

Expanding the Definition of Self-Compassion as Emotion Regulation

By

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Abstract

Emotion regulation is a critical aspect of development and daily functioning. There are several different ways in which an individual can manipulate and control their emotions, and increasing interest has developed toward adaptive strategies that encourage the development of well-being. One approach for developing well-being that is gaining notoriety is self-compassion. I discuss reconceptualizing self-compassion as an emotion regulation strategy from a variety of perspectives and theoretical approaches. To aid this redefinition, I introduce a potential spectrum approach to viewing acceptance-related and cognitive-related emotion regulation strategies.

I established early support for this theory in a series of studies. In the first study, I explored a tactic central to the engagement spectrum of regulation strategies in this theory – emotional engagement – in an adolescent sample. I found that trait acceptance was significantly associated with performance on an emotional engagement task for self-reported emotions and skin conductance responses, but had non-significant relationships with trait reappraisal. This supports predictions made by the theory and establishes that these connections exist early in life.

Second, I completed a set of studies that compared the emotion engagement-related strategies of acceptance (Study A) and self-compassion (Study B) with reappraisal and a non-instructed regulation condition. In both studies, adults completed an emotion regulation task online and reported subjective levels of positive and negative emotion, which I also associated with past experiences of maltreatment. These studies showed that when attempting to mitigate positive emotions reappraisal was more effective compared to acceptance, but was equally effective as self-compassion. When minimizing negative

emotions, reappraisal use was superior to acceptance, but self-compassion outperformed reappraisal. I also observed that both engagement-related strategies preserved the experience of positive emotions compared to reappraisal. Both studies also examined the use of these strategies with respect to maltreatment histories, and both strategies performed equally across all severities of maltreatment or abuse severity. The differences between how these engagement strategies compare to reappraisal demonstrate natural differentiation of skills predicted by the spectrum theory. Their similar responses across maltreatment and abuse severity highlight important similarities in conditions where the emotion regulation processes often get stressed, hinting at possible shared mechanisms or features.

Finally, I compared how youth use self-compassion, reappraisal, and a non-instructed condition. I found that youth use self-compassion in similar ways that adults used acceptance. These findings hint at developmental processes underlying emotion regulation, which are also predicted by the spectrum theory.

Together, these studies provide early support for the spectrum theory of emotion regulation, specifically the emotion engagement spectrum of strategies, and help establish self-compassion as a discrete emotion regulation strategy. I discuss how adopting this framework for regulation strategies can influence both clinical treatment and research by prompting the use of more precise measurement and interventions. This theory, and self-compassion as a regulation strategy, provides opportunities for new directions in both research and clinical care.

CHAPTER 1. REDEFINING SELF-COMPASSION: A SPECTRUM OF ACCEPTANCE-RELATED REGULATION STRATEGIES

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Under Review: Emotion Review

Why is emotion regulation important?

In 1998, James Gross published the seminal article that described the emerging field of emotion regulation (ER) and presented his process model of emotion regulation. Since that time, the field has continued to develop and expand, and interest in the ability to regulate and dysregulate one's emotions has gained attention within the fields of well-being and psychopathology. For instance, Gratz & Roemer (2004) published the Difficulties in Emotion Regulation Scale, which measures general difficulty in regulation. Through the expansion of research on emotion, ER strategies have been characterized in very loose terms as adaptive and maladaptive, with habitual use of many strategies associated with differential risk of psychopathology or well-being (Aldao et al., 2010). It is now well accepted that difficulty regulating negative emotions are closely tied to psychopathology, and work has begun to explore the role that the dysregulation of positive emotions can play across psychiatric disorders (Gilbert et al., 2013).

The ability or inability to regulate one's emotions has also been implicated in many other processes, such as socioemotional development and academic success (Harrington et al., 2020), its interaction with parenting practices (Herd et al., 2021), and interpersonal relationships (Schwartz-Mette et al., 2021). These relationships highlight how emotions

and the ability to regulate them are implicated across a wide spread of effects across one's life. Emotion dysregulation, broadly understood as the inability to effectively regulate one's emotion, is associated with many negative outcomes (Gratz & Roemer, 2004). However, specific definitions of dysregulation can vary. Some define it as difficulties in the ability to implement or select an optimal strategy to use in the moment. Alternatively, some view it as experiencing emotions or expressions that interfere with current goals or behaviors (Daros & Ruocco, 2021). Regardless of the definition used, chronic dysregulation has been associated with other adverse outcomes, such as interpersonal difficulties, communication problems, weak social support, and even greater psychopathology (Aldao et al., 2010).

Within the literature, several specific ER strategies have been identified. Many of these were detailed by Gross (1998) in his influential article. However, one distinct strategy that he did not describe in detail at the time was acceptance, which is now widely considered an important regulation strategy. The addition of acceptance within the ER literature helped develop and expand the conceptualization of adaptive and maladaptive strategies, and acceptance more broadly has influenced many psychological interventions such as dialectical behavior therapy (Linehan, 1993) and acceptance and commitment therapy (Hayes et al., 2006).

More recently, interventions to help mental health concerns have begun to incorporate aspects of self-compassion, such as cognitive-based compassion training (Reddy et al., 2013), mindful self-compassion (Neff, 2003), and other mindfulness interventions. Many of these interventions utilize self-compassion to manage one's emotions, which intuitively implies that it should be included within the collection of ER strategies. However, no formal efforts to determine if self-compassion, or compassion more

broadly, should qualify as an ER strategy have occurred thus far, let alone how it relates to other strategies. This work will examine current definitions and models of ER, and will examine the aspects of self-compassion that define it as an emotion regulation strategy. We will use acceptance and reappraisal as reference points, because of their similarities and overlapping features with self-compassion. Our hope is that anchoring self-compassion in the emotion regulation framework will facilitate further research on the components and effects of self-compassion, which can translate into improved clinical interventions such as enhancements to cognitive behavioral therapy, or minor adaptations to other approaches such as dialectical behavior therapy or acceptance and commitment therapy that already use aspects of compassion. Finally, we will also discuss the implications of the addition of self-compassion into the pantheon of emotion regulation strategies.

Key features of emotion regulation

Before diving into self-compassion, a brief review of the defining features of ER strategies would be useful. Establishing some defining features is effective in determining what features self-compassion needs to possess to be a candidate for an ER strategy. Unfortunately, there is no definitive checklist of criteria used to identify ER strategies, instead they are broadly defined as the ability to modulate emotions in some way. To fill this gap, we will incorporate definitions of emotion regulation from both a psychology perspective, as described by James Gross, and a neuroscience perspective into a core set of criteria for establishing what makes an emotion regulation strategy.

In his 1998 article, Gross defined ER by pulling heavily from stress and coping literature, specifying them as “processes by which individuals influence which emotions they have, when they have them, and how they experience these emotions” (p. 275). More

modern updates to his definition describe ER as “people’s attempts to influence emotions, defined as time-limited, situationally bound, and valenced (positive or negative) states...[and] encompasses up- and down-regulation of positive and negative emotions in accordance with regulation-related goals” (McRae & Gross, 2020, p. 1). Based on these quotes, the definition of emotion regulation has not changed substantially over time. This is beneficial, as it lends a consistent and systematic approach for exploring ER strategies.

This modern definition of emotion regulation above presents several important traits of ER, which specific strategies would, by concept, also possess above and beyond manipulating the emotional intensity. A major aspect is that these strategies are time-limited. They occur for short periods of time, and their effects likely dissipate after the use of the strategy has ceased. Importantly, these strategies should be situationally bound, meaning that strategies and efforts to regulate one’s emotions occur within the context of an emotional experience. These two aspects together mean that if the situation calls for the continuous experience of emotions, and if the strategy is no longer used, the emotion would likely grow in intensity toward its initial trajectory of intensity, then naturally dissipate.

In an alternative but complementary model, Goldsmith and Davidson (2004) attempted to explore the components of ER by examining it from an affective neuroscience perspective. They described both behavioral and neuroimaging findings that supported three components. Looking briefly at their definition, they stated that there may be genetic factors driving in the use of different ER strategies. They argue for the investigation of genetic factors that help create some form of endophenotype regarding the use of emotion regulation ability, which are reflected in early temperament, and later develop into the

ability to utilize strategies, and the possibility for automaticity in use. Further, the authors describe how the genetic predisposition for ER strategies are likely linked to temperament in early life and is reflective of reactive and regulatory processes that can be measured using methods such as heart rate or galvanic skin conductance. This hypothesis implies that strategies may be capable of being used voluntarily or automatically because of their relationship with these implicit reactive and regulatory measures. The authors described automaticity of use to mean processes that are automatically invoked in response to a situation, without much active thought. This is in contrast with voluntary processes that are used consciously in response to a situation.

Similarly to how Gross defined the temporal nature of ER strategies, they agree that ER strategies should be viewed temporally and expand these criteria to include that strategies should improve in automaticity and/or efficiency with training and experience. The final component they explore in concept relates to the individual differences observed in the ability to use ER strategies, and how these differences are influenced and emerge based on context. While they describe stressful states most explicitly, other contexts would be equally important. They describe how the ability to use these strategies differs based on practice, personal preference, and situational demand, indicating that every individual will use each strategy differently. These strategies are not a broad skill but are instead tailored and developed over one's development and the context of each emotional experience.

So, in combining these components in to a more concise set, the following traits or features of ER strategies emerge: the ability to modulate positive and negative emotions upward or downward in intensity, time-limited effects, situationally-bound effects, increases in effectiveness and automaticity with practice, and individual differences in

general ability. One final feature of note is that these strategies do not exist in a vacuum, and may co-occur and interact with one another (Naragon-Gainey et al., 2017).

Finally, some definitions of emotion regulation differentiate these behaviors through a taxonomy of sorts where the more specific behaviors for implementing the strategies are identified (Ochsner et al., 2012; Powers & LaBar, 2019). *Strategies* are the broadest term describing methods to manipulate or control emotions. For example, reappraisal involves shifting of one's mindset to change the emotion triggered by a situation or a stimulus. However, there are more specific methods for describing the behaviors the underly reappraisal. These more specific behaviors are referred to as *tactics*. While still broad, tactics provide more definition to the types of approaches that a strategy implements. Within reappraisal, one can use cognitive reinterpretation, which involves changing the way one understands a stimulus or situation cognitively, or through distancing by which an individual creates some form of space between themselves and the situation or stimulus. In some instances, tactics can be further divided into more nuanced behaviors, referred to as *techniques*. These specialized and specific behaviors describe precise ways in which a strategy can be implemented. Using distancing as an example, generating space between oneself and a stimulus can take the form of temporal distancing or proximal distancing. Temporal distancing has the user recognize or create mental time between them and the situation or stimulus to reduce the intensity of the emotional response. Proximal distancing emphasizes the amount of physical space from the stimulus or situation, with greater physical distance reducing the emotions. Exploring these tactics and techniques have the potential to highlight important relationships between regulation strategies using the proposed theoretical approach. Conceptually, strategies on the same

spectrum should use similar tactics, while un-related strategies should use different tactics or techniques. However, the differences between tactic or strategy use may also be a matter of the *degree* to which a strategy uses them. For instance, both self-compassion and reappraisal use reinterpretation tactics and techniques, however reappraisal uses reinterpretation to a large degree, while self-compassion uses it to a much less degree. These differences in the extent to which a strategy uses these tactics and techniques helps demonstrate the extent to which these strategies are related or unrelated.

Development of Emotion Regulation

The ability to regulate one's emotions, and the tendency to use specific strategies, changes substantially over the course of early life. Often, these capacities are dependent upon development in other areas, such as the ability to act autonomously, and importantly cognitive development (Ratcliff et al., 2021). The ability to regulate will be delayed or shift based on what a child or infant is capable of accomplishing. For instance, until a child can move autonomously, they experience little wariness toward strangers. Once they are mobile, youth will experience greater wariness as they can back away or leave the situation where the stranger is present. As such, regulation in pre-mobile infants often takes the form of self-soothing or attention aversion. These self-soothing behaviors include gaze aversion or thumb sucking to putatively reduce the intensity of exposure to or physiological responses to emotional stimuli.

These self-soothing behaviors remain dominant until approximately 18 months of age, when they become replaced with efforts to gain caregiver assistance to manage situations and adjust their emotions. These behaviors take the form of vocalizations that accompany speech development. Attentional processes and support-seeking become the

dominant form of regulation as toddlers approach 24 months of age. Distraction becomes a particularly important strategy during play, as children can shift from a distressing stimuli or activity by engaging in an alternative activity. These strategies highlight additional executive functioning occurring during this period of life (Ratcliff et al., 2021).

In early childhood, these general processes continue, though avoidance and distraction become more self-driven and behavioral in nature. During middle childhood, coping and regulatory processes begin to incorporate more cognitive features that reflect development in this area during this period of life (Zimmer-Gembeck & Skinner, 2011). As such, other regulation strategies begin to emerge, such as problem-solving. The use of support-seeking begins to expand or transition to include friends and other influential adults (such as teachers) as sources of support.

Adolescents' regulatory capacities expand considerably. They begin to adopt more regulation strategies and begin to address emotions at different times in the emotion generation process (described in Gross's Process Model below). Early in adolescence, there is more anticipatory regulation occurring as youth plan their events and think ahead about what emotions might arise during them. Increases in reflection promote the use of rumination and self-talk. Older adolescents will engage in more social comparison techniques and use perspective taking to engage in reappraisal and other more cognitive regulation strategies (Fombouchet et al., 2023). In the larger scope of regulation, considering how these processes change over time or differ across age groups can inform how strategies are related or what mechanisms are most fundamental to specific strategies. Presumably, this understanding could also inform which children and adolescents are at greatest risk for mental illness, how environmental factors such as

trauma may derail this development, and how and when interventions would be most effectively applied.

Models of Emotion Regulation

Using the definition of key features of ER strategies described previously, we now turn consideration to how they are utilized. This is also important to consider as well because we need to assure that we can work with self-compassion in the way we conceptualize and theoretically work with other ER strategies. If self-compassion fails to be utilized in similar ways, it may be an indicator that self-compassion is missing key features that would make it a true ER strategy. As alluded to a few times thus far, there are several models that have been proposed to explain ER and their general use.

One of the most popular models of ER is the Process Model of ER, developed by James Gross (Gross, 1998; McRae & Gross, 2020). According to this model, there are five families of emotion regulatory processes. These families are temporally based and occur during the generation and response to an emotional experience. The five families are situation selection, situation modification, attention deployment, cognitive change, and response modulation. These can be further divided into antecedent-focused and response-focused strategies. Antecedent-focused strategies describe methods to adapt the emotion generation process, and response-modulation strategies describe methods used after the emotion has occurred.

Within antecedent-focused strategies, the processes include situation selection, situation modification, attentional deployment, and cognitive change. With respect to the discussion related to self-compassion, cognitive change and attentional deployment may be the most relevant. Gross (1998) described attentional deployment as the ability to

selectively focus on specific aspects of a situation. Cognitive change, on the other hand, involves focusing on specific possible meanings derived from a situation. The meaning of a situation gives rise to the emotion, which includes the behaviors, physiological changes, and experiential aspects of the emotion. With respect to response-focused options, the process of focus is response modulation, or efforts to change one's response to emotions after they have already begun.

Since its initial introduction, the model has been updated to explain that temporally the ER process includes 4 broad stages: the emergence of an emotional situation, attention to the emotional situation, appraisal of the situation relative to one's emotional goals, and the emotional response (McRae & Gross, 2020). Many strategies have been identified to fall within these broader parts of the emotion generation and response process. For example, in situation selection, the strategies include avoidance or engagement. In situation modification, one could change or avoid stimuli. In attentional deployment, mindfulness and distraction are prominent, and in cognitive change, reappraisal and acceptance are used. Finally, in response modulation reappraisal and acceptance can influence one's emotions (Naragon-Gainey et al., 2017).

A second popular model described by Aldao et al. (2010) is the adaptive-maladaptive model. This model is more closely aligned with clinical outcomes and factors than the process model. According to this model, ER strategies fall within two very broad categories: adaptive or maladaptive. Adaptive strategies, when used habitually, are associated with resilience and lower rates of psychopathology, while maladaptive strategies are associated with increased rates of psychopathology. Adaptive strategies include reappraisal, problem solving, and acceptance. Maladaptive strategies include suppression, rumination, and

avoidance. Newer updates and conceptualizations to the model have added mindfulness to the adaptive strategies, and within maladaptive strategies avoidance is expanded to experiential avoidance and behavioral avoidance, and suppression has been expanded to expressive suppression. These changes reflect better understanding of how these strategies can focus on the different parts of the emotional experience and updates in conceptual understanding (Naragon-Gainey et al., 2017).

Examining acceptance as an ER strategy

Now that ER strategies more broadly have been defined and placed into models describing their use, it would be useful to explore some examples of some established emotion regulation strategies before diving into self-compassion specifically. Out of the established strategies, acceptance and reappraisal have the most conceptual overlap with self-compassion, so we will begin our discussion with those two. Each will be a strong reference points when determining if self-compassion could be considered an ER strategy. We will begin with acceptance, then describe reappraisal.

Acceptance as an emotion regulation strategy gained more attention in Western cultures during the emergence of third-wave therapies such as dialectical behavior therapy and acceptance and commitment therapy, though it stems out of mindfulness practices from Eastern cultures (Wolgast et al., 2013). From the broader mindfulness perspective, acceptance focuses on developing a non-judgmental stance toward one's experiences in order to have a more present-moment awareness and a stance of openness to other experiences. Within an emotional context, acceptance involves embracing one's emotions, thoughts, and bodily reactions without any efforts to control, avoid, or change them (Dan-

Glauser & Gross, 2015), which could be described as an approach- or engagement-driven relationship.

It is important to note that there is often substantial overlap between acceptance and mindfulness as ER strategies, and in fact, the terms mindfulness and acceptance are often used interchangeably in ER literature. Both emphasize non-judgmental approaches, however in mindfulness there is a greater emphasis on present-mindedness (Keng et al., 2013). Often, acceptance is taught through mindfulness interventions such as mindful-based stress reduction (Goldsmith et al., 2014), so this review will not differentiate the two based on similar conceptualization and training within the ER literature, though we acknowledge that there are distinctive differences between the two. By using this approach, we also improve the overlap between self-compassion and other strategies.

Within ER strategies, acceptance holds a more unique position as it overlaps with many other strategies in similar ways. Conceptually speaking, acceptance also appears to exist in exact opposition to some strategies. Within an acceptance and commitment framework, it is a polarized opposite to experiential avoidance (Hayes et al., 2006). This has led some to debate whether acceptance should be a separate entity, or instead part of a composite structure with experiential avoidance (i.e. its inverse; Chawla & Ostafin, 2007). While most studies acknowledge the relationship, they have generally examined them as separate strategies. For clarity, when using the term “avoidance” within the context of emotion regulation strategies, we are referring to the broader collection of experiential, behavioral, or cognitive avoidance of emotions. If necessary, we will specify a specific form of avoidance.

Let us now examine the components of acceptance that were identified earlier as aspects of ER strategies. The first component was the ability to modulate positive or negative emotions upward or downward in intensity. In one study by Wolgast et al. (2011), acceptance was observed to reduce the intensity of emotions while watching emotional film clips when compared to a watch-only comparison condition for some physiological responses and aversive emotions. This provides evidence that acceptance modulates emotions. With respect to time limited effects, Dan-Glauser and Gross (2015) examined how a variety of physiological responses to emotional stimuli changed throughout the emotional experience. They compared changes across positive and negative emotions, and they describe how acceptance appears to affect the experience of emotions between 3.5 to 5 seconds, indicating that it is limited temporally. In addition, this study describes how different emotional valence contexts influence the use of the strategies, providing evidence that acceptance can be situationally-bound as well. Further evidence for the situational nature of acceptance comes from their descriptions of the different impact acceptance can have on the temporal dynamics of the emotional experience. Many of the previous studies also highlight how we can measure or generate an endophenotype through physiological measures of how acceptance influences emotions. This provides evidence for the neuroscience definition of acceptance as an emotion regulation strategy. In addition, Troy et al. (2018) also describes research in which habitual use of acceptance was associated with less intense experiences of negative emotions. For the next component, increases in effectiveness and automaticity with practice, it appears that use of acceptance during initial and re-exposure to emotionally evocative stimuli decreases in negative affect (Troy et al., 2018). Further evidence comes from Görg et al. (2017) who completed an RCT in which

participants were trained in radical acceptance using a modified version of dialectical behavior therapy, and found that following training, there were significant reductions in several negative emotions, indicating that training can improve effectiveness in strategy use. Finally, some evidence for the presence of individual differences in the ability to use acceptance comes from Grommisch et al. (2020). The authors studied individual differences in their uniquely preferred ER strategies, called their ER repertoire, using an ecological momentary assessment approach. They found five distinct profiles of individuals' preferences to use several strategies, including acceptance, reappraisal, distraction, and suppression. Together, these findings provide strong evidence for the presence of individual differences in the ability and predisposition to use acceptance. Holistically, this provides an example of how we can use the previously described criteria to define an ER strategy.

With acceptance meeting all the criteria of an ER strategy, we can now address the question of how acceptance fits within models of ER. Within the process model framework, acceptance has some unique qualities. As noted previously when describing the model earlier, acceptance possesses some traits that allow it to function within both antecedent-focused and response-focused processes. In antecedent-focused processes, acceptance can be used to adapt cognitive processes leading to different emerging emotions. Within response-focused processes, acceptance can attempt to alter an emotional experience through distancing an emotion (Wolgast et al., 2011). The way that acceptance fits in the adaptive-maladaptive model is more straightforward. Its emphasis and use in several therapeutic interventions and negative association with psychopathology fit it firmly within the collection of adaptive strategies.

Reappraisal as an ER strategy

Reappraisal is the strategy that has received the most attention thus far in ER research, so while important to help frame self-compassion in this manner, it will be explored in less depth. The heavy attention this strategy receives is likely due to its emphasis within the research of James Gross, in addition to its clinical utility. Heavily emphasized in cognitive approaches to therapy made popular by Aaron Beck and Albert Ellis, reappraisal in the clinical sense involves challenging and generating alternative thoughts considered more rational or adaptive (Beck, 2021; Ellis, 2021).

Generally considered an antecedent-focused strategy within ER literature, reappraisal is used to regulate emotions through cognitive change by altering one's thoughts in response to a situation in order to change the subsequent emotional response (Gross, 1998), though there are opportunities to regulate an emotion via reappraisal in a response-modulated approach as well. Reappraisal is well-established in its ability to modulate both positive and negative emotions in a variety of situations, including laboratory and in a variety of real-life contexts, and appears effective in both short- and long-term contexts (Naragon-Gainey et al., 2017; Troy et al., 2018). These traits solidify the time limited effect and situationally-bound aspects of emotions. However, reappraisal also appears to require considerable effort to implement. This means that more intense emotions are likely to require more effort, which means the choice to use reappraisal as a strategy may be more situation and individual dependent, but with training would require less effort (Troy et al., 2018). In fact, many clinical interventions can enhance the use of reappraisal (Goldin et al., 2019). Considering how reappraisal fits within the models described earlier, it is well-established within the process model of emotion regulation, and

as an adaptive strategy (Aldao et al., 2010; McRae & Gross, 2020). Reappraisal, generally speaking, takes a more “emotion-aversive” motivational approach, meaning there is a general disposition when using it to push away one’s emotions. This is in direct opposition to the relationship that acceptance strategies take with respect to emotions.

It is important at this time to also be careful about what definition or form of reappraisal is emphasized here. There is the “emotional reappraisal,” which is the more reactive form of reappraisal used in everyday life to quickly reassess one’s context or stimuli in an antecedent-focused approach. This is the form of reappraisal most described in Gross’s Process Model, and is the definition implicated here. However, there is a different definition or form of reappraisal that is commonly implicated in psychotherapy, which is the “cognitive reappraisal” form. This is a related use of reappraisal, and both utilize similar behavioral and cognitive methods, but it focuses on confronting one’s thoughts directly to change the interpretation. This change in thought can have a more response-focused effect on the emotions, but it typically occurs well after the emotional experience in an effort to “retrain” the way one approaches emotional experiences so the “emotional reappraisals” that occur in everyday life are more adaptive and more goal-directed to mirror what is practiced in the “cognitive reappraisal” form. However, the primary goal of this “cognitive reappraisal” tends to focus more heavily on addressing maladaptive cognitions to address more broad aspects of life and behavior, not solely impact of the emotional experience. This contrasts with “emotional reappraisal”, which focuses nearly exclusively on modulating the experience of emotions. In this paper, we will discuss “emotional reappraisal” rather than “cognitive reappraisal”, though we recognize the two are intimately connected and want to

emphasize that both play a role in the emotional process. With this in mind, when the term “reappraisal” is used, it will refer to the emotional-specific form of reappraisal.

Examining self-compassion as an ER strategy

Similar to acceptance, self-compassion stems from Eastern cultures, with the most prolific Western advocate of self-compassion, Kristen Neff, taking early conceptualizations and perspectives of self-compassion from Buddhist traditions (Neff, 2003). Her early definitions of self-compassion describe it with three main dimensions: self-kindness against self-criticism or judgment, acknowledgement of a common humanity, and mindful acceptance toward suffering. This final dimension is what creates the greatest overlap between acceptance and self-compassion, as acceptance itself is a core feature of self-compassion. However, self-compassion also includes other components, which may make it distinct from other ER strategies. In fact, Kristen Neff acknowledged the utility of self-compassion in the realm of emotion regulation, specifically stating “In many ways, self-compassion can be viewed as a useful emotional-approach coping strategy” (Neff, 2003, p. 92). With these features in mind, self-compassion appears to also embrace emotions as a more emotional engagement-driven approach.

Similar to other adaptive ER strategies, self-compassion has been found to relate negatively with psychopathology. In one study by Krieger et al. (2013), self-compassion was found to be negatively associated with depressive symptoms. In addition, they found self-compassion to be negatively associated with rumination and avoidance. In fact, they found that total avoidance score (measured using the Cognitive-Behavioral Avoidance Scale) mediated the relationship between self-compassion and depressive symptoms, which may indicate some shared features as well. The relationship between self-

compassion and emotions is further elaborated by Neff et al. (2018) who found significant associations between components of self-compassion, as measured by the Self-Compassion Scale (SCS), and emotional intelligence. Generally speaking, several studies have found negative relationships between self-compassion and emotion dysregulation.

Because the field has not taken a strong stance toward self-compassion as an ER strategy, there have been inconsistencies with how it is treated. In some instances, self-compassion is treated more as a state in which it is used to influence other ER strategies (e.g., Diedrich et al., 2016), while in other instances it is treated as its own unique strategy (e.g., Odou & Brinker, 2015). While this may make it appear that self-compassion is not a strategy to some, it is again important to remember that strategies can be used concurrently with one another, so rather than a state it could be a longer-process ER strategy used concurrently with other strategies (such as a strategy that influences multiple steps of the emotional experience). With this in mind, self-compassion can still exist as a potential ER strategy.

Now that there are some established relationships between self-compassion and emotions, is there evidence that self-compassion itself would qualify as an ER strategy? Again, we consider the “criteria” described previously to suggest that it does possess these ER traits. Altogether, it appears that there is a strong argument for self-compassion as an ER strategy. Going through the criteria individually, the first determines if self-compassion has the ability to modulate positive or negative emotions upward or downward in intensity. With respect to this, Neff et al. (2018) describes research in which training and use in the practice of self-compassion was associated with decreases in anxiety, depression, negative affect, and self-criticism. In fact, Sirois et al. (2015) found that self-compassion

was associated with negative and positive affect, both of which moderated positive health behaviors, indicating that self-compassion can modulate emotions. More specifically, they found that self-compassion mediated the relationship between changes in positive or negative emotions and health related behaviors, which may indicate that self-compassion plays a mechanistic role in emotion regulation. Self-compassion appears to have time-limited effects as well. In a study that compared the effectiveness of self-compassion and distraction in combating negative moods (Odou & Brinker, 2015), self-compassion and distraction exerted similar changes in negative emotion over time, indicating that it does in fact possess this feature. There are also aspects of self-compassion that affect its ease of implementation. For instance, some have argued that self-compassion could exert less influence in the face of depression or other negative affect states. Here, there has been some debate about how the intensity of the negative mood state impacts the use of self-compassion (Diedrich et al., 2016). There are also indications that training in self-compassion can increase abilities to practice self-compassion. For instance, studies have found that training in loving and kindness meditation demonstrated increased physiological activity, which was moderated by changes in positive affect (Kok et al., 2013). The ability to train and enhance one's ability to utilize self-compassion skills also indicates that there are individual differences in the ability to use self-compassion. Kristen Neff (2003), in her initial conceptualization of self-compassion, describes the consequences of having too little self-compassion, which also implies that there are individual differences – satisfying some of the criteria derived from neuroscience. Taken together, it appears there is early evidence that self-compassion demonstrates traits of ER strategies.

Having considered whether self-compassion possesses many of the features of ER strategies, how would it fit into the models described previously? Trying to define self-compassion within the process model of regulation brings up similar issues that were described with acceptance. Like acceptance, self-compassion possesses some state-like features, which lend it to impact antecedent-focused processes. If each of the strategy families are considered, self-compassion would likely impact through cognitive change. As described by Neff (2003), self-compassion heavily emphasizes a non-judgmental approach, which would require adapting appraisals so the subsequent generated emotion is less intense. In addition, there is a general acceptance of emotions using a compassionate attitude toward the self, which can influence the experience of emotions through response-focused processes via distancing.

Within the adaptive-maladaptive model, there is clear evidence for self-compassion's inclusion within adaptive strategies as cited earlier. Generally speaking, in many clinical populations, lower levels of self-compassion have been observed (Athanasakou et al., 2020). Other reviews have found that habitual use of self-compassion was associated with decreases in depressive, post-traumatic, and other symptoms later in life (Inwood & Ferrari, 2018). In total, it appears that self-compassion possesses many of the traits associated with ER strategies, and would theoretically fit within two dominant models for ER. However, there remain knowledge gaps linking self-compassion to other ER components. For example, the field would benefit by examining the direct impact that self-compassion has on emotional experiences. A few studies have attempted to look at it as a discrete ER strategy (Ehret et al., 2018; Odou & Brinker, 2015), but additional work in this area in both community samples and in laboratory settings would be beneficial. In addition,

further research such as this would also benefit from the use of the strategy in different contexts. Finally, as alluded to earlier, there is considerable overlap between acceptance and self-compassion, insomuch that acceptance is one of the key aspects of self-compassion. This brings up a very important consideration: should these two strategies be considered discrete strategies, or are they related in some way?

A comparison of cognitive components of self-compassion, acceptance, and reappraisal

When comparing the features that comprise both acceptance and self-compassion, several similarities emerge. In fact, there was considerable repetition across the sections describing both strategies in this very discussion. Both emerged from Eastern philosophy and Buddhist practices, and both are associated with many aspects of mindfulness practices. Both strategies also appear to impact the emotional process in similar ways; impacting one's cognitive approach to the emotion generation process and adapting one's response following the generation of an emotional response.

This cognitive aspect can be explored further, using both acceptance and reappraisal. The main characteristic of reappraisal that overlaps with both acceptance and self-compassion is the focus on cognition and reframing one's thoughts or interpretation to their context. The use of reappraisal involves a few steps, which includes recognition of the initiating event and initial appraisal, determination whether or not the thoughts and subsequent emotional responses are adaptive, and then moving forward with some reinterpretation of the event. This process of reinterpreting the emotional experience may require some inherent understanding that the upcoming emotional experience will be maladaptive or otherwise distressing, and in an effort to avoid the experience, a reappraisal

is warranted. While the process just described is more in line with the “cognitive reappraisal” described above, this does occur rapidly and automatically with the antecedent-focused “emotional reappraisal”. This conceptualization means that reappraisal would inherently be driven by an aversion-driven orientation, meaning there is a desire to not experience or engage with the anticipated emotion.

However, acceptance differs from reappraisal in this area. As described by Goldin et al. (2019), acceptance does not utilize the reinterpretation, response inhibition, and other aspects inherent to reappraisal. Instead, as previously described it embraces an engagement-driven orientation: a willingness to experience the thoughts, feelings, and sensations, and recognize their usefulness. There is some reappraisal of the upcoming experience, but rather than reinterpreting events to reduce and push away the emotional experience, acceptance focuses on awareness and openness toward the experience of emotions. Thus, rather than being driven by aversion-motivated goals, acceptance takes an approach-driven orientation emphasizing non-judgment and awareness toward emotions.

The cognitive changes that occur with the use of self-compassion also have unique attributes. If the definition provided by Kristen Neff is followed, self-compassion has the user take an approach orientation with a non-judgmental and open perspective, like acceptance. In addition, it emphasizes taking a perspective of common humanity and being touched by one’s own suffering, and attempting to alleviate painful or distressing emotions through self-care and self-support to imbue the experience with kindness and understanding (Neff, 2003). This eases the current experience of emotions so one becomes more comfortable with the emotional experience, but specifically not avoiding them.

However, there is some distinct reframing and re-interpretation toward a perspective of

common humanity and self-kindness. While this involves shared aspects with reappraisal; the motivation underlying the reframing is different. Here, self-compassion is motivated by engagement and welcomes the experience, while reappraisal seeks to change or avoid the experience. In this sense, self-compassion is more aligned with acceptance than reappraisal strategies.

This exploration of the cognitive components of acceptance and self-compassion also highlights a significant shared component: taking a non-judgmental, approach orientation to one's experiences. This is a considerable source of overlap between acceptance and self-compassion, to the point that acceptance is a core dimension of self-compassion. In other words, self-compassion cannot be achieved without acceptance. This overlap continues to exist in many of the other core ER components previously identified. Both acceptance and self-compassion appear to utilize similar cognitive and experiential mechanisms to modulate emotions. They both appear sensitive to training, as one's skill in acceptance and self-compassion can be honed using standardized methods such as cognitive-based compassion training (Reddy et al., 2013), acceptance and commitment therapy (Hayes et al., 2006), dialectical behavior therapy (Linehan, 1993), and mindful self-compassion (C. Germer & Neff, 2019), which means both can be improved in terms of effectiveness and automaticity. Many of the trainings that are focused on self-compassion also include acceptance as part of their curriculum, again emphasizing the overlap between the two theoretically and in practice. In fact, self-compassion includes all components of acceptance.

With all of this information in mind, it appears there is a strong argument to also define self-compassion as an ER strategy (Inwood & Ferrari, 2018). As mentioned

previously, there have been some initial efforts to conceptualize self-compassion as an ER strategy. In their novel, Berking and Whitley (2014) integrate self-compassion into their Adaptive Coping with Emotions (ACE) Model. In the framework of their model, they describe it as a strategy that requires less effort compared to other strategies such as reappraisal. So even within the clinical realm self-compassion has been conceptualized through an ER lens, further solidifying its place within ER strategies.

