective empathy, thereby enabling deeper engagement through sympathy. Notably, this interpretation is speculative, as this pattern of ANS was not expected. Therefore, caution is warranted, and further replication of these findings is necessary before drawing definitive conclusions.

Interestingly, we found that it was only the emotion regulation manipulation of cognitive reappraisal that generated links between youths' ANS activity and both behavioral forms of prosocial responding. Youths responded with more altruistic helping behaviors and donations when they had displayed greater SNS arousal (e.g., shorter PEP) while using reappraisal during the emotion film. This finding suggests that a certain degree of arousal may assist youths' responses to witnessing others in need with direct actions aimed at improving others' situations. By using cognitive reappraisal, youths may have been able to maintain their emotional arousal within an optimal range, thereby enabling them to not only feel more emotionally engaged with the situation but also physiologically prepared to provide to assistance, which is reflected in increased SNS activity. Surprisingly, no other differences emerged between the two forms of behavioral responding assessed in this study.

Findings from this study contribute important insights toward a more comprehensive understanding of the adolescents' emotional processes and positive socioaffiliative responding. However, the study also presents some limitations. The first major limitation of the present study was our lack of empirical evaluation regarding youths' adherence to the emotion regulation instruction they received. Without confirming that participants appropriately applied the emotion regulation strategies as instructed, it is difficult to ascertain whether the observed effects (or lack

thereof) are truly due to the emotion regulation strategies themselves or other extraneous factors. The second limitation stems from the temporal gap between the emotion regulation manipulation and the subsequent behavioral tasks. The provided emotion regulation instructions were specific to youths' experiences watching the emotion film scene. Yet, youths may not have continued using that emotion regulation strategy for subsequent tasks, thereby reducing the likelihood of detecting observed effects.

Furthermore, while we did include household income as a covariate in some of our analyses, prior work has demonstrated that family income can influence youths' prosocial outcomes (Miller et al., 2015). As a result, the sample's relatively high socioeconomic status may limit our ability to generalize from the present findings. Future studies would benefit from the inclusion of participants from more diverse backgrounds. Additionally, there are several factors that likely influence how adolescents respond to and regulate vicarious emotional arousal, such as underlying motives and beliefs for attending to others' needs. While our findings provide valuable insights into how emotion regulation may manifest in differences in perceptions of regulatory processes, particularly through assessments of physiological arousal, our study did not have the scope to fully explore these underlying motives and beliefs. Therefore, future research should aim to incorporate a more comprehensive approach to understand the complex interplay between these factors and adolescents' emotion regulation strategies and socioemotional development.

Psychophysiological measures are often interpreted as a reflection of emotion regulation abilities. However, these assessments lack in their ability to reveal the sociocognitive processes that underlie these changes in arousal. In other words, the internal dialogues and active attempts by participants to modulate emotional stimuli may influence abilities and decisions to respond

prosocially (Perchtold-Stefan et al., 2023; Weber et al., 2014). Identifying how individuals' motivational orientations influence their regulatory processes and behavioral outcomes can shed light on the underlying mechanisms driving prosocial behavior. Therefore, future studies could benefit by assessing individuals' approach and avoidance motivations in the context of emotion regulation and prosocial responding. By examining whether individuals are motivated by approach (e.g., altruistic concern for others) or avoidance (e.g., self-preservation) goals, researchers can gain a more nuanced understanding of the interplay between motivation, emotion regulation, and socioemotional development. Moreover, future research could also benefit from employing a mixed-methods approach, by incorporating qualitative data alongside quantitative measures. Qualitative data could offer valuable insights into how participants experience emotion induction task, which would provide a deeper understanding of the underlying processes influencing prosocial responses.

The findings from the present study contribute to our understanding of the interplay between emotion regulation strategies, autonomic nervous system (ANS) functioning, and prosocial responding in adolescents. The findings underscore the importance of considering emotion regulation processes in studies of socioemotional development, as they can significantly influence how youths physiologically process emotional experiences, subsequently impacting their behavioral responses. Despite the prevalent assumption that certain emotion regulation strategies inherently promote prosocial behaviors, our results challenge this notion by demonstrating that engagement in cognitive reappraisal and rumination during the emotion induction did not significantly differ in their effects on prosocial responding. Thus, the effectiveness of different emotion regulation strategies in fostering prosocial behaviors may be more nuanced than previously thought. Overall, our findings emphasize the complex interplay

between emotion regulation, ANS functioning, and prosocial behavior in adolescents. By considering these factors in developmental models, researchers and practitioners can gain a more comprehensive understanding of how youths navigate social interactions and contribute to the promotion of positive socioemotional outcomes.

# CHAPTER THREE

## PAPER 2: PARASYMPATHETIC REACTIVITY TO RECALLED EMOTIONAL EXPERIENCES AND ADOLESCENT PROSOCIALITY

Over the past two decades, developmental researchers have increasingly advocated for the implementation of strength-based approaches to better understand adolescent social and emotional development. Positive youth development research may be particularly important for promoting healthy socioemotional development in adolescence, which has been characterized as a period of heightened emotional intensity and lability (Hay, 2019; Scott-Parker, 2017; Steinberg & Morris, 2001). Greater abilities for self-regulation in adolescence are widely considered to foster prosocial engagement (Hastings, 2023; Hodge et al., 2023). Many studies have expanded beyond behavioral levels of analyses of regulatory systems to include physiological markers of arousal and regulation, particularly the activity within the parasympathetic nervous system (PNS; Hastings et al., 2012; 2023; Miller, 2018; Porges, 2007, 2011). Yet, inconsistencies in the definitions, theoretical models, and methodologies within the extant psychophysiological emotion and positive development literatures have hindered researchers' abilities to make conclusive inferences from findings. Empirical approaches to emotional inductions have widely varied (e.g., film vignettes, emotion recall), which may have significant implications for the demand on participants, and thus, the PNS reactivity to these experiences. Moreover, very few studies have explored the extent to which physiological reactivity to emotional experiences is associated with aspects of youths' prosociality (Cui et al., 2015; Coulombe et al., 2019). Further investigations into the role of physiological regulation in emotional contexts are needed to identify the underlying mechanisms that facilitate youths' positive other-oriented emotional and behavioral responding (Hastings et al., 2023; Miller, 2018). Therefore, the current study aimed to

test the extent to which PNS reactivity to experiences of both thinking and talking about negative emotions were associated with adolescents' prosociality.

**Emotional and Behavioral Facets of Prosociality**

Prosociality reflects dispositions to allocate attention and energy to addressing the needs of others and is a foundational indicator of the development of trust, social bonds, and overall well-being of individuals and communities (Eisenberg et al., 2015; Zahn-Waxler et al., 2018). Prosociality encompasses a range of emotional and behavioral responses that contribute to the welfare of others, including affective empathy, sympathy, and prosocial behaviors (Zahn-Waxler & Radke-Yarrow, 1990). Affective empathy refers to subjective experiences of understanding and sharing others' emotions, thereby deepening interpersonal connections through enhanced awareness of others' emotional states (Hastings et al., 2013; Zahn-Waxler et al., 2018). Sympathy is characterized by expressions of concern for another's distress or need, which often motivate decisions to offer comfort or support for others (Zahn-Waxler & Radke-Yarrow, 1990). Moreover, these internal states are often reflected in prosocial behaviors, which are actions that are intended to benefit others (Einolf, 2008; Zahn-Waxler et al., 2018). Despite the clear conceptual distinctions among these facets of prosociality, empirical studies have considerably varied in how they measure these constructs.

It is important to acknowledge that there exists a notable overlap between internal and external dimensions of prosociality. This may derive, in part, from the variability in the operationalization and measurement of these constructs across empirical studies. Most of the developmental research explores prosociality as singular construct of 'global prosociality' (Coloumbe et al., 2019; Cui et al., 2015; Beauchaine et al., 2013). Yet, some studies have clearly distinguished between the emotional (i.e., internal experiences like empathy and sympathy) and

behavioral (i.e., external actions such as helping and comforting) dimensions of prosociality (Einolf, 2008; Gill & Calkins, 2003; Liew et al., 2011; Yavuz et al., 2024). Burgeoning work has identified the importance of considering these multiple forms of prosociality (Hastings et al., 2023; Hodge et al., 2023) to better identify the extent to which individual differences in youths' regulatory abilities have on different aspects of their socioemotional development. Acknowledging the complexity of youths' prosociality and the complex relationship between internal experiences and external behavioral responses, the present study aims to contribute to this literature by exploring three different models of adolescent prosociality.

**Emotional Experiences and Prosociality in Adolescence**

Emotions are central to both the internal aspects of prosociality and, likely, to its behavioral manifestations as well. Emotional valence and arousal are two key dimensions that characterize emotional experiences (Barrett, 2006; Posner, 2005; Russell, 2003). Emotional valence refers to the positive or negative quality (i.e., perceived pleasantness) of an emotion, whereas arousal represents the intensity or activation level associated with that emotion. Notably, emotions of the same valence can vary in their arousal level, leading to distinct subjective experiences and physiological responses. For example, negative emotions can range from lower arousal states (e.g., sadness, disappointment) to higher arousal states (e.g., anger, frustration). Low-arousal negative emotions are typically associated with perceptions of stillness and diminished alertness (Finucane et al., 2010; Kuppens et al., 2013; Russell, 2003), which is reflected in relatively lower level of physiological arousal (Kreibig, 2010; Siedlecka & Denson, 2019). In contrast, high-arousal negative emotions are characterized by heightened vigilance and perceptions of threat, as well as greater physiological arousal (Finucane, 2011).

Examinations into the different levels of arousal among emotions of the same valence may have important implications for youths' subjective experiences, behavioral responses, and psychophysiological reactions to emotions. Low-arousal negative emotions, such as sadness or disappointment, typically prompt individuals to adopt introspective and contemplative stances, which may result in a decreased tendency towards immediate, outward-facing behaviors (Finucane et al., 2010; Nesse, 2000). The subdued nature of these emotions may also afford more reflective assessment of situations, which may lead to more deliberate and calculated emotional responding (Lench et al., 2011). This shift in attentional focus can facilitate more thoughtful, other-oriented energy allocation that may lead to more successful social interactions requiring sensitivity and emotional nuance (Herwig et al., 2010). Therefore, while low-arousal negative emotions may dampen an individual's immediate energy and motivation, they can also enhance attentiveness to emotional states, including the emotional states of others, thereby fostering a conducive environment for empathic and sympathetic engagement.

High-arousal negative emotions, such as anger and frustration, often prime individuals to be more attentive to their own needs and therefore to focus on promoting the self over others (Carver & Harmon-Jones, 2009). This state of heightened arousal often leads to a narrowing of cognitive focus (Finucane, 2011; Lench et al., 2011), where the primary concern shifts towards personal threats, grievances, or challenges, which may reduce the capacity for other-oriented attention. In such states, the allocation of energy is predominantly directed towards self-preservation, problem-solving aimed at alleviating one's personal distress, or actions intended to confront or remove the source of emotional discomfort.

However, high-arousal negative emotions are not exclusively antagonistic with positive, other-oriented attention (van Doorn et al., 2014). These intense emotional states may heighten

awareness of others' actions and emotions, albeit through a lens heavily influenced by the individual's current emotional state. For instance, anger is associated with a strong approach motivation and might drive an adolescent to take charge and address a perceived injustice, which could affect not just their own welfare but also that of others involved (Carver & Harmon-Jones, 2009). Here, the energy allocation might temporarily align with other-oriented goals, albeit motivated by a high-arousal negative emotion. Yet, further empirical work is needed to better understand the nuanced interplay between arousal levels of negative emotions and their impacts on other-oriented attention and energy allocation. Therefore, this study aimed to explore the extent to which negative valence emotions of different arousal levels have on youths' prosocial responding.

**Parasympathetic Reactivity to Negative Emotions and Prosociality**

Adolescence is a period of heightened emotional intensity and lability (Steinberg & Morris, 2001). Youths with greater abilities to regulate and monitor their own thoughts and negative, vicarious emotions may have greater capacities to allocate the energy and attention needed to empathize and behave prosocially with others (Eisenberg et al., 2015; Zahn-Waxler et al., 2018). Effective regulation enables individuals to orient to the needs of others and respond prosocially, without being consumed by one's own emotional state (Zahn-Waxler et al., 2018). Whereas inabilities to effectively regulate one's vicarious arousal within these contexts, often lead to experiences of personal distress, and thereby withdrawal responses.

Burgeoning research into adolescents' psychophysiological responses during emotional reactivity and regulation has highlighted some of the underlying mechanisms that foster youths' prosociality (Hastings et al., 2023; Miller, 2018). Among the many psychophysiological systems that are implicated in core regulatory processes, the autonomic nervous system (ANS) plays a

critical role in these regulatory processes by modulating arousal and stress responses (Mendes, 2016). The ANS operates through two primary branches: the parasympathetic nervous system (PNS) and the sympathetic nervous system (SNS), both of which are essential for managing acute physiological responses to emotional stimuli. The parasympathetic nervous system (PNS) is often referred to as the "rest and digest" system of the autonomic nervous system, down-regulating or calming arousal and supporting restorative functions. Increases in PNS activity slow heart rate and reduce arousal, whereas decreases in PNS activity allow the heart to beat more rapidly.

According to the polyvagal theory (Porges, 2007, 2011), it is the ability of the PNS to modulate arousal levels that underscores its role in adaptive and positive social engagement. For instance, within perceived safe or non-threatening situations, greater PNS influence down-regulates arousal and supports calm or relaxed states that are appropriate for positive interactions with others (Hastings & Kahle, 2019). Simultaneously, decreases in PNS influence can also be appropriate for orienting towards novel or unexpected stimuli to assess its nature. Therefore, in contexts of witnessing others' distress, differences in the magnitude and direction of change in PNS influence may have implications for adolescents' abilities to respond prosocially (Hastings & Miller, 2014; Miller & Hastings, 2016).