Are compassion and acceptance distinct enough to be separate strategies?

As the evidence to establish self-compassion as an ER strategy was explored, there was one theme that kept emerging: self-compassion and acceptance have considerable overlap, which raises the question of whether they are distinct strategies. Despite the considerable overlap, there are several features within self-compassion that do make it unique. The most obvious features are the emphasis on recognizing a sense of common humanity and the feelings of kindness toward others and toward oneself. While acceptance is more passive in nature, self-compassion more actively attempts to perform some reparative function, emphasizing healing and relief from suffering. These key features build upon the foundational features of acceptance. Other commonalities between the two are the strong connection with mindfulness and their shared origins.

With these differences in mind, it appears that the two strategies are distinct entities. However, their shared aspects warrant recognition. Both strategies also demonstrate similar associations with aspects of experiential and other forms of avoidance strategies (Inwood & Ferrari, 2018), meaning they have a shared directional relationship with avoidance strategies. Within an acceptance and commitment framework (Hayes et al., 2006), experiential avoidance is conceptualized dichotomously compared to acceptance,

and there have been previous suggestions that acceptance and experiential acceptance could be conceptualized as a spectrum (Chawla & Ostafin, 2007). Self-compassion has been found to have similar negative relationships with avoidance (Inwood & Ferrari, 2018), and from a mindful self-compassion perspective it also functions in opposition to avoidance (Neff, 2003).

Taking all of these conceptual and theoretical aspects into consideration, we propose a novel way to conceptualize self-compassion as an enhanced version of acceptance, or acceptance⁺. This would imply a “family” of related ER strategies, where acceptance alone is a less-intense version of self-compassion. However, when we consider the relationship that both strategies have with avoidance strategies, particularly experiential avoidance, it could be argued that all three of these strategies exist along a spectrum (see *Figure 1.1*). This spectrum would range from complete experiential avoidance on one end, to acceptance in-between, and self-compassion on the other end. Across this spectrum, there are graduated increases in the level of engagement with emotions, and with additional experience and training one can progress along the spectrum to more “complex” strategies on this spectrum. This has the added benefit of aligning with overall development of regulation capabilities and may reflect the amount of cognitive effort exerted in regulating one’s emotions. By existing as a spectrum, this opens the opportunity for other strategies, as they are further explored, to be identified as members of this spectrum.

Figure 1.1

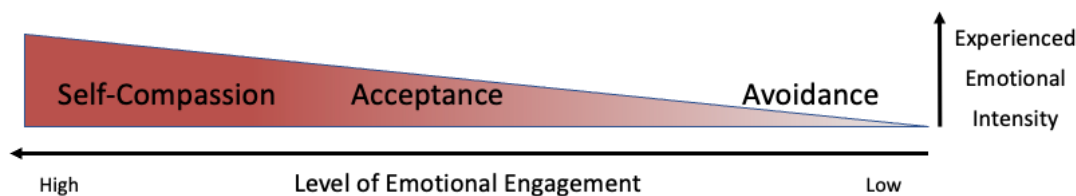


Figure 1.1. A visual representation of the single dimensional model depicting the spectrum of acceptance-related emotion regulation strategies. Here, you see increasing levels of acceptance along the bottom (right to left), with capacity to handle more intense emotions when actively using the specific strategy increasing vertically.

However, additional consideration is warranted with respect to the cognitive components of self-compassion and acceptance strategies. Both strategies involve reappraisal of thoughts to a degree, so this raises the question about their relationship to reappraisal as an ER strategy. The relationship between the cognitive components of acceptance and reappraisal is not a new one, and while both involve some aspects of reframing thoughts, the end goal is sufficiently different that they are considered separate (Troy et al., 2018). On the other hand, all three strategies share similarities in the amount of cognitive effort (difficulty) required, which makes this relationship between the three complicated.

As depicted in *Figure 1.2*, we posit that self-compassion and acceptance partially align with reappraisal, sharing overlap with both the reappraisal strategy, as well as requiring similar cognitive effort required to implement these strategies (emphasizing their more “complex” nature). In this way, self-compassion may be at the intersection of both acceptance and cognitive reappraisal, though certainly sharing more overlap with acceptance and its engagement relationship with emotions. Conversely, based on our

presenting conceptualization reappraisal appears to exist outside the acceptance spectrum (though overlapping based on the similarities described above) based upon its own motivation-driven relationship with emotions.

However, these strategies can interact in multiple ways depending on the way that each is conceptualized. In fact, the whole spectrum of acceptance strategies can interact with individual strategies. In *Figure 1.2*, we attempted to visualize these relationships between the different ER strategies discussed here. In *Figure 1.2*, the acceptance spectrum and other strategies can be depicted through their approach to emotional engagement and a cognitive effort dimension, on the x and y dimensions respectively. However, we also want to emphasize there are likely several other dimensions through which these strategies and spectra can interact as well. In this visual representation, the range of both emotional engagement and cognitive effort is depicted by the size of the circle representing a strategy. For instance, the range of cognitive effort for reappraisal is shown by the diameter of its circle relative to the y-axis, while the amount of emotional engagement can range across the diameter parallel to the x-axis. In addition, the relationship between acceptance, self-compassion, and reappraisal can be seen by the overlap between the three strategies' higher position on the cognitive effort domain (see *Figure 1.2, point A*). This reflects the shared use of some form of reappraisal among all these strategies. In addition, the complete sub-setting of acceptance within self-compassion shows the intimate connection between the two. However, self-compassion extends further into the upper end of the cognitive domain to reflect the additional reframing that occurs with respect to common humanity and kindness. Conversely, the low position of reappraisal in the

emotional engagement domain reflects the critical differences in the relationship with emotions between it and the other two strategies.

Figure 1.2

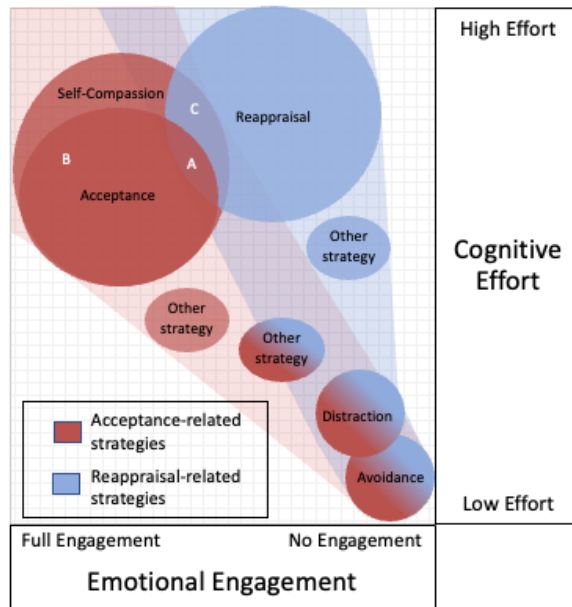


Figure 1.2. Two-dimensional representation of how an acceptance- and cognitive-reappraisal/aversion spectrum view of emotion regulation strategies overlap and interact. The colors represent the related strategies that fall within a proposed spectrum, with the light-colored outlines representing the range of the entire family of strategies within a spectrum. In red are the acceptance-related strategies, and in blue are reappraisal-related strategies. Overlap between strategies represents the shared aspects of core components of the strategies, with the shared cognitive components of self-compassion, acceptance, and reappraisal (A), complete overlap between acceptance and self-compassion (B), and more intimate reappraisal-related features shared between self-compassion and reappraisal (C). Finally, the shared presence of avoidance and distraction on both spectrums, along with place markers for strategies uniquely within a spectrum are shown in the presence of both colors.

This can be further elaborated should other spectra of related emotion regulation strategies exist. If this is the case, these spectra can overlap and interact in other complex ways. In *Figure 1.2*, we attempted to demonstrate this using the theoretical interaction between the acceptance spectrum and a hypothetical cognitive-aversive/reappraisal spectrum (should such a spectrum exist). In this graph, there is overlap across the range of the strategies (shown in the light red and light blue shaded regions in which the strategy bubbles are placed) that could fall within a spectrum, and several unidentified strategies

are depicted. While the boundaries drawn are linear, these may in fact be non-linear and the overlap may be more nuanced than what is depicted. For instance, there may be less overlap between the range of the spectra than what is shown. Also shown is how some strategies may fall between more than one spectrum. This overlap represents shared features of whichever dimensions are analyzed or used to compare the two spectra.

These spectra are likely driven and should be identified through a variety of different mechanisms and methods, such as neuroimaging, biomechanisms, approach/aversion motivation, and many others. In *Figure 1.2*, one way in which the acceptance spectrum and the hypothetical cognitive-aversion is the relationship that each has with emotions, with the acceptance spectrum taking a “approach-motivated” orientation toward emotions, and the cognitive-aversive/reappraisal takes an “aversion-motivated” approach, though this is an over-simplified example. These spectra of ER strategies conceptually also have other mechanisms at play that represent inherent differences (such as behavioral implementation or other neural mechanisms) that indicate these as separate spectra, but the placement of each strategy in a spectrum requires careful exploration and consideration.

One strength of this spectrum approach is that strategies can exist within different spectra depending on the specific motivations, behavioral methods of implementation, and other features and mechanisms considered. Two such examples are shown through avoidance and distancing, though others likely exist. To demonstrate this, in *Figure 1.2* strategies that exist purely within a spectrum are shown entirely in one color, while strategies shared across spectra are bi-colored.

To further elaborate on this point using the example of avoidance, when conceptualizing it on the acceptance spectrum, there is a complete absence of acceptance, so avoidance is the dominant strategy or approach. For the cognitive-reappraisal/aversion, it follows the aversion-motivated relationship with emotions, where there is a desire to push away from emotions. However, this is clearly a very nuanced approach that requires careful consideration, as different perspectives may place a strategy in different spectra, clearly calling for further exploration of the relationship behind these strategies mechanistically and motivationally to place each strategy appropriately.

Objectives and Research Strategy

In this work, I aim to explore evidence in support of this spectrum approach to emotion regulation, and provide further evidence that self-compassion should exist in the taxonomy of regulation strategies, using several studies that I conducted. I will investigate potential mechanisms that differentiate strategies across spectra, examine commonalities or patterns across the use of different regulation strategies on the same spectra in unique contexts, and will explore the use of these strategies in youth. I take a multi-method approach in many studies by incorporating many metrics of emotion regulation, including both subjective self-report measures and implicit measures of autonomic activity. Through our inclusion of several different measures of emotion reactivity, I hope to infer additional components of the emotional process (Niedenthal & Ric, 2017).

Using these various methods, the unique components of emotions can be assessed to get a more comprehensive view of the entire emotional experience. For instance, the subjective experiences and cognitions of emotions are often collected through self-reported emotions. While effective, these subjective reports have notable weaknesses including

demand characteristics and social desirability. Self-report data also relies heavily on introspection and self-reflection, which some populations struggle to accomplish – notably children and adolescents (Rueth et al., 2023). Fortunately, the physiological arousal component does not suffer from this limitation. Arousal can be measured in various ways; the most common include electrodermal activity and heart rate. Electrodermal Activity (EDA) can be measured using skin conductance reactivity (SCR), which is a measure of autonomic reactivity to emotional stimuli. The greater the SCR, the greater emotional reaction (Dubovi, 2022; Grasser et al., 2022). Heart rate can also be a measure of reactivity, though heart rate variability provides a more unique measure related to emotions. By looking at changes in heart rate over time, or heart rate variability (HRV), effort to regulate one's emotions can be assessed indirectly. HRV can be measured over long periods of time, referred to as tonic measures, or using phasic measures that follow dynamic changes that occur in the moment. When regulating phasic HRV increases, and when relaxed HRV decreases (Balzarotti et al., 2017). Throughout most of the current work, I will use subjective self-report, SCR/EDA, and HRV measures to acquire as much information as possible about the experience of emotions.

To examine the impact of different contexts on these strategies, I will examine the influence of mental health and maltreatment on the implementation and impact of these strategies on emotions. There is considerable research describing differences in how individuals who experiences symptoms related to depression, anxiety, post-traumatic stress disorder (PTSD) experience or regulate their emotions, often describing that greater symptom severity results in more distressing (often negative) emotions or difficulty regulating (Aldao et al., 2010; Berking & Whitley, 2014b; Blalock et al., 2016; Ellard et al.,

2017; Görg et al., 2017; Kotsou et al., 2018). Maltreatment also has a significant impact on the emotions and emotion regulation. Across all stages of development, experiences of maltreatment often result in greater levels of negative or distressing emotions and increases the occurrence of dysregulation (Lavi et al., 2019; Miu et al., 2022; Weissman et al., 2019). Because both mental health symptoms and maltreatment influence the emotion generation and regulation processes, they provide excellent contexts for examining and testing how these regulation strategies impact the experience of emotions.

In the context of the spectrum theory, more closely related strategies should exert similar effects on emotions even when examined in similar contexts, or across unique contexts such as those described previously. If the engagement spectrum is true, then self-compassion and acceptance will have comparable effects even with exposure to maltreatment and should be similarly impacted by symptoms. I will examine the effect of depression and anxiety on the use of strategies and will explore maltreatment from both a dimensional manner to evaluate severity of exposure, and categorically between those who do and do not meet threshold for exposure.

Specific aims and objectives. Throughout this work, I will examine evidence testing the spectrum theory of emotion regulation and further establish self-compassion as an emotion regulation strategy. In **Chapter 2**, I will explore a key emotion regulation tactic for the theory, emotional engagement. This first aim will attempt to determine if there are relationships between the tactic and two key regulation strategies described in the theory: acceptance and reappraisal. I will explore these relationships using an emotional engagement task in a youth population and determine if trait levels of either regulation strategy can predict task performance using both self-report and autonomic measures of

emotion. Based on the theory, I expect that acceptance will have a significant relationship with engagement, while reappraisal will have little to no relationship with engagement. In **Chapter 3**, I will explore the influence of maltreatment and symptoms on the use of these strategies to identify similarities or dissimilarities in the impact they have on self-reported emotions in these unique contexts. This second aim will accomplish this through two separate sub-studies involving adult subjects completing an emotion regulation task online through Amazon's Mechanical Turk. In the first study, I compare the use of acceptance and reappraisal on emotions. In the second, I compare the use of self-compassion and reappraisal. I expect that acceptance and self-compassion will have similar patterns of influence on emotional experiences, and will be the most effective strategies in the context of maltreatment for negative emotions. Finally, in **Chapter 4** I compare self-compassion and reappraisal in youth using an exploratory sample. In this study, I expand upon the work completed in Chapter 3 by incorporating self-report and autonomic measures of emotion regulation. In this third aim I hope to identify commonalities between the use of these strategies in youths across both explicit and implicit measures of emotion, and possibly identify cross-sectional changes in regulation across development by comparing results to those found in Chapter 2.

CHAPTER 2. EMOTIONAL ENGAGEMENT AS AN EMOTION REGULATION TACTIC IN YOUTH

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In Preparation: Emotion

Introduction

One of the critical skills that youth develop is the ability to manage their emotions effectively. Emotion regulation, or the ability to manipulate one's emotions (Gross, 1998), is particularly important during adolescence. This period of development comes with many important life changes where emotions play a key role. Teens are faced with increased social demands, higher academic expectations (and burdens), and greater cognitive demands such as identity development, which all involve a variety of complex emotions (Anniko et al., 2019; Phillips et al., 2019). Failure to cope emotionally during these situations can result in negative consequences, such as increased social stress, isolation, lower self-esteem, and greater risk for psychopathology (Cavicchioli et al., 2023; Schwartz-Mette et al., 2021). Alternatively, effective coping leads to greater overall life satisfaction and psychological health – benefits that extend across the lifespan (Chervonsky & Hunt, 2019; Verzeletti et al., 2016).

One mechanism for effectively managing emotions is to embrace experiencing the sensations and other components of emotion as they occur, rather than reflexively pushing

them away - referred to as emotional engagement. This mechanism allows emotions to be experienced naturally and gradually dissipate. Emotional engagement is often described in therapeutic approaches that emphasize acceptance or mindfulness, which indicates some connection among all three concepts (Roth et al., 2018, 2019). Despite the benefits of understanding these techniques and mechanisms, such as informing interventions or developmental processes, they remain poorly understood (Powers & LaBar, 2019). Little work has been done to define underlying processes or mechanisms that are either unique or shared across regulation strategies, with few exceptions that will be discussed later. The current study examines emotional engagement as a potential mechanism of change in regulation strategies by exploring the relationships between trait emotion regulation strategy use and measures of emotional reactions during an emotional engagement behavioral task in an adolescent sample.

Within the field of emotion regulation, there is a taxonomy of the methods or mechanisms used to manipulate emotions referred to as strategies, tactics, and techniques. Emotion regulation *strategies* are purposeful responses to stimuli that can be used to increase or decrease the intensity of emotions (Gross, 1998). Emotion regulation strategies are further divided into specific *tactics*, or methods for implementing a strategy. For example, ‘reappraisal’ involves adopting a new perspective concerning an emotional stimulus (or antecedent) to change the emotional response. Psychological ‘distancing’ – envisioning the stimulus as proximally or temporally distant – is a tactic for engaging the strategy. *Techniques* are specific ways to implement a tactic. In the above example, envisioning a stimulus as spatially distant would be a specific technique underlying

distancing. Within this taxonomy (Ochsner et al., 2012), emotional engagement fits best as a tactic, as it appears to be how specific strategies are implemented.

Several regulation strategies theoretically utilize emotional engagement as a tactic, though these relationships still need to be clearly established. The strategy with the strongest relationship with emotional engagement is acceptance. Acceptance involves embracing the current moment – including emotions – without judgment and approaching one’s feelings with a sense of openness toward the experience (Dan-Glauser & Gross, 2015). Acceptance strongly emphasizes not altering the process, instead letting it unfold naturally. This process embodies many aspects of emotional engagement and has been conceptualized as antithetical to experiential avoidance - or the pushing away of emotions due to the perception they are aversive (Hayes et al., 2006). As both acceptance and emotional engagement support fully experiencing the autonomic arousal that accompanies emotions (Wolgast et al., 2011), it is likely that emotional engagement is a tactic central to acceptance that facilitates embracing the full emotional experience.

Another regulation strategy that may rely on emotional engagement is reappraisal, or adjusting one’s thoughts of an emotional event to change the emotional reaction (McRae & Gross, 2020). More recent taxonomies of reappraisal have defined two tactics underlying the strategy: distancing and reinterpretation (Ochsner et al., 2012). These tactics make the relationship between emotional engagement and reappraisal complicated, as distancing involves either actively pushing away emotions, or a more self-reflective “letting go” of emotions that embraces the experience to let it dissipate. This latter iteration of distancing possesses some shared features with emotional engagement – through recognition that the stimulus has little significance to the individual – but distancing through pushing away

would not. Distancing through avoidance would likely align more with other tactics such as suppression. Because of this “mixed” nature of distancing, reappraisal likely has a weaker connection to engagement than acceptance.

However, previous research on emotional engagement ignores its role in regulation and instead approaches it in primarily one of two contexts: as a mechanism underlying trauma-related psychotherapy, or engagement in academic and career settings (Liu et al., 2023). Other uses of emotional engagement include tourism (Bastiaansen et al., 2022), engagement in medical treatment (Lannie, 2021), or team building in career settings (Lim et al., 2020). In trauma-focused treatment, emotional engagement references the activation of the fear response to facilitate desensitization of the trauma-related narrative and triggers. By repeatedly engaging with one’s fears and trauma-related triggers, they elicit a weaker response over time. Emotional engagement is key to facilitating this process, as one needs to feel able to engage with their emotions to reap the most benefit (Reger et al., 2019). These contexts utilize a variety of methods to probe engagement, including facial expression recognition software, self-reporting, autonomic activity such as electrodermal activity (EDA) or heart rate variability (HRV), and eye tracking software (Dubovi, 2022). Despite these contexts using many measures of emotion regulation, they fail to explore the more basic relationship between emotional engagement and the experience of emotion.

Research on tactics has also ignored emotional engagement and instead focused on distancing or reappraisal more broadly (McRae et al., 2012; Powers & LaBar, 2019). We will continue to follow previous research approaches using autonomic measures such as EDA and HRV paired with self-report measures (McRae et al., 2012; Parikh et al., 2019) that probe for more components of the emotional experience. For example, increases in HRV

are believed to represent increased effort to engage in regulation (Balzarotti et al., 2017; Denson et al., 2011). EDA, on the other hand, reflects the level of autonomic arousal during emotional states, which is a more implicit measure of reactivity (Grasser et al., 2022). These implicit measures are particularly important for youth, who may struggle with social desirability, low interest in analyzing their own emotions, and more – that make explicit self-report measures lacking (Rueth et al., 2023). Much of the past research on tactics has focused on adult populations, which leaves a significant knowledge gap regarding how youth use these tactics, and their physiological correlates.

To investigate the process of emotional engagement, adolescent youth will engage in a behavioral task asking them to engage or distance themselves from their emotions and rate their subjective level of experienced emotion in response to negative and neutral images. To explore these relationships further, we will relate these subjective ratings to using different emotion regulation traits and examine autonomic measures of emotion regulation, specifically HRV, and EDA. We hypothesize that while engaging with their emotions, youth will exhibit greater emotional reactions, specifically in the form of more extreme self-report ratings and greater skin conductance responses. We also expect that there will be less effort to regulate during engagement trials, which will be associated with lower heart rate variability. We expect these changes to be positively associated with trait acceptance, reflecting a stronger relationship between the two. We expect disengagement trials to be associated with less extreme self-report and EDA responses, positively associated with trait reappraisal. We will also perform exploratory analyses to determine if suppression is related to either experimental condition.

Methods

Participants and screening

Prospective participants were identified through a variety of means, including mass emailing, Facebook posts, posting flyers at local clinics, messages through electronic medical record systems, and more. Adolescents between the ages of 10 and 16 were screened and enrolled as part of a large developmental study examining cognitive and emotional development. Participants fell within one of two groups: an atypically developing group with a history of psychopathology and possible maltreatment exposure, and a typically developing group (TD) without any history of psychopathology or maltreatment exposure. The current study only includes participants from the TD group. Participants were excluded from all study groups if they had any neurodevelopmental disorders such as autism spectrum disorder, traumatic brain injury, possible pregnancy, MRI contraindication, or if they were experiencing current severe suicidal ideation. Youth were excluded from the TD group if they had experienced any past traumatic event (such as maltreatment) or history of psychopathology.

We utilized a multi-step screening process for enrollment. After an initial web screen to evaluate broad inclusive criteria, prospective participants completed a phone screen to confirm web screen information, provide study information, and evaluate if they met more specific inclusion criteria. Prospective participants who passed the phone screen were invited to a structured clinical interview designed to assess current and past mental health symptomology and trauma history. During the interviews, youth and a caregiver were consented, interviewed separately, and verbally administered the computerized version of the *Kiddie Schedule for Affective Disorders and Schizophrenia* (KSADS-COMP;

Townsend et al., 2020), *Childhood Experiences of Care and Abuse Questionnaire* (CECA.Q; Smith et al., 2002), *Yale-Vermont Adversity in Childhood Scale* (Y-VACS; Holbrook et al., 2014) and the *Columbia Suicide Severity Rating Scale* (C-SSRS; Posner et al., 2011). The KSADS-COMP is a computerized version of the KSADS, which is a semi-structured interview that assess for mental health diagnoses in youth populations. The KSADS-COMP includes interviews with youth, a parent, and a consensus interview combining the two interviews. The KSADS-COMP has strong convergent validity (area under the curve = 0.89-1.00; Townsend et al., 2020). The CECA.Q is a self-report questionnaire that assess for experiences of abuse and adversity in youth. The instrument has strong test-retest reliability (α ranges = 0.834-0.90), and strong validity to identify cases of abuse (χ^2 range = 53.61-55.76; Smith et al., 2002). The Y-VACS is a self-report measure that assesses for a variety of adverse childhood experiences. The instrument includes a youth self-report and a parent-report version, which can be combined to create an objective rating of overall adversity or separate sub-scores for intra-familial adversity and extra-familial adversity. The scale possesses high inter-rater reliability (α range = 0.95-0.96). Finally, the C-SSRS is a self-report measure of suicide ideation and behavior severity. In adolescent samples, the C-SSRS has demonstrated strong convergent validity ($r = 0.8$), predictive validity (odds ratio = 1.3-3.85), and moderate internal consistency (α range = 0.73; Posner et al., 2011). Interviews were completed by trained staff who completed consensus interview and integrated information provided by both the youth and caregiver to determine youth diagnoses and finalize eligibility.

Following phone screening, 182 adolescent participants were consented and completed interview screenings. After interview screening, a total of 122 participants were

enrolled in the study, 79 of which fell into the typically developing study group. After physiological data quality assurance checks, as described below, 17 participants had poor quality data and were excluded. The final sample included 62 youth participants.

Procedures

All procedures were approved by the University of Wisconsin-Madison IRB. Following screening, participants were given a battery of questionnaires, described below, to complete online and were invited to complete an emotional distancing task during MRI data collection up to 4 weeks after the date of their interview screening visit. Participants reviewed task instructions and were prepared for physiological data collection upon arrival before the MRI. During data collection, youth participants completed the task while concurrently having respiration, electrodermal activity, and pulse oximetry data collected. In this manuscript, we are only evaluating the self-report, skin conductance, and heart rate data.

Self-Report Measures

Participants completed a battery of questionnaires online within two weeks of their MRI session where they completed the emotion distancing task. Both youth and a caregiver completed a series of questionnaires related to mental health symptom severity, trauma and adversity, emotion regulation, parent-child relationship, and more. In these analyses, data from the following questionnaires are used:

Emotion Regulation Questionnaire. The emotion regulation questionnaire (ERQ) is a 10-item scale that assesses for an individual's ability to regulate their emotions using cognitive reappraisal and expressive suppression [Gross & John, 2003]. The instrument possesses strong reliability ($r=0.69$) and validity ($d=0.47$; Gross & John, 2003)

Acceptance and Action Questionnaire (Second edition). The acceptance and action questionnaire (AAQ-II) is a seven-item questionnaire that assesses the ability to engage in emotional flexibility (Bond et al., 2011). However, the AAQ-II also measures trait levels of acceptance, when inverse scores are used. The AAQ-II possessed strong validity ($\alpha = 0.84$) and reliability (range $r=0.81-0.79$).

Emotion Engagement Task

To probe emotional reactivity and emotion regulation, participants completed a cognitive reappraisal task (Ochsner et al., 2004) that was previously implemented in youth samples (Silvers et al., 2012, 2017). During the task, youth viewed images from the International Affective Picture System (Lang et al., 2008) depicting negative or neutral scenes. Prior to each image, participants were given an instruction (shown for 4 seconds) that tells them to engage with their emotions by imagining they are present or engaged with the scene depicted (CLOSE) or reduce their emotional experience by thinking about what the scene depicts objectively (FAR). Here, we used the close condition to represent a sense of engagement with one's emotions, and far is a form of disengagement or detachment from emotions. Images were presented for 8 seconds, and after each image youth rated their current emotional state using an affective slider (Betella & Verschure, 2016). The post-image subjective emotional ratings ranged from highly negative to highly positive, ranging from -5 to +5, and a score of 0 indicating a neutral response. Ratings were anchored to full integers values. Image order was randomized per participant, and each image was randomly assigned a condition. Each block included 16 images consisted of a randomized pairing of valence and condition, and with a total of 4 total blocks of unique images. Image condition (CLOSE/FAR) and valence (negative/neutral) was balanced within

each block. The basic task design is presented in *Figure 2.1*. A list of which IAPS images were used, and the specific instructions provided to participants is provided in Appendix A.

Figure 2.1



Figure 2.1. *Emotional Engagement Task Design.*

Physiological Data

Heart Rate Variability. Heart rate data was collected during the emotional distancing task through the GE 3.0T MRI scanner using photoplethysmography (PPG). Following data collection, we used the RHRV package in R (Garcia Martínez et al., 2017) to process the exported heart rate data. We first applied a 5Hz low bandpass filter to clean the data of noise from the MRI scanner, calculated interpolated heart beats to determine R-R intervals, and removed outliers that were more than 4 standard deviations away from the average interval. We calculated the average R-R interval from the onset of the image to the onset of the image rating to determine heart rate variability (HRV) during that epoch. In total, the epoch included the instruction, the image, and a brief inter-stimulus interval, which resulted in approximately 10 seconds per epoch.

Skin Conductance. Electrodermal activity data was collected concurrently during the emotional distancing task using Biopac's MRI safe electrodermal activity amplifier MP-160. Electrodermal activity data was collected at 1000 samples per second. Following data collection, a 10 hz low bandpass filter was used to remove noise. Artifacts were manually

corrected, and the data was resampled to a lower rate. Skin conductance responses (SCRs) were thresholded at 0.1 microsiemens, following methods used by Gertler et al. (2020). With this threshold, 16 subjects (25.8%) were determined to be SCR non-responders, meaning no SCRs paired with any image presentation. For those that did have a response, we used SCR amplitude as the primary dependent variable. Skin conductance amplitude was determined as the difference between skin conductance level at the time of stimulus presentation, compared to the skin conductance level at the peak of the response. We used amplitude as opposed to peak level because it better represents the relative response to the image.

Statistical Analyses

Task Manipulation Check Analyses. We first analyzed the effect of engagement condition and valence on the intensity of experienced emotions on self-rated emotions following image presentation to determine if the task induced emotions as anticipated. In all every model (these and subsequent models), suggestions by Brauer and Curtin (2018) were followed to adjust the within-subject effects structure if there were issues with model convergence. We predicted the post-image rating from the interaction of valence (negative/neutral) with instruction (engagement/disengagement), included age and sex as covariates, and appropriate within-subject intercept and effects.

We also ran parallel models examining these task manipulation checks using SCR and HRV metrics. These models used the same dependent variables, covariates, and within-subjects effects as described above.

Emotion Regulation and Behavioral Self-Report Analyses. To determine the relationships between emotional engagement and emotion regulation we ran a series of

LMEs predicting self-reported emotions following image presentation using the interaction of valence, task instruction, and trait emotion regulation. We included age and sex as covariates, and appropriate within-subject intercept and effects. Separate models interacted valence and instruction with trait reappraisal, suppression, and acceptance.

Emotion Regulation and Autonomic Nervous System Analyses. We ran the same models as described in the behavioral analyses section, but instead ran separate sets of models using heart rate variability and skin conductance amplitude as dependent variables. Skin conductance amplitude measurements were calculated using the difference in skin conductance response from the time of stimulus presentation to the peak conductance level, which reflected the more precise response to the stimulus image. These allowed us to examine autonomic reactivity to images using skin conductance, and effort to regulate using heart rate variability metrics. We used the same covariates and within-subjects effects described above.

Sensitivity Analyses. We also completed a series of follow-up analyses examining the effect of income. We took models with significant findings and added income as a covariate. These models and their results are described in Appendix A.

Results

Participants

The average age of the sample at time of data collection was 13.5 years with a range of ages 10.2 to 17.1 years. There were 30 biological females in the sample, 29 participants identified as female gendered, and 1 identified as gender non-binary. The majority of the sample identified as white (n=58) and non-Hispanic, (n=58). Most participants reported

yearly household income between \$100,000 and \$199,999 (n = 24). Participant demographics can be found in *Table 2.1*.

Table 2.1
Participant Sample Characteristics

	Male(N=32)	Female(N=30)
Average Age	13.59(1.86)	13.51(1.99)
Race		
American Indian or Alaska Native	0	0
Asian	1	0
Black or African American	0	0
Native Hawaiian	0	0
White	28	29
Mixed Race	3	0
Prefer not to say	0	1
Ethnicity		
Hispanic or Latino	1	3
Not Hispanic	31	26
Prefer not to say	0	1
Average Yearly Income		
\$0-24,999	0	0
\$25,000-49,999	0	0
\$50,000-99,999	3	7
\$100,000–199,999	11	13
\$200,000 or higher	5	3
Not reported	13	7
Average ERQ-Suppression	13.02(6.17)	10.64(4.45)
Average ERQ-Reappraisal	26.56(8.96)	25.86(8.86)
Average AAQ-II	9.96(4.04)	11.57(4.46)
Average SCARED	6.95(5.31)	15.86(12.86)
Average MFQ	3.67(5.33)	3.53(4.03)
Average CTQ	27.38(2.72)	27.93(2.85)

Table 2.1. *Participant Demographics and Clinical Characteristics.* ERQ = Emotion Regulation Questionnaire; AAQ-II = The Acceptance and Action Questionnaire; Second Edition; SCARED = Screen for Child Anxiety Related Disorders; MFQ = The Mood and Feelings Questionnaire; CTQ = Childhood Trauma Questionnaire.

Note: Data table is reporting on sex not gender.

Statistical Analyses

Task Manipulation Check Analyses. Results from the interaction of valence and engagement instruction were significant ($F(1, 2299.47)=52.18, p<0.001$; see *Figure 2.2*), indicating that the task induced the appropriate emotional reactions. In this interaction, neutral image trials had little to no differences across engagement instructions. However, in negative image trials, images in the close/engagement condition were rated as more negative than images in the far/disengagement condition. We also observed significant main effects of engagement instruction (Close/Far; $F(1,33.28)=23.24, p<0.001$) and valence (negative/neutral; $F(1,58.28)=151.89, p<0.001$). The main effect of valence was as expected, with neutral images rated at or slightly above neutral, and negative images rated as negative. The main effects of instruction revealed that images in the close condition were rated more extreme compared to images in the far condition.

Figure 2.2

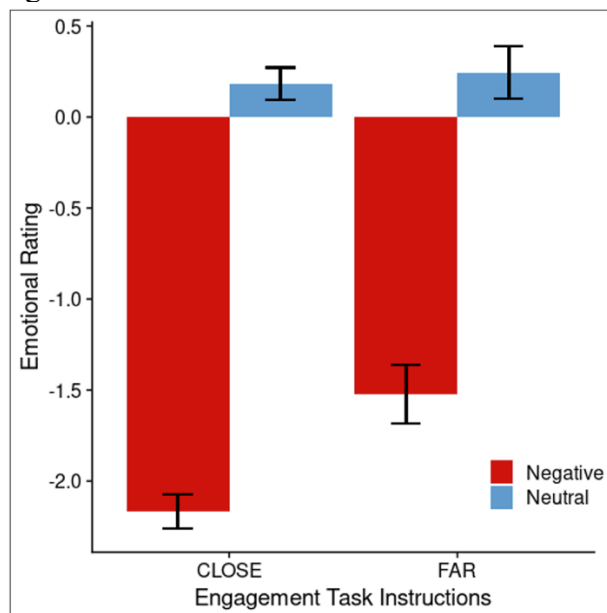


Figure 2.2. Experimental Task Manipulation Check – Behavioral Results: This figure depicts the interaction between valence (red=negative; blue=neutral) and task condition (close = engage with emotions; far = disengage from emotions) on post-image emotional ratings.