Activity of the PNS is commonly indexed through respiratory sinus arrhythmia (RSA), which reflects how the vagus nerve coordinates changes in heart rate in sync with breathing (Porges, 2007; 2011). RSA reactivity in response to a stimulus reflects changes in parasympathetic control of the heart from a resting state to that novel condition and can be quantified as RSA augmentation (i.e., RSA increases from baseline or a resting state to the challenging condition) or RSA suppression (i.e., RSA decreases from baseline or rest; Hastings et

al., 2023). RSA suppression indicates decreased PNS influence on cardiac activity, which can increase heart rate and facilitate orienting on and attending to salient cues. RSA augmentation indicates increased PNS influence, which typically slows heart rate and inhibits sympathetic nervous system input. RSA augmentation facilitates the maintenance of an internal equilibrium and evaluation of situations as safe for positive social engagement, whereas RSA suppression signifies the readiness to respond to internal or external threats or challenges (Hastings & Kahle, 2019; Porges, 2007).

There have been a few recent studies that have begun to explore the extent to which PNS activity is linked to children's and youths' prosociality. However, findings remain inconsistent, such that youths' prosociality has been associated with RSA suppression (Scrimgeour et al., 2016), RSA augmentation (Stellar et al., 2015), or patterns of both RSA augmentation and suppression (Coulombe et al., 2019) while experiencing low-arousal negative emotions, particularly sadness. It is important to note that each of these studies assessed the relation of PNS reactivity with different dimensions of prosociality (e.g., trait-level global prosociality, prosocial emotions, and prosocial behavior, respectively). These inconsistent findings may further suggest that various psychophysiological profiles of regulation may facilitate different forms of prosociality. The findings are similarly mixed regarding youths PNS reactivity to high-arousal negative emotions, like anger. Youths' evincing of greater RSA suppression (Beauchaine et al., 2013; Cui et al., 2015) and of less RSA suppression (Ying et al., 2022) have both been associated with greater prosociality. Once again, different patterns of PNS reactivity were found to predict distinct forms of prosociality within these studies. Specifically, greater RSA suppression to high-arousal negative emotions was associated with higher trait-level reports of global prosociality in youths, whiles less RSA suppression was linked to more prosocial emotional responding.

Furthermore, inconsistencies across studies may stem from differences in the methods used to elicit youths' emotions. A growing body of research has emphasized the importance of considering the contextual and developmental demands of experiencing an emotion (Hastings et al., 2012; Mendes, 2016; Miller et al., 2013). Yet, most studies relating emotional physiology to indices to prosociality have been limited to one context or experience of one emotion. Investigations into the various ways youths can experience emotions may help to address the discrepancies in the current literature regarding patterns of RSA reactivity that support prosocial engagement. Certain emotion induction procedures, such as dyadic emotion reliving, may be more ecologically valid than other assessments of emotion (e.g., self-report, video induction) by simulating emotions in social contexts (Roberts et al., 2007), and thereby producing more reliable effects on measures of PNS reactivity (Mauss & Robinson, 2010). Within these emotion reliving tasks, participants are often asked to recall or discuss an emotional experience with the experimenter or laboratory partner (e.g., parent, peer; Siedlecka & Denson, 2019; Zech & Rimé, 2005). Youths' subjective and physiological reactivity to thinking about emotional experiences function as introspective processes, which may differ from outward discussions of these emotions with a dyadic partner (Pasupathi, 2003). One's autobiographical recall about personal emotions may confer greater exploration of the emotional experience than discussing it with a partner, due to relational constraints or discomfort for scrutiny (Roberts et al., 2007). Moreover, experiencing emotions internally (e.g., thinking about an emotion) does not require as much physiological arousal for engagement compared to external expressions (e.g., talking about an emotion). Thus, the method of experiencing an emotion may serve as unique contexts for which youths may differentially regulate, thereby altering youths' propensities to be prosocial. Given the lack of adolescent developmental psychophysiological research, it follows that there is a need

for further examinations into the many ways in which emotions may be experienced, and how the body processes these experiences.

**Gender Differences in PNS Reactivity and Prosociality**

Gender differences in prosociality are well-recognized in the extant literature, such that adolescent girls tend to respond with greater prosocial emotions and behaviors than boys (Eisenberg et al., 2015; Hastings et al., 2000; 2005; Hodge et al., 2023). In contrast, developmental psychophysiological research has demonstrated a lack of support for gender differences in youths' PNS reactivity to emotional stimuli (Coulombe et al., 2019; Liew et al., 2011; Miller et al., 2013; 2016). Findings across these diverse studies indicate that, at a physiological level, boys and girls are often more similar than different in terms of how their bodies react and regulate in response to these stimuli. Although Cui and colleagues (2015) similarly found no gender differences in RSA, findings from this study do indicate that girls reported behaving more prosocially compared to boys. It is important to note that this is the only study among those listed that examined these associations within adolescents, while the others pertain to young children. This divergence underscores the critical need for further research focused on adolescents to explore the interplay between physiological reactivity and prosocial responding during this pivotal developmental period. Recognizing this gap, the present study aims to further investigate gender differences in the relations among PNS functioning and adolescents' prosociality across various emotional contexts.

**The Current Study**

This study aims to bridge critical gaps in the field of emotion science by considering both adolescents' physiological reactivity to negative emotions of varying arousal as well as the different ways these emotions are experienced, with the goal of advancing research focused on

positive youth development. In the present study, we assess adolescents' PNS reactivity while thinking and talking about two negative emotions (e.g., disappointment, frustration) to explore associations between physiological regulation and prosocial responding. We first examine the latent structure of adolescent prosociality, to determine if youths' responses to measures of affective empathy and prosocial behavior are unitary or multidimensional as a construct. Thus, we conducted confirmatory factor analyses (CFA) to assess if a one, two, or three-factor model was representative of youths' prosociality. We then conducted a structural equation model to investigate how youths' PNS reactivity to experiences of thinking and talking about both disappointment and frustration are associated with youths' prosociality. The findings from this study are intended to extend the existing developmental psychophysiological frameworks of adolescent prosociality by elucidating how different patterns of physiological reactivity to negative emotions relate to the complexity and multifaceted nature of prosocial behaviors in adolescence. By exploring the nuanced ways in which physiological responses to emotions influence prosocial actions, this study contributes to a more holistic view of adolescent development and underscores the importance of considering emotional and physiological processes in efforts to support healthy social and emotional growth.

First, we hypothesized that H1) adolescent prosociality would be best represented with a multidimensional (e.g., two- or three-factor) structure rather than a univariate, global (1-factor) construct. Regarding youths' physiological reactivity to emotions, we hypothesized that adolescents H2a) reacting with greater RSA suppression to experiences of disappointment would report the greatest prosocial emotions and behaviors. Furthermore, youths H3) reacting with less RSA suppression to experiences of frustration were expected to report the greatest prosocial emotions and behaviors. *A priori* hypotheses were not put forward for differences in RSA

reactivity to experiences of thinking and talking and their associations with youths' prosociality, as this is the first study we are aware of to explore these associations. With regard to gender differences, we predicted that H4a) girls would engage in greater prosocial emotions and behaviors compared to boys, yet H4b) girls and boys RSA reactivity to emotional experiences would not demonstrate different associations with their prosocial responding.

## Method

### Participants

The present study is based on the data collected from 220 youths (109 females), aged 11-16 years at recruitment (*M*age= 13.67, *SD* = 1.08) who participated in the Adolescent Emotion Study (AES). The AES is an investigation conducted at the National Institute of Mental Health to examine the role of emotion in the development of psychopathology in adolescence (Klimes-Dougan et al., 2001; Zahn-Waxler et al., 2001). The AES was approved by the Human Subjects Institutional Review Board at the National Institutes of Mental Health. Participants were recruited from the greater Washington, DC, metropolitan area through announcements (e.g., newspapers, flyers). Eligibility for participation was based on the child's age (between the ages of 11 and 16 years at the time of the initial visit) and competency to complete procedures (e.g., free from debilitating language, cognitive, physical, or psychotic impairment). Adolescent participants were oversampled for internalizing and externalizing psychopathology, using a telephone-based screener consisting of the abbreviated version of the Child Behavior Checklist (A-CBCL, Achenback, 1991a). Approximately 1/3 of adolescents exhibited normative levels of total internalizing and externalizing problems, 1/3 had sub-clinical total problems, and 1/3 displayed clinically elevated total problems. The ethnic composition of the adolescent sample

was 70.4% Caucasian, 16.2% African American, 1.9% Hispanic, 2.8% Asian American, and 8.8% mixed race or other.

**Procedure**

Participants visited the laboratory with a parent and signed assent and consent forms. Approximately 1 hour after arriving for the lab visit, three electrodes were affixed to the youth's torso to record cardiac interbeat intervals (IBI). After attaching electrodes to measure ECG, baseline RSA was measured (1 min). Participants were then instructed to think about an experience for one minute in which they were very disappointed or frustrated. Youths then described the details of the experience, the aspects that made them feel this emotion, and how the event ended to the interviewer for about another minute. The same process was repeated for the following emotional experience. To avoid introducing adolescents' physiological acclimation to the emotional stimuli, the present study assesses adolescents' RSA activity during the first minute of thinking and talking about negative valence emotions. The order of disappointment and frustration was counter balanced. Participants then completed the video mood procedure to assess empathy. Participants then completed self-report questionnaire measures.

**Measures**

**Respiratory Sinus Arrhythmia Reactivity.** The electrodes were attached to a Coulbourn electrocardiogram amplifier, and IBI were recorded by detecting consecutive R-waves to the nearest millisecond. Mxedit software (Delta-Biometrics Inc., Bethesda, MD) was used to compute RSA, at the 0.12–0.40 Hz frequency band via the software's rolling 21-point polynomial algorithm set to 30-s epochs. Usable data were obtained for all youths. RSA reactivity was computed with the arithmetic difference between RSA during the emotion reliving

task and baseline RSA. Therefore, negative RSA reactivity values reflect RSA suppression from baseline RSA activity and positive RSA reactivity values reflect RSA augmentation.

**Affective Empathy.** Eight brief (2–4 min) clips from feature films were used as stimuli in the Video Mood Procedure. A video mood induction involved the youth watching eight brief (2–4 min), age-appropriate clips from feature films, with two video clips each selected to strongly represent and evoke sadness, fear, anger, and happiness. Clips were presented in a fixed order to keep conditions as consistent as possible across participants in this examination of individual differences in emotional reactivity. To minimize carry-over effects, a 2-min pause followed each clip, in which the youth answered some questions and was then allowed to relax. The current study utilized participants responses from the two sadness video clips: *The Champ* and *Steel Magnolias*. Youths then reported how "sad" and "down" they felt for each of the scenes (5-point Likert scale; $\alpha = .88$) to assess empathy for other's experiences.

**Prosocial Behaviors and Sympathy.** Items were drawn from three measures to assess prosocial behaviors and sympathy. Participants completed a 20-item version of the Children's Social Behavior Scale measure (Crick & Grotpeter, 1995), which assesses social-affiliative behaviors with peers on a 5-point Likert scale (1 = *Never*, 2 = *Almost never*, 3 = *Sometimes*, 4 = *Almost all of the time*, 5 = *All of the time*). Three items were used from this scale (e.g., "Some kids help out other kids when they need it. How often do you do this?"; "Some kids let their friends know that they care about them. How often do you do this?"). Youths then completed the 61-item Child Sex Role Inventory (CSRI; Boldizar, 1991), which is aimed at assessing gender roles in youth on a 4-point Likert scale (1 = *not at all true of me*, 2 = *a little true of me*, 3 = *mostly true of me*, 4 = *very true of me*). Five items were used from this scale (e.g., "I like to help others"; "I care about what happens to others"). Last, participants completed the 112-item Youth

Self Report (Achenbach, 1991b), which is intended to assess youths' behavioral patterns on a 3-point Likert scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*). Two items were used from this scale (e.g., "I am willing to help others when they need help").

**Internalizing and Externalizing Problems.** To measure internalizing and externalizing problems, mothers completed the Child Behavior Checklist (CBCL; Achenbach, 1991a) and youths completed the Youths Self Report (Achenbach, 1991b). Mothers' and youths' reports were significantly correlated for both internalizing ($r = .29$, $p < .001$) and externalizing problems ($r = .36$, $p < .001$). The averages of mother- and youth-reported internalizing and externalizing problems were used in this study.

**Analytic Approach**

Items from across the different measures were first standardized using z-scoring to ensure comparability and control for variability. Outliers were considered to be any scores exceeding 3 standard deviations from the sample mean. The data were examined for univariate outliers, and bivariate outliers were examined using scatterplots of all pairs of variables of interest. However, there were no instances of outliers established in the data. Missingness was addressed by using full information maximum likelihood estimation, which is thought to provide less biased estimates than listwise or pairwise deletion and is considered appropriate even when data are not missing completely at random (Schafer & Graham, 2002).

**The Hypothesized Models**

To assess the factor structure of adolescents' prosociality, a series of confirmatory factor analyses (CFA) were conducted to compare a one-factor model (e.g., global prosociality), two-factor model (e.g., emotional and behavioral prosociality), and three-factor model (e.g., affective

empathy, sympathy, prosocial behaviors). Model specifications included correlated factors, uncorrelated unique variances, and the variance of one item on each factor fixed to 1.

The identified measurement model from this CFA was then used in a structural equation model (SEM) to assess the associations among adolescents' RSA reactivity to thinking and talking about disappointment and frustration and prosociality. Within this model, age, gender, as well as internalizing and externalizing behaviors were regressed onto all variables of interest as covariates. Additionally, to account for individual differences in baseline levels of RSA, baseline RSA was used as a predictor in regression analyses examining its relationship with RSA reactivity variables.

A multiple group comparison analysis was then conducted to assess for gender differences in the associations within the model. To explore gender differences in PNS reactivity to emotional stimuli, a multiple-group analysis was performed by partitioning the SEM into categorical groups based on two gender identities (i.e., male and female). One model was first created with all regression pathways constrained, which was then compared to a model with all paths in the SEM freely estimated. If the freely estimated model was found to significantly improve model fit compared to the fully constrained model, a subsequent model would then be created by releasing constraints on the pathways of interest in the model (specifically, allowing only the paths from RSA reactivity to prosocial measures to vary by gender). If model fit significantly improved compared to the fully constrained model, gender differences would be interpreted for each of the pathways within the model.

Analyses were conducted in Mplus 8.3. Multiple indices were used to examine different aspects of model fit for the CFA and SEM. Model fit is considered good when the comparative fit index (CFI) is greater than or equal to .95 (or .90 for adequate fit), the root mean square error

of approximation (RMSEA) is less than or equal to .06 (or .08 for adequate fit), and the standardized root mean square residual (SRMR) is less than or equal to .08 (or .10 for adequate fit; Hu & Bentler, 1999; Kline, 2005).