Our model predicting HRV from the interaction of valence and engagement instruction did not have a significant interaction ($F(1, 533.45) = 0.021, p=0.886$). However, there was a significant main effect of age ($F(1,2837.13)=800.476, p<0.001$). This main effect showed that as age increased, mean HRV increased. There was also a significant main effect of sex ($F(1,533.45)=587.25, p<0.001$) that showed males in the study had higher average HRV than females. For SCR amplitude, there were no significant effects for the interaction of valence and engagement instruction ($F(1,195.02)=0.28, p=0.597$). There was a trending main effect of sex ($F(1,24.6)=3.13, p=0.089$), which showed that female youth had a higher skin conductance amplitude compared to male youth.

Emotion Regulation and Behavioral Self-Report Analyses. When we interacted valence, engagement instruction, and trait reappraisal on the behavioral ratings, the three-way interaction was non-significant ($F(1,2017.02)=0.74, p=0.39$). The three-way interaction of valence, engagement instruction, and trait suppression was also found to be non-significant. However, when we examined the interaction of valence, engagement instruction, and trait acceptance, we observed a trending interaction effect ($F(1, 2246.71)=0.028, p=0.066$). We also observed a significant two-way interaction between engagement instruction and trait acceptance ($F(1, 2089.12)=0.135, p<0.001$; see Figure 2.3). In this two-way interaction, we observed a negative association between trait acceptance and emotional ratings in the close condition, meaning ratings became more negative as trait acceptance increased, and a positive association between emotion ratings and trait acceptance in the far condition, with images becoming more neutral with increasing acceptance. Similar to the previous trait regulation analyses, we observed a significant two-way interaction of valence and engagement instruction

($F(1,2072.12)=45.54, p<0.001$), main effect of valence ($F(1,52.8)=199.34, p<0.001$), and main effect of engagement instruction ($F(1,65.17)=53.95, p<0.001$), which resembled those described previously.

Figure 2.3

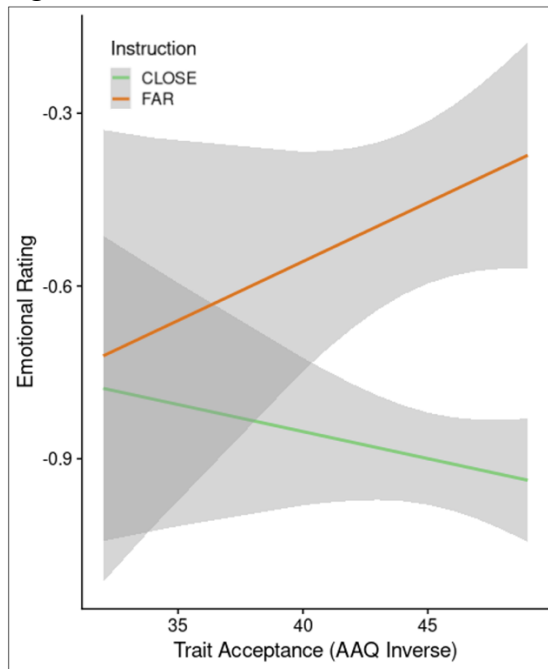


Figure 2.3. Figure depicting the relationship between trait levels of acceptance (measured using the inverse score of the Acceptance and Action Questionnaire-II) and instruction (green=close/engagement condition; orange=far/disengagement) on post-image emotional ratings.

Emotion Regulation and Autonomic Nervous System Analyses. In our models predicting HRV metrics, there were no significant effects observed for the interaction of valence, engagement instruction with trait reappraisal ($F(1,2589.07)=0.75, p=0.387$), suppression ($F(1,2589.04)=0.84, p=0.36$), or acceptance ($F(11,2588.08)=0.00057, p=0.93$). We observed a significant effect of age in the reappraisal model ($F(1, 46.97)=11.766, p<0.001$), suppression model ($F(1, 46.97)=11.346, p<0.001$), and acceptance model ($F(1, 46.97)=8.951, p<0.001$), whose effects were as seen in the task manipulation check model.

Results from the SCR models revealed non-significant interactions of valence, engagement instruction, with both trait reappraisal ($F(1,169.38)=1.54, p=0.22$), and trait suppression ($F(1,167.06)=1.01, p=0.32$). In both models, lower-level interactions and main effects were also not significant. However, the SCR model including trait acceptance had a trending three-way interaction, $F(1,114.22)=3.132, p=0.07$. We observed a significant interaction of valence and trait acceptance, $F(1,35.84)=4.51, p=0.041$ (Figure 2.4). Across both negative and neutral image trials, there was an increase in skin conductance amplitude as trait acceptance increases. At lower levels of acceptance, negative images had greater SCR amplitude responses compared to neutral images. At greater levels of trait acceptance, this relationship was reversed, and neutral images were associated with greater amplitude SCRs. Finally, we observed a significant sex main effect, $F(1,67.3)=4.89, p=0.03$. In this sample, females had greater amplitude SCRs compared to males.

Figure 2.4

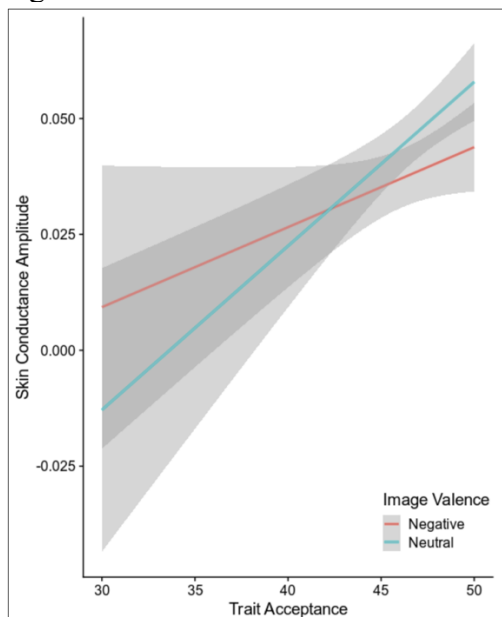


Figure 2.4. Figure showing the relationship between trait levels of acceptance and valence (red=negative, blue=neutral) on skin conductance amplitude response to emotions ratings.

Discussion

This study examined the relationship between reappraisal, suppression, and acceptance with emotional engagement as tactic in a typically-developing adolescent sample. We found evidence relating emotional engagement as a tactic to trait acceptance, but not reappraisal or suppression. As predicted, when asked to engage with their emotions youth reported significantly more intense negative emotions, which was significantly related to greater trait acceptance. Youth also exhibited greater autonomic reactions, specifically EDA reactivity, to negative stimuli with greater trait acceptance. These support our predictions that greater acceptance would facilitate greater reactivity and arousal. However, we did not see a relationship with heart rate variability metrics. These findings help elucidate differences between processes or mechanisms that underlie specific emotion regulation strategies.

These findings support previous research in adults that acceptance preserves the experience of some autonomic components of the emotional experience – specifically skin conductance level (Troy et al., 2018; Wolgast et al., 2011), even if it reduces the subjective experience of emotions. Our results suggest a possible mechanism underlying these differences is driven by emotional engagement. If emotional engagement is a primary tactic underlying acceptance, greater levels of acceptance would result in greater physiological reactivity since acceptance preserves this component of the emotional experience. The lack of a statistical relationship between reappraisal and emotional engagement likely reflects the muted physiological arousal that can be observed when adults use reappraisal (Troy et al., 2018; Wolgast et al., 2011). Our findings support both aspects of this explanation

through a significant relationship between trait acceptance and EDA reactivity and the nonsignificant relationship with trait reappraisal.

There are a few potential explanations for the null findings related to HRV. Some metrics of in-the-moment phasic HRV (the measures used in the present study) are conceptualized as measures of the parasympathetic nervous system to reduce heart rate. In the context of emotion regulation, when actively regulating heart rate is adjusted to restrict both one's emotional state and manage the body's response – resulting in increased HRV to adapt to autonomic reactions to emotional stimuli. The greater amount of effort placed on regulating, the more effort exerted by the heart to bring HRV back to a controlled, near baseline level (Balzarotti et al., 2017). This makes HRV a measure of *effort* to regulate, rather than *intensity* of the emotional response. However, this task may not be the most appropriate means to assess these metrics. Based on the fast-paced nature of the task there may not have been sufficient time to adequately measure regulation effort, though emotional response (measured by SCR) could be adequately measured. Alternatively, the stimuli may not elicit a strong arousal in youth, which would weaken our ability to detect these changes even if they were present.

There are important limitations of the study that should be noted. Several are related to the collection of physiological data. Data for the task was collected during a multiband fMRI paradigm, which introduced considerable noise to our autonomic measurements. Despite consulting with specialists, the bandpass filtering and other corrections may not have adequately removed all the noise from both the HRV and SCR data. This reduces our ability to adequately detect significant changes in both skin conductance level and heart rate. We also calculated HRV using photoplethysmography

(PPG), not electrocardiography (ECG). While the two approaches tend to be highly correlated, PPG can introduce electrical artifacts into recordings and create additional noise (Lu et al., 2009). In addition, we also used short epochs of approximately 10 seconds in length to calculate HRV. While some metrics of HRV can be accurately measured during these ultra-short time frames (Balzarotti et al., 2017), this epoch included the stimulus and rating. Including both events reduces interpretability and introduces additional noise to the autonomic measures. Due to potential noise from the fMRI setting, PPG, and the mixed-event epoch, our ability to detect meaningful changes in HRV and SCR is limited. There are also limitations related to our sample. The present study included a relatively small sample size, which was predominantly white and from a middle-class background. The small sample size weakens our statistical power to detect significant differences and limits our ability to generalize findings beyond individuals from these groups.

These findings provide potential insight into how third-wave therapies, such as Dialectical Behavior Therapy (DBT; Linehan, 1993) or Acceptance and Commitment Therapy (ACT; Hayes et al., 2006) target emotional engagement by teaching clients this tactic to manage their emotions. ACT is designed to target the avoidance of challenging emotions, which would directly enhance emotional engagement as a tactic. In this study, we observed that with greater levels of acceptance, youth reported more neutral emotions and greater negative emotions, which may reflect greater levels of diffusion – a key therapeutic goal of ACT. On the other hand, more traditional cognitive or cognitive behavioral therapies likely target other processes (Beck, 2021) such as those found in reappraisal. These highlight how, in the context of emotions, both approaches teach emotion regulation skills

using unique tactics. Further research would benefit from exploring whether these specific interventions alter the use of specific tactics.

Our results demonstrate an important need for additional research in this area. Further studies dismantling the mechanisms, tactics, or techniques underlying regulation strategies may be useful in determining how various emotion regulation strategies are related. Once these relationships between strategies are identified, they can be used to inform how to teach strategies in therapy to improve developmental processes or outcomes. Strategies with related tactics or mechanisms can be taught developmentally with one building off each other – creating greater conceptual bridges between them. Future research should explore these relationships across a variety of regulation strategies, using multi-method approaches as well, and examining these relationships using more than trait acceptance. Relating behavioral measures of acceptance and emotional engagement would strengthen the relationships, since both would be observed in similar manners.

The current research provided early evidence that emotional engagement is a tactic closely related to trait acceptance, but not reappraisal or suppression. We found support for this relationship using both skin conductance reactivity and self-reported emotions, though not in heart rate variability. These findings highlight tactics of emotion regulation that emphasize the unique features of various strategies, and provide explanations for various findings where acceptance preserves physiological reactions to emotional stimuli. They also provide potential mechanisms of change that underly why these strategies may be effective in certain therapeutic approaches, such as third-wave cognitive behavioral therapies like DBT or ACT. Future research would benefit from exploring these

relationships in more regulation strategies, and in a larger sample using a variety of approaches.

CHAPTER 3. COMPARISON OF REGULATION STRATEGIES IN ADULTS

STUDY A: THE IMPACT OF CHILDHOOD MALTREATMENT ON ADAPTIVE EMOTION REGULATION STRATEGIES

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Introduction

Childhood maltreatment is the most potent known risk factor for psychopathology, accounting for nearly 30% of the risk for mental illness in adulthood (Green et al., 2010).

One mechanism by which maltreatment contributes to psychopathology is through impairments in emotion regulation (Kim-Spoon et al., 2013), or the ability to modulate the experience of positive or negative emotions (Gross, 1998). Maltreatment exposure during childhood has been linked to maladaptive impairments in emotion regulation throughout one's life, including utilization of fewer emotion regulation strategies, greater non-acceptance toward one's emotions, and weaker clarity of one's emotions (Gratz & Roemer, 2004). Furthermore, maltreatment has been associated with greater use of maladaptive strategies during adulthood including suppression and rumination, which in turn mediate general psychopathology risk (Weissman et al., 2019). In contrast, adaptive emotion regulation strategies, such as acceptance, reappraisal, and problem solving, are associated with enhanced positive emotions, reduced reactivity to stressful and emotional stimuli, and

better mental health outcomes (Aldao et al., 2010). However, while the relationship between maltreatment and maladaptive emotion regulation strategies has received ample study, little remains understood about how childhood maltreatment influences the use of *adaptive* emotion regulation strategies.

Further exploration of adaptive emotion regulation strategies, particularly reappraisal and acceptance, are important due to their demonstrated effectiveness within therapeutic approaches such as Cognitive Behavioral Therapy, Dialectical Behavior Therapy (Linehan, 1993) and Acceptance and Commitment Therapy (ACT; Hayes et al., 2006). Reappraisal is typically described as reinterpreting an emotional situation to create a more neutral perspective (Gross, 1998). As a regulation strategy, it appears to be effective in reducing negative emotions, increasing positive emotions, and reducing physiological reactions to emotional stimuli, though it can also be used to keep positive emotions in check to avoid the development of manic symptoms (Painter et al., 2019). In comparison, acceptance, which stems out of Eastern philosophy, has been incorporated into therapeutic interventions such as mindful-based stress reduction (Kabat-Zinn, 1994). When engaging in acceptance, there is an emphasis on non-judgmental acceptance of emotions and the accompanying thoughts, feelings, and sensations (Aldao et al., 2010). In the only study to directly compare these strategies in the context of positive and negative emotions, reappraisal appeared to result in a greater reduction of negative emotions and greater increases in positive emotions, but required more effort compared to acceptance (Troy et al., 2018). However, the study did not have a non-instruction control condition, limiting the ability to form definitive interpretations comparing the two strategies. Furthermore, no studies have examined the impact of childhood maltreatment on the comparative use and

effectiveness of these strategies. This study's inclusion of positive emotions is particularly novel, as few studies explore the specific changes that occur in positive emotionality.

The role of positive emotion regulation represents another critical knowledge gap in understanding the relationship between childhood maltreatment and psychopathology risk. Despite the importance of both positive and negative emotions, the majority of research on childhood maltreatment and psychopathology risk has focused solely on negative emotions (Waugh, 2020). For instance, women who have experienced domestic violence exhibit greater rates of nonacceptance of positive emotions, greater impulsivity in response to emotions, and greater posttraumatic symptoms (Weiss et al., 2018). Furthermore, childhood maltreatment markedly increases risk for multiple disorders characterized by a limited ability to experience positive emotions including depression, anxiety, and posttraumatic stress disorder (PTSD). However, more work is needed to examine how early experiences of maltreatment can specifically influence both positive and negative emotion regulation. Here, examining the intersection of childhood maltreatment and positive emotions may lead to identifying novel therapeutic targets, potentially improving outcomes for victims of childhood maltreatment.

To date, no study has examined how experiences of childhood maltreatment affect the use of these key emotion regulation strategies, comparing acceptance and reappraisal, as well as its impact on both positive and negative emotion. To address these critical knowledge gaps, we conducted a study to explore the impact of childhood maltreatment on acceptance and reappraisal in adulthood, incorporating both positive and negative emotions along with a non-instruction comparison condition. We examined the effects of childhood maltreatment exposure (including neglect and abuse) on the effectiveness and

perceived effort of these strategies. In conjunction with research indicating greater rates of emotional dysregulation following maltreatment and the broad impact of maltreatment on psychopathology risk, we hypothesized reappraisal would be more effective at modulating both positive and negative emotions, and that maltreatment experiences would be associated with greater intensity of emotional experience (compared to the non-instructed conditions).

Methods

Participant Recruitment

All data was collected from 207 participants in a cross-sectional design, who were recruited through Amazon's Mechanical Turk and using Qualtrics to administer the task online. Inclusion criteria for this study were 18 years of age or older, English language fluency, and residence in the United States. Data were collected online over the course of two days in November of 2019. All study procedures were approved by the University of Wisconsin-Madison Health Sciences Institutional Review Board.

Trauma and Clinical Measures

Participant demographics are summarized in *Table 3.A1*. Participants provided information about maltreatment experiences during childhood using the *Childhood Trauma Questionnaire* (CTQ; Bernstein et al., 2003). We used the standard cutoff scores on the CTQ subscales to determine if a participant had been exposed to a specific form of maltreatment: physical abuse if the subscale had a total of 8 or above, sexual abuse if the subscale had a total of 6 or above, and emotional abuse if the subscale had a score of 9 or above. The physical and sexual subscales were combined into a "CTQ Abuse" score. If a subject qualified for any of the three, they were classified as abuse-exposed. Neglect

exposure was separately classified using the same procedure. CTQ cutoff scores for neglect subscales were determined using the following scores: emotional neglect if the subscale had a score of 10 or above, and physical neglect if the subscale had a total of 8 or above. If a subject qualified for either form of neglect, they were classified as neglect-exposed.

Table 3.A1
Participant Demographics and Clinical Characteristics

	Maltreated (N=148)	Non-Maltreated (N=52)		Maltreated (N=148)	Non-Maltreated (N=52)
Sex			Ethnicity		
Male	31	82	Hispanic	22	2
Female	20	65	Not Hispanic	118	49
Prefer not say	1	1	Prefer not say	8	1
Age Range			Income		
18-29	75	10	Below 20,000	21	3
30-39	54	25	20,000-29,999	24	8
40-49	10	5	30,001-49,999	35	18
50-59	4	10	50,00-74,999	27	12
60+	1	2	75,000-99,999	11	6
Race			100,000+	15	4
White	74	40	Prefer not say	6	1
Black	6	6	Mean CTQ	44.76 (19-70)	16.09 (15-20)
American Indian or Alaskan Native	3	0	Average BDI	42.1 (22-62)	25.84 (22-53)
Latinx	3	1	Average STAI-Trait	53.29 (33-75)	45.03 (35-57)
Asian or Pacific Islander	58	3			
Mixed Race	3	1			
Prefer not say	1	1			

Table 3.A1. Participant demographics broken down by those who met cutoffs for maltreatment vs those who did not meet the cutoff score. Participants were categorized as maltreated-exposed if they scored above “minimal” on any one of the three abuse subscales in the Childhood Trauma Questionnaire (CTQ; physical abuse ≥ 8 , sexual abuse ≥ 6 , emotional abuse ≥ 9). BDI = Beck Depression Inventory; STAI = State-Trait Anxiety Inventory.

Finally, participants reported their level of awareness of bodily sensations, associated mental states, and bodily perceptions using the *Multidimensional Assessment of Interoceptive Awareness* (Mehling et al., 2012), and their depression and anxiety severity

using the *Beck Depression Inventory* (BDI; Beck et al., 1996), and *State-Trait Anxiety Inventory* (STAI; Marteau & Bekker, 1992), respectively.

Emotional Strategies Task

The task was a modified version of the paradigm described by Dan-Glauser and Gross (2015). See *Figure 3.A1* for visual representation of the task. Participants were provided in-depth details regarding how to implement each emotion regulation strategy and practiced each strategy prior to beginning the task. Instructions for acceptance strategies were adapted from Ellard et al. (2017), the reappraisal strategies were adapted from Goldin et al. (2019), and the non-instruction trial was adapted from Ellard et al. (2017). Specific language for each block of instructions is located in Appendix B.

Figure 3.A1.

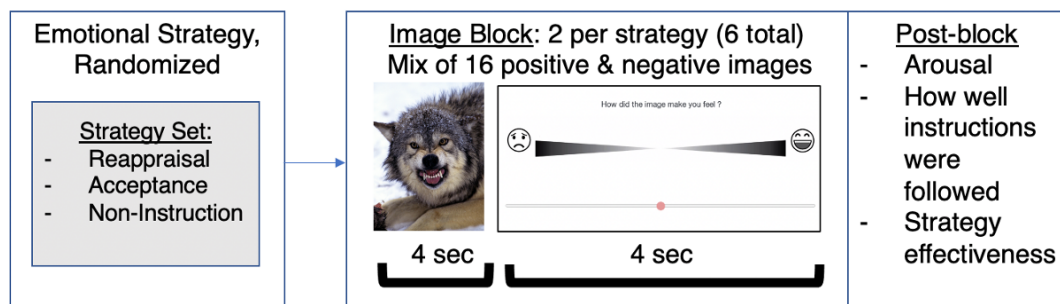


Figure 3.A1. Experimental task design.

In a pseudo-randomized design, images were presented in 6 blocks. At the start of each block, participants were instructed to engage in one of three emotion strategies: acceptance, reappraisal, or a non-instructed strategy. Block assignment of strategy instructions was pseudo-randomized, with participants randomly assigned an order in which to apply each strategy for the first three blocks, which was repeated in the last three blocks. This pseudo-randomization was implemented to improve generalizability and

reduce bias should a static set of images be only associated with a single strategy. At the end of each block, participants were asked to rate their level of arousal using a 7-point *Self-Assessment Manikin* scale (Bradley & Lang, 1994). Participants were also asked questions about how well they followed the instructions and how effective they thought the strategy was for them using a 5-point Likert scale ranging from “Extremely well/effective” to “Not well/effective at all”.

Within each block 16 unique images were selected across both negative and positive valences and presented randomly for 4 seconds each. Following each image, participants were asked to rate their emotional experience using a modified version of an *Affective Slider* (Betella & Verschure, 2016), where they were asked “How did the image make you feel?” and responded on a continuous slider ranging from a frowning face to a smiling face. The slider translated to a continuous score ranging from a score of 0 (extremely negative) to 100 (extremely positive), with 50 representing a neutral rating. Participants were provided 5 seconds to rate each image. These ratings were primarily used as the outcome variable in analyses. Statistically, we designed the task to have 32 items per strategy, extending past the 20 minimum suggested by Brauer and Curtin (2018). We also followed their recommendation by having at least 200 subjects, which provides between 60-70 subjects per strategy analyzed.

Emotional Strategies Task Stimuli

Images presented in the task were selected from the *Nencki Affective Picture System* (NAPS; Marchewka et al., 2014) due to the high image resolution and updated image content compared to the *International Affective Picture Set* (IAPS). The entire image set was re-normed for valence and arousal in an American population using Mechanical Turk in a

previously unpublished project, increasing applicability of arousal and valence for the present study. A list of all NAPS images, with block groupings, and re-normed valence and arousal ratings can be found in the Appendix B (*Table S3.1*).

Statistical Analyses

Image Selection Analyses. While selecting images from the greater NAPS image set, we attempted to find distinct valence and similar arousal ratings using the re-normed data collected in a separate study using Mechanical Turk, and a series of analyses were run in R. One set of linear models were run including all selected images, predicting valence and arousal ratings based on the valence category (positive or negative) as determined by the norming process. To compare valence and arousal ratings between blocks, a second set of linear models were run examining the effect of block grouping on the normed rating values.

Primary Statistical Analyses

Task validation analyses. All statistical analyses were completed in R (version 1.4.1717; R Programming Team, 2018) using RStudio (RStudio Team, 2012). Following data collection, 7 subjects missing 40% or more of the post-image ratings were omitted from analyses, leaving a total final sample of 200. As linear mixed effect modeling (LME) is fairly robust against missing data, no additional steps to rectify missing data were completed. A LME (v2.9.13; Bates et al., 2015) was used to first validate the task's successful induction of positive and negative affect. To do so, we examined the interaction of regulation strategy and image valence on emotional ratings for each individual image rating. Age and sex, centered around 0, were included as covariates in each model based on the literature indicating age-related changes in emotional experiences (Isaacowitz et al., 2017). The model also included the by-subject effects for the interaction between strategy

and valence. We did not include a random intercept or lower-order random effects in the model in order to help with model convergence, following suggestions by Brauer and Curtin (2018), as the model would not converge correctly with the random intercept and lower-order random effects.

Abuse exposure analyses. Next, we examined the effect of childhood abuse on the use of strategies across valence. This model also allowed us to investigate the effect of abuse on emotional experience through the main effect of CTQ abuse used dichotomously. First, an LME was used to estimate the three-way interaction of regulation strategy, image valence, and abuse exposure. Here, abuse was dichotomously defined using the CTQ abuse cutoff scores described above, and all dichotomous variables were centered at 0. Age and sex were included as covariates, as well as the interaction of strategy and valence. A random intercept was included and random effects were restricted to just the interaction of strategy and valence to help with model convergence, following suggestions by Brauer and Curtin (2018).

To help decompose the effects further, we examined the effect of abuse exposure within each strategy, and the effect of strategy within abuse exposure, separately within each valence. This was accomplished by selecting trials of each strategy or abuse exposure individually, and running an LME predicting post-image rating from abuse exposure or strategy, controlling for age and sex, and including a by-subject intercept.

Abuse severity analyses. A second model then examined the effects of abuse severity, using the continuous CTQ abuse score. This model successfully converged with a random intercept and restricting the random effects to the interaction of strategy and valence.

Neglect exposure and severity analyses. Finally, an additional two models were run to separately estimate the impact of neglect, as measured by the CTQ. Similar to the models described above, one LME estimated the interaction using a dichotomous classification of neglect exposure, while the other used a continuous neglect severity score. To achieve model convergence, the random effect structures and covariates of the neglect severity was restricted to the random interaction of valence and instruction, while the neglect exposure mode included both a random intercept and random interaction of valence and instruction.

Post-Hoc Analyses. Within all significant effects involving abuse or neglect from the primary statistical analyses, we further examined whether there was a differential impact of specific forms of maltreatment. To do so, separate LME's were run to estimate the effect of dichotomous sexual abuse, physical abuse, emotional abuse, emotional neglect, and physical neglect exposure. Using the same model parameters described above, each LME included the three-way interaction of regulation strategy, valence condition, and maltreatment type, with age and sex as covariates, and we included a random intercept and only the random effect of the interaction of image valence and emotion regulation strategy to simplify the model and improve model convergence, again following recommendations by Brauer and Curtin (2018). However, because the three specific forms of abuse were highly correlated (emotion and physical, $r=0.83$; emotion and sexual, $r=0.77$, sexual and physical, $r=0.81$), we also included the other forms of abuse as covariates to determine if each form of abuse contributes uniquely.

Supplemental analyses. We also ran a series of analyses examining how maltreatment severity impacts the perceived strategy effectiveness, and separate analyses

examining how depression and anxiety symptom severity relate to the post-image ratings. These are described in greater detail in the Appendix B.

Results

Participant Statistics

Out of the 207 subjects initially enrolled in the study, 200 remained after 7 were omitted from analyses due to missing data. Participants were primarily White (see *Table 3.A1*) and Non-Hispanic, though a considerable number of subjects identifying as Asian American or Pacific Islander also completed study activities. Subjects were fairly balanced across males and females, with 56% identifying as male. Most subjects reported being under 40 years of age.

Image Selection Analyses

First, blocks were detected to be evenly balanced across both valence and arousal using data collected from a separate norming study (see Methods). Image block designation was not a significant predictor of either valence ($F(5,90)=0.009, p=1$) or arousal ($F(5,90)=0.16, p=0.98$). When separately examined within the positive and negative categories as determined by the normed ratings, there were again no significant effects of block for either positive or negative images across both arousal (negative, $F(5,42)=0.038, p=0.99$; positive, $F(5,42)=1.3, p=0.28$) and valence (negative, $F(5,42)=0.34, p=0.87$; positive, $F(5,42)=0.3, p=0.91$).

As expected, when modeling valence category on valence and arousal ratings across all images and blocks, no significant differences in arousal were detected ($F(1,94)=1.092, p=0.299$). However, there was a significant main effect of valence ($F(1,94)=1027, p<0.001$, partial eta = 0.92). This anticipated difference between positive and negative images

confirmed previously-normed ratings, with positive images receiving higher ratings than negative images. Altogether, all subsequent analyses of valence differences across abuse and strategy were completed without concern of potential effects of arousal, so block order or designation was not included in future analyses.

Primary Statistical Analyses

Task validation analyses. When first examining the effectiveness of the task, we detected a significant interaction of valence and regulation strategy (*Figure 3.A2*; $F(2,197.8)=29.03, p<0.001, r^2=0.47$). Again, positive images received more extreme ratings than negative images across all trials. With respect to regulation strategy, as expected non-instruction trials had the most extreme ratings, reappraisal trials had the least extreme ratings, and acceptance trials had intermediate ratings. Results indicated that the interaction of acceptance and valence was significantly different than the interaction of both reappraisal trials with valence ($F(5,204.5)=16.99, p<0.001$) and the non-instruction and valence ($F(5,204.1)=31.51, p<0.001$). Here, reappraisal downregulate emotional intensity more than acceptance, non-instruction trials were less impactful than acceptance, and ratings were more extreme for all positive emotions than negative emotions.

Figure 3.A2.

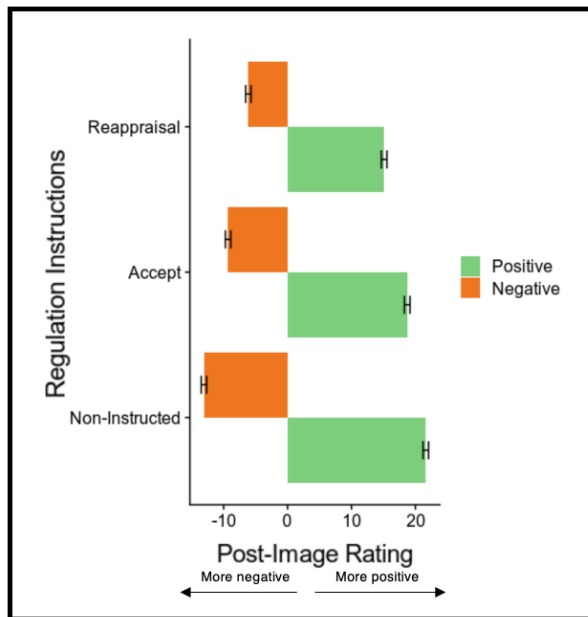


Figure 3.A2. The emotion strategies task successfully induced positive and negative affect across regulation instruction, as measured by post-image emotional ratings. Brackets indicate confidence interval.

Abuse exposure analyses. Next, we detected a significant interaction of abuse exposure, image valence, and emotion regulation strategy on emotional ratings, $F(2, 194.6)=5.01$, $p<0.01$, $r^2=0.48$ (see *Figure 3.A3, panel A*). While we again found positive images rated higher and more extreme than negative images, within each valence there were significant interactions between abuse exposure and strategy (negative, $F(2, 197.21)=11.47$, $p<0.001$; positive, $F(2, 196.82)=11.57$, $p<0.001$). Within positive image trials, there was a significant effect of abuse exposure on emotional ratings for acceptance trials ($F(1, 192.55)=16.44$, $p<0.001$), reappraisal trials ($F(1, 194.07)=12.06$, $p<0.001$), and non-instruction trials ($F(1, 194.17)=15.83$, $p<0.001$). Regardless of the strategy, those who experienced abuse rated positive images more extreme than those without an abuse history. Interestingly, when viewing negative images, there were no significant effects of abuse exposure on image rating within any of the strategies, while the effect of strategy

remained similar to previous findings. However, in non-instructed trials of negative image, there was a trending difference between maltreated and non-maltreated individuals, $F(1,194.13)=3.1, p=0.07972$, where non-maltreated individuals showed more extreme ratings compared to their maltreated counterparts.

In addition, across positive valence trials, there was a significant effect of strategy for both maltreated ($F(2,145.26)=11.75, p<0.001$) and non-maltreated adults ($F(2,49.99)=15.05, p<0.001$). The same was true for negative trials, with significant effects of strategy on post-image rating for abused ($F(2,145.7)=7.74, p<0.001$) and non-abused ($F(2,49.99)=30.23, p<0.001$) individuals. These results indicate that similar strategy effects are present across emotional valence. Similar to the task validation findings, non-instruction trials had the most extreme ratings, acceptance had intermediate ratings, and reappraisal had the least extreme ratings. These support our hypothesis that acceptance will be less effective than reappraisal, and that those with a history of abuse exposure process positive images differently than non-maltreated individuals, but negative images are processed similarly regardless of abuse exposure. In addition, the emotion regulation strategy effects described above remained statistically significant regardless of abuse history or when the data were subset for valence (positive and abused, $F(2,145.26)=11.75, p<0.001$; positive and non-abused, $F(2,49.99)=15.05, p<0.001$; negative and abused, $F(2,145.7)=7.47, p<0.001$; negative and non-abused, $F(2,49.99)=30.23, p<0.001$).

Figure 3.A3.