## Results

### Confirmatory Factor Analysis

Table 2.1 presents the comparative model fit statistics for the three assessed models of adolescent prosociality. As we hypothesized, the one-factor model of global prosociality demonstrated poor model fit. The two-factor model also demonstrated poor model fit, whereas the three-factor model demonstrated good model fit. However, as seen in Figure 2.1, the factors of prosocial behavior and sympathy displayed a high correlation ($r = .89$, $p < .001$) in the three-factor model. The presence of multicollinearity often leads to issues in model convergence as well as abilities to distinguish the unique contribution of each predictor in the subsequent SEM (Kyriazos & Poga, 2023).

Therefore, we created an updated two-factor model that retained the affective empathy factor from the three-factor model and collapsed the two highly correlated factors of sympathy and prosocial behavior into one factor. This updated two-factor model demonstrated good model fit comparable to the three-factor model for most criteria. Yet, the two-factor model demonstrated a marginally lower CFI fit statistic (.90) compared to the three-factor model (.91). Despite this, we selected the two-factor model to represent adolescent prosociality due to the principle of parsimony and the issue of multicollinearity present in the three-factor model.

**Table 2.1**
Comparative Model Fit Statistics for Confirmatory Factor Analyses of 1-Factor, 2-Factor, and 3-Factor Models of Adolescents' Prosociality

| | *df* | $\chi^2$ | Scaling Correction Factor for MLR | CFI | RMSEA | SRMR |
|---|---|---|---|---|---|---|
| 1-Factor Model of Global Prosociality | 77 | 561.41 | 1.0624 | .62 | .17 | .14 |
| 2-Factor Model of Prosocial Emotions and Behaviors | 76 | 553.49 | 1.0439 | .63 | .17 | .13 |
| 3-Factor Model of Affective Empathy, Sympathy, and Prosocial Behaviors | 74 | 193.08 | 1.0476 | .91 | .09 | .06 |

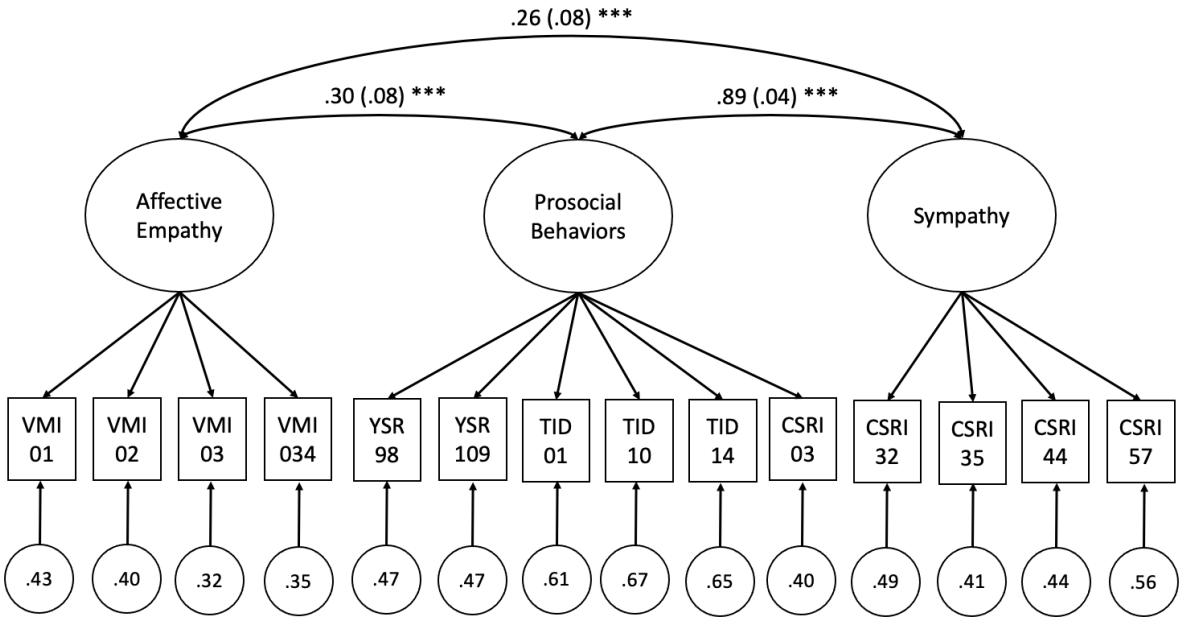



*Figure 2.1.* Confirmatory factor analysis for prosocial behaviors, empathy, and sympathy. $N = 220$. $\chi^2$ (74) = 193.08, $p < .001$, Scaling Correction Factor for MLR = 1.0476, CFI = 0.91, RMSEA = .09(.07 - .10), SRMR = .06

Upon reviewing the items in this updated factor, we identified that all items assessed youths' outward, other-oriented prosocial engagement with others. As seen in Figure 2.2, greater affective empathy was correlated with greater prosocial engagement in the two-factor model. There was significant variability in factor scores; all factor variances were statistically different than zero (Table 2.2). All items were meaningful indicators of the factors, as indicated by item loadings ranging from 0.57 to 0.83.

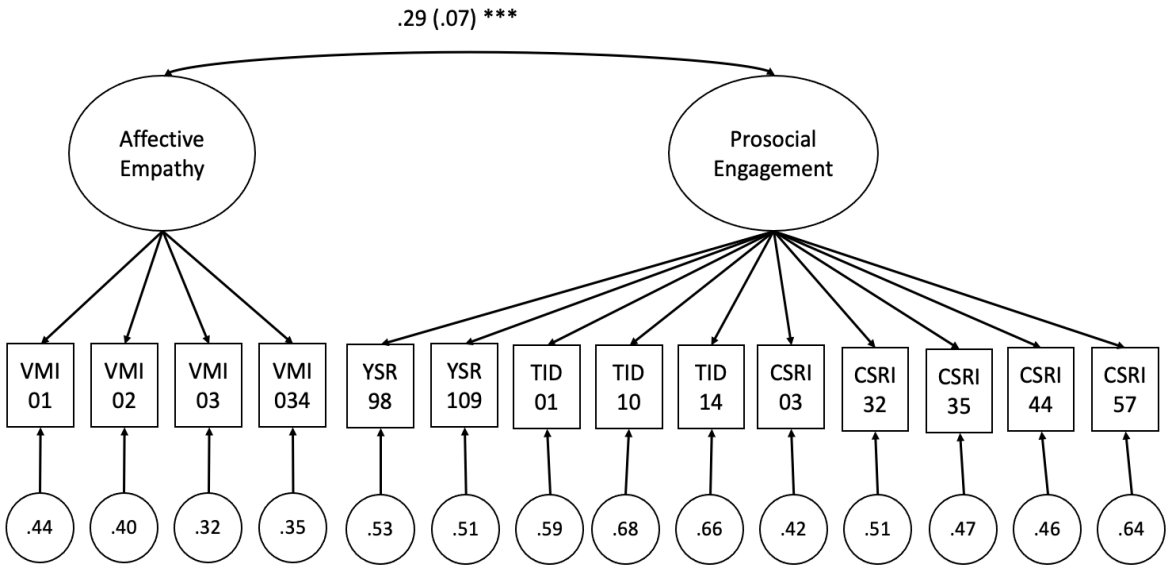



*Figure 2.2.* Confirmatory factor analysis for affective empathy and prosocial engagement. $N$ = 220. $\chi^2$ (76) = 209.97, $p < .001$, Scaling Correction Factor for MLR = 1.0583, CFI = 0.90, RMSEA = .09(.08 - .10), SRMR = .06.

**Table 2.2**
Item Factor loading for the 2-Factor Model of Prosociality

| Items | Affective Empathy | Prosocial Engagement |
|---|---|---|
| Feels sad for *The Champ* character (VMI 01) | .75 | |
| Feels down for *The Champ* character (VMI 02) | .78 | |
| Feels sad for *Steel Magnolias* character (VMI 03) | .83 | |
| Feels down for *Steel Magnolias* character (VMI 04) | .81 | |
| Likes to help others (CSRI 03) | | .76 |
| I care about what happens to others (CSRI 32) | | .70 |
| Consoles others when they feel hurt (CSRI 35) | | .73 |
| Kind and caring person (CSRI 44) | | .73 |
| Careful not to say things that hurt others (CSRI 57) | | .60 |
| Likes to help others (YSR 98) | | .69 |
| Tries to help others (YSR 109) | | .70 |
| Tries to cheer up others that are sad (TID 01) | | .64 |
| Helps others when they need it (TID 10) | | .57 |
| Say or do nice things for others (TID 14) | | .59 |

**Preliminary Analyses for Structural Equation Model**

Table 2.3 presents the means, standard deviations, and zero-order correlations of target variables and demographic characteristics. Paired sample t-tests were conducted to evaluate whether baseline RSA significantly differed from RSA during each of the emotion reliving tasks. Results indicated that baseline RSA was significantly higher than RSA while thinking about disappointment, $t(203) = 8.32$, $p < .001$, thinking about frustration, $t(202) = 7.33$, $p < .001$, talking about disappointment, $t(190) = 7.50$, $p < .001$, and talking about disappointment, $t(203) = 6.72$, $p < .001$.

Affective empathy was significantly and positively associated with prosocial engagement. Youths displaying less RSA suppression while talking about disappointment reported greater affective empathy and prosocial engagement. Youths with less RSA suppression while thinking about frustration also reported greater affective empathy. RSA reactivity among the different emotion reliving tasks (i.e., thinking and talking about disappointment and frustration) all significantly and positively correlated with each other, such that youths with greater RSA suppression in one task demonstrated greater RSA suppression to the other tasks. Moreover, there was a significant and negative correlation between baseline RSA activity and RSA reactivity to each of the four emotion reliving tasks. Youths with greater internalizing problem behaviors reported greater externalizing behaviors. Externalizing behaviors were reported for older participants. Girls reported more affective empathy and prosocial engagement than boys.

**Table 2.3**
Descriptive Statistics and Intercorrelations Among Demographics, RSA Reactivity, Affective Empathy, and Prosocial Engagement

| | *M* | *SD* | Gender | Age | INT | EXT | BL RSA | RSA Think Dis | RSA Think Fru | RSA Talk Dis | RSA Talk Fru | Aff Emp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | 13.71 | 2.28 | - | | | | | | | | | |
| INT | 53.71 | 86.22 | -.01 | .01 | | | | | | | | |
| EXT | 52.80 | 91.58 | .07 | .23*** | .48*** | | | | | | | |
| Baseline RSA | 6.94 | 1.44 | .00 | -.11 | -.08 | .03 | | | | | | |
| RSA Think Dis | -.54 | .93 | .01 | .03 | .04 | -.05 | -.42*** | | | | | |
| RSA Think Fru | -.52 | 1.01 | -.06 | .01 | .03 | -.05 | -.48*** | .61*** | | | | |
| RSA Talk Dis | -.71 | 1.33 | -.11 | .06 | .11 | .00 | -.56*** | .51*** | .55*** | | | |
| RSA Talk Fru | -.65 | 1.33 | -.05 | .11 | -.01 | -.06 | -.52*** | .47*** | .57*** | .69*** | | |
| Aff Emp | .00 | .02 | .26*** | .04 | .04 | -.01 | .07 | -.07 | -.15* | -.18* | -.01 | |
| Prosocial Engagement | .01 | .03 | .35*** | -.09 | -.12 | -.24** | .06 | .08 | -.02 | -.19** | -.13 | .29*** |

*Note.* Abbreviations: INT = internalizing problems, EXT = externalizing problems, BL RSA, baseline respiratory sinus arrhythmia, RSA Think Dis = RSA reactivity to thinking about disappointment, RSA Think Fru = RSA reactivity to thinking about frustration, RSA Talk Dis = RSA reactivity to talking about disappointment, RSA Talk Fru = RSA reactivity to talking about frustration; Aff Emp, affective empathy. For gender, 0 = Male, 1 = Female.
*$p < .05$, **$p < .01$, ***$p < .001$

**Structural Equation Model of RSA Reactivity and Prosociality**

Table 2.4 and Figure 2.3 present the model testing the associations between youth's RSA reactivity to emotional experiences and affective empathy and prosocial engagement; all direct associations are included in Table 4 whereas Figure 3 includes only the significant path coefficients. When controlling for the effects of age, gender, baseline RSA, and internalizing and externalizing behaviors, the model demonstrated good fit, $\chi^2$ (186) = 360.89, $p < .001$, CFI = 0.90, RMSEA = .07(.06 - .08), SRMR = .05.

In line with Hypothesis 2, less RSA suppression while thinking about disappointment was associated with greater prosocial engagement. Moreover, youths with greater RSA suppression to talking about disappointment reported greater affective empathy and prosocial engagement. As predicted in Hypothesis 3, less RSA suppression to talking about frustration predicted greater affective empathy. However, thinking about frustration did not predict either form of prosociality. Youths with greater externalizing problems reported significantly lower prosocial engagement.

**Table 2.4**
Direct Effects Among Demographics, RSA Change, and Prosociality

| | Affective empathy | | | Prosocial engagement | | |
|---|---|---|---|---|---|---|
| | *β* | *SE* | *p* | *β* | *SE* | *p* |
| Gender | **.24** | **.08** | **.002** | **.34** | **.07** | **.001** |
| Age | .05 | .07 | .478 | -.01 | .07 | .915 |
| Internalizing | .12 | .09 | .165 | .03 | .08 | .713 |
| Externalizing | -.09 | .09 | .312 | **-.27** | **.08** | **.001** |
| Baseline RSA | .05 | .07 | .478 | .01 | .07 | .713 |
| RSA Think Dis | .05 | .09 | .585 | **.18** | **.09** | **.044** |
| RSA Think Fru | -.15 | .09 | .112 | .05 | .09 | .538 |
| RSA Talk Dis | **-.26** | **.12** | **.032** | -.20 | .10 | .054 |
| RSA Talk Fru | **.26** | **.10** | **.010** | -.11 | .10 | .266 |

*Note.* RSA Think Dis = RSA reactivity to thinking about disappointment, RSA Think Fru = RSA reactivity to thinking about frustration, RSA Tfalk Dis = RSA reactivity to talking about disappointment, RSA Talk Fru = RSA reactivity to talking about frustration
*$p < .05$, **$p < .01$, ***$p < .001$

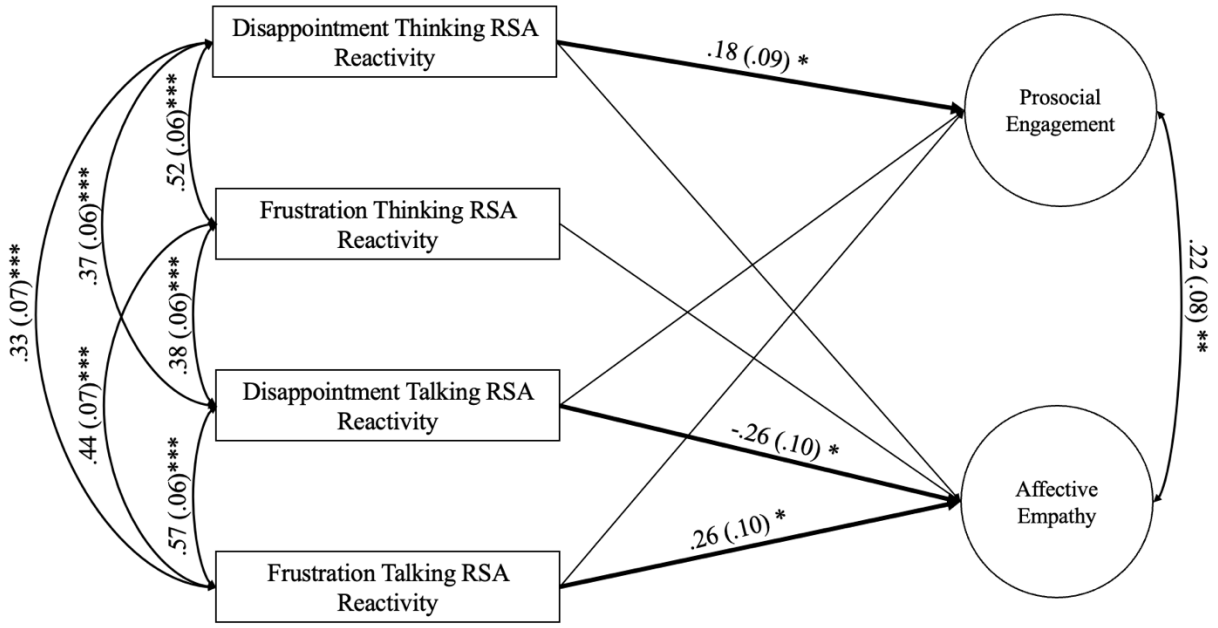



*Figure 2.3.* Structural equation model including standardized results (pathway coefficients and standard error) for predictions of adolescent prosociality by RSA reactivity to thinking and talking about disappointment and frustration. Covariates are age, gender, and baseline RSA. $N$ = 220. $\chi^2$ (184) = 360.45, $p$ < .001, CFI = 0.90, RMSEA = .07(.06 - .08), SRMR = .05.

**Gender Differences in PNS Reactivity and Prosociality**

In support of Hypothesis 4a, girls reported experiencing more affective empathy and greater prosocial engagement than boys (Table 4). A model was first created with all pathways constrained, which was compared to a model will all paths in the SEM freely estimated SEM. The freely estimated model demonstrated a significant improved model fit compared to the fully constrained model (Table 5). Thus, a subsequent model was conducted by removing constraints from only the pathways of interest in the model, which was not found to significantly improve model fit from the fully constrained model. Therefore, in support of Hypothesis 4b, gender differences were not found among youths' PNS reactivity and dimensions of prosociality.

## Discussion

Understanding the physiological underpinnings of emotional processing is important for developing strengths-based models fostering adolescent prosocial development. The present findings extend the positive youth developmental literature by presenting a multidimensional model of adolescent prosociality. In addition, this study examined the extent to which PNS reactivity to not only multiple emotions, but also different methods of experiencing these emotions, is associated to adolescents' prosociality. Our findings revealed that associations differed between youths' experiences of thinking and talking about negative emotions, and that these differences extended across individual emotions.

Our first goal in this study was to examine the structure of adolescent prosociality. In line with of our hypothesis, findings from this study support the emerging strengths-based adolescent research calling for multidimensional considerations of prosociality in adolescence. Global assessments of prosociality may be lacking ecological validity by not addressing the various facets of adolescents' emotional and behavioral experiences of other-oriented attention and energy allocation. Moreover, the literature that has taken a singular, global approach to prosociality, have been primarily limited to assessments of behavioral manifestations of prosociality (Coloumbe et al., 2019; Cui et al., 2015; Beauchaine et al., 2013).

Findings from this study indicate that adolescents' prosociality may be explained by experiences of affective empathy and their prosocial engagement with others. This two-factor model aligns with research exploring differences between internal, emotional forms of prosociality and more outward, behavioral forms of prosociality (Einolf, 2008; Liew et al., 2011). While we initially hypothesized that a two-factor model of prosociality would reflect distinctions in emotional and behavioral forms of prosociality, we found that the items of

sympathy were highly correlated with those assessing prosocial behaviors. Upon a closer inspection of the items determining the sympathy and prosocial behavior factors, we noticed that the items assessing sympathy were positioned to assess youths' other-oriented engagement as a result of their feelings of sympathy, rather than the internal, emotional experiences while feeling sympathy. Therefore, our two factors assessed affective empathy as an internal process of experiencing prosocial emotions, and prosocial engagement, reflecting youths' attention and actions directed at other's welfare. These findings suggests that adolescents' experiences of other-oriented concern and motivations to help derive from both internal, emotional processes, as well as outward, socially-engaged processes.

However, it is important to note that this structure of prosociality found in this study may be a result of how these different facets of prosociality were operationalized. Youths' sympathy and prosocial behavior were assessed through self-report questionnaires designed to capture trait-level characteristics, whereas affective empathy was based on youths' self-reported subjective responses to two sad film inductions. Consequently, the high correlation we observed between factors of sympathy and prosocial behavior on our tested three-factor model of prosociality may be attributed, in part, to their similar self-report methodology, which differed from our approach to assessing empathy. Future studies exploring multiple dimensions of prosociality should more independently assessment methods across all measures to avoid issues of multicollinearity in interpreting results.

Regarding youths' physiological reactivity to emotions, we hypothesized that adolescents reacting with greater RSA suppression to experiences of disappointment would report the greatest prosociality. Results support this hypothesis, yet were limited to youths' experiences of talking about their disappointment in predicting affective empathy. Talking about emotional

experiences is a more physically and socially demanding task than solely thinking about these emotional experiences. Therefore, withdrawal of the PNS during these emotional experiences reflects appropriate allocation of energy and attention to the task, to enter a more socially engaged state (Hastings & Miller, 2014). Furthermore, youths displaying these patterns reported greater experiences of affective empathy, which may suggest that an upregulation of arousal in contexts requiring more active social engagement (i.e., talking about emotional experiences with others) may align with youths' subjective experiences of sharing emotional states with others.

Contrary to Hypothesis 2, less RSA suppression while thinking about disappointment was associated with greater prosocial engagement. As a lower-arousal negative emotion connected to sadness, disappointment elicits more introspective and contemplative states (Finucane et al., 2010; Nesse, 2000), as well as a dampening on physiological arousal (Kreibig, 2010; Siedlecka & Denson, 2019). Therefore, we expected that a degree of PNS withdrawal would provide the required arousal to prompt youth for social engagement. Yet, this finding may suggest that during internal experiences of thinking about, greater maintenance of physiologically calmer states confer greater prosocial engagement with others. Notably, this pattern of PNS reactivity to disappointment was only found to predict greater prosocial engagement with others, and not the internal, subjective experiences of affective empathy. More effective down-regulation of arousal during negative emotions, as indexed by greater PNS activity, have been suggested to shift one's attention from personal emotional states to address others' needs (Eisenberg et al., 2015; Zahn-Waxler et al., 2018). Accordingly, this pattern of PNS reactivity may indicate greater abilities to focus their attention and energy to address the needs of others, rather than stronger subjective, emotional forms of prosociality (e.g., affective empathy).

In support of Hypothesis 3, youths that displayed less RSA suppression while talking about frustrating experiences, reported more empathy for others. Frustration is a more anger-related emotion compared to the stilled, quieted nature of disappointment, and typically elicits physiological arousal (Finucane, 2011). Adolescents who did not down-regulate arousal while talking about frustration, by maintaining relatively more PNS influence, most likely mirrored physiological responses affiliated with anger, which has been shown to be negatively associated with prosociality in adolescence (Cui et al., 2015). While PNS reactivity to thinking about frustration was not associated with prosociality, talking about negative emotional experiences with another person has been suggested to function as a cathartic, relieving process (Zech & Rimé, 2005). Therefore, youths who were more effective at down-regulating arousal while talking about frustration may have been able to openly engage more with the emotions of the characters during the video mood induction.

Most surprisingly, youths' RSA reactivity while thinking about frustration was the only physiological measure that was not significantly related to either aspect of prosociality. Adolescents have been shown to engage in certain forms of emotion regulation (i.e., rumination) that can prolong the experience of a negative emotional stimulus (Volkaert et al., 2020; Zuzama et al., 2021). Thus, as a high-arousal negative emotion, many adolescents may not have the sufficient regulatory skills to down-regulate the subjective and physiological impact of frustration to effectively reorient attention to the needs of others. Future studies intent on exploring the effect of emotional experiences on prosociality would benefit from the inclusion of several emotion regulation measures to decipher the cognitive processes that align with physiological functioning.

Regarding gender differences, girls were found to report greater experiences of affective empathy and prosocial engagement compared to boys. This finding supports our hypotheses and extends prior work demonstrating greater prosociality in girls (Eisenberg et al., 2015; Hastings et al., 2000; 2005; Hodge et al., 2023). Moreover, in support of Hypothesis 4b, we did not find any significant gender differences in how youths' PNS reactivity to negative emotions were associated with their prosocial outcomes. Thus, the required patterns of PNS regulation during negative emotional experiences to support prosocial outcomes may be more similar than they are different for boys and girls. However, further work is needed to explore the effect of gender on these associations in other groups of adolescents, including gender diverse samples including non-binary or gender non-conforming youth.

While the current study provides valuable evidence that may help inform how underlying PNS reactivity may predict adolescent behaviors and orientations of prosociality, the study also has limitations. Although our goal was to explore the multidimensional aspects of adolescents' prosociality, we were unable to assess differences in youths' prosocial behavioral tendencies. Different dimensions of behavioral forms of prosociality have been suggested to serve different motivational goals (Eisenberg et al., 2016), and have been shown to be uniquely associated by different regulatory abilities and socioaffiliative motives (Hodge et al., 2023; Carlo & Padilla-Walker, 2020). In addition, youths within this study were oversampled for symptoms of internalizing and externalizing problems, which limit our ability to make generalizations of these findings to typical adolescent development. While we included internalizing and externalizing problems as covariates in our analyses, we also found that youths with fewer eternalizing problems had greater prosocial engagement. This aligns with prior research suggesting that externalizing problems in adolescence (e.g., relational aggression, antisocial behavior) hinders

development of healthy social and emotional well-being (Crick & Grotpeter, 1995; Hastings et al., 2000).

Furthermore, we were limited in our inability to directly assess a broader panel of systems of physiological arousal and regulation, by only measuring activity within the PNS, which is an index of down-regulation of arousal (Porges, 2011). Including assessments of adolescents' reactivity to emotional experiences within the sympathetic nervous system (SNS) would have allowed us to make more comprehensive conclusions regarding physiological arousal to the emotional stimuli. Prior work has demonstrated that concerted activity between the systems support more nuanced considerations of reactivity and regulation to emotional stimuli, such that activity in both systems may have facilitated greater propensities for adaptive responding (Miller, 2018).

This study contributed to the growing body of positive developmental research advocating for greater investigations using multidimensional perspectives of adolescent prosociality. Findings from this study demonstrated that youths' internalized and socially-engaged experiences of prosociality are differentially related to physiological regulation of emotional experiences. Behavioral facets of prosocial responding alone have also shown have various forms of engagement (Carlo & Padilla-Walker, 2020), and can be differentially influenced by adolescents' emotion regulation skills (Hodge et al., 2023).

Future studies would also benefit from longitudinal assessments of RSA reactivity to emotional experiences and prosociality. These analyses would allow researchers to explore the cross-lagged changes in the associations between RSA change and prosociality, which would better highlight the developmental implications of these findings. Moreover, while this study was an initial exploration of the associations between youths' physiological reactivity to emotional

experiences and prosociality, future studies should further explore ANS reactivity to additional emotions, particularly of positive valence, as well as varying contexts of experiencing these emotions.

Our findings provide new evidence that adolescents' parasympathetic reactivity to granular emotional experiences have unique associations with their ability to respond prosocially. These findings further underscore the complexity of the relationship between emotional experiences, physiological reactivity, and adolescent prosocial behavior, demonstrating that the nuanced ways in which youths process and respond to emotions like disappointment and frustration significantly impact their prosocial engagement. This research contributes to our understanding of positive adolescent development, highlighting the role of emotion regulation and socioaffiliative responding in fostering a supportive and empathetic society. By identifying specific emotional and physiological patterns that predict increased prosocial behaviors, these findings offer valuable insights for developing targeted interventions aimed at enhancing emotional intelligence and prosociality among adolescents, thereby supporting their overall well-being and social connectedness.

# CHAPTER FOUR

## PAPER 3: EFFECTS OF EMOTION REGULATION ON ALTRUISTIC AND EGOISTIC PROSOCIAL BEHAVIORS DURING COVID-19

The COVID-19 pandemic has had pervasive and detrimental effects on daily life, mental health, and social behaviors for individuals across the world (Gruber et al., 2020; Holman et al., 2020; Van Bavel et al., 2020). To prevent the virus's spread, public health authorities recommended or mandated individuals practice novel behaviors such as social distancing, masking, and remote work or schooling. These rapid changes to fundamental, normative social behaviors presented unique psychosocial stressors and challenges to communities globally (Smith & Gibson, 2020). Explorations of potential buffers against the effects of these compounded stressors on adaptive functioning are imperative.