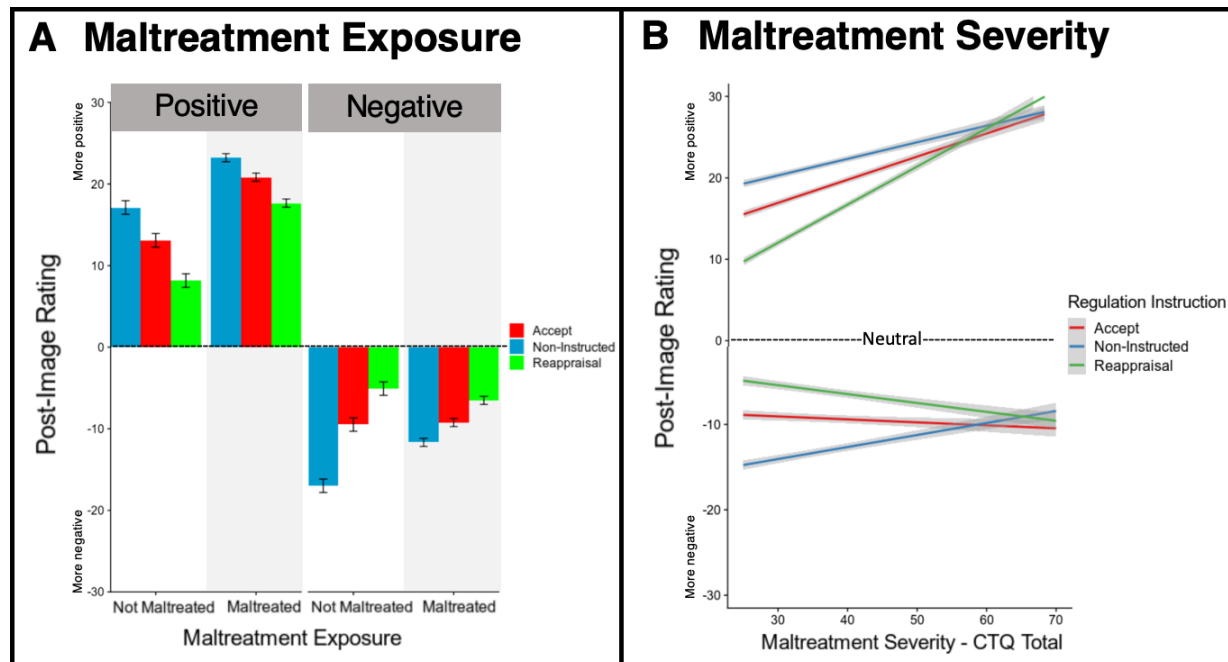


Figure 3.A3. Effects of maltreatment exposure (Panel A) and maltreatment severity (Panel B) on post-image ratings during negative and positive images. Brackets indicate confidence interval.

Abuse severity analyses. We then examined the effect of childhood abuse *severity* across strategies and valence. We detected a significant three-way interaction of regulation strategy, image valence, and abuse severity, $F(2,194.6)=15.93$, $p<0.001$, $r^2=0.48$ (Figure 3.A3, panel B). Consistent with our previous findings, at lower levels of abuse the use of reappraisal strategies was associated with the least extreme emotional ratings, followed by acceptance strategies, and finally non-instruction trials were associated with the most extreme emotional ratings, across positive and negative images. At greater levels of abuse, any differences in emotional intensity based on strategy were no longer present.

Neglect exposure and severity analyses. Finally, in models investigating childhood neglect, we did not detect any significant three-way interactions for either neglect severity ($F(2,195.1)=0.64$, $p=0.53$) or dichotomous experience ($F(2,194.2)=1.01$, $p=0.37$).

Therefore, all subsequent analyses of strategy effectiveness and sensitivity were examined solely using abuse experience and severity.

Post-Hoc Analyses. Here, we examined whether dichotomous experience of different forms of childhood abuse in driving the three-way interactions between abuse severity, image valence, and emotion regulation strategy. Here, we see that dichotomous experience of both childhood sexual abuse ($F(2,195.7)=13.73, p<0.001$), physical abuse ($F(2,195.2)=12.89, p<0.001$), and emotional abuse ($F(2,194.7)=6.22, p<0.01$) significantly predicted post-image ratings. When the models were run controlling for the other forms of abuse, we found the unique effect of sexual abuse ($F(2,196.7)=14.79, p<0.001$), emotional abuse ($F(2,196.9)=7.81, p<0.001$), and physical abuse ($F(2,196.9)=16.74, p<0.001$) remained significant.

Supplemental analyses indicated that increasing symptom severity for depression and anxiety were associated with increased intensity of positive emotions and reduced intensity of negative emotions (see *Figure S3.A1*). In addition, as maltreatment severity increased, perceived strategy effectiveness also appeared to increase. However, at lower levels non-instruction was perceived as more effective than acceptance and reappraisal, while the latter two strategies equally increased in effectiveness as maltreatment severity increased (see *Figure S3.A2*). See Appendix B for a more detailed summary of results.

Discussion

In this study, we aimed to examine how a history of childhood maltreatment influences the experience of emotions and the use of specific emotion regulation strategies in a community sample of adults. We asked participants to view both positive and negative emotional images while practicing acceptance, reappraisal, or reacting without instruction,

and to subsequently rate the strength of their emotions. We had two main hypotheses. We first predicted that reappraisal would be more effective at impacting emotions than acceptance, and also that abuse would be associated with more extreme ratings. We found full support for our first hypothesis, and partial support of our second hypothesis. To our knowledge, this is the first investigation of the distal effects of abuse on the use of specific adaptive emotion regulation strategies, while examining the effects in both positive and negative emotions.

When examining overall task and strategy effects, we found that reappraisal showed the greatest effectiveness in decreasing emotional intensity rating compared to acceptance and non-instruction. Notably, this effect was seen across positive and negative images, and appeared regardless of maltreatment exposure, supporting our first hypothesis. When examining whether the valence of emotional images interacts with regulation strategy use, we found that each of the emotional strategies had similar impact on the intensity of emotions regardless of whether the image was positive or negative. These findings support previous research by Boehme et al. (2019), Goldin et al. (2019), and Troy et al. (2018), where reappraisal was found to be more effective than acceptance in reducing the intensity of emotions. These findings also support the use of these strategies in managing not only negative emotions, but also reducing the intensity of positive emotions. This expands upon the current literature, as a majority of research focuses nearly exclusively on negative emotions. As proposed by Waugh (2020), examining positive emotions is important because of the lack of understanding in their role of psychopathology and treatment of mental disorders. As such, the current study continues this idea and expands the potential

use of these strategies in therapeutic interventions across disorders involving dysregulation of positive emotions.

When comparing acceptance and reappraisal, the increased effectiveness of reappraisal could reflect an overall difference in strategy effectiveness. On the other hand, the observed differences may also reflect how these strategies uniquely affect the phases of the emotional experience as described in Gross's (1998) Process Model of emotion regulation. Building off of this model, Wolgast et al. (2011) proposed that while both reappraisal and acceptance exert some effect in the early stages of the emotional experience, acceptance may also play a role in response-focused elements of the emotional experience, also known as the emotion regulation process. By exerting less influence on the immediate and early emotion regulation processes of situation selection and situation modification (i.e., influencing emotions less than reappraisal), acceptance allows the user to non-judgmentally experience more of the emotion and therefore allowing them to experience the early aspects with less substantial distress. Then, by also influencing the later phases of emotion regulation via response modulation, it continues to keep the emotion at a manageable level, and may prevent subsequent extreme distress. This ability to act on multiple parts of the emotion regulation process across positive and negative emotions may make acceptance a strong fit for therapeutic interventions such as exposure therapy, response and prevention therapy, and narrative processing in trauma work. In comparison to reappraisal, which exerts its full impact on the initial aspect of the emotional experience process, acceptance exerts a more consistent, yet less intense, influence across the emotional experience process. This also falls in line with research that indicates that reappraisal requires more effort to implement, necessitating a large force of influence in a

short period of time compared to a lower level of influence across time (Troy et al., 2018). However, additional research is needed to confirm and explore this explanation in greater depth, as our paradigm is unable to look at how these strategies influence the emotional experience across time.

Next, when examining the impact of childhood abuse on emotion regulation, we found a three-way interaction among abuse *exposure*, strategy, and valence. Surprisingly, for negative images we found trending differences for non-instruction trials, but no differences between groups for acceptance or reappraisal. For non-instruction trials, we found that abused individuals rated negative images as less extreme than their non-abused counterparts. This interaction is particularly interesting, as it may indicate that abused individuals default to automatically regulating their negative emotions. Alternatively, these results could provide evidence that both groups were equally effective in utilizing the specific emotion regulation strategies as instructed. This finding builds off of previous research, which has suggested that following abuse some dysfunction in emotion regulation of positive and negative emotions should occur (Berfield et al., 2021; Gratz & Roemer, 2004). One possible explanation for these findings could be the specific strategies included. In the present study, only adaptive strategies were investigated. Notably, prior work suggests increased use of maladaptive strategies following maltreatment (Weissman et al., 2019). However, it is possible that the adaptive strategies tested are less impacted by exposure to maltreatment alone when compared to maladaptive strategies such as rumination or suppression. Future studies would benefit from comparisons between alternative strategies across the adaptive and maladaptive spectrum, and could examine these effects in populations with more severe psychopathology.

Positive emotions, on the other hand, appeared to be processed differently for those with childhood abuse exposure compared to those who did not. Surprisingly, abused subjects rated positive images as more extreme than their non-abused counterparts irrespective of regulation strategy. One potential explanation for the overall difference in positive emotions comes from the known cognitive changes that occur following trauma and maltreatment such as abuse. Following maltreatment, individuals often develop biases toward recalling negative events (Vrijssen et al., 2017), and may even develop a negative cognitive bias toward their environment. Difficulty experiencing positive affect is characteristic of both major depressive disorder and PTSD, which are found in higher rates in trauma-exposed populations. This predisposition toward negative emotions and cognitions, coupled with the innate regulation of negative emotions seen in this study, may leave some subjects unprepared or unpracticed to regulate their positive emotions, causing them to be experienced physiologically at more extreme levels. Future research should continue to explore the role that positive emotions play, and should examine the use of these strategies toward different emotional goals, such as increasing positive mood.

Examination of the *severity* of abuse provided additional nuanced information to the exposure findings above. Here, we found that at higher levels of abuse severity, the impact of strategies appears to converge, where strategies become equally impactful. However, we see different patterns within each valence. When the strategies are applied toward positive emotions, at higher levels of abuse we see a gradual increase in emotional intensity, which is consistent with the greater emotional experience observed in positive emotions across abuse-exposed participants. In comparison, when applied toward negative images, emotion intensity across strategies appeared to merge towards equal effectiveness, but rather than

increasing in intensity they regressed toward the mean. This resulted in non-instruction trials becoming less effective and reappraisal strategies becoming more effective for negative images as abuse severity increased. Interestingly, acceptance was similarly effective when regulating negative images across the range of abuse severity. This finding provides evidence that acceptance may be more robust to negative valences in cases of abuse compared to other strategies and may also support the proposal by Wolgast et al. (2011). Here, if acceptance does influence emotions throughout the entire emotional process, it may prove more applicable to address the dysfunctions in emotion regulation that often accompany maltreatment and abuse (Gratz & Roemer, 2004a). This could prove beneficial in treatment, as the lower impact of acceptance at lower maltreatment and abuse severity could prove useful for interventions such as exposure therapies, while still proving effective to help alleviate distress at higher levels of severity. Together, these results also provide partial support for our second hypothesis that acceptance will be less effective than reappraisal, but only at lower levels of abuse severity.

In the future, research should further examine the relationship between differences in the use of these emotion regulation strategies and symptoms, as recent research has supported links between dysregulation between negative and positive emotions and post-traumatic symptoms (Simpson et al., 2021). Our supplemental findings indicate that while anxiety and depressive symptoms interact with image valences in unique ways, controlling for their unique effects did not influence the primary interactions. We found the interaction between abuse exposure, valence, and strategy effectiveness persisted even after controlling for the effects of depression and anxiety severity, which indicates that abuse has some unique influence on the experience and regulation of emotions, particularly

positive emotions, in which emotions become more positive or extreme as severity increases.

A caveat of these findings is that PTSD symptoms, which were not measured in the current study, could exert unique influence beyond anxiety or depressive symptoms. One study that examined the use of these strategies on post-traumatic symptoms was Lee et al. (2015). They used factor analysis to examine how several emotion regulation strategies relate to a variety of PTSD symptom clusters. They found suppression and experiential avoidance were significantly associated with symptom clusters. They also found a significant positive association between acceptance and reexperiencing symptoms. While Lee et al.'s (2015) findings provide some conflicting results, they utilized self-report measures which may not have reflected the most accurate measure of acceptance. Further examination of research in this direction would benefit from the use of experiential and self-report measures.

Further exploration of these symptom relationships, particularly PTSD symptoms, in future research could substantially increase the clinical utility of these findings and their ability to inform treatment. In addition, future research would benefit by examining the effects of maltreatment exposure and severity, and its interaction with emotion regulation strategies such as acceptance proximal to maltreatment exposure. The present findings also indicate the pursuing research in positive emotions may prove beneficial, as positive emotions have a unique relationship with abuse. Because a majority of youth will experience maltreatment before 18 years of age (Lewis et al., 2019), examining these effects in closer proximity to the exposure may help identify earlier areas of intervention to help to reduce or even prevent many of the lifelong effects of maltreatment.

While this study provides novel information about the relationship of childhood abuse to emotion regulation, it does have limitations. Due to task design, we are unable to determine if any of the results reported were due to overall emotional arousal during the task, as arousal ratings were captured only at the block level. However, we were able to determine that the blocks were not statistically different in ratings of arousal, which minimizes the probability that emotional arousal may be a potential confound. Finally, we are unable to determine what subjects were doing during the non-instruction trials as they were simply asked to do whatever felt most natural to them in the moment. This allowed subjects to potentially downregulate their emotions, suppress them, accept them, use reappraisal, or not use any form of regulation. Without knowledge of what subjects did during the non-instruction trials, the ability to interpret differences or non-differences among strategies is limited. A final limitation of the study is the method of recruitment through Amazon's Mechanical Turk. There are some concerns about the generalizability and difficulty representing the broader U.S. population (Buhrmester et al., 2018), however we opted to avoid heavily pre-screening our population to make it more inclusive in the hopes of a more generalizable sample. However, our sample demographics indicate this may not necessarily be the case. Our sample also consists of generally healthy individuals, which may influence these findings, and may differ if replicated in a more clinical sample. Examining these effects in a more clinical and trauma-exposed population would build upon many of the future directions and proposed mechanisms introduced in this paper.

Despite these limitations, this study provides important insights into the complex way that acceptance and reappraisal interact with positive and negative emotions and abuse history. The findings suggest that adults who experienced abuse experience positive

images more intensely, and with increasing abuse severity they are equally effective at different emotion regulation strategies. In addition, it appears that acceptance is more robust to abuse severity, which may augur a broader utility of acceptance-based approaches in the treatment of abuse individuals.

STUDY B: A COMPARISON OF REAPPRAISAL AND SELF-COMPASSION AS AN EMOTION REGULATION STRATEGY IN THE CONTEXT OF MALTREATMENT

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Under Revision: Child Abuse & Neglect, Self-Compassion Special Edition

Introduction

Early experiences of maltreatment, such as physical abuse, sexual abuse, or neglect, have negative sequelae that impact the whole lifespan, including contributing to higher rates of anxiety, depression, and other psychopathology (Li et al., 2016; Varese et al., 2012), lower academic achievement (Strathearn et al., 2020), and substantial economic burden for treatment (Peterson et al., 2018). In many cases, early maltreatment exposure may specifically impact the ability to manage one's emotions, resulting in greater dysregulation of emotions (Gruhn & Compas, 2020). This dysregulation often is accompanied by fear, guilt, shame, sadness, and anger (Shahar et al., 2015), emotions that are known to reduce the effectiveness of clinical interventions (Nanni et al., 2012). If interventions fail to provide relief, many of these emotions can further increase in intensity, creating a vicious cycle of suffering in the wake of maltreatment.

The cyclical patterns of shame, guilt, and self-criticism may be disrupted through the practice of self-compassion. Self-compassion is a contemplative practice that consists of three components: self-kindness, a sense of common humanity, and mindfulness (Neff, 2003). Theoretically, these components may help to address many aspects of the sequelae of maltreatment. For instance, self-kindness is often referenced to help manage guilt, while

the sense of common humanity may help mitigate the sense of shame. In fact, self-compassion has already been proposed as an effective strategy for managing maltreatment-related emotion dysregulation due to its effective regulation of shame and guilt (Ross et al., 2019). Thus far, the research has not expanded beyond its management of shame and guilt, despite mounting evidence that it may effectively manage other emotions. For example, others have found that it performs similarly to or superior to reappraisal or acceptance in mitigating depressed moods or emotions (Diedrich et al., 2014; Ehret et al., 2018).

Despite this growing evidence, few have explored self-compassion in response to more generalized emotions. Establishing how self-compassion manages the broader range of emotions is vital to characterize its baseline capabilities, which can then be used to understand how environmental factors, such as maltreatment, influence its effectiveness. Changes in emotion regulation following trauma or maltreatment are well documented, including reports of the limited use of emotion regulation strategies, a lack of acceptance of emotions, and poor emotional clarity (Gruhn & Compas, 2020; Lavi et al., 2019). For example, maltreatment has been associated with more intense emotions, which applies to both negative (Barlow et al., 2017) and positive (Wooten et al., 2022) emotions. To our knowledge, however, there are no studies comparing self-compassion and other strategies within the context of maltreatment nor comparing its use in response to both negative and positive evoked emotion.

The present study aims to explore these knowledge gaps by exploring self-compassion as an emotion regulation strategy to manage positive and negative emotions and explore its relationship with maltreatment using an adapted emotion regulation task

(Wooten et al., 2022). In our previous study, we administered an emotion regulation task on Amazon's Mechanical Turk comparing reappraisal, acceptance, and a non-instructed condition to positive and negative images, and their interaction with maltreatment exposure history. When we compared the strategies, we found reappraisal use resulted in the least intense emotions, acceptance had intermediate emotions, and non-instructed trials had the most intense emotional ratings. Participants who reported maltreatment (abuse) exposure reported more intense responses to positive emotions regardless of strategy, but no differences in negative emotions. When we included abuse severity, we observed that strategy influence on emotions converged at greater levels of abuse, though reappraisal remained the most impactful for both positive and negative image trials. Importantly, their results indicated that acceptance had a similar impact on negative emotions regardless of maltreatment severity.

The adapted task in the current study compares reappraisal, self-compassion, and a non-instructed condition in response to blocks of emotionally evocative images. Given past research, we anticipate that reappraisal and self-compassion would have similar influences on self-reported emotional responses across the entire cohort. When incorporating abuse history, we expect self-compassion to be more effective than reappraisal when managing negative emotions for those with maltreatment history. We also expect to replicate findings by Wooten et al. (2022), which found more extreme positive emotions in those who experienced maltreatment. Finally, we expect that greater levels of trait reappraisal would be associated with less extreme emotional ratings and greater levels of trait self-compassion would be associated with more extreme subjective emotional ratings due to increased tolerance of emotional intensity.

Methods

Participant Recruitment

The current study recruited a community sample of 201 participants through Amazon's Mechanical Turk. Participants were required to be 18 years of age or older, possess English language fluency, and reside in the United States. Participants were excluded if they could not endorse any of these inclusion criteria. All study procedures were approved by the University of Wisconsin-Madison Health Sciences Institutional Review Board and all participants provided informed consent prior to completing study activities.

Emotional Strategies Task and Procedures

The emotional strategies task is a modified emotion regulation paradigm and details regarding the task and its development can be found elsewhere but are summarized here (Wooten et al., 2022). Prior to receiving task instructions, participants provided demographic information including income, age, gender, level of income, and biological sex. Participants completed a practice block, where they were instructed to follow self-guided directions explaining how to comply with each regulation instruction and were guided through a practice image for each strategy. Participants were allowed to complete the practice block up to two times before beginning the task.

The task itself requires participants to view blocks of mixed positively- and negatively-valenced images while engaging in one of three emotional regulation strategies. In this modified paradigm, participants were asked to engage in self-compassion, reappraisal, or a non-instructed condition where they reacted in a way that felt most natural (*Figure 3.B1*). The instructions for the reappraisal and non-instructed trials were

left unchanged from Wooten et al. (2022). The reappraisal instructions were adapted from Goldin et al., (2019), and the non-instruction instructions were adapted from Ellard et al. (2017). The reappraisal instructions asked participants to reframe their interpretation of the image content to make it more neutral emotionally. The non-instructed condition asked participants to respond in whatever way felt most natural to them. The instructions for self-compassion were adapted from Diedrich et al. (2014) and focused on awareness of the present emotional experience, the need for support, and providing that support to oneself mentally or verbally. The current study used adapted instructions that were arranged in the same order and expressed similar content as those described by Diedrich et al. (2014). Overall, both the reappraisal and self-compassion instructions asked participants to make the feelings more neutral. Specific language for each block of instructions can be found in Appendix B.

Figure 3.B1

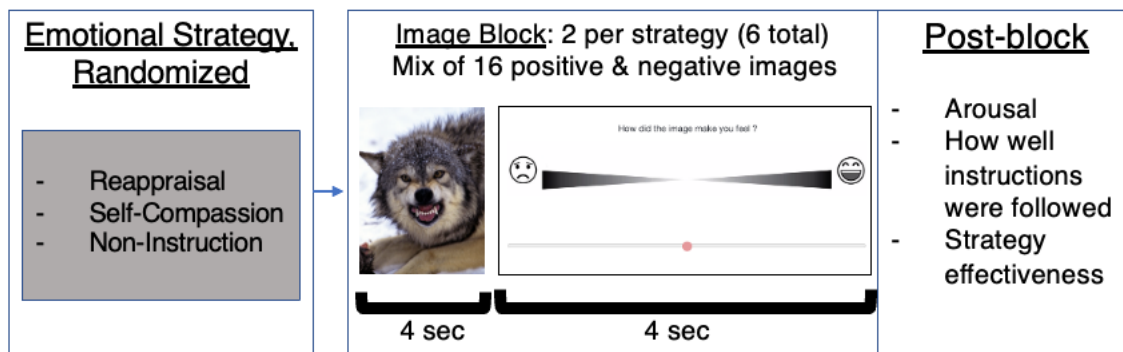


Figure 3.B1. Experimental task design.

Participants viewed 6 blocks of unique images, with 2 blocks for each regulation strategy. Block order was pseudo-randomized, and image order within a block was randomized for each participant. Following each image, participants rated their current emotional state using an affective slider (Betella & Verschure, 2016). After each block of

images, participants rated how well they felt they followed the instructions, level of arousal, and how effective they felt the strategy was for them. The affective slider was initially presented in the neutral position, and participants could move the slider according to their emotional response.

Following data collection, it was apparent that a substantial number of participants left the slider in a neutral position (approximately 40% of responses in over 40% of participants) meaning they did not move the slider or adjust their rating from neutral. This behavior is task-relevant, because if participants followed the task instructions and made their emotions more neutral, they would not have a need to respond to the item or adjust the affective slider. Due to the way that Qualtrics codes responses, these instances where participants did not adjust the slider were marked as missing data. If we did not adjust these ratings, we would experience a significant loss of statistical power and data. Given that a neutral response is task- and goal-relevant, if the slider did not move for any given trial, rather than coding the trial as missing data, the trial was given a neutral score (i.e., a score of 50 on a scale of 0-100). As described below, we performed additional data quality measures to omit cases with extreme cases of missingness prior to coding a neutral score.

Participants completed all research activities through Amazon's Mechanical Turk. Once they accessed the job request, they were redirected to Qualtrics where they accessed an online version of the task. Participants were provided with the instructions for each strategy, which they could repeat once if they desired. Participants took an average of 42 minutes to complete all study activities, and 25 minutes on average to complete the task itself. After the task was complete, participants completed the clinical and trauma questionnaires outlined below.

Data Quality Assurance Measures

After data collection, we evaluated behavioral data quality. First, participants with no response variation emotional ratings ($SD=0$) were removed from analyses ($n=3$). Next, participants with greater than 70% missing data in responses to emotional images (prior to recategorized neutral responses above) were removed ($n=10$). Finally, formal assessment of model assumptions resulted in no subjects removed for outliers. Altogether, this resulted in a final sample of 188 participants.

Clinical and Trauma Measures

Childhood Maltreatment. The *Childhood Trauma Questionnaire-short form* (CTQ; Bernstein et al., 2003) was used to assess for experiences of childhood maltreatment. The scale consists of 28 items rated on a five-point Likert scale. The scale provides subscales related to physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect. The CTQ possesses strong internal consistency (α range 0.81-0.95) and test-retest reliability is strong ($r=0.8$), and factor analysis indicates strong validity and structural invariance (Bernstein & Fink, 1998). Both the continuous and cutoff scores were used to assess for severity of maltreatment and exposure to maltreatment, respectively. We combined all the physical, emotional, and sexual abuse subscales into a larger “CTQ Abuse” score and combined the physical and emotional neglect subscales into a larger “CTQ Neglect” score. To determine exposure with high sensitivity, we used the standard thresholds for “low” and above using the cutoff scores as defined in the CTQ manual (Bernstein & Fink, 1998). Participants were assigned into the exposure group if they met threshold for any subscale within the “CTQ Abuse” and “CTQ Neglect” scales.

Missing data within the CTQ was addressed using previously described methods (Adamowicz et al., 2022). Briefly, if a subscale had less than 20% missing responses (i.e., 1 item), the missing value was mean imputed. If a participant had more than 20% missing data, the subscale was not calculated and the corresponding “CTQ Abuse” or “CTQ Neglect” score was missing, meaning the subject was omitted from abuse, neglect, or overall maltreatment analyses. Overall, 5 instances of physical abuse (2%), 4 emotional abuse (2%), 8 sexual abuse (4%), 7 physical neglect (3%) and 0 instances of emotional neglect were mean imputed. There were 9 subjects who could not have a total maltreatment score and were omitted from calculations due to missing data.

Symptom Severity. Across all symptom severity instruments, we used a total score to represent overall symptom severity, rather than use a singular cutoff score to categorize participants. Participants completed the *Beck Depression Inventory*, Second edition (Beck et al., 1996) online to report depression symptom severity and possesses strong reliability (α near 0.9) and convergent validity with other measures and factor analytic approaches (r range from 0.66 to 0.86; Wang & Gorenstein, 2013).

To assess anxiety severity, the *State-Trait Anxiety Inventory* (STAI; Spielberger et al., 1983) was administered online. The STAI assesses for state and trait levels of anxiety. While participants completed both subscales, we utilized only the trait level of anxiety, as it assesses for more consistent levels of anxiety. The STAI possesses stable reliability and validity, with a mean internal consistency of $\alpha = 0.89$ and a reliability of $d = 0.7$ (Barnes et al., 2002).

Participants reported their level of trauma symptom severity using the *PTSD Checklist for DSM-5*. The PCL-5 possesses high internal consistency ($\alpha=0.95$) and validity (range $r=0.75-0.84$; Blevins et al., 2015).

Trait Emotion Regulation. Participants reported their trait level of reappraisal using the reappraisal subscale of the *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003). The ERQ consists of 10 questions answered on a Likert scale. The ERQ contains both a suppression and reappraisal subscale, but we only utilized the reappraisal subscale because of its relevance to our hypothesis relating the task performance with trait reappraisal. The ERQ possesses strong reliability ($r=0.69$) and validity ($d=0.47$; Gross & John, 2003).

Trait Self-Compassion. Trait level of self-compassion was assessed using the *Self-Compassion Scale-Youth version* (SCS; Neff et al., 2021). The SCS-Youth version consists of additional items beyond the Short Form version, which prompted us to use it instead. Being unsure of the sample collected on Mechanical Turk, the youth version was more language inclusive. The SCS is composed of 6 subscales: self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification, and it possesses strong reliability (α over 0.82) and moderate to strong validity for most subscales (range $r=0.83-0.01$; Neff et al., 2021). Analyses included the self-kindness, common humanity, and mindfulness subscales, as these subscales capture the three core components of self-compassion.

Mindfulness Training. Finally, we asked participants to describe their overall prior experience with mindfulness or self-compassion. Participants could select from the following: informal training (e.g., teacher, mindfulness app), formal training course (e.g.,

MBSR, MBCT, CBCT, MSC), meditation retreat, daily or near-daily meditation or self-compassion practice, daily or near-daily yoga practice, or other.

Statistical Analyses

Task main effects. All statistical analyses were completed in R (version 1.4.1717; R Programming Team, 2018) using RStudio (RStudio Team, 2012). Linear mixed effect modeling (LME; v2.9.13; Bates et al., 2015) was used to examine the task's main effects of strategy and valence. We examined the interaction of regulation strategy and image valence on emotional ratings for each individual image rating. Age and sex, centered around 0, were included as covariates to adjust for age-related changes in emotions (Isaacowitz et al., 2017). If we experienced model convergence concerns, we followed suggestions by Brauer and Curtin (2018).

Maltreatment analyses. We examined the effect of childhood maltreatment on the use of strategies across valence to investigate the effect of abuse exposure on the experience of emotions in a similar manner to the previous task version (Wooten et al., 2022). We ran linear mixed effect models using the image rating as the dependent variable and the interaction of valence, strategy, and maltreatment as measured by: total maltreatment severity (CTQ total score), abuse (CTQ Abuse sum score), neglect severity (CTQ Neglect sum score), maltreatment exposure (dichotomous exposure to any maltreatment), abuse exposure (dichotomous exposure to abuse), and neglect exposure (dichotomous exposure to neglect). We treated the total maltreatment models as the primary analyses, and approached the others as exploratory so we did not use multiple comparison correction. Each model included age and sex as covariates. All dichotomous CTQ variables were centered at 0. If we experienced model convergence issues, we

followed suggestions by Brauer and Curtin (2018) to modify the within-subject effects and intercepts. If the three-way interaction was significant or trending ($p \leq 0.9$), we opted to decompose it further. Here, the data was subset by valence or exposure group and was run with the lower-level two-way interactions as appropriate, using the same covariates and convergence modifications described above.

Trait measures of emotion regulation analyses. To examine the relationship between trait levels of emotion regulation strategies and our behavioral measures of emotion regulation, we performed a series of linear mixed effect models predicting the post-image behavioral ratings of emotions from the self-reported trait levels of emotion regulation separately within each regulation strategy. We specifically used the reappraisal subscale of the ERQ as well as the self-kindness, common humanity, and mindfulness subscales of the SCS to represent the three core components of self-compassion. Sex and age were included as covariates and a random intercept by subject.

Sensitivity analyses. To examine the impact of educational level and income on these factors, we performed additional sensitivity analyses on the maltreatment models. We reran the maltreatment severity and exposure models, adding income as a covariate, and repeated this process for level of education. Additional information about these models and the results of these sensitivity analyses can be found in the Appendix B.

Results

Participants

Participants demographics can be found in *Table 3.B1*. Most participants were between the ages of 18 and 59, with a roughly even distribution of males to females. The non-maltreated group had a higher average age than the maltreated group. The sample was

predominantly white and non-Hispanic. While we collected data on income, the validity of this data is suspect. Self-reported income ranged from \$3 to \$8,000,000. We report income in *Table 3.B1* for a basic descriptive view of the sample, but this value should be interpreted cautiously. In this sample, most subjects had incomes between \$30,000 and \$100,000. Subjects also reported current level of education using various categories, also depicted in *Table 3.B1*. The majority of subjects had a bachelor's degree or greater. A large proportion of the sample met threshold for low exposure or greater for maltreatment: 85% experienced some form of maltreatment, 76% experienced abuse, and 82% experienced neglect.

Task main effects

Task main effects are depicted in *Figure 3.B2* and summarized here. While the interaction between valence and regulation strategy was not significant ($F(2,183.1)=0.46$, $p=0.63$, $r^2=0.22$), we detected significant main effects of image valence ($F(1,184.9)=296.98$, $p<0.001$) and age ($F(1,17305.3)=6.805$, $p<0.001$), and a trending main effect of regulation strategy ($F(2,17302.3)=2.4$, $p=0.09$). As expected, positive images were rated more positively than negative images across the full cohort, while average rating intensity decreased with age. Finally, we saw a trending effect of self-compassion associated with the most extreme ratings, reappraisal with the least extreme ratings, and non-instruction trials received intermediate ratings.

Table 3.B1
Participant Demographics and Clinical Characteristics

	Maltreated (N=160)	Non-Maltreated (N=19)		Maltreated (N=160)	Non-Maltreated (N=19)
Sex			Income		
Male	81	13	Below 20,000	5	5
Female	78	6	20,000-29,999	7	2
Prefer not say	1	0	30,000-49,999	41	6
Age Range			50,000-74,999	54	19
18-29	54	1	75,000-99,999	17	5
30-39	44	0	100,000+	16	6
40-49	43	14	Prefer not say	3	0
50-59	13	2	Education		
60+	6	2	No high school diploma	1	0
Race			High school graduate	5	1
White	142	17	Some college, no degree	7	0
Black	5	2	Associate's degree	3	1
American Indian or Alaskan Native	2	0	Bachelor's degree	124	15
Latinx	3	0	Some graduate school	3	1
Asian or Pacific Islander	5	0	Graduate degree	16	1
Mixed Race	1	0	Prefer not say	1	0
Prefer not say	2	0	CTQ		
Ethnicity			Total Abuse	29.24 (15-45)	15.63 (15-18)
Hispanic	35	7	Total Neglect	23.13 (11-38)	10.79 (10-14)
Not Hispanic	117	12			
Prefer not say	8	0			

Note. Participants were categorized as maltreated-exposed if they scored above "minimal" on any one of the three abuse subscales in the Childhood Trauma Questionnaire (CTQ; physical abuse ≥ 8 , sexual abuse ≥ 6 , emotional abuse ≥ 9). 9 participants were unable to have maltreatment total score/exposure determined due to missing values.

Because of relevance for our hypotheses comparing reappraisal and self-compassion, we decomposed the trending two-way interaction further, which indicated significant differences between reappraisal and self-compassion ($F(1,14117.1)=5.716$, $p<0.001$), but non-significant differences between non-instruction trials and self-compassion ($F(1,14123.4)=1.72$, $p=0.19$) and reappraisal and non-instruction trials ($F(1,17305.2)=0.526$, $p=0.47$). These differences indicated self-compassion was associated with the less extreme ratings than reappraisal and non-instructed for negative trials, and

had more extreme ratings than reappraisal but similar ratings to non-instructed for positive image trials.

Figure 3.B2

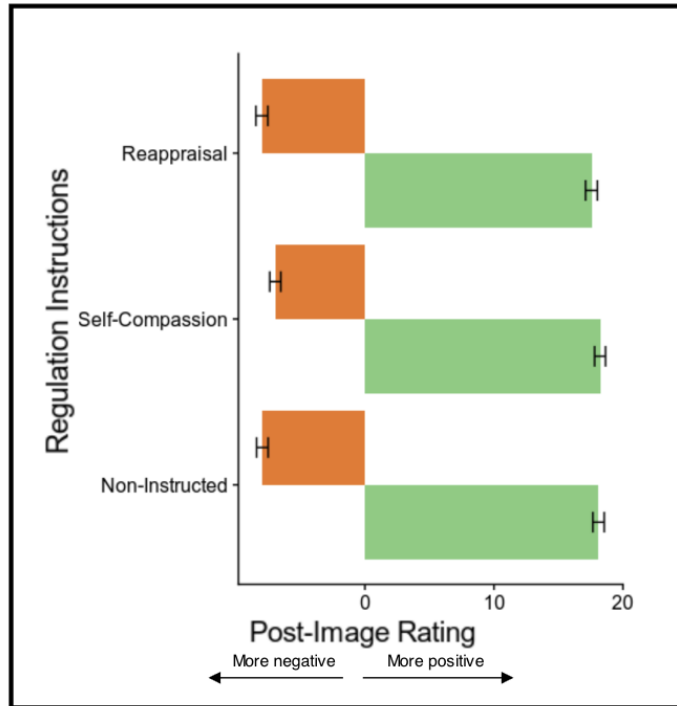


Figure 3.B2. The emotion strategies task successfully induced positive and negative affect across regulation instruction, as measured by post-image emotional ratings. Brackets indicate confidence interval.

Maltreatment Analyses

We describe the total maltreatment findings here while the abuse and neglect findings can be found in Appendix B. The three-way interaction of valence, regulation strategy, and maltreatment *exposure* was not significant ($F(2,213.5)=1.43, p=0.24$; see *Figure 3B.3, panel A*). When examining lower-level effects, there was a significant main effect of regulation instruction ($F(2,16469.2)=3.05, p=0.047$) and valence ($F(1,292.1)=148.12, p<0.001$).

To test our hypothesis regarding differences in positive emotions identified in task main effects across maltreatment exposure, we performed an additional decomposition

analysis examining the interaction of regulation instruction and maltreatment exposure separately in positive and negative trials. Results indicated all non-significant effects, including a non-significant interaction in positive image trials ($F(2,211.71)=1.33, p=0.27$) and a trending interaction in negative image trials ($F(1,189.81)=2.37, p=0.096$). The main effects of maltreatment exposure were also non-significant in positive ($F(1,455.02)=0.12, p=0.72$) and negative trials ($F(1,317.8)=0.014, p=0.91$).

Figure 3.B3

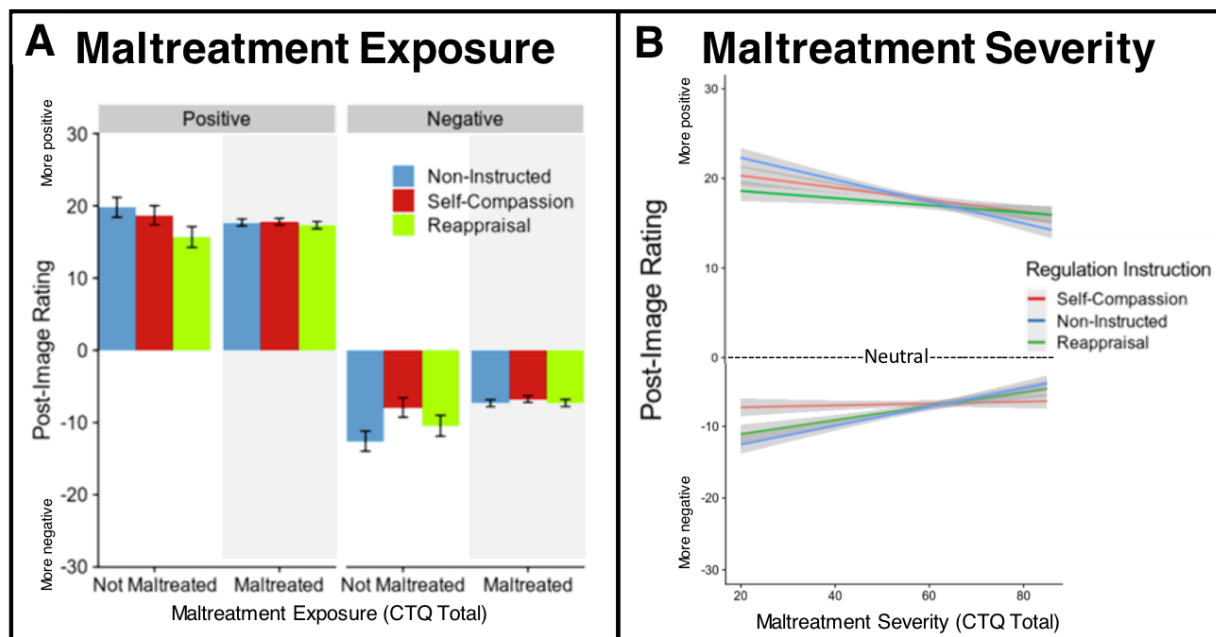


Figure 3.B3. Childhood total maltreatment exposure (Panel A) and severity (Panel B) by emotional strategy and valence on post-image ratings. The dotted line represents a neutral score of zero on post-image ratings and brackets indicate confidence interval.

Next, we detected a significant valence, regulation strategy, and maltreatment severity interaction ($F(2,16818.2)=4.24, p=0.014$; Figure 3.B3, panel B). Decomposing this three-way interaction revealed a significant difference between non-instructed trials and self-compassion ($F(2,16818.4)=8.21, p=0.004$), but not between reappraisal and self-compassion ($F(2,16818.2)=0.81, p=0.37$). These differences appear to be driven primarily

by negative trials, where self-compassion appeared to be more stable across maltreatment severity compared to both reappraisal and non-instructed trials.

Specifically, the interaction was driven by differences between higher and lower levels of maltreatment severity in positive and negative images. Within negative image trials at low levels of maltreatment severity, self-compassion trials had the least extreme emotional rating, non-instructed trials had the most extreme, and reappraisal had intermediate ratings. In contrast, at high maltreatment severity, self-compassion instead resulted in the most extreme ratings and non-instructed had the least extreme ratings.

Within positive image trials, at lower levels of maltreatment severity, non-instructed trials had the most extreme ratings, reappraisal had the least extreme, and self-compassion ratings were intermediate. At high levels of maltreatment, reappraisal resulted in the most extreme ratings and non-instructed trials had the least extreme positive ratings.

Trait measures of emotion regulation analyses

Linear mixed effects modeled detected no significant relationships between trait reappraisal and image ratings ($F(174.59)=0.11, p=0.74$). Interestingly, we did detect significant relationships between trait self-compassion and image ratings for all three components of self-compassion: self-kindness ($F(1,187.62)=7.23, p>0.01$), common humanity ($F(1,203.59)=7.44, p<0.01$), and mindfulness ($F(1,203.74)=17.91, p<0.001$). Within each component, there was a positive relationship between the self-compassion component and image rating.

Discussion

In this study, we examined the use of self-compassion as an emotion regulation strategy as compared to reappraisal and a non-instruction regulation within a sample of adults with and without childhood maltreatment. In partial support of our hypotheses, this novel investigation provides initial evidence that self-compassion may be a similarly effective emotion regulation strategy as reappraisal – regardless of maltreatment history. Notably, when examined in the context of maltreatment severity, self-compassion appeared to outperform reappraisal at lower levels of maltreatment and was the most robust strategy across maltreatment severity when applied to negative emotions. These findings represent advances in the characterization of self-compassion in regulating a broad array of emotions and lays the foundation for efficacy trials of self-compassion in trauma-based disorders.

We also observed notable non-significant interaction effects; the first of which is the two-way interaction of valence and instruction for our task main effects analyses. The task effectively induced valence effects when not including maltreatment as a factor, indicating that it performed as expected, though the trending main effect of regulation instruction reflects greater similarities between self-compassion and reappraisal than dissimilarities. These null findings possibly reflect shared mechanisms across both strategies, such as cognitive change and distancing, which can drive comparable change in emotions.

Similarly, we observed a non-significant interaction of maltreatment *exposure* with valence and regulation strategy, however during sensitivity analyses these interactive effects became trending. These weak findings could be interpreted as either weak true differences, or they reflect study-specific influences that contributed to a weak and non-

significant interaction. In the first explanation, these findings could be the result of the imbalance between study groups. With approximately 8.5 times as many maltreated individuals as non-maltreated, we are likely underpowered to detect a true difference between these groups if it exists, and the sample may be biased. In addition, by using a “low/minimal” threshold as the cutoff for determining exposure may influence these findings. By emphasizing sensitivity to exposure, we limited the specificity of these findings, which would result in weak or null findings. Alternatively, as we will describe later, the current sample from Mechanical Turk possibly reflects a resilient population that experiences less impact from their maltreatment than other populations. The statistical and sampling limitations are likely, as our SES-related sensitivity analyses made these effects trending. Further research is needed to confirm possible effects regarding maltreatment exposure and explore these proposed explanations further.

Together, our findings report initial evidence that self-compassion may function as efficiently as, if not surpass, reappraisal in the management of emotions, and facilitates one’s ability to experience positive affect. These findings in our task main effects replicate those by Ehret et al. (2018), where self-compassion was found to be more effective than reappraisal in managing depressed moods. While we detected patterns of more extreme emotional experiences associated with self-compassion, this may also represent self-compassion inducing a greater facilitation of the emotional experience. While speculative, it may be that this facilitation of emotions is mechanistically related to self-compassion fostering a state of curiosity toward one’s internal states. Curiosity involves both stretching experiences and knowledge and embracing new and unpredictable aspects of daily life (Bluth et al., 2018). When we consider curiosity within the perspective of emotions,

embracing new aspects of life may facilitate willingness to explore and accept the experience of one's emotions in a non-judgmental way. Previous findings have found that self-compassion, as a contemplative practice, is positively correlated with curiosity (Bluth et al., 2018; Neff et al., 2007), and negatively correlated with negative affect. Our results provide consistency in the link between self-compassion and the facilitation of non-judgmental experiences of strong emotions, and future work may delineate how this may relate to curiosity.

More specifically, our findings suggest that self-compassion may be more effective in regulating negative emotions while simultaneously allowing for, or enhancing, the experience of positive emotions. This novel mechanistic target of self-compassion, as compared to reappraisal, may have distinct clinical relevance. The enhancement of positive emotions following self-compassion regulation may have resilience-promoting benefits as positive affect has been proposed to help build resilience and “undo” the impacts of negative affect on the body (Fredrickson, 1998). If interventions aimed to treat maltreatment or trauma integrate self-compassion skills, specifically toward managing emotions, these unique mechanistic targets of self-compassion could enhance these interventions and improve their effectiveness. Such interventions could alleviate distress from negative emotions, while enhancing positive emotions to build resilience and repair effects of negative emotions associated with the trauma or maltreatment.

Next, we explored whether the use of reappraisal and/or self-compassion regulation strategies are impacted by experiences of childhood maltreatment. While our categorical maltreatment exposure results were null, as described previously, our severity analyses resulted in three important patterns. First, the differential effectiveness of self-compassion

and reappraisal was most pronounced in adults with low levels of childhood maltreatment. Here, self-compassion was associated with the highest reductions of negative emotional experiences and more extreme positive emotional experiences as compared to reappraisal. Second, of the three regulation strategies examined, self-compassion was the most effective in consistently regulating negative affect across all levels of childhood maltreatment severity. Third and finally, we see a trending effect of those with a maltreatment history experiencing more extreme positive emotions than non-maltreated individuals.

This stability of efficacy in self-compassion across all levels of maltreatment mirrors our previous findings of acceptance as an emotion regulation strategy (Wooten et al. (2022). Together, these findings intuitively replicate the shared relationship between self-compassion and acceptance where acceptance is a core feature of the mindfulness component of self-compassion (Neff, 2003). In fact, some findings have provided initial support that acceptance functions as a mediator, or underlying mechanism, for self-compassion and the use of self-compassion improves acceptance (Zhang et al., 2020; Zhang & Chen, 2016). However, further research is needed to fully disentangle the relationship between the two regulation strategies and contemplative practices. Most acknowledge the interplay between the two strategies, though little research has explored it directly.

When approaching self-compassion and acceptance as a contemplative practice some findings suggest the two practices have similar impact on shame and guilt, though the two may use different mechanisms (Crisan et al., 2023). However, ours and the previous study take a novel approach toward these practices from an emotion-regulation stance in response to more generalized emotions. While further research is needed to explore the relationship between these two strategies, they both appear to have similar effects in a

maltreatment context. These findings may indicate a possible shared mechanism or relationship between the two strategies, though what drives these patterns in a maltreatment context is yet to be identified.

Finally, while we detected increased intensity of positive emotions in those with maltreatment histories, this pattern is opposite what most would expect. Maltreatment is often associated with reduced experiences of positive emotions (Xiang et al., 2021) and difficulty managing positive emotions (Weiss et al., 2018). It may be that an Amazon Mechanical Turk sample is inherently more resilient than those used in the past. The platform requires workers to be self-directed and intrinsically motivated, choosing which jobs on the platform to pursue on their own, which may reflect a sampling-specific effect. While others have noted some concerns about Mechanical Turk samples (Goodman et al., 2013), the specific sampling-related effect we propose would need to be confirmed in research. Alternatively, it may be that adults with maltreatment histories experience some form of automaticity in regulating negative emotions that does not occur for positive emotions. For example, there is evidence that those with maltreatment histories suppress facial mimicry for only negative stimuli, which is an indicator of emotional expression and regulation (Ardizzi et al., 2016), meaning there is some implicit effort to suppress negative emotions prior to experiencing the emotion. Finally, it may be that the positive images used simply invoke a stronger reaction than the negative images. This seems unlikely, however, as this effect would not be specific to those with maltreatment histories. Regardless of the mechanism underlying this effect, our work suggests a unique relationship between positive emotions, maltreatment, and self-compassion that warrants further basic and translational research.

Upon identification of differential regulation effectiveness and relationships with maltreatment, we finished by examining whether these patterns in behavioral ratings may be related to trait measures of emotion regulation strategies. Interestingly, in partial support of our hypotheses, we only found significant associations with trait self-compassion. These findings first provide support that the self-compassion instructions were effective in providing guidance for implementing the practice behaviorally. They also provide evidence of task validity in that our task effectively captures self-compassion in ways that align with current definitions in the field, and that these can be applied even when specifically using it for managing emotions. The null findings related to reappraisal could be due to differences between the specific form of reappraisal that the ERQ measures or the task instructions themselves. For instance, following concepts from the process model by Gross (1998), the task may probe more of the respondent-related form of reappraisal, as the task asked participants to change their reaction to the image, while the ERQ measures antecedent-related forms of reappraisal. Alternatively, it has been theorized that reappraisal can take a more distancing form, where the motivation is to reduce the emotions, or a more reinterpretation form, that is more engagement-driven (Powers & LaBar, 2019). If our task and the ERQ probe use different forms of reappraisal, this may be the reason we did not detect any significant relationship between trait reappraisal and their emotional experience during reappraisal trials.

There are several limitations to the current study. First, our Amazon Mechanical Turk recruitment resulted in a predominantly white and non-Hispanic cohort with high rates of maltreatment, which together reduces broad generalizability. Further, as mentioned previously, this sample is inherently self-motivated and intrinsically driven,

which may reflect a more resilient sample as compared to the national average. While we did not collect a full clinical history, such as history with psychotherapy, the overall effectiveness of strategy implementation may be closely related to a history of therapy or reappraisal training. Those with more experience or formal skill with reappraisal are likely more efficient at using the strategy, which could influence the results, and future work would benefit from including these important environmental variables. As noted previously, there are substantial limitations to some aspects of recruitment. Our sample is heavily skewed toward those with maltreatment, despite attempting to be a more balanced and representative sample. We attempted to reduce these limitations by evaluating maltreatment both categorically and dimensionally, and through sensitivity analyses incorporating additional socioeconomic metrics. Finally, the task only probed for self-reported emotions, and does not include any implicit measures of emotion regulation, such as markers of autonomic nervous system activity, which may correct for issues related to social desirability. Altogether, future research would benefit from a larger, more diverse sample and the implementation of alternative paradigms to investigate comparative strategy effectiveness.

Taken together, these findings provide initial support for defining self-compassion not just as a contemplative practice, but as an emotion regulation strategy. Our results show that self-compassion seems to function similarly to, if not superior to, reappraisal. In adults with childhood maltreatment histories, self-compassion was associated with more intense positive emotions and less intense negative emotions, and had similar impacts on emotions as reappraisal. In addition, like acceptance (Wooten et al., 2022), self-compassion appeared to perform robustly regardless of maltreatment severity. While these results are

intriguing, further examination of these findings with respect to clinical symptoms and physiological mechanisms is needed to disentangle these relationships. Exploring how self-compassion and acceptance facilitate changes in the emotional experience, and potential underlying mechanisms, can inform where they can have the best impact and inform potential interventions. For example, if future research replicates our findings about acceptance and self-compassion being robust against maltreatment severity, then interventions could incorporate these approaches to make them more effective. If specific mechanisms underlying these strategies are identified, then those mechanisms can be utilized strategically. Moreover, it will be important to investigate the effectiveness of self-compassion as a mechanism of psychotherapy outcomes or whether specific interventions facilitate the development of self-compassion as an emotion regulation strategy. Altogether, this work has the possibility to facilitate novel treatment modalities or mechanisms of positive mental health outcomes that have yet to be explored.

CHAPTER 4. A Pilot Study Comparing the Use of Self-Compassion and Reappraisal in a Clinical Youth Sample

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Introduction

There is increasing evidence that emotion regulation is a transdiagnostic risk factor for developing mental health symptomatology (Anderson et al., 2021; Cavicchioli et al., 2023; Cludius et al., 2020; Kökönyei et al., 2023). This relationship appears to be particularly true during adolescence, though this risk persists throughout the lifespan (Klein et al., 2022). The ability to regulate one's emotions influences many areas in an adolescent's life, including responses to social and family stressors (Klosowska et al., 2020), quality of sleep (Palmer et al., 2018), academic performance (Harrington et al., 2020), and interpersonal relationships (Schwartz-Mette et al., 2021). Difficulties regulating both positive and negative emotions contributes to various disorders such as depression, anxiety, and posttraumatic stress disorder (Kraft et al., 2023; Nelis et al., 2015; Volkaert et al., 2019).

The influence of emotion regulation on symptom severity also includes the use of specific emotion regulation strategies (Aldao et al., 2010). For example, ample evidence supports that regularly using reappraisal and acceptance is a protective factor that defends against psychopathology, while chronic use of suppression and rumination are risk factors (Chervonsky & Hunt, 2019; Verzeletti et al., 2016; Volkaert et al., 2019). Meta-analyses examining the relationships between regulation strategies and symptoms in children and adolescents found significant negative relationships between acceptance and symptoms

related to anxiety, depression, and addiction (Kraft et al., 2023). In contrast, reappraisal had negative relationships with depression, but not anxiety. One explanation for these relationships with reappraisal involves the context of the use for the various strategies. Depending on when a regulation strategy is used during the emotion generation process, and what other strategies are available, it will become more or less relevant. Following James Gross's Process Model (Gross, 1998), regulation strategies use specific mechanisms to evoke change in a generated emotion either prior to, or in response to a generated emotion. If a strategy is applied at a point of time in the emotion generation process that best aligns with when it can influence the emotion, one receives the largest benefit from its use. Some strategies can be used along multiple points of the generation process, but are often most effective in one point in this process. This alignment plays a significant role in the motivation to use a strategy, how effectively a strategy can be used, and the priority with which one uses a strategy. Emotional intensity, physiology, attentional processes, and other contextual factors also shift a strategy's priority (Aldao et al., 2010). For example, attempting to use reappraisal prior to experiencing an emotion will be less effective than after it has been generated. Understanding the antecedent of the strategy and how it stimulates an emotion confers the greatest benefit for cognitive change. In the context of anxiety, there is greater physiological arousal and lower attentional resources which results in lower motivation and effectiveness when using cognitively demanding strategies such as reappraisal (Wolgast et al., 2011). Depression involves longer-lasting emotions, so response-focused strategies such as reappraisal are more beneficial for managing the enduring negative thoughts and corresponding emotions, increasing its priority in that context (Gross, 1998).

A novel, yet promising, approach to help manage emotional reactions and facilitate healing in clinical populations is self-compassion (Wilson et al., 2019). Defined by Kristen Neff as a contemplative practice consisting of self-kindness, a sense of common humanity, and mindfulness (Neff, 2003), there is ample evidence that self-compassion alleviates or reduces the severity of mental health symptoms (McBride et al., 2022; Prentice et al., 2021; Tao et al., 2021). Self-compassion moderates other emotion regulation strategies; for example it makes reappraisal more effective at reducing depressed mood (Diedrich et al., 2014; 2017). However, self-compassion also influences emotions more directly as an emotion regulation strategy (Odou & Brinker, 2015). In the context of mental illness, self-compassion is more effective than acceptance, and is equal to or superior to reappraisal at alleviating depressed mood (Ehret et al., 2018). These differences in strategy effectiveness can be attributed to self-compassion containing both the acceptance-based features of mindfulness, and cognitive change found in reappraisal when reframing contexts for self-kindness and common humanity (Neff, 2003). Together, these make self-compassion a “hybrid” regulation strategy that uses the active aspects of reappraisal and acceptance, which give it the potential to be more effective than either strategy alone. However, further research is needed to fully explore how self-compassion as an emotion regulation strategy relates to symptom severity or changes in symptoms – especially during adolescence.

Previous findings indicate that while self-compassion is negatively associated with psychopathology, its effectiveness in improving symptoms differs by diagnosis. For example, self-compassion appears to impact anxious symptoms more than depression (McBride et al., 2022; Preuss et al., 2021). One explanation for these differences posits that being in a depressed state diminishes the capacity to engage in self-compassion, as

depression is believed to make it more difficult to adopt a self-compassionate mindset (Trompetter et al., 2017). Thus, depression also makes it more challenging to receive benefits from self-compassion to manage one's emotions. However, there are few examining these effects specifically in adolescents, let alone comparing these effects across regulation strategies, so it's unclear if these patterns are unique to adults.

Utilizing alternative methods to measure emotion regulation, such as implicit measures like skin conductance reactivity (SCR) or heart rate variability (HRV) can reveal more about the experience of emotions. These implicit measures are notably useful in youth populations who experience greater levels of demand characteristics or have poor insight into their own emotions (Compas et al., 2017a). SCR can be used as an implicit measure of autonomic emotional reactivity, with greater SCRs reflecting more intense emotional reactions or states that are free of many social demand characteristics found in self-report measures. These make SCR and self-reported emotional states distinct, yet related, measures (Grasser et al., 2022). HRV, on the other hand, is an implicit measure of regulatory effort. HRV can be measured using tonic HRV – long-term resting HRV – to measure more trait-like effort to regulate, or in the moment phasic changes. In phasic measures of HRV, greater HRV indicates greater effort to regulate while decreases in HRV reflect lower regulatory effort (Balzarotti et al., 2017; Denson et al., 2011). These implicit measures of emotion regulation provide important insights often missed by self-report data – providing insight into processes that cannot be accessed explicitly. Using these approaches together provide a comprehensive understanding of these processes to fill knowledge gaps about these processes in youth and have rarely been explored for natural change over a short period of time or differentially in positive and negative emotions.

This pilot study attempts to fill these knowledge gaps by having clinically presenting youth complete an emotion regulation paradigm, and examining if changes in the ability to use the targeted regulation strategies are associated with changes in depressive or anxiety symptoms. This task is a modified version of the regulation task used in Chapter 3, Study A (Wooten et al., 2022) that compared acceptance, reappraisal, and a non-instructed condition. However, in the current work we have modified that task to compare reappraisal, self-compassion, and a non-instructed regulation condition, similar to that performed in Chapter 3, Study B (Wooten et al., under review). In the task, youth view positive and negative emotionally evocative images while engaging in reappraisal, self-compassion, and a non-instructed condition. The task measures self-reported subjective emotions while using each strategy in response to emotionally evocative images (rating emotions on a -5 to +5 scale), and implicit autonomic measures of regulation and emotional reactivity using HRV and SCR, respectively. Each metric of emotion regulation will be compared separately based on the unique information they provide to define the emotional experience. Youth will complete the task at two separate times to measure changes in symptoms and in their ability to use these strategies in the task over a 6- to 8-week span of time.

Our first aim will examine if there are differences across how youth use self-compassion and reappraisal. Chapter 3, Study A, when we compared acceptance and reappraisal, we observed that reappraisal was the most effective strategy at minimizing emotions, the non-instructed condition had the most extreme ratings, and acceptance had intermediate ratings. These patterns were present in both positive and negative emotions. In Study B of Chapter 3, which compared reappraisal and self-compassion, our results

showed non-significant interaction between valence and regulation instruction. However, when we decomposed the interactions, we found self-compassion had less extreme ratings than reappraisal or the non-instructed trials for negative emotions. In positive image trials, self-compassion and the non-instructed trials had greater ratings than reappraisal. Taking these past iterations of the task in consideration, we predict that youth will exhibit similar patterns to those found in adults – that self-compassion will be more effective than reappraisal for negative emotions, but the two will have a similar effect on positive emotions. We anticipate that the non-instructed trials will be statistically similar to self-compassion across positive and negative trials, resembling the adult findings.

Our second aim is to examine if changes in the effectiveness of these strategies over the time (assessed by differences over time in the self-reported emotions, SCR, and HRV during the behavioral) are associated with changes in depression and anxiety symptoms. We hypothesize that greater improvement in the ability to use reappraisal and self-compassion – as evidenced by greater reductions in negative emotions across study visits – will be associated with greater symptom reductions. We anticipate that the use of self-compassion will be associated with greater reductions in negative emotions compared to reappraisal, and that a reduction in negative emotions will be associated with a reduction in symptoms. Based on previous findings from Chapter 3, Study B (Appendix B) and others (McBride et al., 2022; Preuss et al., 2021), we expect that these will be present in anxiety, but not for depression.

Methods

Participant Recruitment and Screening

A total of 16 adolescents were recruited into the study. Youth were recruited using a variety of methods including posting flyers at local mental health clinics, therapist referral, and mass emails. Youth and a parent or guardian completed an online web screening to determine eligibility. Youth were included if they were between 13 and 18 years of age, were able to provide assent or consent in English, were currently engaged in treatment with a mental health provider (such as a therapist, psychologist, psychiatrist, or social worker), reported a history of depression or anxiety, or reported a history of challenging interpersonal relationships, suicidal ideation, or intense difficult emotions. During eligibility screening, symptom severity was determined using the *Patient Health Questionnaire-9* (PHQ-9; Kroenke et al., 2001) and the *Generalized Anxiety Disorder-7* (GAD-7; Spitzer et al., 2006). Difficulties with emotions were assessed using the *Difficulties with Emotion Regulation Scale* (DERS; Gratz & Roemer, 2004), and suicidal risk was assessed with the *Brief Reasons for Living Inventory for Adolescents* (BRFL-A; Osman et al., 1996). The PHQ-9 is a well-validated 9-item screener for depression severity. It possesses strong reliability ($\alpha = 0.892$) and validity ($r = 0.61$), and has demonstrated strong psychometric in adolescent populations (Allgaier et al., 2012; Sun et al., 2020). The GAD-7 screens for anxiety, and has demonstrated strong convergent validity (r range 0.6-0.7) and reliability ($\alpha = 0.91$; White & Karr, 2023), with evidence of psychometrics in adolescent populations (Mossman et al., 2017). The DERS is a self-report measure designed to assess for issues related to emotion regulation along several sub-scales. The scale has excellent reliability ($\alpha = 0.93$) and construct validity (r range of 0.4-0.62; Gratz & Roemer, 2004), with similar psychometrics in adolescent samples (Neumann et al., 2011). Finally, the BRFL-A is an adolescent-specific measure of suicide risk. Youth rank items on a 6-point scale indicating

reasons to not commit suicide. Scores can be divided into 6 subscales, with total average scores below 1.5 indicating severe risk. The BRFL-A has adequate internal consistency ($r=0.45$) and convergent validity (r ranges 0.6-0.53; Osman et al., 1996).

Youth were enrolled if they reported at least mild symptom presentation for either depression or anxiety. The DERS and BRFL-A were used qualitatively to assess for and confirm reports of emotion dysregulation and suicide risk, respectively, and strict cut-offs were not used. If youth endorsed either some level of dysregulation or some thoughts of self-harm, they were considered for enrollment. Youth were excluded if they endorsed being pregnant, if a parent or guardian endorsed that the youth had unmanaged Attention-Deficit/Hyperactivity Disorder, psychosis, or a diagnosis of autism spectrum disorder. All study procedures were approved by the University of Wisconsin-Madison Health Sciences Institutional Review Board and all participants provided informed consent or assent prior to participation in study activities.

Emotional Strategies Task and Procedures

The emotional strategies task used in the current study is a modified version of the task used by Wooten et al. (2022). Briefly, the task requires participants to view 6 blocks of positive- and negative-valenced images while engaging in three different emotion regulation strategies in two separate blocks each. After viewing each image, youth provided a self-reported rating of their current emotional state using an affective slider that ranged from -5 to +5, with 0 as a neutral rating (Betella & Verschure, 2016). Ratings were restricted to full integers, giving youth 11 total possible ratings to report their current emotions. In the present study, participants engaged in reappraisal, self-compassion, and a non-instructed regulation in response to emotional images. The present study replaced the

acceptance instructions in the original version of the task with self-compassion regulation instructions and adapted instructions for all regulation trials to be age appropriate. The instructions for self-compassion were adapted from Diedrich et al. (2014). Blocks were presented in a pseudo-random order, and images were presented randomly within a block. The specific language for each block of instructions can be found in Appendix C. See Wooten et al. (2022) for a detailed description of the randomization process. In addition, a 5 second inter-stimulus interval was added between the end of the affective slider emotional rating and the subsequent image to extend the epoch of HRV calculation to 10 seconds, as this is considered reliable for measures of ultra-short HRV (Nussinovitch et al., 2011).

Participants began study activities by having temporary electrodes for skin conductance (SCR) and heart rate (HRV) measurement placed on their fingers and torso, respectively. All physiological data was collected using BioPac equipment, using the MP160 amplifier at a rate of 1000 Hz. Youth were guided by staff through a practice block, where they were provided directions about how to comply with regulation instructions and completed a series of practice images. Upon completion of the practice block, participants had a breathing belt affixed to their torso and completed the task while autonomic measures were collected. Participants completed the clinical symptom and emotion regulation questionnaires described below after completing the task.

Youth participants returned between 6 to 8 weeks later and completed a second visit that consisted of the same procedure. They completed the same practice block, but the pseudo-random pairing of image block to regulation instruction made it unlikely that the same image was paired with the same instruction across both study visits.

Clinical and Emotion Regulation Questionnaires

Youth completed all questionnaires below at both timepoints, exception for the CTQ, which was only completed at the baseline visit. Longitudinal symptoms assessments established baseline symptom measurements and symptom change over time and emotion regulation questionnaires measured changes in trait regulation across the two visits. A schematic of assessments completed during screening and during each study visit can be found in *Table 4.1*.

Table 4.1

Screening	Baseline Visit	Follow-Up Visit
PHQ-9	PROMIS-Depression*	PROMIS-Depression*
GAD-7	PROMIS-Anxiety*	PROMIS-Anxiety*
DERS	ERQ	ERQ
BRLI-A	SCS	SCS
	CPSS-V	CPSS-V
	CTQ	

Table 4.1. Schematic of which instruments were administered at which study timepoints. Follow-Up Visit was scheduled 6-8 weeks after Baseline Visit.

* Indicates scales used to determine baseline or change in symptoms over time used in analyses.
PHQ-9= Patient Health Questionnaire; GAD-7= Generalized Anxiety Questionnaire-7; DERS= Difficulties in Emotion Regulation Scale; BRLI-A= Brief Reasons for Living Inventory for Adolescents; ERQ= Emotion Regulation Questionnaire; SCS= Self-Compassion Scale – Youth Report; CPSS-V= Child PTSD Symptoms Scale for DSM-V; CTQ= Childhood Trauma Questionnaire.

Emotion Regulation Measures. To measure trait levels of reappraisal and suppression, youth completed the *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003). The ERQ possesses strong reliability ($r=0.69$) and validity ($d=0.47$; Gross & John, 2003).

Participants reported trait levels of self-compassion using the *Self-Compassion Scale-Youth version* (SCS; Neff et al., 2021). The SCS contains 6 subscales, including self-kindness, self-judgment, common humanity, mindfulness, over-identification, and isolation. The SCS

is reported to have strong reliability (α over 0.82) and moderate or greater validity for most subscales (range $r=0.83-0.01$; Neff et al., 2021).

Symptom Severity Measures. All symptom severity scores were assessed using a total score, rather than discrete cutoff scores, to better reflect continuous severity than discretely categorize participants. Youth participants completed the PROMIS-Anxiety to report anxiety severity, and the PROMIS-Depression to report depression severity (Irwin et al., 2010). The PROMIS-Anxiety has strong convergent validity with the GAD-7 ($r=0.75$) and test-retest reliability ($r = 0.69$; Guzick et al., 2024), and the PROMIS-Depression is reported to have strong convergent validity (r range 0.79-0.83) and internal consistency (α range 0.96-0.97; Kaat et al., 2019). Both assessments track symptoms over the past 2 weeks.

Physiological Data Processing

Heart Rate Variability. All physiological data was processed using AcqKnowledge (v5.0.5). After data collection, HRV data had a 1Hz high bandpass and a 35Hz low bandpass filter to clean electronic noise. Data were visually inspected for artifacts and corrected as needed. HRV was calculated for 14-second epochs. These epochs included the emotional image stimulus presentation (5 seconds), affective slider emotional rating (4 seconds) and inter-stimulus interval (5 seconds). Analyses included the root mean square of successive NN intervals (rMSSD) metric for heart rate variability, as it is believed to be the most reliable metric for ultra-short HRV metrics near for data approximately 10 seconds in length (BIOPAC Systems, Inc., 2023; Shaffer et al., 2020).

Electrodermal Activity. Electrodermal activity (EDA) data was resampled from 1000Hz to 78Hz. A 10Hz low bandpass filter was applied to remove electrical noise, and

artifacts were manually corrected. An event-related analysis of SCR data detected skin conductance responses (SCRs) with a threshold of 0.1 microsiemens, following recommendations for adolescent populations by Gertler et al. (2020). With this threshold, one subject was a non-responder across all blocks the first visit, one subject missed at least 1 block across 2 timepoints (non-responding to all the non-instruction blocks during the second visit), 3 subjects non-responded to 1 block, and 2 subjects did not respond to 2 blocks of stimuli. Across all subjects, 8 non-instruction blocks, 6 self-compassion blocks, and 4 reappraisal blocks had no stimuli paired with a significant skin conductance response.