Certain emotion regulation strategies (e.g., cognitive reappraisal, expressive suppression) may influence individuals' experiences of emotional distress in the face of such stressors (Davis et al., 2018), by permitting individuals to allocate energy and attention to positive social behaviors (Zahn-Waxler & Radke-Yarrow, 1990). Prosocial behaviors, which are conducted voluntarily with the intent to benefit others, are indicators of adaptive socioemotional functioning (Eisenberg et al., 2015; Li et al., 2021; Poulin & Holman, 2013). Decisions to behave prosocially may derive from a variety of motives, leading to diverse forms of expression (Eisenberg et al., 2016). Understanding how to leverage certain forms of emotion regulation may help promote positive sociobehavioral outcomes during times of distress. Thus, the present paper explored the effects of emotional distress caused by COVID-19 on different forms of helping behaviors during the pandemic in two independent samples, and the extent to which cognitive

reappraisal and expressive suppression may promote or diminish these forms of prosocial behaviors.

**Prosocial Behavior during the COVID-19 Pandemic**

The COVID-19 pandemic represents a unique context to explore ecologically valid forms of prosocial behaviors that individuals engage in during times of distress. While many studies identify adherence to public health safety measures (e.g., vaccination adherence, social distancing, information sharing) as an indicator of prosocial behavior during the pandemic (Butterworth et al., 2023; Coroiu et al., 2020), these behaviors are pandemic-specific and limited to this context. A smaller literature has examined more traditional conceptions of prosocial behaviors, such as helping others who are ill or donating to causes, within the context of the pandemic in response to the widespread personal, social, and financial effects of the pandemic (Oliveira et al., 2021; Scharf et al., 2023). These studies demonstrated that some individuals delivered food to others, provided emotional support, and informed others about coping practices.

A growing body of research has underscored the importance of considering multiple forms of prosocial behavior, which individuals may decide to engage depending on contextual demands and individual difference characteristics (Carlo et al., 2010; Eisenberg & Spinrad, 2015). Carlo and colleagues have identified several distinct dimensions of prosocial behavior (Carlo & Randall, 2002), including emotional (i.e., enacted under emotionally evocative situations) and public (i.e., open displays in the presence of others) prosocial behaviors. Emotional prosocial behavior are associated with more altruistic engagement, which are facilitated by empathic feelings for others' distress or needs (Eberly-Lewis & Coetzee, 2015),

whereas public prosocial behavior serves self-promotive goals of social acceptance and approval (Carlo & Randall, 2002).

While direct examination of these two forms of prosocial behavior during the pandemic is lacking, burgeoning research into the motivations for prosocial behavior suggests this could be an important line of investigation to inform public health messaging on coping strategies. Moral decision-making theories often distinguish two primary motivational domains of prosocial behavior: altruistic (i.e., fulfill goals of increasing another's welfare) and egoistic (i.e., fulfill goals of increasing one's own welfare; Batson, 2022; Eberly-Lewis & Coetzee, 2015; Eisenberg et al., 2016). While altruism and egoism are often modeled as opposing motivational influences (Eberly-Lewis & Coetzee, 2015), decisions to help others may derive from simultaneous altruistic and egoistic motives (Batson, 2022). For instance, within the context of the pandemic, a person may have purchased groceries on behalf of a friend who was in quarantine with the goal of helping their friend (i.e., altruistic) and with the notion that the friend may reciprocate if the tables were to turn later (i.e., egoistic).

Prior work has demonstrated positive associations between altruism and egoism with prosocial behaviors in the global context of the pandemic (Coroiu et al., 2020; Jones et al., 2022; Rodríguez et al., 2021). For instance, Zhu and colleagues (2022) found that more empathic individuals engaged in greater volunteering behaviors, which could reflect altruistically-motivated prosocial behavior. However, perceived health risks of the pandemic moderated the association between individuals' empathy and volunteer behaviors, such that greater risk perceptions were associated with weaker effects of empathy on volunteering, suggesting that egoistic motivations were also at play. However, studies examining altruistic and egoistic motivations do not speak directly to the varying forms of prosocial behaviors in which

individuals engage. Therefore, the present study explored the extent to which individuals engaged in both altruistic and egoistic forms of prosocial behavior during the pandemic.

**Emotional Distress and Prosocial Behaviors**

The COVID-19 pandemic induced heightened emotional distress in many people (Choi et al., 2020). Decades of theory and research on empathy, personal distress, and prosocial behavior have suggested that distress may diminish prosocial responsiveness. Witnessing another person in need often elicits personal distress (i.e., an emotion contagion response; Zahn-Waxler & Radke-Yarrow, 1990), such that another's discomfort or suffering induces negative arousal in oneself. Experiencing personal distress can lead to withdrawal and self-protective actions rather than altruistic engagement with the person experiencing distress (Eisenberg & Eggum, 2009). Several studies have found both acute personal distress in response to evocative, empathy-eliciting stimuli (Eisenberg, 2006; Eisenberg et al., 1989) and dispositional tendencies to feel more personal distress (Carlo et al., 1999; Henschel et al., 2020) to be negatively associated with prosocial behavior.

Yet, an alternate possibility for the association of distress and prosocial behavior emerged in Taylor's (2006, 2011) introduction of the tend-and-befriend hypothesis. Taylor proposed that experiences of distress may prompt certain individuals to cope with stressors by engaging in tending behaviors (e.g., attending to the needs of others) or befriending strategies (e.g., establishing new or improving social relationships) to strengthen social connections that also support personal well-being. Thus, tend-and-befriend responses to stressors may be evidenced through prosocial behaviors. Support for these responses has been mixed, though, with both increased and decreased prosociality having been reported or observed following various stressors. For instance, following exposure to social stressors, individuals have displayed

increased sharing behavior (von Dawans et al., 2019) and propensities to donate to charity (Sollberger et al., 2014), as well as decreased reciprocity and sharing behaviors (Steinbeis et al., 2015; Vinkers et al., 2013).

Despite the mixed findings from studies of acute stress, emotional distress experienced during the pandemic has been positively associated with prosocial behaviors (Mullins et al., 2023; Romero-Rivas & Rodriguez-Cuadrado, 2021; Ye et al., 2020), conforming to the tend-and-befriend hypothesis. Thus, we tentatively predicted that individuals with greater emotional distress resulting from the pandemic would engage in more prosocial behavior. As both others and the self are thought to benefit from prosocial actions motivated by tend-and-befriend responses, we expected personal distress to be associated with both altruistic and egoistic prosocial behavior. Recognizing the past mixed support for positive relations between distress and prosocial behavior, we examined how individual differences in emotion regulation strategies may affect these associations.

**Emotion Regulation and Prosocial Behaviors**

Emotion regulation, which is defined as processes responsible for the management and modification of emotional reactions (Gross, 2014). Emotion regulation strategies vary among individuals and can contribute to diverse behavioral responses in stressful situations. Indeed, different emotion regulation strategies have been found to be positively or negatively associated with prosocial behaviors. Cognitive reappraisal, an emotion regulation strategy involving the reinterpretation of an emotional stimulus (Mauss et al., 2007), has been shown to promote prosocial behaviors (Lockwood et al., 2014). For example, Hodge and colleagues (2023) found that emerging adults who reported using more cognitive reappraisal also reported engaging in more general and other-focused prosocial behaviors. Therefore, we expected greater use of

cognitive reappraisal strategies to be associated with both more altruistic and egoistic prosocial behaviors. Furthermore, effective emotion regulation is considered to be an important competency for redirecting emotional contagion responses in constructive other-oriented ways (Preston & de Waal, 2002). Cognitive reappraisal may permit an individual to interpret vicarious emotional arousal from witnessing another person in distress as being empathic concern rather than personal distress. This would support an individual allocating their attention and energy toward helping the other person in distress (Lockwood et al., 2014). Thus, we expected cognitive reappraisal strategies to promote more engagement in altruistic helping for those experiencing greater emotional distress.

In contrast, expressive suppression involves inhibiting ongoing emotionally-expressive behavior, possibly to better adhere to social norms and to avoid escalation of interpersonal conflicts (Gross & John, 2003; Thomson et al., 2018). Expressive suppression primarily alters the behavioral expression of emotions and does not necessarily manage subjective experiences of emotions (Cutuli, 2014). Consequently, individuals engaging in expressive suppression may withdraw during evocative social interactions, which could lead to diminished altruistic prosocial behaviors (van't Wout et al., 2010). Furthermore, individuals utilizing expressive suppression may conceal their emotions to better present themselves in a socially desirable way (e.g., calm) or to avoid conflict (Thomson et al., 2018). This focus on self-presentation may reflect prioritization of one's own needs and desires over the well-being of others (Batson, 2022), such that any prosociality displayed may be expected to consist of more egoistic prosocial behaviors, rather than altruistic prosocial behaviors.

Prior studies have demonstrated both positive (Benita et al., 2017) and negative (Li et al., 2021; Lockwood et al., 2014) associations between expressive suppression and prosocial

behavior. Of note, these studies did not distinguish between different forms of prosocial behavior; aggregates of altruistic and egoistic prosocial behaviors may have been included within the construct of prosociality in their analyses. Therefore, the present paper used a multidimensional understanding of prosocial behaviors to elucidate the associations between expressive suppression and prosociality.

**The Current Studies**

To better understand the extent of individuals' helping behaviors during times of distress, we examined the effects of emotional distress on altruistic and egoistic prosocial behavior during the COVID-19 pandemic in two samples. Additionally, we examined whether two emotion regulation strategies, cognitive reappraisal, and expressive suppression, both directly predicted these two forms of prosocial behavior and moderated the relations between emotional distress and prosocial behavior. In Study 1, we assessed these associations in a sample drawn from the general public of the United States during the early months of the pandemic. In Study 2, we sought to replicate and extend these results by examining undergraduate students' responses at three different points of progression within the pandemic.

We hypothesized that emotional distress caused by the pandemic would be positively associated with altruistic (H1a) and egoistic (H1b) prosocial behavior. We further hypothesized that greater cognitive reappraisal would predict both more altruistic (H2a) and more egoistic (H2b) prosocial behavior. Greater expressive suppression was predicted to be negatively associated with altruistic prosocial behavior (H3a) and positively associated with egoistic prosocial behaviors (H3b). Finally, we hypothesized that cognitive reappraisal would moderate the association between emotional distress and altruistic prosocial behavior, such that individuals experiencing high levels of emotional distress would engage in more altruistic prosocial

behaviors when cognitive reappraisal was higher rather than lower (H4). *A priori* hypotheses were not put forward for the moderating influence of expressive suppression on the associations between distress and prosocial behavior; these tests were considered to be exploratory.

## Study 1: Community Sample

### Method

#### Participants

Recruitment was based upon convenience sampling of adults (18 years or older) with access to a device with internet capabilities and who were fluent in English. From April 30 to June 15, 2020, advertisements for "an online study to better understand people's emotional and behavioral responses to the COVID-19 pandemic and the associated public health regulations" were placed on internet social networking sites and disseminated through university-affiliated portals and e-newsletters. 326 adults consented to participate ($M_{age}$ = 38.66 years, $SD_{age}$ = 14.29, *range:* 19-87; 254 females, 63 males, 5 non-binary or genderqueer individuals, and 4 declined to report). Participants primarily identified as White (72.91%) and were from 17 states and Washington, D.C. (77% California, 4% Colorado, less than 4% for any other state, 4% declined to report). Within the sample, 8.3% of the participants lived in households with an annual income of $20,000 or less, 13.2% earned between $20,000 to $40,000 annually, 35.8% earned between $41,000 and $100,000, 37.7% earned greater than $100,000, and 4.9% of the sample either declined to respond or didn't know their annual household income. The sample overrepresented highly educated individuals, such that 40.80% of the sample had obtained a bachelor's degree and 36.70% of the sample had obtained a graduate degree.

#### Procedure

All procedures were approved by the Institutional Review Board at University of California, Davis. Participants completed the study using Qualtrics, an online data collection tool. Data collection started one week after the first online advertisements, from May 7, 2020 through June 15, 2020. Participants first viewed an online informed consent page. After providing consent, participants completed questionnaires regarding their demographics, emotional distress, emotion regulation strategies, and prosocial behaviors. Participants were thanked for their time at the end of the survey. There was no financial incentive for participation. The survey took participants approximately 15-20 minutes to complete.

## Measures

### *Emotional Distress*

The Positive and Negative Affect Scale-Short Form (PANAS-SF) is a 10-item scale that assesses both positive and negative affect (Mackinnon et al., 1999). The PANAS-SF has 5 items in the Negative Affect scale (*nervous, hopeless, restless, worthless, fatigue*). Items were adapted from this scale to assess overall emotional distress following the onset of the pandemic (e.g., "Since the pandemic began, about how often did you feel nervous?"). Participants reported the extent to which the statements relate to their emotional experiences and expressions on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*). A composite score was created from the 5 items, with good internal consistency (Cronbach's $\alpha$ = .82*).*

### *Emotion Regulation*

The Emotion Regulation Questionnaire (ERQ) scale was used to measure participants' engagement in cognitive reappraisal and expressive suppression strategies (Gross & John, 2003). On this 10-item scale, cognitive reappraisal is measured by 6 items (e.g., "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm"), whereas

expressive suppression is measured by 4 items (e.g., “I keep my emotions to myself”). Participants reported the extent to which the statements relate to their use of the emotion regulation strategies (1 = *Strongly disagree*, 4 = *Neutral*, 7 = *Strongly agree*). Composite scores were created for the Cognitive Reappraisal and Expressive Suppression subscales based on the mean of the item scores, with good internal consistency ($\alpha$ = .89 and .75, respectively).

***Prosocial Behaviors***

To assess prosocial behaviors in the context of the COVID-19 pandemic, 15 items were adapted from the Prosocial Tendencies Measure-Revised (PTM-R; Carlo & Randall, 2002). Participants were asked to rate the extent to which statements described them on a 5-point Likert scale (1 = *does not describe me at all*, 5 = *describes me greatly*). To assess altruistic prosocial behaviors, a composite score was created from 4 items (e.g., “Since the pandemic began, knowing that others are not adjusting well has motivated me to reach out to them to offer support”), with good internal consistency ($\alpha$ = .75). Similarly, a composite score of four items was created to assess egoistic prosocial behaviors (e.g., “Since the pandemic began, having others see me helping COVID-19 causes makes me feel good”), with moderate internal consistency ($\alpha$ = .61).