Statistical Analyses

Strategy Differences in Youth Analyses. To test the first hypothesis investigating the effect of task valence and regulation instruction on emotion, we performed a series of Linear Mixed Effect Models (LMEs). Considering the low sample size, all findings should be considered preliminary and exploratory due to limited statistical power. All analyses were completed in R (v4.3.2; R Core Team, 2023) using the LME4 package (v1.1.35.1; Bates et al., 2015). We first ran series of parallel models that predicted the different metrics of emotion (self-report emotional rating, HRV, SCR) from the interaction of valence, instruction, and timepoint. We included age and sex as covariates, and appropriate within-subject intercept and effects to explore these effects over time. As described previously, the self-reported emotional ratings are interpreted as subjective experiences of emotion, SCR measures implicit autonomic measures of emotional reactivity, and HRV measures implicit effort to regulate. This comprehensive model would detect if there were changes in the ability to use these strategies in youth across study visits, which could inform other analysis plans. If we

experienced difficulties related to model convergence, we followed guidelines described by Brauer and Curtin (2018) to modify the random effects structure to allow for proper model convergence.

We also ran a series of more focused models to examine just the interaction of valence and strategy on post-image rating, SCR, and HRV. This included aggregated emotion measures from both timepoints to maximize potential statistical power, rather than just examining one timepoint's data. We included age, sex, and time point as covariates, and within-subject intercept and effects for the interaction of valence and regulation instruction, all lower-level effects, and time point. These models were run to make comparisons with previous findings from Chapter 3 more appropriate.

Across all models, if we experienced difficulty achieving model convergence, we subset the data by task valence and ran equivalent models separately by valence. Based on past task performance (Wooten et al., 2022), this task exhibited clear valence effects – making the need to explicitly examine valence effects an effective choice to subset the data if needed. Like above the model including timepoint above, we adjusted the random effects structure as necessary if we experienced issues related to model convergence.

All models were corrected for multiple comparisons across multiple models using false discovery rate (FDR). Models were corrected across dependent variables. For example, all models including self-reported emotional ratings as the dependent variable were included within the same family of comparisons, and the same occurred with SCR and HRV metrics, and symptom outcome measures.

Symptoms Change Related to Strategy Use Over Time Analyses. A series of LMEs tested the hypotheses relating anxiety and depression symptoms with strategy use over

time. In these models, symptoms as reported at the follow-up timepoint were predicted from the interaction of measured emotion, regulation instruction, and timepoint.

Covariates included age, sex, and baseline symptoms, along with the appropriate random effects structure. Measured emotion was defined as self-reported subjective emotional ratings, SCR measures, and HRV measures. Due to sample size and anticipated limitations to power, we began with models run separately across valence to capture the differences across valences, since running a more complicated four-way model was unlikely to be successful. The same random effects structure modifications were made as described above. If severe issues with model convergence occurred, separate models in different trials (e.g. only in reappraisal or self-compassion trials) were completed to test the emotion by time interaction. If a model is significant, we will perform sensitivity analyses including the other symptom as a covariate to compensate for the high levels of comorbidity between depression and anxiety. All models were FDR corrected across dependent variables.

Results

Participants

Participant demographics and clinical characteristics can be found in *Table 4.2*. The sample ($N = 16$) was predominantly white and non-Hispanic. Most subjects were between 14 and 15 years of age at the baseline visit. There were slightly more females than males enrolled. Across the two visits, more than half of the subjects experienced decreases in depression, anxiety, and post-traumatic symptom severity. There was little difference in trait emotion regulation measures across the two timepoints.

Table 4.2
Participant Demographics and Clinical Characteristics

Sex		ERQ-Reappraisal	
Male	6	Baseline	23.12 (4.88)
Female	10	Follow-Up	23.57 (5.22)
Ages		ERQ-Suppression	
14 Years	8	Baseline	15.38 (4.59)
15 Years	6	Follow-Up	14.62 (5.04)
16 Years	0	SCS Total Score	
17 Years	2	Baseline	6.71 (1.77)
Ethnicity		Follow-Up	6.78 (1.73)
Hispanic	0	PROMIS-Anxiety	
Not Hispanic	16	Baseline	40.56 (11.52)
Race		Follow-Up	38.81 (9.45)
Asian American	1	PROMIS-Depression	
Black	1	Baseline	47.00 (11.31)
White	11	Follow-Up	45.81 (13.10)
Mixed Race	3	CPSS-V Total Score	
Income		Baseline	37.56 (15.91)
\$25,000-\$49,000	1	Follow-Up	33.5 (18.09)
\$50,000-\$99,999	2	CTQ Total Abuse	22.12 (8.13)
\$100,00-\$199,999	6	CTQ Total Neglect	29.69 (3.36)
\$200,000 or higher	6		
Prefer not say	1		

Table 4.2. Participant demographics and clinical characteristics. Sex represents sex assigned at birth, not identified gender.

ERQ = Emotion Regulation Questionnaire; SCS = Self-Compassion Scale – Youth Report; CPSS-V = Child PTSD Symptoms Scale for DSM-V; CTQ = Childhood Trauma Questionnaire.

Statistical Analyses

Strategy differences in youth analyses

Self-Reported Emotions Models. The model including the three-way interaction of task image valence, self-reported emotion ratings, and visit timepoint had a non-significant three-way interaction ($F(2,3045)=0.15, p=0.86$), depicted in *Figure 4.1*. There was a significant interaction of valence and instruction ($F(2,3045)=5.617, p=0.0367$), and a main effect of valence ($F(1,3045)=253.29, p<0.001$). The interaction effects demonstrated that positive emotions were rated positively and negative images were rated negatively, as

expected. In negative trials, there were non-significant differences between strategies, though reappraisal had the least extreme ratings, compassion had intermediate ratings, and non-instructed trials had the most extreme ratings. These resemble findings from Chapter 3, Study A comparing acceptance and reappraisal in adults. In positive trials, in the baseline visit self-compassion and non-instructed trials had significantly higher ratings than reappraisal, and no differences between self-compassion and the non-instructed trials. In the follow-up visit, there were non-significant differences, though the pattern between strategies resembles those observed in negative trials. Before FDR correction, there was trending interaction of valence and study timepoint in which ratings at the follow-up visit were attenuated compared to the baseline – but this did not remain after correction.

Our models using just the more focused valence and regulation strategy data were run separately in negative and positive trials due to model convergence issues. After FDR correction we observed no significant effects in negative image trials, but a significant main effect of instruction in positive image trials ($F(2,1502)=12.98, p<0.001$) survived multiple comparison correction. Depicted in *Figure 4.2*, there were significant differences between reappraisal and both non-instructed trials ($t(1502)=-4.59, p<0.001$) and self-compassion trials ($t(1502)=4.21, p<0.001$), but not between non-instructed trials and self-compassion, $t(1502)=0.387, p=0.92$). Images viewed during reappraisal trials were associated with significantly less positive ratings than ratings during self-compassion or non-instructed trials.

Figure 4.1

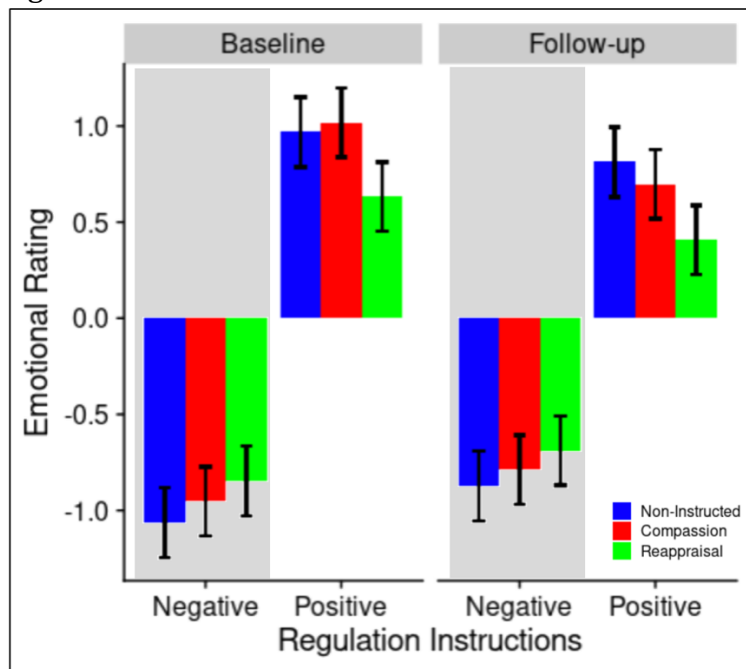


Figure 4.1. Figure depicting the effect of valence and instruction across study visits on post-image emotional rating. Brackets indicate *confidence interval*.

SCR Models. No significant effects emerged in the model including the three-way interaction with timepoint. Like the self-reported emotion models, the SCR models using just the valence and strategy data were run separately in negative and positive trials. After FDR correction, no significant effects emerged in either model.

HRV Models. In the model examining the three-way interaction of valence, regulation strategy, and timepoint, there was a significant main effect of time point in the three-way model, $F(1,3035)=14.97$, $p<0.01$. Participants experienced lower average HRV in the follow-up time point compared to the baseline visit. Consistent with the self-reported emotion ratings and SCR models using only the valence and strategy data, the HRV models were also run separately in positive and negative image trials. No significant effects remained after FDR correction, though prior to FDR correction there was a significant main

effect of instruction on HRV in which non-instructed trials had significantly higher HRV than reappraisal, and self-compassion had intermediate HRV.

Figure 4.2

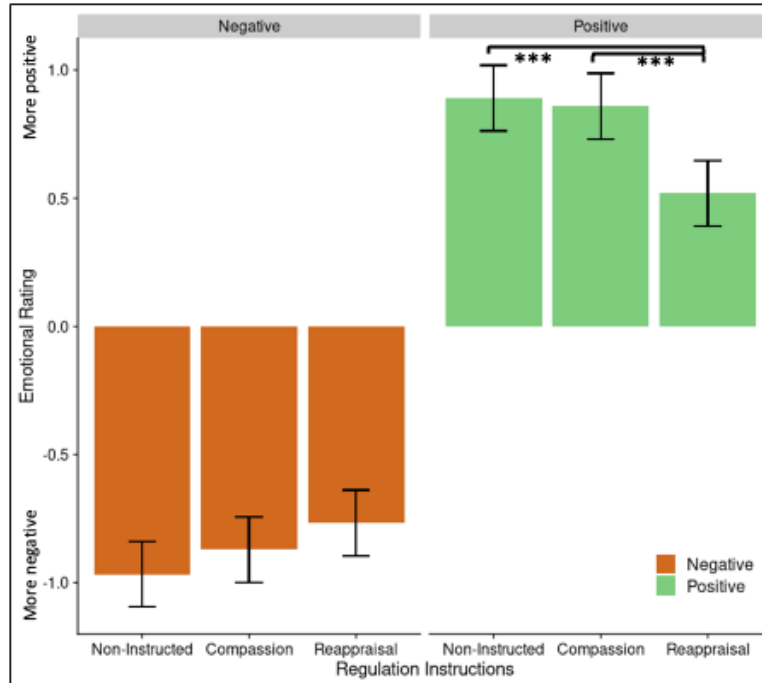


Figure 4.2. Figure depicting the effect of valence and instruction on post-image emotional rating using data aggregated from both timepoints. Orange indicates negative trials, and green indicates positive trials. Brackets indicate *confidence intervals*.

Symptoms change related to strategy use over time hypotheses. Unfortunately, we were unable to get any models examining the interaction of instruction and study visit were able to run without encountering issues related to model convergence. These limitations occurred in the three-way interaction model, and when we subset the data by positive and negative trials and ran the more focused two-way instruction by timepoint interactions. We also attempted to run a model including the change in symptom change predicted by the interaction of valence and regulation instruction, controlling for baseline symptoms, age, and sex, but this also would not run without any model convergence issues. For these reasons, we are unable to test the hypotheses predicted without a larger sample.

Discussion

In this pilot study, we explored the use of reappraisal and self-compassion in a clinical youth sample. We compared responses to positive and negative emotionally evocative images using a combination of both explicit self-reported emotions and implicit metrics of autonomic emotional reactivity to examine if there are differences in the experience of emotions when youth use self-compassion, reappraisal, and non-instructed regulation. We also examined if symptom changes are associated with changes in the impact of strategies on emotions. Due to statistical limitations, we were unable to explore symptom change relative to changes in strategy impact on emotions. Despite these limitations, we observed significant differences in strategy use between positive and negative emotions in the various regulation strategies we investigated. Because we are unsure what approach youth took during the non-instruction trials, explaining differences involving these trials is challenging. Based on the strategies we have identified, it appears youth engaged in self-compassion during these trials, though without probing youth we cannot be certain.

In our findings, youth's self-reported emotions suggest there are significant differences in the way that they use these strategies across positive and negative emotions. We detected no differences in the way that youth use these strategies when applied in response to negative images, though there were significant differences in response to positive images. Both self-compassion and the non-instructed condition resulted in more extreme positive emotions compared to reappraisal. These findings did not support for our hypotheses that self-compassion would be more effective than reappraisal at managing negative emotions, and the two would be similarly effective for positive emotions. Our

results provide partial support for our predictions about the non-instructed trials, which were associated with non-significantly higher ratings than other strategies for negative emotions, and equally high ratings as self-compassion for positive emotions. We also did not detect differences in autonomic nervous system measures (skin conductance response, heart rate variability) of emotion regulation.

These results highlight some consistencies across the effectiveness of strategies on the experience of emotion in this sample. While not always statistically significant, reappraisal appeared to exert the most influence on both positive and negative emotions, with the least extreme ratings. This was most profound in positive emotions, where self-compassion and the non-instructed condition had significantly higher ratings when youth first came into the lab – though this disappeared in follow-up visit where overall emotional reactions were attenuated due to repeated exposure to images. Interestingly, these results resemble those found in adults using acceptance (Wooten et al., 2022; Chapter 3, Study A) rather than when adults used self-compassion (Wooten et al., Under Review; Chapter 3, Study B). In Study A, acceptance use resulted in greater positive affect, but Study B found no differences between self-compassion and reappraisal.

These similarities in findings across studies also applies to the responses to negative emotions. Again, the findings observed in the present study show similarities between youth using self-compassion and adults using acceptance (Chapter 3, Study A), but not adults using self-compassion (Chapter 3, Study B). Like the acceptance findings, reappraisal was the most impactful at minimizing emotions, while self-compassion had an intermediate effectiveness compared to the non-instruction regulation condition. These findings did not

fall in line with our predictions that self-compassion would be the most effective strategy in youth.

There are a few possible explanations for the lack of consistency between how adults and youth use self-compassion. One relates to youths' cognitive growth and how it relates to the development of regulatory abilities. Often, the ability to regulate emotions depends on development in other areas such as cognition. As youth enter adolescence, their cognitive ability progresses and their regulatory ability begins to adopt more of these burgeoning mental processes (Fombouchet et al., 2023; Zimmer-Gembeck & Skinner, 2011). Early in adolescence these strategies experience a 'ceiling effect' that limits the extent to which they can be used. As development continues into adulthood, cognitive abilities provide further support for these strategies, allowing them to differentiate in their effectiveness. The present results may reflect these developmental processes, as the null findings reflect the limited growth adolescents possess in this area.

A second explanation comes from the limited sample size. The previous samples in Chapter 3 included samples of approximately 200 participants, while the present work only consisted of 16. This limited power restricts our ability to detect these changes, even if they are present. These limitations are particularly relevant for the null findings we had regarding SCR and HRV. Acquiring additional participants and expanding the sample will improve confidence in the findings and the ability to detect any of these changes. Also, as this work was intended to function as a pilot study, we did not perform a formal power analysis. Instead, we hope these results can be used to generate power analyses for future studies.

Our findings related to positive emotions are also notable. Both self-compassion and the non-instructed trials use led to significantly more intense ratings than reappraisal. While these results reflect that reappraisal is more impactful than self-compassion (and the non-instructed condition), a complementary explanation posits that self-compassion facilitates the experience of positive emotions. As a strategy that promotes the experience and engagement of emotions, self-compassion implicitly prioritizes valences in unique ways and preserves the experience of emotions – particularly if they are helpful to the individual. Positive emotions are believed to serve many protective and beneficial functions (Fredrickson, 1998, 2001), so self-compassion embraces these emotions rather than pushing them away. Alternatively, negative emotions result in poorer outcomes, which self-compassion would restrict. Reappraisal depends on the more explicit goals of the individual, meaning that it is applied equally to positive and negative emotions unless the user purposefully adjusts their use of the strategy. Our findings support both models, though this second explanation falls in greater line with the spectrum theory of emotion (Chapter 1).

These results provide important insight into how youth can utilize these strategies. If our second explanation regarding why self-compassion has higher self-reported ratings of positive holds true, providing youth additional training in self-compassion should help facilitate greater experiences of emotion that are less distressing. Since there were minimal differences between self-compassion and reappraisal for negative emotions, self-compassion appears to mitigate potentially distressing negative emotions, while preserving positive emotions to improve mental health and well-being (Fredrickson,

1998). Integrating this regulation strategy, alongside the contemplative practice, into mental health treatment could prove fruitful and would grant youth additional tools.

There are a few notable concerns to address regarding this study. While we were unable to properly test our hypothesis that symptom change will be associated with changes in strategy use, we recognize that this relationship is likely bi-directional. Evidence suggests both that symptom change can promote changes in the ability to use certain regulation strategies (e.g., Joormann & Stanton, 2016) and that regulation strategy use can influence symptoms (Aldao et al., 2010; Schäfer et al., 2017). Future research would benefit from exploring these relationships in depth to investigate the direction of these effects, such as using a cross-lagged study approach. Previous investigations using a cross-lagged study related to PTSD symptoms found significant effects of regulation on symptoms (Meuleman et al., 2024), supporting further research in this area. In addition, because youth were required to be engaged in therapy, there is a potential confound regarding training in some regulation strategies. Reappraisal as an emotion regulation strategy shares many mechanisms with cognitive reappraisal in Cognitive Behavior Therapy (CBT) and engagement in CBT increases the use of reappraisal (Jazaieri et al., 2017), so controlling for these processes is important. While we did ask youth to report the number of therapy sessions they attended during the study, we did not inquire about the nature of those sessions – meaning the approach to therapy. Thus, it becomes difficult to adequately examine the impact of therapy sessions on these metrics. Though future research should explore how specific therapeutic approaches can influence the use of specific regulation strategies.

There are several limitations to the current study. Most importantly, the small sample significantly limited our ability to explore our second hypothesis related to the impact of strategies on symptom change. The inability to explore these relationships was particularly impactful, as it limited our ability to address a core hypothesis. These effects were also prevalent in our interactive models, where we needed to apply many modifications to the optimal within-subjects effects to reach model convergence. The sample also suffers from a lack of diversity regarding race, ethnicity, SES, and more, weakening the generalizability of these findings. Across all models, these above limitations weaken our confidence in these findings. Future research should explore these processes in much larger and representative samples to address these limitations.

We also discovered a limitation in our self-reported measures of emotion. The affective slider that youth used to report their emotions fell on an 11-point scale ranging from -5 to +5 (including 0). While easy for youth to interpret, this scale restricted the variance in these a outcome variable – which further impacted our statistical power. Future studies would benefit from using a scale with a larger number of points to increase the variance in responses. Doing so would decrease the need to adjust the within-subject effects structure. Finally, we experienced some limitations with the metrics used for SCR. By using only *significant* skin conductance reactions, we experienced a significant amount of missing data if a subject did not respond to an image. Exploring alternative SCR-related metrics, such as overall skin conductance level, could reduce missingness which would improve statistical power.

There are several future directions for this work. As alluded to several times, exploring these effects in a larger and more representative sample would improve

statistical power and help detect differences. Increasing the range of the affective slider for post-image emotional ratings would improve variability in the outcome variables, and provide a richer dataset. In addition, adjusting the task stimuli to include more evocative images, and alternate stimuli across timepoints would be beneficial. Increasing the arousal of images included in the task – or alternative the types of stimuli – may help evoke a strong autonomic response, which may help improve these metrics of emotion regulation in youth. The weaker arousing ratings of images limits our ability to detect changes in autonomic reactivity, so exploring alternatives may prove fruitful. Recruiting participants with greater variety in clinical symptomatology across depression, anxiety, and expanding to other disorders such as PTSD would be informative. Previous work with this task found interesting effects of maltreatment on positive emotion, so exploring these effects in youth can examine if these effects are lifelong (Wooten et al., 2022). In addition, integrating information about what type of psychotherapy youth attend would be helpful. For instance, if youth are engaged in mindfulness-based interventions they get some training in self-compassion-based skills, which significantly changes their ability to use these strategies. Similarly, including medications, treatment attendance frequency, and other similar variables would improve understanding of these processes. While we collected data regarding medication changes and therapy, the small sample size made exploring these effects difficult.

In this study, we explored reappraisal and self-compassion as emotion regulation strategies in youth with mental health symptoms. We examined the differential impact these strategies have on positive and negative emotions during a lab task and examined changes in depression and anxiety symptoms over a 6-8 week period in youth engaged in

treatment. In response to positive images, self-compassion appeared to preserve the subjective experience of positive emotions, while reappraisal reduced it. All strategies had similar effects on negative emotions. We did not detect any effect of baseline emotions on symptom change, but observed that youth with more severe symptoms at baseline experienced worsening symptoms at the follow-up visit. These findings provide some insight into how strategies can be used therapeutically, and provide points for future directions in research.

CHAPTER 5. GENERAL DISCUSSION

Across the studies presented in this work, I found preliminary evidence in support of the spectrum theory of emotion regulation and for self-compassion as an emotion regulation strategy. The results from **Chapter 2** studies provided evidence supporting a specific tactic underlying a key regulation emotional engagement-related strategy in the theory. I explored similarities across self-reported emotions in adults using various adaptive regulation strategies in **Chapter 3**, and in **Chapter 4** I compared a subset of these strategies in adolescents. I also examined unique contexts in which the use of these strategies gets stressed, specifically maltreatment and symptom severity. While there is a need for further research to establish this theory, the present work provides a strong case for this approach.

Exploring a key tactic of the engagement spectrum

In **Chapter 2**, I explored a key tactic underlying the primary spectra proposed in the theory, the emotional engagement spectra. I examined the relationship between trait reappraisal, suppression, and acceptance with performance on an emotional engagement task measured by self-report and autonomic measures (SCR and HRV) to measure associations with these regulation strategies and emotional engagement as a tactic. Based on the proposed theory, acceptance is a core strategy on the engagement spectrum, while reappraisal at most has a very weak relationship with this spectrum and the tactic of interest. As such, I proposed that acceptance should exhibit a strong relationship with performance on the engagement task, while reappraisal has a weak to non-existent relationship with engagement. My findings indicated significant relationships between performance on the task and trait acceptance using both self-reported emotions and SCR,

but not with reappraisal or suppression. I also did not observe any effects in the models including HRV, which may be attributed to the small measurement epoch being a poor fit for HRV measurement, or the task being ill fit for measuring effort to regulate. The task required participants to switch between engagement and disengagement as quickly as every 10 seconds, which wouldn't allow much time to exert effortful regulation. These results support the spectrum theory with findings that match its proposed relationships regarding emotional engagement.

To my knowledge, this is both the first study to examine emotional engagement as a tactic and to relate it to specific regulation strategies. While other studies have explored tactics related to reappraisal, (Livingstone & Isaacowitz, 2019; Vlasenko et al., 2024), little to no research has investigated tactics related to other strategies. The lack of exploration of other tactics leaves a significant knowledge gap that could explain development of these strategies. By exploring these processes early in adolescence, I investigated these relationships before participants gained substantial experiences with these cognitive strategies – allowing me to explore these relationships with less influence from outside forces. These results establish a strong connection between acceptance and engagement which is predicted by the spectrum theory and fill notable knowledge gaps in the area of emotion regulation.

Commonalities Across Engagement-Related Regulation Strategies in Adults

Across both studies of **Chapter 3**, I compared the use of strategies on the emotional engagement spectrum – specifically acceptance and self-compassion – with reappraisal in response to positive and negative images. In Study A, acceptance and reappraisal were compared, and in Study B, I contrasted self-compassion and reappraisal. In Study A,

reappraisal was the most effective strategy for reducing the intensity of all emotions, while acceptance still had a greater influence on emotions than a non-instructed condition. These results support previous findings that reappraisal is more effective than acceptance at adjusting the subjective experience of emotions (Boehme et al., 2019; Goldin et al., 2019b; Troy et al., 2018). In Study B, while I observed a non-significant interaction effect, decomposition analyses revealed that self-compassion was more effective at reducing negative emotions. These results fall in line with previous findings that self-compassion can be more effective at reducing some negative emotions compared to reappraisal (Diedrich et al., 2014). Together, I found that while reappraisal is more effective than acceptance at minimizing both positive and negative emotions, self-compassion can be more effective in response to negative emotions though there are more similarities between reappraisal and self-compassion than differences.

When I examined strategy use in the context of maltreatment or abuse, additional patterns emerged. Abuse- and maltreatment-exposed individuals reported consistently greater levels of positive affect compared to non-abused or maltreated individuals across both samples. Reappraisal was the most effective strategy compared to acceptance and a non-instructed regulation condition for those who met abuse or maltreatment exposure thresholds, though there were no differences between reappraisal and self-compassion. In my severity analyses, I found both engagement strategies had a similar effect on negative emotions – they had consistent ratings across all levels of maltreatment or abuse severity. These consistent ratings both support the spectrum theory and establish consistency across engagement spectrum strategies, while those differences I observed between engagement spectrum strategies in the context of maltreatment exposure fall in line with

other predictions made by the spectrum theory – which I will describe in greater detail below.

Examining Patterns in Engagement Strategies in Adolescents & Commonalities with adults

Finally, in **Chapter 4** I completed an exploratory study that examined how adolescents use these strategies and compared the use of self-compassion and reappraisal using self-report and autonomic measures of emotion regulation. Due to small sample size, these results should be considered preliminary. Youth participants reported that implementing self-compassion as a regulation strategy resulted in greater self-reported positive affect compared to reappraisal and similar responses to negative images across all strategies.

I detected no differences in emotional reactions or effort to regulation between strategy use in autonomic measures – meaning youth did not exhibit significant autonomic reactions to stimuli. These null findings reflect either stimuli that elicit a very weak physiological response or poor power to detect real differences in the sample. If youth did not have a strong reaction to the images, their SCRs would be insignificant. Despite youth exhibiting a significant SCR in response to at least one image, there were many null trials. If youth are not getting autonomically aroused during trials, their need to exert effortful regulation is diminished – resulting in weak to null HRV measures as well. While there are significant benefits to exploring these measures, future research would benefit from exploring more arousing stimuli and adapting the task to better probe these processes.

Comparing the results from task performance in youth with those from adults, there are some notable commonalities. Across both the youth and adult studies, reappraisal had the largest impact on positive emotions, resulting in the least extreme ratings. For negative

emotions, acceptance use in adults and self-compassion in youth resulted in intermediate ratings. This deviated when adults used self-compassion – which resulted in the least extreme ratings for negative affect. There were also non-significant differences in youth's responses to negative emotions that followed the same patterns found in adults in Study A of Chapter 3. These findings show preliminary evidence regarding the impact that self-compassion has on the experience of emotions that is more effective at managing negative emotions, and equally effective for positive emotions.

These cross-sectional patterns across findings from Chapter 3 and 4 also fall in line with predictions from the spectrum theory to provide tentative evidence in support of the theory. The first prediction is that these differences are the result of development related to the use of emotion regulation skills. There is a natural development of skills on the engagement spectrum that occurs as one ages and gains experience with their emotions. When first developing emotional engagement skills (transitioning away from avoidance), the use of these will resemble acceptance regardless of the strategy used due to a possible ceiling effect. Simply put, without further experience and development youths' ability to use more complicated compassion-based skills will be limited to those found in the “simpler” strategy: acceptance. With further experience and expertise, these skills likely transition into those found in self-compassion. In summary, because youth have little experience in self-compassion and other engagement skills, their use of self-compassion takes a less refined approach – resembling acceptance use in adults.

A second explanation involves other developmental processes across the lifespan. All of these strategies require considerable cognitive skill to implement. As depicted in the spectrum theory (*Figure 1.2*), self-compassion and reappraisal both rely heavily on more

cognitively demanding tactics and techniques. Youths' current cognitive capacities are still under development, so regulation strategies that use these more cognitively intense tactics and techniques hit a "ceiling" of their cognitive ability, resulting in similarly effective strategies. As further cognitive development unfolds, related skills underlying strategies differentiate and become more refined, which results in differences between the impact these strategies have on experienced emotions observed in adults.

Examining Commonalities in Strategy Use Across the Special Context of Maltreatment

To test how unique contexts that push regulatory capacity influence these strategies, I examined how experiences of maltreatment associate with these patterns of use. Due to statistical and sample limitations, I was unable to explore these processes in youth. Comparing these patterns of strategy use cross-sectionally would reveal how self-compassion and mechanisms of the spectrum theory occur developmentally, and I began this work by exploring these strategies in adults. Across both adult samples, I observed more extreme positive self-reported emotions for those who experienced maltreatment and abuse. These findings are opposite to most other findings, which describe restricted positive emotions following maltreatment exposure, though there are some findings that support my observed effects in positive affect (DePierro et al., 2018). One possibility is that there is an overall numbing of the emotional experience following maltreatment or trauma, (Kerig et al., 2016), others propose that decreased positive affect results from interference from more intense negative emotions. Essentially, the experience of negative affects prohibits the experience of positive emotion (DePierro et al., 2018). However, other research suggests that resilient individuals experience more intense positive affect, which results in less intense symptoms (Gerin et al., 2024). Because Mechanical Turk workers

tend to be more self-reliant and self-driven, evidenced by taking initiative to seek out and select jobs on the site on their own, they likely fall into this resilient group of individuals. My maltreatment exposure findings support a more resilient subtype of individual that experiences greater levels of positive affect following trauma.

Comparing strategy use more directly in the context of maltreatment, there is a common pattern across positive emotions: reappraisal is more effective at mitigating emotions. These differences were significant for acceptance, but not self-compassion. While this could reflect that engagement-based effects are less effective, they may also reflect that engagement-based strategies facilitate the experience of positive emotions – since they are believed to be beneficial for cognition and “undo” the effects of negative emotions (Fredrickson, 1998, 2009). To this end, engagement strategies would ‘preserve’ their presence to reap these benefits. With respect to negative emotions, in maltreated individuals, reappraisal was more effective than acceptance, while self-compassion was the superior strategy. These differences in negative emotions fall in line with predictions from the spectrum theory. Since the theory proposes that self-compassion uses the reinterpretation tactics of reappraisal *above and beyond* the tactics and techniques of acceptance, it combines the effectiveness of both strategies – making it more effective in response to negative emotions. Together, these patterns show differential effects of each strategy on emotions, while supporting the spectrum theory of regulation.

Finally, I observed some unique effects in my maltreatment severity analyses that provide support for the spectrum theory of regulation. In these analyses, one notably consistent finding appeared in response to negative images. When using engagement-related strategies, participants reported consistent, or stable, emotional ratings across all

levels of maltreatment severity. Since the spectrum theory proposes that these regulation strategies rely on similar mechanisms and processes – specifically that they both rely on engagement with emotions, the use of these strategies results in similar responses when stressed such as in the context of maltreatment. If these engagement-related strategies were dissimilar, they would result in different patterns of ratings across levels of severity. These findings fall in line with the theory since the use of both acceptance and self-compassion resulted in consistent ratings across all levels of maltreatment severity, which follows predictions from the spectrum theory – providing further support for the theory.

Implications

These findings have the potential to inform both clinical intervention and education in emotion regulation. Interventions that use self-compassion as a core mechanism of change can begin to explore the role that compassion plays as a regulation strategy. Often, these interventions heavily integrate the cognitive components of self-compassion, but often do not directly address the emotional component. Interventions should work to take the active components from self-compassion that can be used to address emotions and integrate them into their curriculum. For example, Cognitive-Based Compassion Training emphasizes awareness of sensations and feelings, and addresses them through self-awareness, attention, finding meaning, and connecting to others. As the name suggests, this intervention takes a very cognitive-based approach to change (Pace et al., 2009) and places little focus on emotions. Mindful Self-Compassion (MSC), on the other hand, integrates more of the emotional experience. One of the eight sessions of MSC is dedicated to dealing with difficult emotions, often anger, and discusses how to use them in daily life (Neff & Germer, 2013). There is a modified version of MSC that also targets adolescents (Bluth et

al., 2018) that also incorporates the importance of navigating difficult emotions.

Interventions should consider taking more aspects from MSC to help use this unique dual identity that self-compassion possesses as both a regulation strategy and a contemplative practice.

To this end, providing individuals with training in self-compassion as a contemplative practice is likely to have substantial benefits for their everyday and emotional lives. As a contemplative practice, self-compassion use has been associated with substantial benefits such as reduced severity of mental illness, reduction of automatic negative thinking, and more (Neff, 2023). In Study A of Chapter 3, I did not detect significant interactions between acceptance and depression or anxiety, though I did find a significant interaction with anxiety symptoms and anxiety in Study B. The use of self-compassion resembled my maltreatment findings, in which emotional ratings were the most consistent when participants used self-compassion. My results underscore how self-compassion can increase resilience, and how these skills can be beneficial for individuals to learn. The more precise skills that self-compassion utilizes to navigate difficult emotions can also be adopted more widely and applied to other therapies. For example, the “soften-allow-soothe” skill helps develop awareness of the experience of emotions in the body and label them (Germer & Neff, 2013). Extracting skills such as “soften-allow-soothe” and disseminating them more widely as a tactic of emotion regulation would help a considerable number of peoples in need, which can be produced by training in self-compassion as a contemplative practice. In addition, the precise training in self-compassion as a contemplative practice gives individuals the opportunity to practice the regulatory skills embedded in the practice in a controlled environment, where others can provide

guidance and assistance to learn the skills effectively. If, as I propose, these practices begin to emphasize the emotion regulatory capacities of these practices, training in self-compassion can serve a dual purpose for supporting everyday practices and emotional skills.

However, there are instances where some of these self-compassion skills may not be the most appropriate. In cases of maltreatment and trauma, some of the body awareness strategies may be triggering depending on an individual's unique trauma-related symptom profile. In addition, the emphasis on thought reflection may be difficult for those with substantial negative self-thoughts. If these individuals focus on their thoughts, they may become fixated on them rather than allowing them to pass without much attention – which would be antithetical to the desired outcome. This focus on current thoughts may be particularly relevant for thoughts that accompany guilt and shame which are common post-trauma or in depression (Brinckman et al., 2024), and should be considered when applying self-compassion. In cases of trauma, taking a stepwise approach to treatment planning would be beneficial, with training in self-compassion occurring later in the therapeutical process, or focusing on skills that do not relate to body awareness or focusing on thoughts early in treatment. Being considerate of the unique overlap between mindfulness practices and trauma-related symptoms should take a priority, and learning to balance the benefits of engagement-related strategies and symptom needs would be a useful area of future investigation.