**Analytic Approach**

***Data pre-processing***

Any measure exceeding 3 standard deviations from the sample mean were considered outliers. There were no outliers were found in the data. Little’s Missing Completely at Random (MCAR) was not significant, $\chi^2(6) = 1.50$, $p > .05$, suggesting that data could be treated as missing completely at random.

***Hypothesis testing***

A path analysis was conducted to assess the associations among emotional distress, emotion regulation, and prosocial behaviors. Within the model, all possible path coefficients were unconstrained to assess for all possible associations between variables, resulting in 20 parameters in the model. An adequate sample size for a model with 20 parameters should have at least 200 participants (Kline, 1998). Thus, the 326 participants in the present study provide sufficient power.

Less than 2% of the sample identified as non-binary, and thus were not included in the examination of how gender predicted the focal measures. Within the model, all possible path coefficients were unconstrained to assess for all possible associations between variables. In the event of significant interaction effects, simple slopes analyses were conducted to explore the conditional effects of emotional distress with motivations for prosocial behaviors at lower (−1 *SD*) versus higher (+1 *SD*) levels of emotion regulation.

To account for missing data, analyses were conducted with full information maximum likelihood (FIML) estimation. Good model fit was determined by the comparative fit index (CFI) (greater than or equal to .95), standardized root mean square residual (SRMR; less than or equal to .08), and root mean square error of approximation (RMSEA; less than or equal to .06; Hu & Bentler, 1999). Adequate model fit was determined by a CFI between .90 and .95, an SRMR between .08 and .10, and an RMSEA between .06 and .08.

## Results

### Preliminary Analyses

Table 3.1 presents the means, standard deviations, and zero-order correlations of variables in raw units. Participants who reported greater emotional distress from the pandemic also reported less use of cognitive reappraisal and greater use of expressive suppression.

Emotional distress was positively associated with egoistic prosocial behaviors. Participants who used more cognitive reappraisal and less expressive suppression reported more altruistic prosocial behaviors. Engaging in altruistic prosocial behavior was positively associated with engaging in egoistic prosocial behavior. Male-identifying participants reported more egoistic prosocial behaviors and expressive suppression, older participants reported less emotional distress, more highly educated participants reported more altruistic prosocial behavior, and participants with higher incomes reported less distress, less expressive suppression, and more altruistic behavior.

**Path Analysis**

Table 3.2 and Figure 3.1 present the model testing the associations between emotional stress, emotion regulation, and forms of prosocial behaviors; all paths are included in Table 2, whereas Figure 1 contains only the significant path coefficients. Interactions between emotional distress and both cognitive reappraisal and expressive suppression were computed to assess their combined effect on both forms of prosocial behaviors. Model fit parameters were as follows, $\chi^2$ (6) = 29.68, $p < .001$, CFI = 0.90, RMSEA = .11(.08 - .16), SRMR = .04.

Controlling for the effects of age, gender, income, and educational status, there was a significant, positive association between emotional distress and egoistic prosocial behavior; participants who reported greater pandemic-related emotional distress also reported more egoistic prosocial behaviors, supporting Hypothesis 3b. In line with Hypothesis 2, cognitive reappraisal was significantly and positively associated with both altruistic and egoistic prosocial behaviors. Contrary to our hypotheses, neither emotional distress nor expressive suppression distress were significantly associated with altruistic prosocial behaviors, nor was there evidence that emotion regulation strategies moderated the associations of emotional distress with altruistic

**Table 3.1**

*Descriptive Statistics and Zero-Order Correlations among Demographics, Emotional Distress, Emotion Regulation, and Prosocial Behaviors from a Public Sample*

| | *M (SD)* | Male | Female | Non-Binary | Age | Edu | Inc | Distress | CR | ES | Alt |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | 38.66 (14.29) | .00 | .03 | -.10 | | | | | | | |
| Edu | 4.00 (1.11) | -.01 | -.01 | -.04 | .02 | | | | | | |
| Inc | 4.96 (2.62) | .03 | .02 | -.10 | .23 *** | .05 | | | | | |
| Distress | 2.57 (.81) | -.05 | .02 | .08 | -.36*** | -.04 | -.24 *** | | | | |
| CR | 4.80 (1.19) | -.05 | .08 | -.11 | .11 | .09 | .10 | -.33 *** | | | |
| ES | 3.21 (1.21) | .14 * | -.13 * | -.05 | -.06 | -.05 | -.13 * | .16 ** | -.06 | | |
| Alt | 2.79 (.90) | -.01 | .01 | -.01 | .00 | .21 *** | .15 ** | -.01 | .19 *** | - .13 * | |
| Ego | 1.53 (.61) | .14 * | -.10 | -.07 | -.10 | .03 | .04 | .14 * | .07 | .01 | .40 *** |

*Note.* $N = 326$ (254 females, 63 males, and 5 gender non-binary, 4 declined to respond). Abbreviations: Edu, education; Inc, income; Distress, emotional distress; CR, cognitive reappraisal; ES, expressive suppression; Alt, altruistic prosociality; Ego, egoistic prosociality.

*$p < .05$, **$p < .01$, ***$p < .001$

or egoistic prosocial behaviors. With respect to the covariates, participants with higher educational achievement reported greater engagement in altruistic prosocial behaviors.

**Table 3.2**

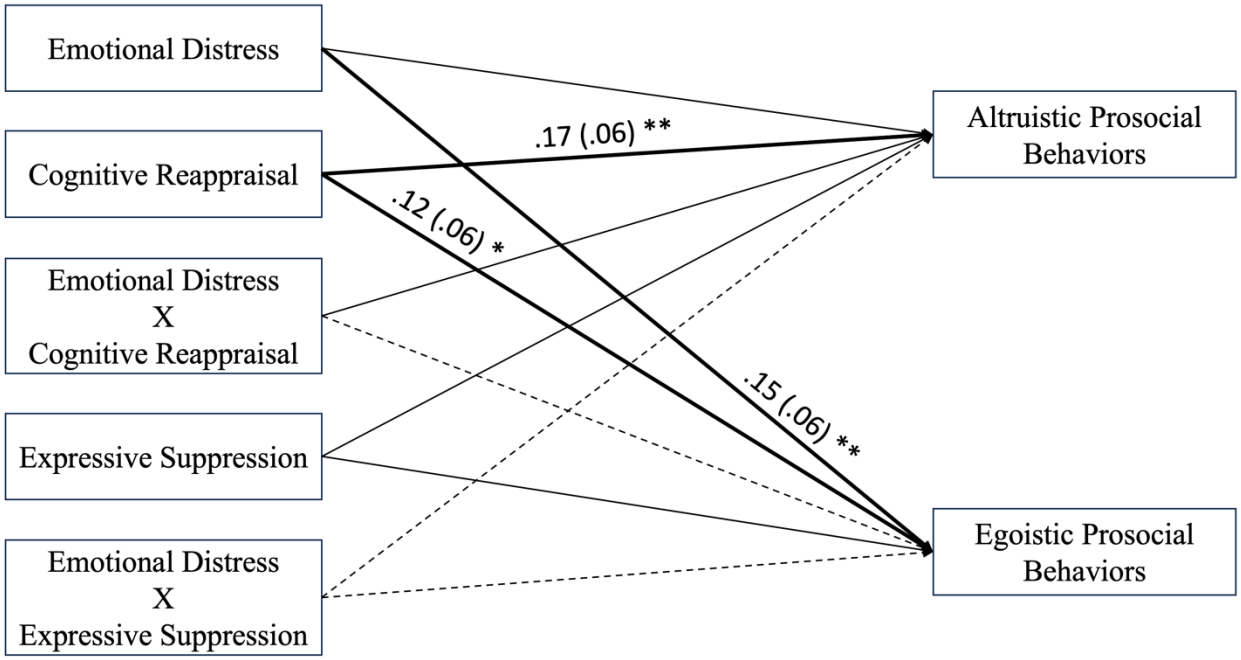
*Direct and Moderated Effects of Demographics, Emotional Distress, Emotion Regulation, on Prosocial Behaviors in a General Public Sample*

| | Altruistic | | Egoistic | |
|---|---|---|---|---|
| | *β* | *p* | *β* | *p* |
| Age | -.01 | .870 | -.06 | .302 |
| Male | -.11 | .461 | .28 | .071 |
| Female | -.14 | .363 | .14 | .359 |
| Education | **.16** | **.004** | .06 | .286 |
| Income | .10 | .087 | .06 | .286 |
| Emotional Distress | .09 | .139 | **.17** | **.007** |
| Cognitive Reappraisal | **.16** | **.004** | **.12** | **.039** |
| Expressive Suppression | -.08 | .179 | - .02 | .785 |
| Emotional Distress X Cognitive Reappraisal | -.04 | .461 | .04 | .455 |
| Emotional Distress X Expressive Suppression | -.03 | .588 | .03 | .625 |

*Note*. $N = 326$. Less than 2% of the sample identified as non-binary, and thus were not included in the examination of how gender predicted the focal measures. Significant associations are presented in bold font.

**Figure 3.1**

*Prediction of Altruistic and Egoistic Prosocial Behaviors by Emotional Distress, Cognitive Reappraisal, and Expressive Suppression during COVID-19 in a General Public Sample*




*Note.* Path analysis model including significant paths with standardized path coefficients (standard error in parenthesis). Covariates included age, gender, income and educational status; nonsignificant paths and covariates are not presented for clarity of the figure. $N = 326$.
* $p < .05$, ** $p < .01$, and *** $p < .001$.

## Study 1 Discussion

The findings from Study 1 extend the current literature regarding the associations between emotional distress, emotion regulation, and different forms of prosocial behaviors. These findings have important implications for understanding how individuals' experiences of emotional distress and regulation of their emotions were related to their engagement in prosocial acts during the first months of the COVID-19 pandemic.

As we hypothesized, individuals who experienced higher levels of emotional distress during the pandemic were more likely to engage in egoistic prosocial behavior. Yet, emotional distress was not significantly associated with altruistic prosocial behavior. Partially supporting

the tend-and-befriend hypothesis (Taylor, 2006, 2011), these findings suggest that experiences of emotional distress may have led individuals to behave prosocially in ways that specifically prioritized their own well-being, self-regard, or social standing during the pandemic. These findings may partially explain some of the inconsistent findings from prior work regarding the tend-and-befriend hypothesis (Sollberger et al., 2014; Steinbeis et al., 2015; Vinkers et al., 2013; von Dawans et al., 2019), and further highlight the importance of considering multiple forms of prosocial behavior when using this framework. Furthermore, these findings underscore the need to consider the emotional state of individuals when studying prosocial behaviors, as emotional distress may influence the nature and focus of prosocial actions (Padilla-Walker & Carlo, 2015).

Regarding Hypothesis 2, the significant, positive association between cognitive reappraisal and both altruistic and egoistic prosocial behaviors demonstrates that individuals who employ cognitive reappraisal as an emotion regulation strategy are more likely to engage in both more selfless and more self-focused prosocial behaviors. Cognitive reappraisal, which involves reframing and reinterpreting emotional experiences, may enhance individuals' motivation to help others as well as meet their own needs in a constructive manner (Harvey et al., 2010). Thus, in contexts of future natural disasters or other times of heightened stress, promoting the use of cognitive reappraisal to individuals as an emotion regulation strategy may be one way to promote greater community support and cooperation.

Contrary to expectations, expressive suppression was not significantly associated with either form of prosocial behavior. Prior work has found mixed associations between expressive suppression and prosocial behaviors, yet these studies did not differentiate between altruistic and egoistic forms of prosociality (Benita et al., 2017; Li et al., 2021; Lockwood et al., 2014). The present study’s results suggest that expressive suppression may not be a robust predictor of

prosocial behaviors. That is, engaging in expressive suppression may not necessarily hinder or promote individuals' decisions to engage in helping behaviors regardless of altruistic or egoistic motivations. These results highlight the need for further exploration of the complex interplay between emotional experiences, emotion regulation strategies, and altruistic behaviors.

Furthermore, we did not find a moderating effect of cognitive reappraisal on the association between emotional distress and prosocial behaviors. This may provide evidence consistent with the long-standing view that when emotional contagion leads to personal distress, individuals are more likely to withdraw rather than engage (Eisenberg et al., 1989; Zahn-Waxler & Radke-Yarrow, 1990). Pandemic-related personal emotional distress did not motivate altruistic other-oriented actions, even for individuals with strong emotion regulation capacities; conversely, distress made self-focused public prosocial behaviors more likely for people regardless of their use of cognitive reappraisal. Future work should explore other pathways through which emotion regulation may impact prosocial behaviors, as different strategies may have distinct effects depending on the specific context. Regarding the covariates, participants with higher educational achievement reported greater engagement in altruistic prosocial behaviors, which is consistent with prior research suggesting that education may play a role in fostering a sense of empathy and promoting acts of kindness and assistance towards others (Westlake et al., 2019).

Overall, these results provide insight into the relations between emotional distress, emotion regulation strategies, and different forms of prosocial behaviors. Yet, while some illuminative findings emerged, the majority of our expected associations were not supported. These unanticipated findings may reflect the effect of the unique context presented by the early months of the COVID-19 pandemic on individuals’ experiences of emotional distress, uses of

emotion regulation strategies, and decisions to help other people. For example, the pervasiveness and novelty of public guidelines around social distancing and remote work may have interfered with typically-expected associations (Daly, & Robinson, 2021). Yet, the lack of support for our hypotheses may partially be a result of our sample consisting of predominantly female-identifying, white, and highly educated individuals. Variations in socioemotional development and socioaffiliative behaviors exist among diverse groups of people, thus demonstrating the need for more diverse samples to be included in research (Carlo et al., 2010; Henrich et al., 2010; Roberts et al., 2020). Moreover, our moderate sample may not have been sufficient for detecting subtle moderation effects. Therefore, further research is needed to unravel the underlying mechanisms that drive individuals' prosocial tendencies in various emotional contexts. To begin this process, we employed the same method as Study 1 in a sample of undergraduate students to replicate and extend these findings in a larger and more diverse sample over a longer period of the pandemic.

## Study 2: Undergraduate Sample

Study 1 demonstrated associations among emotional distress during the pandemic, emotion regulation strategies, and two aspects of prosocial behavior. However, these findings are limited to assessments obtained near the onset of the pandemic in a relatively homogenous sample of adults. Within the United States, there is evidence that experiences of emotional distress may have changed as the events of the pandemic unfolded (Daly & Robinson, 2021; Robinson & Daly, 2021). For this reason, we could not rule out the possibility that individuals' emotional distress and forms of emotion regulation strategies and prosocial behavior were subject to change as the pandemic progressed. Therefore, in Study 2 we tested the same

hypotheses in a larger and more diverse sample recruited across three measurement occasions, extending to a year after the start of the pandemic.

## Method

### Participants

The present study incorporated three waves of online self-report surveys from 1,526 undergraduate students (1122 females, 380 males, 23 non-binary or genderqueer individuals, and 1 declined to respond; $M_{age}$ = 19.92 years, $SD_{age}$ = 2.28) at a university in Northern California, during the extended period of remote online instruction in 2020 and 2021 following the onset of the COVID-19 pandemic. There were 818 participants of Asian or Pacific Islander descent (405 Chinese, 109 Indian, 77 Vietnamese, 66 Filipino, 44 Korean, 13 Japanese, 11 Pacific Islander, and 93 "Other"), 514 participants of European descent, 31 participants of Native North or South American descent, 28 participants of Black or African American descent, and 87 biracial or multiracial participants; 48 participants did not report race or ethnicity. In addition, 22.2% of the sample identified as Hispanic or Latinx ethnicity. Within the sample, 18.9% of the participants lived in households with an annual income of $20,000 or less, 11.7% earned between $20,000 to $40,000 annually, 22.0% earned between $41,000 and $100,000, 22.1% earned more than $100,000, and 25.2% of the sample either declined to respond or didn't know their annual household income. Participants received partial course credit as compensation.

### Procedure

All procedures were approved by the Institutional Review Board of the researchers' university. Data collection occurred across 7 months, between August 4, 2020 and March 4, 2021, reflecting three sequential academic quarters (Summer, Fall, Winter). Participants who consented were asked to complete a demographic questionnaire and measures of emotional

distress, emotion regulation, and prosocial behaviors. Participants were asked, but not required, to answer all questions before they could continue to the next page of the survey, and had the option to quit the survey at any time. Participants' student ID number and computer IP addresses were tracked to determine whether multiple entries were made from the same individual, for which no data were required to be removed.

**Measures**

***Emotional Distress***

The same 5 items used in Study 1 adapted from the PANAS-SF were used to assess increases in overall emotional distress responses as a result of the pandemic. Items demonstrated good internal consistency ($\alpha$ = .85*)*.

***Emotion Regulation***

The same ERQ items from Study 1 were used to assess cognitive reappraisal and expressive suppression strategies. Composite scores were created for both factors and displayed good internal consistency ($\alpha$ = .87 for cognitive reappraisal, $\alpha$ =.76 for expressive suppression).

***Prosocial Behaviors***

The same items were used to assess altruistic and egoistic prosocial behavior. Composite scores demonstrated good internal consistency ($\alpha$ = .79 for altruistic, and .78 for egoistic).

***Time***

Data were collected from August 4 to September 7, 2020 (Summer; $N$ = 161), approximately two months later (75 days) from November 21 to December 10, 2020 (Fall; $N$ = 684), and approximately 1 month later (40 days) from January 19 to March 4, 2021 (Winter; $N$ = 681). A grouping variable was created to represent each wave of data collection (1 = *Summer*, 2 = *Fall*, and 3 = *Winter*).

## Analytic Approach

### *Data pre-processing*

Any measure exceeding 3 standard deviations from the sample mean were considered outliers. There were no outliers were found in the data. Little's Missing Completely at Random (MCAR) was not significant, $\chi^2(25) = 32.60$, $p > .05$, suggesting that data could be treated as missing completely at random.

### *Hypothesis testing*

A path analysis was conducted to assess the associations among emotional distress, emotion regulation, and prosocial behaviors. Within the model, all path coefficients were unconstrained to assess for all possible associations among variables, resulting in 20 parameters in the model. An adequate sample size for a model with 20 parameters should have at least 200 participants (Kline, 1998). Thus, the 1,526 participants in the present study provide sufficient power.

Less than 2% of the sample identified as non-binary, and thus were not included in the examination of how gender predicted the focal measures within the path analysis. In the event of significant interaction effects, simple slopes analyses were conducted to explore the conditional effects of emotional distress with motivations for prosocial behaviors at lower (−1 *SD*) versus higher (+1 *SD*) levels of emotion regulation.

To account for missing data, analyses were conducted with full information maximum likelihood (FIML) estimation. Good model fit was determined by the comparative fit index (CFI) (greater than or equal to .95), standardized root mean square residual (SRMR; less than or equal to .08), and root mean square error of approximation (RMSEA; less than or equal to .06; Hu &

Bentler, 1999). Adequate model fit was determined by a CFI between .90 and .95, an SRMR between .08 and .10, and an RMSEA between .06 and .08.

## Results

### Preliminary Analyses

Table 3.3 presents the means, standard deviations, and zero-order correlations of variables in raw units. Participants who reported greater emotional distress also reported less use of cognitive reappraisal, but more engagement in both altruistic and egoistic prosocial behaviors. Participants using more cognitive reappraisal reported more expressive suppression, altruistic prosocial behaviors, and egoistic prosocial behaviors. Participants reporting more expressive suppression reported more egoistic prosocial behaviors. Altruistic and egoistic prosocial behaviors were positively correlated.

Male-identifying participants reported less emotional distress than female and non-binary identifying participants. Male participants also reported fewer altruistic prosocial behaviors, more expressive suppression, and greater household income than female participants. Non-binary participants reported less cognitive reappraisal. Older participants reported less expressive suppression and lower household income. Participants with greater household income reported less emotional distress, cognitive reappraisal, expressive suppression, and egoistic prosocial behavior. Students assessed later in the pandemic reported less cognitive reappraisal and more altruistic and egoistic prosocial behaviors.

**Table 3.3**

Descriptive Statistics and Zero-Order Correlations among Demographics, Emotional Distress, Emotion Regulation, and Prosocial Behaviors from an Undergraduate Student Sample.

| | *M* (*SD*) | Male | Female | Non-Binary | Age | Inc | Time | Distress | CR | ES | Alt |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | 19.92 (2.28) | .04 | -.04 | .01 | | | | | | | |
| Inc | 5.47 (3.51) | .07 ** | -.07 ** | .01 | -.14 *** | | | | | | |
| Time | 2.34 (.66) | .05 | -.06 * | .03 | -.06 * | .09 *** | | | | | |
| Distress | 2.93 (.88) | -.16 *** | .13 *** | .12 *** | .00 | -.14 *** | .02 | | | | |
| CR | 4.72 (1.10) | -.03 | .04 | -.06 * | .04 | -.06 ** | -.06 * | -.08 ** | | | |
| ES | 4.17 (1.05) | .10 *** | -.09 *** | -.03 | -.06 * | -.06 * | .00 | .03 | .41 *** | | |
| Alt | 2.82 (.90) | -.12 *** | .11 *** | .03 | .00 | -.04 | .07 ** | .18 *** | .15 *** | -.01 | |
| Ego | 1.99 (.87) | .00 | .00 | -.02 | -.04 | -.08 ** | .06 ** | .09 *** | .07 *** | .10 *** | .56 *** |

*Note.* $N$ = 1,526 (1122 females, 380 males, and 23 gender non-binary, 1 declined to respond). Time was coded such that Summer 2020 = 1, Fall 2020 = 2, and Winter 2021 = 3. Abbreviations: Inc, income; Distress, emotional distress; CR, cognitive reappraisal; ES, expressive suppression; Alt, altruistic prosociality; Ego, egoistic prosociality.

*$p$ < .05, **$p$ < .01, ***$p$ < .001

**Path Analysis**

Table 3.4 and Figure 3.2 present the model testing the associations between emotional distress, emotion regulation, and altruistic and egoistic prosocial behaviors; all paths are included in Table 4, whereas Figure 2 includes only the significant path coefficients. Concurrent interactions between emotional distress and both cognitive reappraisal and expressive suppression were computed to assess their combined effect on both forms of prosocial behaviors. The model demonstrated good fit, $\chi^2$ (6) = 33.81, $p < .001$, CFI = .98, RMSEA = .06 (.04 - .08), SRMR = .03.

Controlling for the effects of age, gender, income, and time point in the pandemic, there were positive, significant associations between emotional distress and both altruistic and egoistic prosocial behaviors, which is consistent with Hypothesis 1. Cognitive reappraisal was significantly and positively associated with altruistic prosocial behaviors, as predicted, but not with egoistic prosocial behaviors. In line with Hypothesis 3, expressive suppression was significantly and negatively associated with altruistic prosocial behaviors, and also significantly and positively associated with egoistic prosocial behaviors. Contrary to Hypothesis 4a, cognitive reappraisal did not significantly moderate the association between emotional distress and altruistic prosocial behaviors. However, the interaction between cognitive reappraisal and emotional distress significantly predicted egoistic prosocial behavior, in line with Hypothesis 4b (Figure 3). Emotional distress was positively associated with egoistic prosocial behavior when cognitive reappraisal was higher ($\beta = .11$, $p < .001$), but not when it was lower ($\beta = .05$ $p = .21$).

With respect to the covariates, the time at which participants completed the surveys was significantly and positively associated with both altruistic and egoistic prosocial behaviors;

participants reported engaging in more prosocial behaviors as the pandemic persisted. Income was significantly and negatively associated with egoistic prosocial behavior.

**Table 3.4**

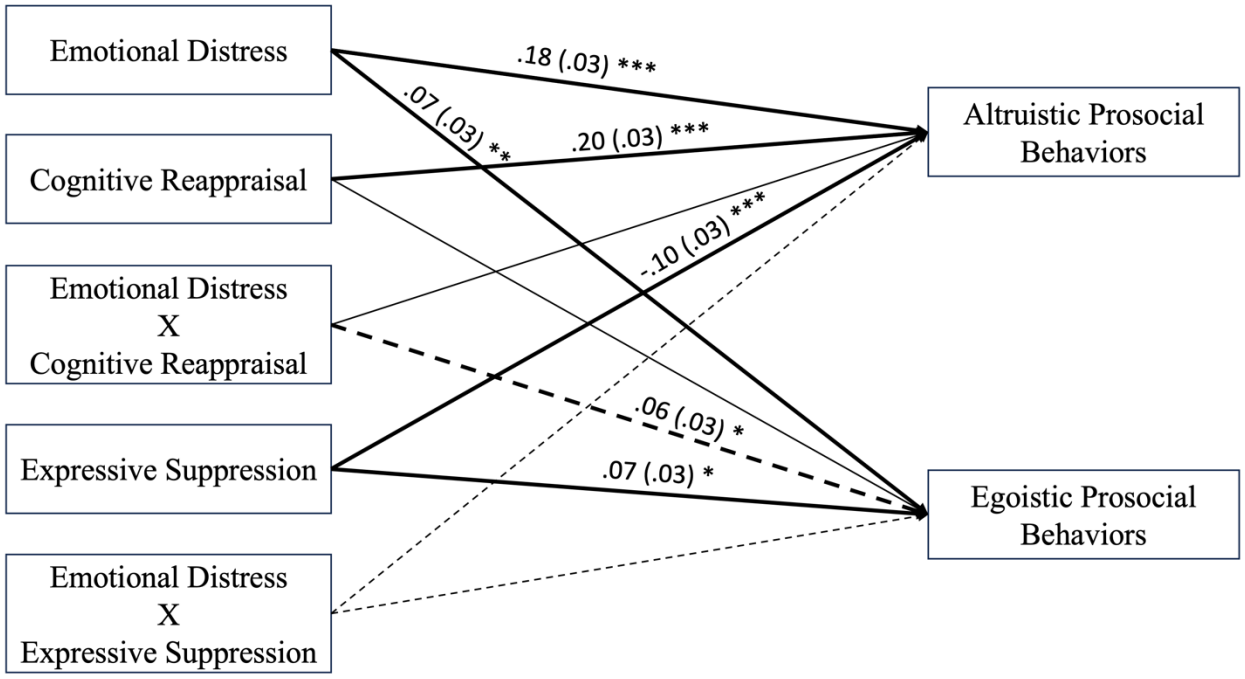
*Direct Effects among Demographics, Emotional Distress, Emotion Regulation, and Prosocial Behaviors in an Undergraduate Student Sample*

| | Altruistic | | Egoistic | |
|---|---|---|---|---|
| | *β* | *p* | *β* | *p* |
| Age | .00 | .876 | -.04 | .128 |
| Male | -.13 | .095 | .06 | .510 |
| Female | -.06 | .094 | .05 | .577 |
| Income | - .01 | .667 | **-.07** | **.007** |
| Time | **.08** | **.003** | **.07** | **.006** |
| Emotional Distress | **.18** | **.001** | **.07** | **.007** |
| Cognitive Reappraisal | **.20** | **.001** | .05 | .083 |
| Expressive Suppression | **-.10** | **.001** | **.07** | **.010** |
| Emotional Distress X Cognitive Reappraisal | .00 | .998 | **.06** | **.028** |
| Emotional Distress X Expressive Suppression | .01 | .859 | -.04 | .161 |

*Note*. N = 1,526. Less than 2% of the sample identified as non-binary, and thus were not included in the examination of how gender predicted the focal measures. Significant associations are presented in bold font.

**Figure 3.2**

*Prediction of Altruistic and Egoistic Prosocial Behaviors by Emotional Distress, Cognitive Reappraisal, and Expressive Suppression during COVID-19 in an Undergraduate Sample*




*Note*. Path analysis model including significant paths with standardized path coefficients (standard error in parenthesis). Covariates included age, gender, income and duration of pandemic; paths for covariates are not presented for clarity of the figure. $N$ = 1,526.

* $p < .05$, ** $p < .01$, and *** $p < .00$

## Study 2 Discussion

As hypothesized, greater emotional distress during the pandemic was associated with more altruistic and egoistic prosocial behavior in the university sample of Study 2. These findings support the tend-and-befriend hypothesis (Taylor 2006, 2011), such that emerging adults sought out ways to help others when experiencing distress during the pandemic. During the first year of the pandemic, undergraduate students experienced both social distancing guidelines and remote education that likely diminished their social connections, possibly contributing to their emotional distress. Our findings suggest that students with greater pandemic-related emotional distress may have engaged in tend-and-befriend responses to form and maintain social relationships (Mullins et al., 2023; Romero-Rivas & Rodriguez-Cuadrado, 2021; Ye et al., 2020).