Importantly, the spectrum theory and addition of self-compassion to the field of emotion regulation have larger-scale implications. By acknowledging the inherent connections between these strategies, other strategies can be reconceptualized into other

related spectrums. For instance, reappraisal, a heavily cognitive strategy, may be related to distraction through emphasis on cognitive emotionally-aversive processes. This is further supported by increasing emphasis that distraction as a tactic is related to reappraisal (Powers & LaBar, 2019). The development of alternative spectrums of ER strategies can reframe the way future research on emotions progresses, and the approaches used to investigate emotions.

By developing further effort into the spectrum theory, the field of emotion regulation can begin to incorporate more of a developmental approach toward regulation strategies. This theory emphasizes the natural development of skills and processes, which lends itself to a developmental psychopathology approach. Because skills develop along these spectra, it becomes easier to predict the level of influence one strategy will have on experienced emotions compared to other strategies. This knowledge can be used in research contexts to acquire more precise emotions to meet those needs, and in clinical contexts to help tailor interventions to best meet client needs. Further development in understanding the nuanced effects these strategies can greatly influence the precision of both clinical and research interventions.

In addition, taking a spectrum approach to ER strategies can also provide the opportunity to tailor interventions more appropriately. By understanding a client's current level of functioning, clinicians can select more appropriate ER strategies to emphasize in treatment. For example, if a client with depression is struggling cognitively due to the severity of their depression, a clinician might select more acceptance-oriented strategies in treatment. As the client improves and their cognitive ability recovers, they may be more capable of handling the cognitive demands required of self-compassion. Alternatively, if a

client has a history of trauma and struggles accepting the physiological aspects of the acceptance, reappraisal may be more appropriate with its lower placement on the acceptance spectrum.

Finally, understanding ER through a spectrum lens also allows greater specialization and precision in the development of clinical interventions. Depending on where a client is in their program of treatment, different intensities of strategies can be planned, making developing evidence-based treatment manuals easier. For instance, acceptance-based strategies can be emphasized in treatment, and as treatment progresses self-compassion skills can begin to take over in treatment. Understanding ER strategies through this spectrum lens lends itself to develop a curriculum where less intense strategies are taught prior to their more intense versions. While this certainly occurs in treatments today, the spectrum approach may facilitate a more systematic and individualized approach to therapeutic interventions.

Future Directions

Future research related to this work would benefit from additional exploration of emotional engagement as a tactic – but exploring this with respect to self-compassion. Doing so would determine if engagement is closely related to self-compassion and would establish more commonalities across the regulation strategies along this spectrum. Completing this research cross-sectionally would determine age-related differences in the use of this tactic that occur across development. The current work establishes some patterns in youth, providing a strong foundation for future efforts. Exploring these processes in both typically developing youth and those experiencing mental health

difficulties would also increase generalizability and examine the strategy in important contexts that test these strategies and tactics when they are more taxed.

Research on engagement-related strategies would also benefit from studying their use in response to complicated emotions such as shame, guilt, or embarrassment. In theory, self-compassion possesses unique traits that make it extremely effective in the face of these self-evaluative and self-comparative emotions. The self-kindness and social comparison components are particularly important features that would prove beneficial for managing these emotions with strong negative self-evaluative features. Because these emotions frequently occur following trauma such as maltreatment, self-compassion is likely to be exceedingly appropriate. With my severity findings in mind, self-compassion is poised to be effective for individuals at all stages of treatment when addressing their feelings of shame, guilt, or embarrassment, both for oneself and for others.

There are also some adaptations to the emotional regulation task used in Chapters 3 and 4 that would be fruitful to explore. The first suggested adaptation would be to include more emotionally evocative stimuli such as videos, more evocative images, or other stimuli. This adjustment could increase variability and intensity of experienced emotions, which improves both statistical power and interpretability. Increasing the intensity of emotional stimuli would also increase the ability to measure implicit measures of emotion regulation. Second, comparing other strategies to self-compassion would get a more comprehensive view of the strategy. The more information comparing strategies, the greater evidence there is to support or disprove the spectrum approach to emotion regulation.

Third, there should be greater exploration of the shared mechanisms, tactics, and processes underlying strategies to identify possible spectra of regulation strategies.

Importantly, identifying new dimensions to derive spectra from is important. Without these dimensions, these spectra cannot be identified. Using tactics or mechanisms as the inspiration for these dimensions is likely to prove effective, as they best represent the shared processes underlying these spectra. Because these related strategies have the potential to inform many interventions and activities, defining them is likely to prove fruitful.

Finally, the field of emotion regulation would benefit from completing dismantling studies for self-compassion. In these types of studies, researchers should explore the unique “active components” of self-compassion beyond acceptance to provide evidence that self-compassion can function as an independent regulation strategy. In addition, such studies would also reveal which components are best served in research and therapeutic contexts to inform the precise interventions described previously.

Limitations

There are several notable limitations to the current work. First is the limited generalizability of findings due to sampling methods. Many of these studies used samples acquired using Mechanical Turk or a small collection of youth. Mechanical Turk may not be a representative means of enrolling prospective subjects, so recruiting participants using other methods would rectify many of these limitations (Burnham et al., 2018; Engle et al., 2020). These samples had very skewed distributions based on race, ethnicity, and income that limit the ability to apply these findings to a broader population of individuals.

Second, I was often limited in my ability to examine the effects of maltreatment and symptom severity on these regulation strategies. For instance, in Chapter 4 I was unable to explore these processes at all due to sample limitations. I measured only maltreatment,

which increases the ability to identify patterns across studies, but limits specificity to other forms of adversity. The samples from Chapters 2 and 3 were also community-based samples without mental health symptoms. While this increases generalizability, it provides weak variability in mental health symptoms – decreasing inferences I can make for this context. Future research would benefit from recruiting samples with greater presence of symptoms and acquiring additional measures of symptoms and adversity to truly test compassion as an emotion regulation strategy and the spectrum theory.

Another limitation related to my measurement method stems from differences in measurement methods for the engagement variables across nearly all studies. In all studies, one variable of interest was measured behaviorally and others were measured using self-report method. While these methods tap into different aspects of the emotional process, their ability to infer a true relationship may be limited due to different forms of variance and measurement scope. Future work should find methods to align measurement methods to better synchronize variance and increase the relationship between variables.

My ability to make inferences regarding the non-instructed trials in chapter 3 and 4 was often limited because I did not explore what participants did during these trials. While this was included in Study B of Chapter 3, I failed to probe these processes in Study A or in the youth sample described in Chapter 4. In the future, adequately probing for which strategies were used in different blocks, and in response to specific image valences, would be extremely beneficial. If participants are using other strategies consistently during these trials, a greater number of comparisons between strategies could be made. Alternatively, substituting the non-instructed condition for more explicit regulation strategies could be informative.

Across nearly every study I experienced considerable limitations regarding statistical power. Future research would benefit from increasing sample sizes to allow all statistical models to run with the most robust random effects structure to increase interpretability and validity of findings. Expanding the sample size would also allow more complicated statistical procedures to be used. Using alternative analytical methods could also improve the ability to detect autonomic nervous system measures of emotion regulation.

Finally, one of the largest limitations relates to my measurement of somatic arousal. While the intention was to explore more implicit processes, many of the models exploring these measures resulted in null findings. While weak statistical power played a significant role in these non-significant models, these findings may also be a result of stimuli that trigger low levels of physiological arousal. Future studies would find using more arousing stimuli beneficial, in addition to using alternative measures of my autonomic metrics. For example, alternative measures of physiological reactivity, such as skin conductance level or heart rate, may be more effective. By using skin conductance *reactions*, I encountered many null trials with non-significant reactions. HRV is typically measured in longer epochs, so the ultra-short epochs used in these studies may not be the most appropriate measure of effort to regulate, or modifications to the task could be made to increase generalizability and inferences.

Final Conclusion

In the present work, I proposed two novel concepts: that self-compassion can be used as an emotion regulation strategy, and a new model for conceptualizing regulation strategies in spectra that fall along different dimensions of measurement, metrics, and

processes. I provided evidence that self-compassion should be considered not only a contemplative practice, but also a more discrete emotion regulation strategy. Specifically, I proposed the existence of a unique spectrum of regulation strategies that rely on engagement with one's emotions. I explored emotional engagement in a key regulation strategy underlying this spectrum – acceptance – and found significant relationships between emotional engagement and this strategy in youth. I observed several commonalities in self-reported emotions when acceptance and self-compassion; in which engagement strategies help facilitate the experience of positive affect. My findings in adults indicated that acceptance is less impactful than reappraisal across positive and negative emotions, but self-compassion was more effective for negative and less impactful for positive emotions. Interestingly, it appears that the engagement strategies facilitate or preserve the experience of positive emotions. Several commonalities also emerged in the context of maltreatment exposure and severity, specifically that self-compassion is equal to or surpasses reappraisal in response to negative emotions, and that both engagement strategies result in stable negative emotions regardless of maltreatment severity. These findings provide strong evidence to establish self-compassion as a regulation strategy and for the spectrum theory– as these contexts tend to exert greater pressures on emotions. I explored developmental differences across these key engagement strategies, and found evidence for developmental processes in both youth using self-compassion and adults using acceptance and self-compassion that the spectrum theory would predict. These findings have important implications for the field of emotion regulation broadly, and in the development and refinement of clinical interventions.

APPENDIX A. CHAPTER 2 SUPPLEMENT

Methods

Task instructions

Now we're going to do the perspective task. <Advance to screen of dog barking CLOSE>

We will start with practicing when the word is close.

If you see the word CLOSE, I want you to pretend you are standing right in front of this dog. Think of yourself as being so close that you can REALLY see its teeth and hear it barking. You're even close enough that you could reach out and touch its fur and think about how it feels in your fingers. You are close enough that the dog may bite you. When you are this CLOSE, you might feel good or bad inside because you are really a part of what you are seeing. If you start to feel good or bad, let yourself really feel it, even if it does not feel good.

So, what would you think about if you were looking at this dog and imagining yourself standing really close to it?

And how does it make you feel inside when you think about yourself being really close to this dog?

Great! Now, the pictures are on the screen for several seconds. I want you continue to try and feel CLOSE to the picture for the entire time it is on the screen without closing your eyes or looking away.

It seems like you understand what to do when you see CLOSE. Now we'll go over what happens when you see the word FAR. < Advance to next screen: Barking dog FAR >

If you see the word FAR, I want you to pretend you are standing farther away from the dog. You can still see them, but you are not right in front of them. You can pretend that you are making a movie about the dog; but you aren't in the movie yourself. Pretend that you are standing behind the camera. You could even pretend that you are looking at a picture of a dog on the wall, or that it is a plastic dog and not real. When you are far away, you should try to record everything you see without thinking about your feelings. Focus more on what you see and not on how you feel.

So, what would you think about if you were looking at the dog and pretending that you are standing far away from it? What strategies did you use?

And how does it make you feel inside when you think about yourself being far away from the dog?

Do you have any questions about the close/far task?

Did you find one more difficult than the other? What about it felt hard? < Advance to next screen: Fire hydrant CLOSE >

Now, there may be times in the Perspective Task when you are instructed to feel CLOSE or FAR from a picture, but you don't feel much inside (not good or bad). That's just fine. We would like you to still try the same actions for CLOSE and FAR that we talked about for the dog picture.

So, for example if you see this fire hydrant, and are given the CLOSE instruction, imagine that you are standing next to the fire hydrant. You can reach down and touch the surface of it ("Is it wet from the rain?"), you feel the grass crunch under your feet, you can lift the chains and roll them around in your fingers. What else could you think about? How would you feel if this fire hydrant was right in front of you? < Advance to next screen: Fire hydrant FAR >

Conversely, how does it make you feel when you imagine yourself far from this fire hydrant? What else could you think about? How would you feel? < Advance to next screen: Rating scale >

After each picture goes off the screen, there will be a brief fixation and then this rating screen will appear. Each time you see this screen, I want you to rate how you are feeling IN THAT MOMENT.

The cursor starts in the middle, and if you are feeling neither good nor bad, you can leave it there. Point to the sad face on the left: This end represents the biggest bad feeling you've ever felt. Point to the happy face: And this end is the biggest good feeling you've ever felt.

You can move the cursor toward either end depending on what you are feeling, and how strong that feeling is. Does that make sense?

You can move the cursor to the left or right using these two buttons (point to left and right arrow keys). For child: In the scanner, you will use these two buttons on the button box (buttons 1 & 2).

Do you have any questions about the Perspective task? (if not) OK, it sounds like you are ready to practice on your own.

Analyses

Because of our interest in engagement while regulating, we also explored the trait emotion regulation model effects in just negative image trials. This more focused analysis allowed us to explore the effects of emotional engagement in greater depth. For these analyses, we subset the data to just negative image trials, and predicted post-image ratings

from the interaction of engagement condition and trait emotion regulation in separate models. We applied the same covariates and within-subjects effect described previously.

Sensitivity analyses. We completed some follow-up analyses for models with significant results to examine the impact of SES. We added level of income, which was entered in discrete income groups as depicted in *Table 1*, as a covariate in these models. We adjusted model random effect structures as needed using the same methods described previously to accommodate this additional covariate. We specifically added income to the task manipulation check analysis model using behavioral self-reported emotions, acceptance and self-reported emotions model, and the acceptance and SCR model.

Results

Emotion Regulation and Behavioral Self-Report Analyses. When we explored these effects in negative image trials, we observed no significant main effects related to trait emotion regulation, though we did observe significant main effects of instruction for the model including reappraisal ($F(1,31.62)=18.7, p<0.001$), suppression ($F(1,30.51)=17.82, p<0.001$), and acceptance ($F(1, 30.05)=22.96, p<0.001$). We performed identical additional exploratory analyses in only neutral image trials, and there were no significant effects or interactions. These results suggest the two-way interaction of valence and instruction was driven by responses to negative trials.

Emotion Regulation and Autonomic Nervous System Analyses. Models run in only negative image trials also resulted in non-significant except for significant main effects of age in models including the interaction with reappraisal ($F(1,46.68)=12.77, p<0.001$), suppression ($F(1,46.82)=12.38, p<0.001$), and acceptance ($F(1,46.9)=9.82, p=0.003$). When we ran parallel models in only neutral trials, there were significant effects of age all three

models as well (reappraisal, $F(1,46.95)=11.99$, $p<0.001$; suppression, $F(1,46.95)=11.5$, $p=0.001$; acceptance, $F(1,1386.41)=362.3$, $p<0.001$). In addition, the acceptance model for neutral trials also had significant main effects of trait acceptance ($F(1,1386.41)=9.25$, $p=0.002$) and sex ($F(1,1399.22)=259.26$, $p<0.001$).

Sensitivity analyses. When we added income as a covariate to the task manipulation check analysis, the two-way interaction of valence and instruction remained significant ($F(1,1277.28)=17.74$, $p<0.001$). Other main effects remained significant as previously described, and no effects emerged as significant. The model predicting self-reported emotions from the interaction of valence, instruction, and acceptance had some notable changes when income was added as a covariate. The three-way interaction was no longer trending ($F(1,1603.58)=0.73$, $p=0.39$), and the two-way interaction of regulation instruction and acceptance became non-significant, $F(1,43.26)=0.001$, $p=0.975$). The main effect of instruction also lost its significance, $F(1,48.37)=2.46$, $p=0.12$, though valence remained significant, $F(1,47.43)=77.78$, $p<0.001$. Finally, the three-way interaction of valence, regulation instruction, and acceptance predicting SCR also experienced substantial changes. When we controlled for income, all previous effects were no longer significant, including the interaction of valence and trait acceptance, $F(1,139.18)=0.8$, $p=0.37$, and the main effect of sex, $F(1,17.54)=0.28$, $p=0.601$. These sensitivity analyses indicate that SES may play a role in the physiological responses to these images, but the subjective experiences of these emotions may be similar across SES. However, because of the restricted range of income, and because these analyses were performed with income separated into categories, these effects may not be the most generalizable.

Table S2.1. IAPS Images Included in the Engagement Task

Image Name	Description	Arousal	Arousal (SD)	Valence	Valence (SD)	Valence Category
3500.bmp	Attack	6.99	2.19	2.21	1.34	Negative
6520.bmp	Attack	6.59	2.08	1.94	1.27	Negative
9908.bmp	CarAccident	6.63	2.13	2.34	1.49	Negative
2850.bmp	Tourist	3	1.94	5.22	1.39	Neutral
5971.bmp	Tornado	6.65	2.02	3.49	1.87	Negative
6231.bmp	AimedGun	6.82	2.11	2.49	1.54	Negative
9940.bmp	Explosion	7.15	2.24	1.62	1.2	Negative
7175.bmp	Lamp	1.72	1.26	4.87	1	Neutral
5510.bmp	Mushroom	2.82	2.18	5.15	1.43	Neutral
7010.bmp	Basket	1.76	1.48	4.94	1.07	Neutral
2305.bmp	Woman	3.63	2.04	5.41	1.12	Neutral
7012.bmp	Rubberbands	3	1.94	4.98	1.05	Neutral
7224.bmp	FileCabinets	2.81	1.94	4.45	1.36	Neutral
2320.bmp	Girl	2.9	1.89	6.17	1.51	Neutral
6838.bmp	Police	5.8	2.09	2.45	1.44	Negative
9184.bmp	InjuredDog	5.75	2.43	2.47	1.52	Negative
1304.bmp	AttackDog	6.37	1.93	3.37	1.58	Negative
7032.bmp	Shoes	3.18	1.88	4.82	1.46	Neutral
2235.bmp	Butcher	3.36	1.92	5.64	1.27	Neutral
7020.bmp	Fan	2.17	1.71	4.97	1.04	Neutral
2393.bmp	Factoryworker	2.93	1.88	4.87	1.06	Neutral
2411.bmp	Girl	2.86	1.84	5.07	0.85	Neutral
6350.bmp	Attack	7.29	1.87	1.9	1.29	Negative
9904.bmp	CarAccident	6.08	2.06	2.39	1.36	Negative
6560.bmp	Attack	6.53	2.42	2.16	1.41	Negative
7040.bmp	DustPan	2.69	1.93	4.69	1.09	Neutral
2280.bmp	Boy	3.77	1.89	4.22	1.54	Neutral
9600.bmp	Ship	6.46	2.31	2.48	1.62	Negative
1201.bmp	Spider	6.36	2.11	3.55	1.88	Negative
2440.bmp	NeutGirl	2.63	1.7	4.49	1.03	Neutral
9421.bmp	Crying Soldier	5.04	2.15	2.21	1.45	Negative
6212.bmp	Soldier	6.01	2.44	2.19	1.49	Negative
2811.bmp	Gun	6.9	2.22	2.17	1.38	Negative
2593.bmp	Men	3.42	1.84	5.8	1.34	Neutral
1120.bmp	Snake	6.93	1.68	3.79	1.93	Neutral
9413.bmp	Hanging	6.81	2.09	1.76	1.08	Negative
6570.bmp	Suicide	6.24	2.16	2.19	1.72	Negative

1930.bmp	Shark	6.42	2.07	3.79	1.92	Neutral
2104.bmp	NeuWoman	3.11	1.84	4.42	1.09	Neutral
2102.bmp	NeuMan	3.03	1.87	5.16	0.96	Neutral
7035.bmp	Mug	2.66	1.82	4.98	0.96	Neutral
6550.bmp	Attack	7.09	1.98	2.73	2.38	Negative
7217.bmp	ClothesRack	2.43	1.64	4.82	0.99	Neutral
5731.bmp	Flowers	2.74	1.95	5.39	1.58	Neutral
9611.bmp	PlaneCrash	5.75	2.44	2.71	1.95	Negative
6263.bmp	AimedGun	6.62	2.23	2.48	1.53	Negative
7491.bmp	Building	2.39	1.9	4.82	1.03	Neutral
7004.bmp	Spoon	2	1.66	5.04	0.6	Neutral
9911.bmp	CarAccident	5.76	2.1	2.3	1.37	Negative
3530.bmp	Attack	6.82	2.09	1.8	1.32	Negative
2840.bmp	Chess	2.43	1.82	4.91	1.52	Neutral
1300.bmp	PitBull	6.79	1.84	3.55	1.78	Negative
2480.bmp	ElderlyMan	2.66	1.78	4.77	1.64	Neutral
7950.bmp	Tissue	2.28	1.81	4.94	1.21	Neutral
2880.bmp	Shadow	2.96	1.94	5.18	1.44	Neutral
2890.bmp	Twins	2.95	1.87	4.95	1.09	Neutral
9623.bmp	Fire	6.05	1.88	3.04	1.51	Negative
6230.bmp	AimedGun	7.35	2.01	2.37	1.57	Negative
9332.bmp	CryingWoman	5.34	2	2.25	1.33	Negative
7000.bmp	RollingPin	2.42	1.79	5	0.84	Neutral
7020.bmp	Fan	2.17	1.71	4.97	1.04	Neutral
7010.bmp	Basket	1.76	1.48	4.94	1.07	Neutral
5971.bmp	Tornado	6.65	2.02	3.49	1.87	Negative
6212.bmp	Soldier	6.01	2.44	2.19	1.49	Negative

Table S2.1. List of images used in the emotion engagement task. Arousal = mean arousal rating from norming study; Arousal (SD) = standard deviation of arousal scores; Valence = mean valence rating from norming study; Valence (SD) = standard deviation of valence ratings; Valence Category = designation as negative or neutral images based on valence rating.

APPENDIX B. CHAPTER 3 SUPPLEMENT

Study A: Supplemental Materials

Methods

Regulation Task Instructions

The task began with a general introduction, and then specific instructions for how to practice each of the three regulation strategies included in the task. After reviewing the instructions for each strategy, participants were shown an image and asked to engage in the strategy. An example of how to engage in the task was also provided. After instructions for the three strategies were provided, participants were informed that they would observe each image 5 seconds, would have 4 seconds to rate their feelings, and allowed them to review the instructions one more time if they desired. The specific instructions for each strategy are below.

Reframe. When we ask you to REFRAME, we would like you to work with your thoughts to change your sensations and feelings. We would like you to rethink the way you are reacting to the picture so it is more neutral (less positive or negative) for you. This is not to just telling yourself “*It doesn’t matter,*” or “*I’m not feeling this emotion.*” Instead, change your reaction by finding a different way to think about the picture. You may imagine another point of view or another way to interpret what is happening in the image. Find a new, specific and believable narrative so that your emotional reaction is more neutral (less negative or positive).

Acceptance. When you see the instruction OBSERVE and ACCEPT, see if you can simply notice how you’ve reacted to the picture and let your reaction progress as it would without any action on your part. When we ask you to OBSERVE, we mean that instead of

changing the way you feel or react when you see the pictures, we want you to try to observe your reaction non-judgmentally. Your reaction is neither good or bad. When we ask you to ACCEPT, we mean allow yourself to feel your initial emotional reaction to the picture, knowing that any strong feelings will fade, and that even painful emotions have their place. Rather than focusing on your thoughts or trying to get rid of them, try to be curious about your reactions.

Non-Instructed. When you see the instruction REACT NATURALLY, let yourself respond in whatever way is most natural to you. Allow yourself to have the thoughts and feelings you would normally have when looking at this picture. If you would normally start to feel one way about a picture and then try to change it with thoughts, go ahead and do that. If you would normally try not to think about the picture, that is okay too. React in whatever way is most natural to you as long as you keep paying attention to the screen without looking away.

Analyses

Perceived Strategy Effectiveness Analyses. We were interested in examining how perceived strategy effectiveness differs based on abuse history. Here, an LME was used to estimate the interaction of regulation strategy and abuse severity (using the continuous CTQ abuse score) to predict perceived strategy effectiveness ratings. This model included a random intercept and the random effect for strategy by subject, and included sex and age as covariates. An additional model examined the interaction of perceived effectiveness and emotion regulation strategy on post-image ratings. This model included a by-subject random intercept. Due to task design, we were unable to probe the effect of regulation strategy on positive and negative valences separately.

Symptom Covariate Analyses. Finally, confound analyses were run in order to determine whether current depression and anxiety symptoms were contributing to the effects of childhood abuse on emotion regulation strategy use. We ran all primary statistical models with significant abuse severity and exposure effects while including STAI Trait and BDI as covariates. We encountered convergence difficulties, so we could not include a by-subject effect of image instruction in these models. Both continuous symptom measures were centered, age and sex were included as covariates, and a random intercept was included, while predicting post-image rating.

In order to better understand the relationship between current symptoms and childhood abuse, we also investigated whether abuse severity was predictive of both depressive symptom severity (BDI total score) and anxiety severity (STAI Trait total score). Models controlled for age and sex, and we ran separate models that interacted the symptom severity with strategy, and symptom severity with valence. Across all models described above, the STAI Trait was chosen due to our *a priori* interest in the static nature of the trait anxiety that is likely to emerge over time as a result of abuse as opposed to state anxiety that fluctuates over time.

Results

Perceived Strategy Effectiveness Analyses

When examining overall the effect of the participant's perceived strategy effectiveness, we did not find a significant interaction of strategy and perceived effectiveness ($F(2,16957.5)=0.47, p=0.63$). However, we did detect a significant abuse severity by strategy interaction when predicting perceived effectiveness ($F(2,197.01)=3.46, p=0.03, r^2=0.82$). Specifically, at lower levels of abuse, non-instructed

trials were perceived to be most effective, but at higher levels of abuse severity there were no differences in perceived strategy effectiveness. In addition, there was no difference in perceived effectiveness between acceptance and reappraisal across levels of abuse ($F(2,198)=1.92, p=0.98$). When examining the same model using dichotomous abuse experience, the interaction was not significant, $F(2,196.99)=2.11, p=0.12$.

Symptom Covariate Analyses

Confound analyses investigating the potential effects of depression and anxiety symptom severity confirmed that our primary models of abuse exposure and severity detected unique variance outside of current depressive or trait anxiety symptoms on post-image. Including both depression and anxiety symptom severity as covariates did not alter the interaction of valence and strategy with abuse severity ($F(2,183.6)=13.01, p<0.001$) or exposure ($F(2,180.9)=4.07, p=0.019$).

Models predicting symptom severity from maltreatment did not reveal a significant interaction for regulation strategy instruction with either depression severity ($F(2,16273.4)=0.42, p=0.65$) or anxiety severity ($F(2,16194)=0.18, p=0.83, r^2=0.82$). However, the main effect of depression severity was trending ($F(1,299.6)=2.84, p=0.09, r^2=0.72$), and the main effect of anxiety severity was significant ($F(1,287.5)=21.51, p<0.001$). Results indicated that as anxiety severity increased, ratings of emotions became more extreme. Our valence and symptom severity models resulted in significant interactions between valence and both anxiety severity ($F(1,16187.8)=319.39, p<0.001$) and depression severity ($F(1,16265.8)=8.22, p<0.001$). Results indicated substantial differences in the way positive and negative images were influenced by anxiety severity (see *Figure S3.A1*). There appeared to be little to no relationship between anxiety severity

and negative valences. However, there was a strong positive relationship between anxiety severity and positive valences; such that more extreme emotional ratings occurred with greater anxiety severity. The interaction with depression severity and valence showed that positive images were rated more extreme than negative images, and negative images were less intense as symptom severity increased (see *Figure S3.B2*).

Figure S3.A1.

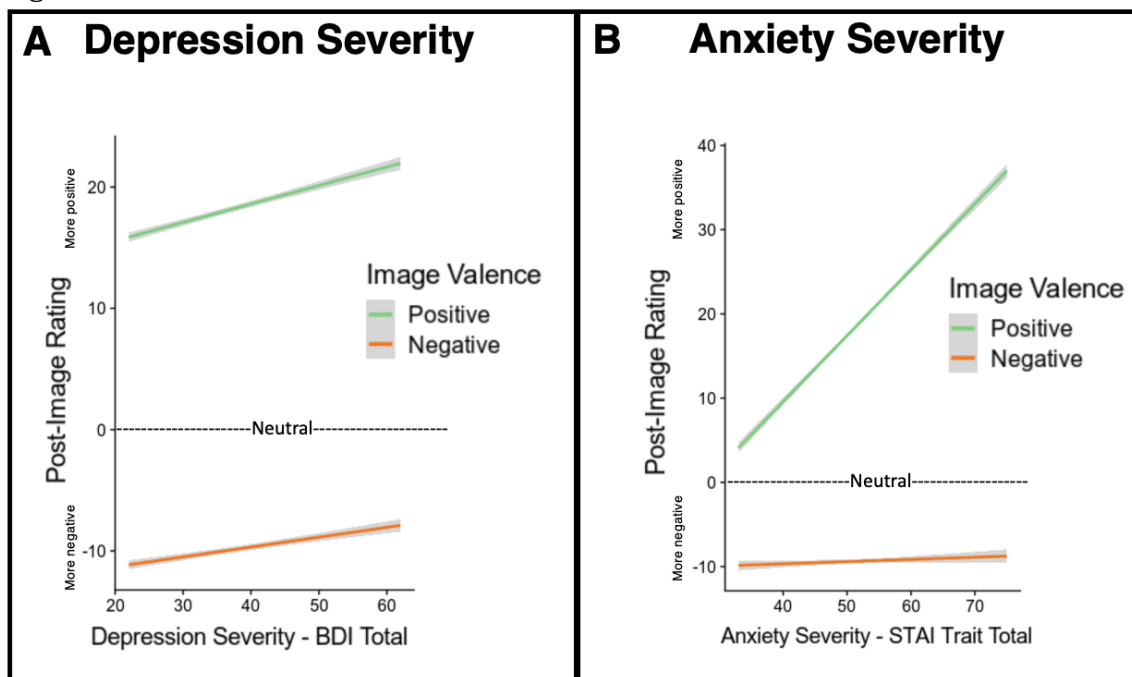


Figure S3.A1. The effects of depression symptom severity (Panel A) and anxiety symptom severity (Panel B) by image valence on post-image ratings. Brackets indicate confidence interval.

Figure S3.A2.

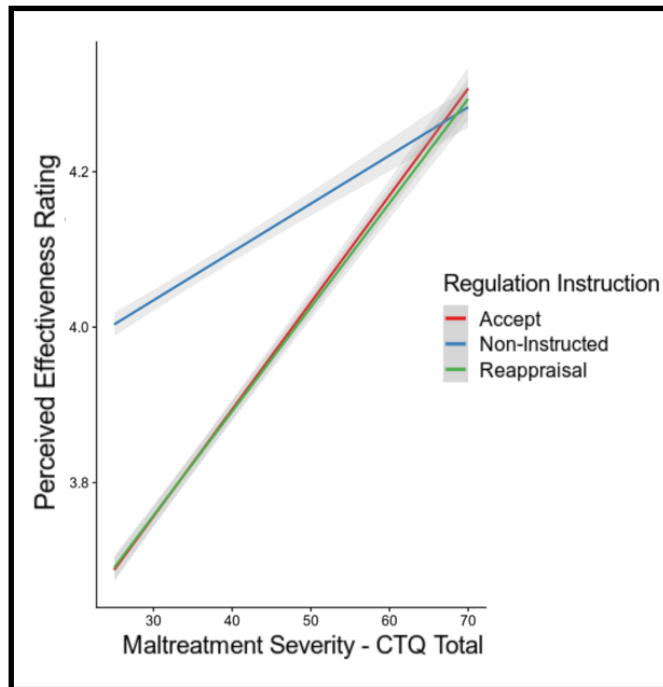


Figure S3.A2. Differences in perceived strategy effectiveness per block regulation instructions and maltreatment severity.

Discussion

After seeing the results from the abuse analyses, we were interested in examining how the participants perceived the effectiveness of the strategies used. Because subjects were only asked about perceived strategy effectiveness at the end of each block using a single question, these findings should be considered as exploratory. However, results indicated that differences in perceived effectiveness of strategies disappeared at greater levels of abuse severity. Interestingly, participants with greater levels of maltreatment severity reported greater levels of perceived effectiveness. When compared to the ratings observed in the abuse severity models, these perceived effectiveness strategies appear counter-intuitive. It appears that at greater levels of severity, participants reported the greatest levels of strategy effectiveness, despite experiencing the most extreme positive emotions and decreased reappraisal impact on negative emotions. The mis-match between these

perceived effectiveness ratings and actual behavioral ratings are notable but require additional investigation at the trial wise level.

We only measured perceived effectiveness at the end of each block. This limits our ability to determine how perceived effectiveness interacts with the strategies across the different valences. This also limits interpretation of the perceived effectiveness findings described as well, which we attempted to address by exploring the findings in an exploratory manner. This limits our ability to effectively use the data in several ways.