Furthermore, cognitive reappraisal was positively associated with altruistic prosocial behaviors but not associated with egoistic prosocial behaviors in Study 2. This supports prior work demonstrating that cognitive reappraisal strategies specifically promote more altruistic forms of prosocial behavior (Hodge et al., 2023; Lamm et al., 2007). Engaging in cognitive reappraisal during times of general distress may promote more selfless forms of helping by reducing an inundating emotional contagion response (Lockwood et al., 2014; Preston & de Waal, 2002). These findings further demonstrate the importance of public health efforts to educate the public on engagement in effective emotion regulation to better support mental health and well-being.

As predicted, expressive suppression was negatively associated with altruistic prosocial behaviors and positively associated with egoistic prosocial behaviors in the emerging adult sample. Previous research has yielded mixed results when examining the association between expressive suppression and prosocial behavior, from positive (Benita et al., 2017) to negative

associations (Li et al., 2021; Lockwood et al., 2014). Expressive suppression functions to restrain behaviors and conform to norms of emotional self-control (Gross & John, 2003; Thomson et al., 2018). Egoistic prosocial behavior similarly reflects conforming to norms by seeking approval from others for having engaged in helping behaviors (Batson, 2022; Eisenberg et al., 2016), and thus may align with self-preservation efforts of expressive suppression. Furthermore, expressive suppression does not diminish experienced arousal, which may lead to greater avoidance or withdrawal from others' strong emotions (Cutuli, 2014). Altruistic prosocial behaviors reflect engagement with others' distress or need, as well as putting the self at risk to help another (Eberly-Lewis & Coetzee, 2015), which run counter to the functions of expressive suppression. Past inconsistent findings for the association between expressive suppression and prosocial behavior may be a result of using general measures of prosocial behavior, further reinforcing the importance of having a multifaceted consideration of prosocial behaviors. Subsequent studies ought to investigate the possible mechanisms underlying the unknown associations between expressive suppression and forms of prosocial behavior.

Most strikingly, cognitive reappraisal moderated the association of emotional distress and egoistic prosocial behavior in Study 2. While cognitive reappraisal did not directly predict engagement in egoistic prosocial behaviors in this emerging adult sample, greater use of cognitive reappraisal strengthened the tendency for people who experienced more pandemic-related emotional distress to engage in more egoistic prosocial behavior. Individuals experiencing greater pandemic-related emotional distress and who engaged in more cognitive reappraisal may have been experiencing tend-and-befriend responses that stimulated self-promotional interactions with others, as a means of coping, feeling efficacious, and resolving one's personal distress. For instance, a distressed individual may have believed that helping

others could vicariously improve their own emotions (Eisenberg et al., 2016) and lead to future reciprocity from the person being helped (Batson, 2022). This suggests that individuals reappraising following a stressor may engage in prosocial behaviors for self-promotional reasons, rather than for the sake of community building. This may not be a maladaptive response; if cognitive reappraisal is an emotional coping mechanism during times of heightened distress that leads one to engage in helpful actions that are seen by others, it could serve to promote social integration and emulation of the prosocial acts by others. Thus, emerging adults' use of cognitive reappraisal during the pandemic was associated with increased altruistic prosocial behavior, and for those experiencing greater emotional distress, also greater egoistic prosocial behavior.

## General Discussion

Understanding the efficacy of emotion regulation capacities is of great importance for developing strength-based models aimed at fostering positive responses during periods or contexts of significant distress. Prosocial behaviors are indicators of positive adjustment and can promote community well-being following the wake of a large-scale stressor (Giovanis & Ozdamar, 2022). To better inform efforts aimed at promoting adaptive responding during times of distress, it is imperative to assess the underlying individual difference characteristics that promote engagement in varying forms of prosocial behavior. Therefore, this pair of studies was designed to examine the extent to which cognitive reappraisal, expressive suppression, and emotional distress during the COVID-19 pandemic were associated with individuals' altruistic and egoistic prosocial behavior. The present findings contribute to a growing body of literature positing certain emotion regulation strategies as effective methods of buffering against stressors

and promoting decisions to behave prosocially, both generally and during unprecedented disruption like the COVID-19 pandemic.

When comparing the findings between Study 1 and 2, some associations were replicated, including that greater emotional distress significantly predicted increased egoistic behaviors. Thus, experiences of major stressors may motivate individuals to initially engage in self-promotional tend-and-befriend responding (Schweda et al., 2019). The magnitude of the effect was notably larger in Study 1 than in Study 2, which could relate to the timing of data collection. Data for the general public sample were collected two to three months after the onset of the pandemic, whereas data collection for the undergraduate sample started two months after this period and continued across seven months, ending near the first anniversary of the onset of the pandemic. During the earlier and most stressful period of the pandemic (Daly & Robinson, 2021), when conditions were most novel and public health restrictions on social behavior were strongest, people may have been particularly likely to respond to pandemic-related distress with public displays of kindness and generosity, thereby soliciting praise or support from others. Interestingly, the pattern was reversed for altruistic prosocial behavior. Although emotional distress also was positively associated with altruistic prosocial behaviors in both studies, this was nonsignificant in the general public sample and robust in the undergraduate sample. Again, this discrepancy may stem from the timing of data collection. When students were surveyed for Study 2, many public health restrictions on social interactions had been loosened, and people had more opportunities both for receiving support and for directly seeing the states that others were in. In these circumstances, personal feelings of emotional distress may have motivated individuals to engage in more selfless forms of prosocial behavior in service of the community-building aspects of the tend-and-befriend model (Taylor 2006, 2011). Indeed, students assessed

later in the first year of the pandemic reported engaging in significantly more prosocial behaviors of both kinds, suggesting that they perceived increasing opportunities for multiple forms of prosocial behavior as people began spending more time together. Collectively, these findings may suggest that emotional distress may shift from promoting more egoistic to more altruistic forms of prosociality when stressors are perceived as more manageable or less overwhelming.

As we predicted, greater cognitive reappraisal skills significantly and robustly predicted more altruistic prosocial behaviors in both samples. This finding replicated prior work demonstrating a positive association between cognitive reappraisal and emotional forms of prosocial behavior, thereby demonstrating the effectiveness of cognitive reappraisal even during experiences of novel, global-scale natural disasters. Encouraging cognitive reappraisal as a coping method may facilitate greater engagement in cooperative and communal action, ultimately promoting positive social change and well-being for all. The adults surveyed in the general public sample who engaged in more cognitive reappraisal also reported more egoistic prosocial behaviors, whereas this association was marginal for the undergraduate sample. In addition to the timing and pandemic conditions considered previously, this weaker association in the undergraduate sample may have been influenced by factors specific to the developmental stage and social environment of the students. Cognitive reappraisal may have had a weaker association with egoistic than with altruistic prosocial behaviors among undergraduate students due to the emphasis on personal growth, moral development, and social responsibility that often occurs within the educational context of universities (Liddell & Cooper, 2012). These results further underscore the importance of considering contextual factors when examining the relations between emotion regulation strategies and prosocial behaviors.

In the Study 2, expressive suppression was negatively associated with altruistic prosocial behavior and positively associated with egoistic prosocial behavior, whereas these associations were nonsignificant for the Study 1 sample. The lack of replication for significant associations between expressive suppression and prosocial behaviors may derive, in part, from the difference in sample sizes between the two studies. The magnitude and direction of the association between expressive suppression and altruistic prosocial behavior in Study 1 was very near to that of Study 2, suggesting that the small effect size necessitated a larger sample to reach statistical significance. Indeed, twice as many effects were significant in Study 2 than in Study 1.

Although the current pair of studies provides valuable evidence that may help to inform how personal distress can motivate prosocial engagement with others, and how emotion regulation strategies can promote prosocial behaviors during times of broad public distress, the studies also had some limitations. Perhaps the greatest limitation was our inability to assess these associations in additional diverse samples. Participants from both studies were predominantly of European or Asian descent. Furthermore, while educational status and income were controlled in our analyses, it is important to note that both samples had representation from highly educated individuals that is not reflective of the national nor global population. A second limitation included our dependence on self-report assessments of prosocial behaviors in the pandemic, which could introduce reporter or self-presentation biases. The inclusion of more diverse methodologies (e.g., behavioral tasks) would have potentially provided a more accurate assessment of individuals' engagement in prosocial behaviors. Another limitation stemmed from assessing prosociality without identifying the individuals on whose behalf these behaviors were conducted. Given the uncertainty and widespread impact of the pandemic, individuals may have been more inclined to help certain social group members (e.g., family members, close friends)

over others (e.g., strangers, community members). Investigating the specific targets of different forms of prosocial behavior more thoroughly would provide insights for subsequent prosociality research (Carlo & Padilla-Walker, 2020).

Future studies aimed at exploring ways to promote prosocial behaviors during times of heightened stress would benefit from assessments of other forms of stress alongside emotional distress. While the COVID-19 pandemic has presented a unique context to study the effects of stressors, future work would benefit from assessments of stressors that exist beyond the pandemic (e.g., daily stressors, work and personal stressors). In addition, assessments of other forms of individual difference characteristics that buffer the effects of stress on engagement in prosocial behaviors, such as social support systems, perceived competence, and coping styles, should be explored. Last, insight into the enduring effects of the stressors associated with the pandemic is needed to assess if the associations we documented herein have persisted or changed following the end of the pandemic.

The present findings advance a more nuanced understanding of the associations between stress and emotion regulation strategies in promoting prosocial behaviors. Such findings provide support for positive intervention efforts aimed at improving mental health and well-being for individuals not only during the COVID-19 pandemic, but also during times of other contexts of heightened stress. Our findings suggest the importance of fostering cognitive reappraisal, and possibly other emotion regulation skills, as effective means of promoting positive socioaffiliative behaviors toward others.

# CHAPTER FIVE

# GENERAL CONCLUSION

Adolescence, which is characterized by increases in emotional intensity and the salience of social contexts, presents a critical developmental period to develop strength-based models aimed at promoting healthy socioemotional functioning and positive social affiliative behaviors. Prosocial behaviors, which are voluntary actions intended to benefit others, are a hallmark of positive social proficiency development in adolescence (Eisenberg et al., 2015; Hart & Carlo, 2005; Wentzel et al., 2007). Greater prosociality in adolescence has been associated with, and may contribute to, a variety of other indicators of positive socioemotional adjustment, such as greater acceptance from peers, improved self-esteem, self-efficacy, well-being, and life satisfaction, and fewer problem behaviors (Caprara et al., 2014; Carlo & Padilla-Walker, 2020). Youths' propensities for prosocial emotions and behaviors are partially contingent on their abilities to regulate emotional arousal, particularly during times of witnessing others in need or distress. Moreover, the various strategies and contextual demands that might influence the patterns of regulation that support adaptive responses may facilitate different forms of prosocial development. Yet, few studies within the extant developmental literature have directly examined these associations within adolescence.

The present dissertation begins to address these gaps and advances the current understanding of the role of emotion regulation in adolescents' prosociality. Findings from these three studies provide a foundation for future emotion and positive developmental research aimed at applying multidimensional approaches to prosociality and developing strengths-based models that foster greater socioemotional functioning.

Paper 1 examined the influence of cognitive reappraisal and rumination as regulatory strategies on adolescents' ANS activity and prosocial responding. Findings from Paper 1

contribute to our understanding of the interplay between emotion regulation strategies, autonomic nervous system (ANS) functioning, and prosocial responding in adolescents. Contrary to prevailing assumptions that engagement in certain emotion regulation strategies inherently confer prosocial outcomes, youths' engagement in cognitive reappraisal and rumination did not differentially predict their emotional and behavioral prosocial responding. Rather, findings from this study suggest that youths' use of cognitive reappraisal and rumination significantly altered the extent to which ANS activity was associated with different forms of their prosocial responding. Therefore, the efficacy of various emotion regulation strategies in promoting prosocial behaviors appears to be more intricate than previously assumed.

Paper 2 investigated the extent to which PNS reactivity to experiences of both thinking and talking about negative emotions were associated with adolescents' prosociality. Findings from this study provide novel evidence to suggest that adolescents' parasympathetic reactivity to granular emotional experiences have unique relations with their ability to respond prosocially. Specifically, associations differed between youths' experiences of thinking and talking about negative emotions and these differences extended across individual emotions.

Paper 3 aimed to examine the effect of emotional distress experienced during the COVID-19 pandemic on different forms of helping behaviors during the pandemic, as well as the extent to which cognitive reappraisal and expressive suppression may promote or diminish these forms of prosocial behaviors. Results from two independent samples suggest that emotional distress promotes prosocial behaviors for some individuals, depending on their emotion regulation strategies during times of distress. Specifically, individuals who experienced greater emotional distress during the pandemic engaged in more egoistic forms of prosocial behavior. Moreover, for undergraduate students, emotional distress also predicted greater engagement in

altruistic prosocial behavior. Across both studies, greater use of cognitive reappraisal was associated with more altruistic prosocial behaviors, thereby supporting prevailing research identifying cognitive reappraisal as an effective emotion regulation strategy. Interestingly, cognitive reappraisal also moderated the association between undergraduate students' experiences of emotional distress and egoistic prosocial behaviors. This finding may suggest that for individuals experiencing greater emotional distress, engaging in more cognitive reappraisal may elicit tend-and-befriend responses that confer self-promotional interactions with others.

Taken together, the three studies herein demonstrate that emotion regulation abilities and strategies contribute to diverse forms of prosocial engagement. Moreover, findings from this dissertation begin to address the existing gaps in emotion regulation research by identifying psychophysiological profiles that facilitate greater prosociality across emotional and situational contexts. Multidimensional perspectives of prosociality can address more ecologically valid and nuanced insights into the various factors that contribute to adolescents' prosocial development. This dissertation highlights areas for future research and further supports efforts to identify positive developmental trajectories, with its novel focus on psychophysiological functioning and emotion regulation processes during adolescence. Overall, these insights reveal nuanced associations among emotion regulation, autonomic nervous system (ANS) functioning, and prosocial behaviors in adolescents. By integrating these elements into developmental models, both researchers and practitioners can develop a deeper understanding of adolescent social interactions and enhance positive socioemotional outcomes.

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