Table S3.1. NAPS Images by Block Designation

Image_ID	Block Assigned	Arousal	Valence	Valence Category
Animals_004_v	Block_1	5.228070175	4.01754386	Negative
Faces_021_h	Block_1	4.984375	2.859375	Negative
People_070_v	Block_1	5.65625	2.78125	Negative
People_137	Block_1	3.796610169	3.62711864	Negative
Faces_301_h	Block_1	3.636363636	3.87878788	Negative
Faces_148_h	Block_1	3.969230769	3.47692308	Negative
People_015_h	Block_1	3.784615385	3.36923077	Negative
Faces_294_h	Block_1	4.033898305	2.6440678	Negative
Animals_178_v	Block_1	4.476190476	7.14285714	Positive
Faces_352_h	Block_1	4.859375	7.046875	Positive
People_180_h	Block_1	4.880597015	6.49253731	Positive
Faces_351_h	Block_1	3.666666667	7.18181818	Positive
Faces_234	Block_1	4.25	6.328125	Positive
People_161_h	Block_1	4.594202899	6.95652174	Positive
Faces_120_h	Block_1	4.307692308	7.47692308	Positive
Faces_348_h	Block_1	4.384615385	6.27692308	Positive
Animals_034_h	Block_2	5.590909091	2.87878788	Negative
People_035	Block_2	3.898305085	3.86440678	Negative
Faces_272_h	Block_2	6.238095238	2.58730159	Negative
Faces_155_h	Block_2	3.949152542	3.38983051	Negative
People_120	Block_2	3.777777778	3.0952381	Negative
Faces_293_h	Block_2	4.9375	2.96875	Negative
People_133_h	Block_2	3.830769231	3.52307692	Negative
Faces_169	Block_2	3.136363636	3.13636364	Negative
Animals_213_h	Block_2	4.09375	6.96875	Positive
Faces_134_h	Block_2	4.4	7.24615385	Positive
People_182_h	Block_2	4.153846154	6.72307692	Positive
Faces_140_h	Block_2	4.046875	7.640625	Positive
Faces_353_h	Block_2	3.707692308	6.96923077	Positive
People_183_h	Block_2	4.765625	6.9375	Positive
Faces_261_v	Block_2	3.462686567	6.35820896	Positive
People_172_v	Block_2	4.268656716	7.2238806	Positive
Animals_076_v	Block_3	5.847457627	3.05084746	Negative
Faces_037_h	Block_3	3.863636364	3.16666667	Negative
Faces_016_h	Block_3	5.835820896	2.73134328	Negative
Faces_158_h	Block_3	3.606060606	3.22727273	Negative
People_131_h	Block_3	3.046875	4.03125	Negative

Faces_161_h	Block_3	3.5	3.21212121	Negative
People_170_v	Block_3	3.833333333	3.8030303	Negative
Faces_174_h	Block_3	5.620689655	2.10344828	Negative
Animals_186_h	Block_3	4.313432836	7.26865672	Positive
Faces_137_h	Block_3	3.365079365	7.49206349	Positive
People_190_h	Block_3	4.227272727	7.34848485	Positive
Faces_356_h	Block_3	4.173913043	6.71014493	Positive
Faces_361_v	Block_3	4.40625	6.546875	Positive
People_160_h	Block_3	4.695652174	6.49275362	Positive
People_052_h	Block_3	3.567164179	7.79104478	Positive
Animals_179_h	Block_3	4.015625	6.65625	Positive
Animals_009_v	Block_4	4.424242424	5.06060606	Negative
Faces_024_h	Block_4	3.909090909	3.04545455	Negative
Faces_274_h	Block_4	5.878787879	2.63636364	Negative
Faces_175_v	Block_4	3.625	3.3125	Negative
People_122_h	Block_4	3.136363636	4.48484849	Negative
Faces_366_h	Block_4	6.046153846	1.72307692	Negative
Faces_165_v	Block_4	3.40625	3.84375	Negative
Faces_177_v	Block_4	4.76119403	4.11940299	Negative
Animals_096_h	Block_4	4.461538462	6.89230769	Positive
People_174_v	Block_4	4.031746032	7.22222222	Positive
People_193_h	Block_4	4.813559322	6.88135593	Positive
Faces_347_h	Block_4	4.474576271	6.06779661	Positive
Faces_342_h	Block_4	4.46969697	6.90909091	Positive
People_187_h	Block_4	4.597014925	7.07462687	Positive
Faces_122_h	Block_4	4.104477612	7.55223881	Positive
People_191_h	Block_4	4.515625	6	Positive
Animals_012_h	Block_5	5.73015873	2.87301587	Negative
Faces_019_h	Block_5	3.754385965	3.78947368	Negative
Faces_271_h	Block_5	5.389830508	2.84745763	Negative
Faces_279_h	Block_5	3.5625	3.40625	Negative
People_141	Block_5	3.353846154	3.81538462	Negative
People_071_h	Block_5	4.898305085	3.54237288	Negative
People_124_h	Block_5	4.8125	2.921875	Negative
Faces_157_h	Block_5	3.28358209	4.02985075	Negative
Animals_187_h	Block_5	4.431034483	7.13793103	Positive
Faces_133_h	Block_5	4.144927536	6.92753623	Positive
People_173_h	Block_5	3.25	6.59375	Positive
Faces_109_v	Block_5	4.242424242	7.37878788	Positive
Faces_321_h	Block_5	5.059701493	6.7761194	Positive

People_029_h	Block_5	5.776119403	6.88059702	Positive
Faces_106_h	Block_5	3.938461538	7.4	Positive
People_051_h	Block_5	4.608695652	6.7826087	Positive
Animals_200_v	Block_6	3.953125	4.125	Negative
Faces_038_h	Block_6	4.575757576	3.98484849	Negative
People_076_h	Block_6	4.893939394	3.60606061	Negative
Faces_142_h	Block_6	3.375	3.71875	Negative
People_136_h	Block_6	3.723076923	2.96923077	Negative
Faces_270_h	Block_6	4.742424242	3.42424242	Negative
People_200_h	Block_6	6.014925373	1.80597015	Negative
Faces_041	Block_6	5.104477612	2.17910448	Negative
Animals_175_h	Block_6	4.15625	7.171875	Positive
Faces_108_h	Block_6	3.47761194	7.32835821	Positive
People_196_h	Block_6	4.567164179	6.8358209	Positive
Faces_330_v	Block_6	3.385964912	6.21052632	Positive
Faces_252_h	Block_6	3.525423729	6.74576271	Positive
People_096_h	Block_6	4.484375	6.796875	Positive
Faces_132_h	Block_6	4.579710145	7	Positive
Faces_002_v	Block_6	4.076923077	7.58461539	Positive

Table S3.1. Designation of images per task block, including mean valence and arousal ratings. Arousal = mean arousal rating from norming study. Valence = mean valence rating from norming study. Valence Category = designation as negative or positive images based on valence rating.

Study B: Supplemental Materials

Methods

Regulation Task Instructions

See Wooten et al. (2022) for an explanation of the general task instructions, reframe instructions, and non-instructed instructions.

Self-Compassion. When you see the instruction USE SELF-COMPASSION, begin by simply noticing how you've reacted to the picture. Try to notice how your feelings show up in your posture, facial expression, and other parts of your body. Imagine yourself receiving help or support from someone else to calm yourself so your emotions are easier to control and neutral. Allow yourself to have feelings of warmth and support throughout your body if you feel bad, or if you feel too excited imagine a calming presence. Recognize that these emotions are felt by everyone. Give yourself the support you feel you need in this moment to experience these emotions. You can tell yourself "I can do this. I can get through this emotion. I've done this before."

Perceived Effectiveness Ratings

After each block of images, participants rated how effective they thought the strategy was when applied across the entire block. They rated this using a 5-item Likert scale ranging from "Extremely effective" to "Not effective at all." This was converted to a numerical scale ranging from one to five.

Supplemental Analyses

Perceived effectiveness analyses. We ran a series of LMEs examining how perceived strategy effectiveness interacts with several of the variables of interest. In each of these models, age and sex were included as covariates, and any within-subjects effects were

included as appropriate. If there were no random effects, we included a random intercept by subject to accommodate for multiple image ratings.

We first ran models using post-image emotional rating as the dependent variable, predicted by perceived effectiveness interacted with regulation instruction. We then ran a series of models using perceived effectiveness as the dependent variable. In one LME, we predicted effectiveness from an interaction of image instruction and valence. Finally, we ran an LME that predicted effectiveness from regulation instruction interacted with total maltreatment. We also ran an LME interacting instruction with total abuse, to mirror analyses by Wooten et al. (2022). We did not decompose interactions for any supplemental analyses if they were not significant.

Non-instructed condition analyses

A final set of analyses examined which trait level measure best related to the non-instruction condition. This analysis was completed to help discern comparisons between it and the other task conditions. In these analyses, we decided to include the suppression subscale as it may be used based on task instructions. In these analyses, we performed separate LME predicting image ratings from trait levels of reappraisal, suppression, and mindfulness as measured by the ERQ and SCS, respectively. We chose mindfulness from the SCS as it appeared to best capture the unique aspects of self-compassion compared to the other strategies. We include age and sex as covariates and included a random intercept.

Mental Health Symptom Severity Analyses

We also explored the effect that depressive and anxiety symptom severity has on the use of these strategies. We completed a series of LMEs that interacted depression severity or anxiety severity with regulation strategy and valence to predict image ratings.

We calculated depression severity using total BDI score, and anxiety severity with the total BAI score. Models included age and sex as covariates, and included appropriate within-subject effects.

Sensitivity Analyses

To examine the impact of educational level and income on these factors, we performed additional sensitivity analyses on the maltreatment models. We re-ran the maltreatment severity and exposure models, adding income as a covariate, and repeated this process for level of education. In the income analyses, the model for maltreatment severity ran without any additional modifications aside from adding the covariate. However, in the exposure model we had to simplify the random effects structure, which means differences between the original model output and those from the sensitivity models should be interpreted cautiously.

Results

Statistical Analyses

Abuse Analyses. The three-way interaction of valence, regulation instruction, and abuse exposure was trending ($F(2,204.5)=2.495, p=0.08$; see *Figure S3.B1*). We observed that for positive images, there was little variation between ratings regardless of strategy used. In negative images, those who experience abuse also had little variation across strategies. However, in those without abuse exposure, self-compassion received the least extreme ratings, non-instructed received the most extreme ratings, and reappraisal was intermediate. When we decomposed this interaction, we found significant differences between self-compassion and non-instruction trials ($F(2,208.3)=4.95, p=0.027$), but not between self-compassion and reappraisal ($F(2,202.3)=2.51, p=0.46$). We observed

significant main effects of valence ($F(1,213.6)=216.56, p<0.001$), abuse exposure ($F(1,473.6)=5.59, p=0.019$), and age ($F(1,192.8)=5.1, p=0.025$). Valence effects resembled those described in the task main effects results. In the main effect of abuse, it appeared that those who experience abuse had more extreme ratings of positive stimuli than those without abuse histories. Finally, there was a trending main effect of regulation instruction ($F(2,16977)=2.73, p=0.065$).

Figure S3.B1.

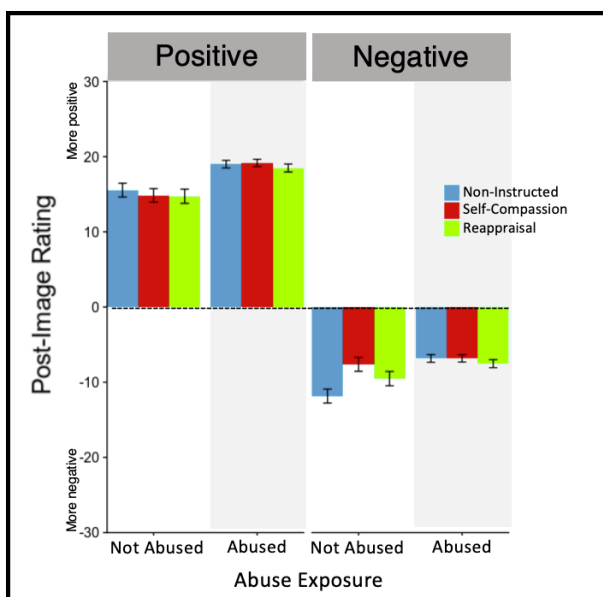


Figure S3.B1. *Childhood total abuse exposure (Panel A) by emotional strategy and valence on post-image ratings. The dotted black line represents a neutral score of zero on post-image ratings and brackets in Panel A indicate confidence interval.*

For the abuse *severity* analyses, the interaction of valence, regulation instruction, and *severity* was not significant ($F(2,200.8)=2.29, p=0.1$). We observed trending interactions of regulation strategy and valence ($F(2,198.1)=2.75, p=0.066$), and regulation instruction and total abuse ($F(2,17114.2)=2.45, p=0.086$). The strategy and valence effects resembled those described previously. For the interaction of abuse severity and instruction, as abuse severity increased, image ratings became more extreme. However, the slope of change was significantly greater in reappraisal and non-instructed trials than self-

compassion. Self-compassion had little change across abuse severity, resembling those effects observed in the total maltreatment analyses. Finally, we observed significant main effects for regulation instruction ($F(2,17114)=3.49, p=0.03$), valence ($F(1,334.6)=32.55, p<0.001$), and age ($F(1,17117.4)=6.63, p=0.01$). Those effects mirror those described previously.

Neglect Analyses. Our model examining the interaction of valence, regulation strategy, and neglect *exposure* was not significant ($F(2,210.2)=1, p=0.37$). We observed significant main effects of regulation strategy ($F(2,16620.5)=3.03, p=0.048$), valence ($F(1,259.1)=170.82, p<0.001$), and age ($F(1,190.4)=4.11, p=0.043$). Effects were similar to those described previously. Our neglect severity model revealed a unique significant main effect of total neglect ($F(1,16655.4)=12.54, p<0.001$). In this main effect, there was a negative association between total neglect score and post-image rating, where ratings become less extreme as neglect severity increased (see *Figure S3.B2*).

Figure S3.B2.

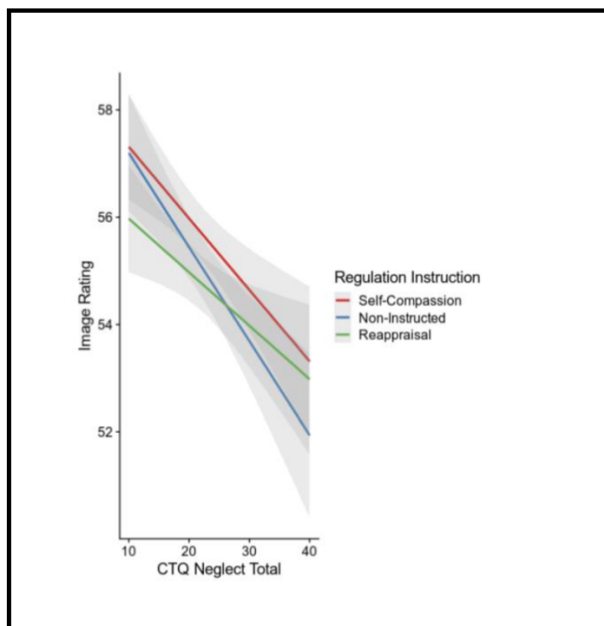


Figure S3.B2. *Childhood* neglect severity by emotional strategy on post-image ratings. Brackets indicate confidence interval.

Perceived effectiveness analyses

When we predicted effectiveness rating from regulation strategy and valence, the interaction was not significant ($F(2,17668.2)=0.87, p=0.92$). There was a unique main effect of regulation strategy ($F(2,17670.5)=19.92, p<0.001$). In the main effect of regulation strategy, we observed reappraisal was perceived to be the most effective, self-compassion to be the least effective, and non-instruction was intermediate. Compared to self-compassion, both reappraisal ($F(2,17672.7)=38.33, p<0.001$) and non-instructed ($F(2,17669.2)=16.28, p<0.001$) were significantly different.

The interaction of regulation strategy and maltreatment severity on perceived effectiveness was significant ($F(2,783.8)=5.41, p<0.01$; see *Figure S3.B3*). In this interaction, we observed positive trends in both self-compassion and reappraisal, with increases in perceived effectiveness as maltreatment severity increases. Reappraisal was consistently rated as more effective than self-compassion, with this difference widening as severity increased. However, there was a negative association between abuse severity and perceived effectiveness in non-instructed trials. Further decomposition of this analysis revealed significant differences between self-compassion and non-instructed trials ($F(2,838.2)=4.31, p=0.038$), and trending differences between reappraisal and self-compassion ($F(2,725.9)=2.74, p=0.098$).

In the two-way interaction involving abuse severity and regulation strategy on perceived effectiveness, we also observed a significant interaction ($F(2,762.6)=6.01, p<0.01$; see *Figure S3.B4*). Here, non-instructed trials and self-compassion had similar positive associations, with the two converging in increased perceived effectiveness as

abuse severity increased. Similar to maltreatment, reappraisal had a much greater increase in perceived effectiveness as abuse severity increased.

Figure S3.B3

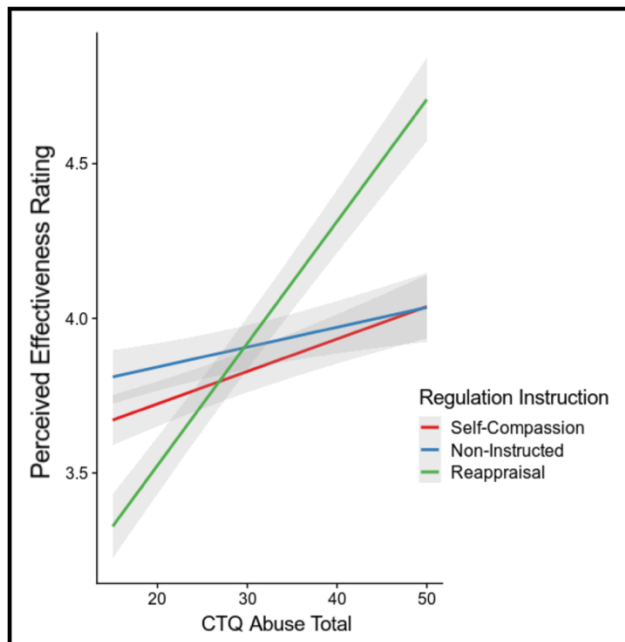


Figure S3.B3 *Childhood* maltreatment severity by emotional strategy on post-block regulation strategy perceived effectiveness ratings. Brackets indicate *confidence interval*.

Figure S3.B4

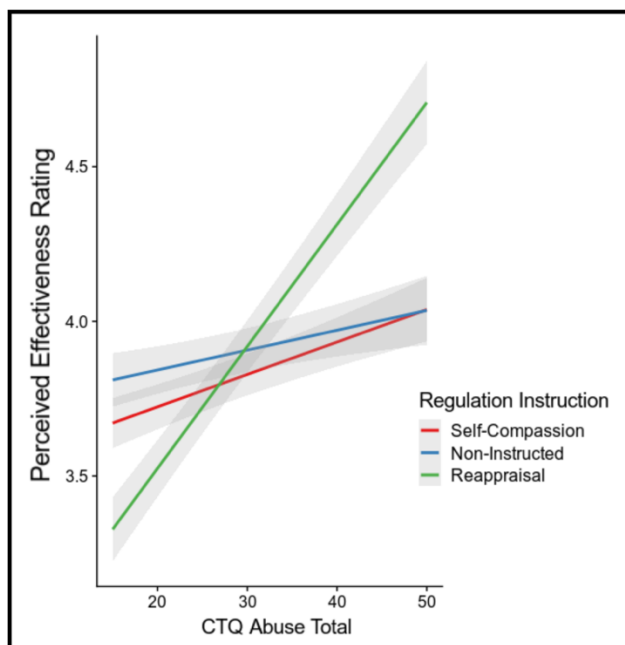


Figure S3.B4. *Childhood* abuse severity by emotional strategy on post-block regulation strategy perceived effectiveness ratings. Brackets indicate *confidence interval*.

Non-instructed trials analyses

Finally, the analyses examining which trait emotion regulation strategy was most closely related to non-instructed trials indicated that across just non-instructed trials, only the main effect of suppression (as measured by the ERQ), while controlling for all other trait regulation strategies, was significant, $F(6,5768)=3.104$, $p=0.005$. Results indicated that as trait levels of suppression increased, average image rating increased (i.e. less negative or more positive). To determine if there were differences between abused and non-abused individuals, we re-ran the analyses in both subsets of the sample. Analyses in neither the abused nor non-abused samples indicated a significant effect for any specific strategy.

Mental Health Symptom Severity Analyses

The model with depression severity resulted in a trending three-way interaction of regulation instruction, valence, and depression severity, $F(2,164.2)=2.7$, $p=0.07$. Novel interactions that emerged as significant include a valence by depression severity interaction, $F(1,172.8)=8.5$, $p<0.01$, and a main effect of depression total, $F(1,15363.6)=16.95$, $p<0.001$. In the two-way interaction, participants who reported greater depression severity reported more neutral negative and positive emotions than those who reported lower levels of symptoms. The main effect of depression revealed that participants who reported greater symptoms reported more intense emotions.

The anxiety model resulted in a significant 3-way interaction of regulation strategy, valence, and anxiety severity, $F(2,16630.2)=7.83$, $p<0.001$. There were also unique significant 2-way interactions of anxiety severity with both regulation strategy, $F(2,16663.4)=3.98$, $p=0.018$, and image valence, $F(1,16630.2)=18.98$, $p<0.001$. In the three-way interaction (see *Figure S3.B5*), we observed that as anxiety severity increased, positive

images were rated as more intense (more positive), though the slope was greatest for reappraisal and least steep for the non-instructed trials. Self-compassion had intermediate ratings. There were greater differences across strategies for negative emotions.

Compassion and the non-instructed had similar, yet more neutral ratings than reappraisal at the lowest levels of anxiety. Ratings became more neutral with the use of reappraisal, more intense in non-instructed trials, and were consistent when self-compassion was used.

Figure S3.B5

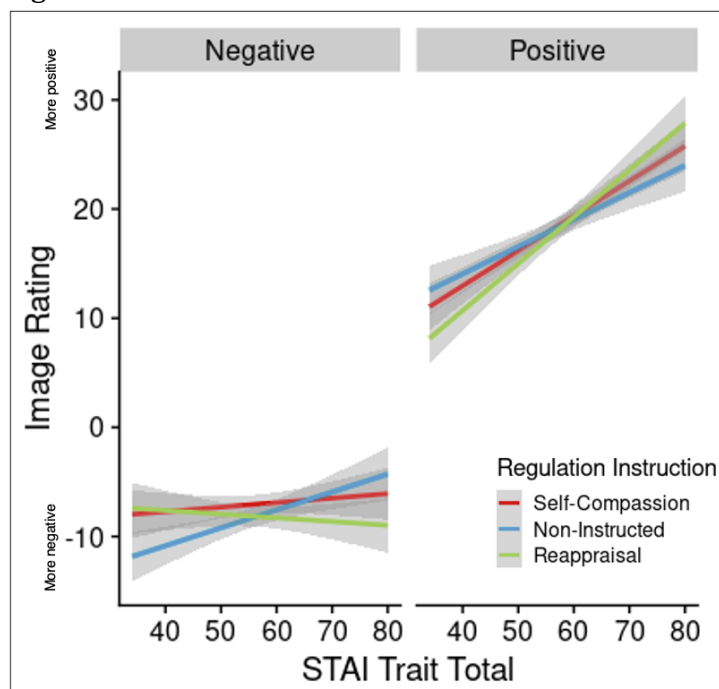


Figure S3.B5. Interaction of image valence, regulation strategy, and total anxiety (continuous STAI Trait total score). Brackets indicate *confidence interval*.

Sensitivity Analyses

Income. With the addition of income as a covariate, the maltreatment *severity* three-way interaction remained significant ($F(2,16536.2)=4.4, p=0.01$), and several effects emerged as significant that were not previously significant. The interaction of CTQ and regulation instruction became significant ($F(2,16564.8)=3.87, p=0.021$), as did main effects for regulation instruction ($F(2,16565.7)=4.83, p<0.01$) and total maltreatment severity

($F(875.3)=11.77, p<0.001$). The interaction of maltreatment severity and regulation strategy had a converging effect on image ratings. At low levels of severity, reappraisal had the least extreme ratings, and self-compassion had the most extreme ratings, and non-instructed trials had intermediate ratings. As severity increased, the ratings appeared to converge and became similarly effective. The main effect of income was not significant ($F(1,169.8)=0.12, p=0.7$).

Several effects also emerged following the addition of income in the maltreatment *exposure* models. The three-way interaction of maltreatment exposure, valence, and regulation instruction became trending, $F(2,16535.9)=2.45, p=0.08$. Significant two-way interactions of valence and maltreatment exposure ($F(1,16535.7)=14.867, p<0.001$) and the interaction of valence and regulation strategy ($F(2,16535.9)=3.43, p=0.03$) emerged, as did a main effect of maltreatment exposure ($F(1,1320.8)=9.33, p<0.01$). In the two-way interaction of valence and maltreatment exposure, maltreated individuals rated negative images as less negative than their non-maltreated counterparts, while both groups rated positive images similarly. The main effect of CTQ maltreatment also indicated that maltreated individuals rated negative images less negatively than non-maltreated participants. The main effect of income was not significant ($F(1,170.9.8)=0.13, p=0.72$).

Education. The addition of level of education as a covariate maintained the significant three-way interaction of maltreatment severity, valence, and regulation instruction ($F(2,16817.3)=4.25, p=0.014$). Additional significant effects that emerged included the interaction of instruction and maltreatment severity ($F(2,16848.4)=3.42, p=0.03$), regulation strategy ($F(2,16848.7)=4.36, p=0.013$), and a main effect of maltreatment severity ($F(1,604.2)=6.89, p<0.001$). Level of education also had a significant

main effect ($F(7,196.4)=2.88, p<0.01$) on post-image ratings. When we compared across the education categories, there was a significant difference between ratings in those who acquired a bachelor's degree and those with acquired just a high school diploma ($p=0.016$), and trending differences between those who acquired a graduate degree and those who just acquired a high school diploma ($p=0.079$). Those with just a high school diploma had less extreme ratings than those with both bachelors and more advanced degrees.

The addition of level of education also revealed several significant effects. Similar to the income model, the three-way interaction of maltreatment exposure, valence, and regulation strategy became trending with the addition of education as a covariate ($F(2,16817.2)=2.55, p=0.78$). Additional significant interactions emerged for valence and maltreatment exposure ($F(1,16816.9)=12.29, p<0.001$), valence and regulation strategy ($F(2,16817.2)=3.33, p<0.01$). Significant main effects emerged for maltreatment exposure ($F(1,786.1)=7.7, p<0.01$) and level of education ($F(7,193.4)=2.79, p<0.01$). The direction of all effects are as described previously.

Together, these sensitivity analyses provide enhance the previous models, and provide additional support for our hypotheses. Across all models, all previously significant effects remained significant, and several interactions emerged as significant. When interacting with only maltreatment severity, self-compassion appears to be associated with the most extreme ratings at lower levels of maltreatment, while reappraisal use results in the least extreme ratings. However, these interaction effects fail to accommodate valence, and these differences may be driven by the more intense positive emotions observed in the significant 3-way interaction with maltreatment severity. Interestingly, we also found that the three-way interaction with maltreatment exposure became trending in both sets of

sensitivity analyses. These findings also indicate unique traits found in those with maltreatment in self-reported emotions – notably that those with maltreatment exposure reported less negative emotions than their non-maltreated counterparts.

Discussion

In our supplemental analyses, we observed significant effects of abuse *exposure* and neglect *severity* on post-image ratings. In these models, those who experienced abuse reported more extreme positive emotions than those without an abuse history. These findings are interesting, as they replicate findings from Wooten et al. (2022). We fully describe potential explanations for these findings in our primary discussion, but we propose these could be due to sampling- or stimulus-related factors. These findings should be explored in greater depth and warrant further research to determine the precise mechanisms at work. Our results for neglect indicated a negative relationship between and image rating, and showed that those with greater rates of neglect experienced less extreme emotions. These findings fall in line with previous findings, as youth who experience neglect report greater emotional dysregulation and difficulty identifying emotions and expressions, which could manifest as muted emotional expressions. This effect also follows those expected based on diagnostic features of PTSD, where there is emotional restriction following experiences of trauma (American Psychiatric Association, 2013).

Our models examining perceived effectiveness did not reveal a significant relationship between perceived effectiveness and image ratings. However, we observed significant relationships predicting effectiveness from the interaction of strategy and both maltreatment and abuse. Interestingly, we observed effects in opposite directions, with greater maltreatment severity associated with less perceived effectiveness, and greater

abuse severity associated with greater perceived effectiveness. We anticipated that both would influence emotions in the same direction, making these unexpected results. Instead, total maltreatment and neglect severity effects were in the same direction, and total abuse had an opposite effect. These differences observed in abuse effects are likely driven by the unique enhancement of positive emotions, which are likely biasing the direction of the results.

We observed some interesting effects of anxiety and depression severity on the use of these strategies. While depression did not appear to have a significant effect on strategies, there was a significant interaction with anxiety severity. It appears that self-compassion results in the most consistent emotional ratings across negative emotions, which resembles the effects of our maltreatment and abuse severity findings. These consistent findings also support self-compassion as the most robust strategy in the context of negative emotions. Our findings support previous research demonstrating that self-compassion is effective at managing anxiety, but not depression (Bosley et al., 2019; Sewart et al., 2019; Taylor et al., 2017, 2023). One explanation for these findings posits that anxiety requires less attentional and cognitive resources than depression, which makes more antecedent-based approaches like acceptance and self-compassion more effective at managing the anxiety (Wolgast et al., 2011). In this way, anxiety can be addressed more like an emotion using these strategies, making the skills one learns to address anxiety apply to emotions in a more synergistic manner. On the other hand, depression relies on more enduring negative thoughts and feelings, which would require alternative strategies and skills.

Finally, our models examining what participants did during the non-instruction condition revealed that suppression had the strongest relationship with ratings for these trials. These provide interesting insights into our other model results, indicating that many of the non-instructed trials may be more representative of suppression than other strategies. If this is in fact true, then in the models where self-compassion performed like non-instructed trials, both strategies may involve some disengagement from the emotional material. However, the process of disengagement may differ between the strategies, with suppression taking a more active form of disengagement and self-compassion taking a more passive approach through non-judgmental acceptance. Alternatively, participants may have related more strongly to the non-judgmental acceptance portion of the instructions and decided to lean into that component of self-compassion compared to the more cognitive components of common humanity and self-kindness. This further highlights a limitation of a single instance of instruction for self-compassion, which involves a complex interplay of all three components. The exact mechanism and processes underlying both strategies would benefit from further investigation.

APPENDIX C. CHAPTER 4 SUPPLEMENT

Supplemental Materials

Regulation Task Instructions

Reframe. When we ask you to REFRAME, we would like you to work with your thoughts to change your sensations and feelings. We would like you to rethink the way you are reacting to the picture so it is more neutral (less positive or negative) for you. This is not just telling yourself "it doesn't matter", or "I'm not feeling this emotion." Instead, change your reaction by finding a different way to think about the picture. You may imagine another point of view or another way to interpret what is happening in the image. Find a new, specific, and believable narrative so that your emotional reaction is more neutral (less negative or positive).

Compassion. When you see the instruction USE SELF-COMPASSION, begin by simply noticing how you've reacted to the picture. Try to notice how your feelings show up in your posture, facial expression, and other parts of your body. Imagine yourself receiving help or support from someone else to calm yourself so your emotions are easier to control and more neutral (less negative or positive). Recognize that your emotions are felt by everyone, and that you are not alone when you feel this way. Give yourself the support you feel you need in this moment to experience these emotions. You can tell yourself "I can do this. I can get through this emotion. I've done this before."

Non-Instructed. When you see the instruction REACT NATURALLY, let yourself respond in whatever way is most natural to you. Allow yourself to have the thoughts and feelings you would normally have when looking at the picture. If you would normally start to feel one way about a picture then try to change it with thoughts, go ahead and do that. If

you would normally try not to think about the picture, that is okay too. React in whatever way is most natural for you as long as you keep paying attention to the screen without looking away.

Additional instructions:

We will ask you to use one strategy with a series of pictures. Each picture will be on the screen for 5 seconds. Please look at the screen and picture the whole time it is on the screen.

Supplemental Analyses – The Impact of Baseline Affect on Symptom Change Background

When examining symptom change relative to emotions, an additional aspect that should be considered is baseline levels of emotions – meaning emotions at a single timepoint can predict symptom presentation later. Generally, higher levels of negative affect and low levels of positive affect result in slower rates of recovery from depression and anxiety (Forbes et al., 2012). However, these findings are inconsistent across disorders, as others have found that a greater propensity to experience positive affect at one timepoint predicts larger reductions in anxious symptoms, but not depressive symptoms (Bosley et al., 2019; Sewart et al., 2019; Taylor et al., 2017, 2023). This research has also occurred almost exclusively in adults, resulting in little exploration of these processes in youth. Assessing for baseline effects of emotion are important, since they can shift the amount of impact that these strategies can have on emotions and informs prognoses for treatment outcomes.

In our supplemental analyses we hope to explore additional factors that may affect symptom change by exploring the role of baseline affect on symptom change between

study visits; building off the idea that emotions at one time influence symptom presentation at a later time. We anticipate that youth who express less intense emotions in the task through both self-reported emotions and SCRs in response to negative emotions will experience greater symptom improvement compared to those who have greater responses. Conversely, youth who exhibit greater positive affect or SCRs in response to positive affect will experience greater symptom improvement at the follow-up visit.

Methods

Statistical Analyses

Symptoms change related to baseline affect hypotheses

To test the hypothesis relating baseline levels of affect with changes in symptoms over time, a series of LMEs were run predicting depression and anxiety symptoms change (difference between the baseline and follow-up timepoint in PROMIS measures) from the measured emotion at the baseline visit (self-reported emotion, HRV, SCR) interacted with valence. Age, sex, and baseline symptoms covariates matched those set for the dependent variable and included the appropriate random effects structure similar to that described above. The random effects structure was adjusted as needed to achieve proper model convergence, and again subset the data according to valence if severe issues occurred while reaching model convergence.

Results

Symptoms change related to baseline affect hypotheses

Changes in depressive symptom severity. The models predicting depression change from self-report emotional ratings were also subset by valence due to challenges reaching model convergence. No interaction effects were significant. In negative image

trials, significant main effects emerged for baseline depression severity, $F(1,762.8)=47.08$, $p<0.001$, and sex, $F(1,758.81)=173.55$, $p<0.001$. In positive image trials the same significant main effects of baseline depression ($F(1,762.99)=28.5$, $p<0.001$) and sex ($F(1,759.16)=201.09$, $p<0.001$) were observed. Males reported worsening depressive symptoms, while females appeared to improve. Those with greater baseline depressive symptoms experienced worsening symptoms at the follow-up visit, while those with less severe baseline symptoms experienced symptom improvement.

The model using SCR to predict depressive symptom change successfully ran without subsetting by valence, however no significant effects survived FDR correction. The similar HRV models also ran without subsetting by valence. No interactions emerged as significant, but a significant unique main effect emerged for baseline HRV ($F(1,1517.9)=55.16$, $p<0.001$) beyond the expected main effects of baseline depression and sex. In the sample, those with higher baseline HRV reported increases in depressive symptoms compared to those with lower baseline HRV.

Changes in anxiety symptom severity. Like the depression change analyses, the anxiety models predicting anxiety symptom change from self-reported emotional ratings were subset by valence. No interactions emerged as significant. Several main effects emerged in negative trials, including baseline anxiety ($F(1,761.09)=236.9$, $p<0.001$), sex ($F(1,759.2)=8.71$, $p=0.029$), and age ($F(1,762.19)=10.56$, $p=0.016$). In positive trials, there was a significant main effect of baseline anxiety ($F(1,755.12)=345.45$, $p<0.001$) and sex ($F(1,759.01)=11.62$, $p<0.01$). Participants who were older at baseline reported less severe symptoms at the follow-up visit. Males reported stable or worsening symptoms, while

females reported improvement in symptoms. Participants with greater baseline anxiety experienced minor increases in symptom severity over the course of the study.

The SCR models successfully ran without subsetting by task valence. No interactive effects were significant, though we observed a unique trending effects of baseline SCR on anxiety change ($F(1,293.9)=8.38, p=0.055$) accompanied the expected main effect of baseline anxiety and trending main effect of age. Those with greater skin conductance reactions at baseline experienced increases in anxiety symptoms at the follow-up visit. The HRV model ran would not run without being subset by valence. No significant interactive effects emerged, and no unique main effects emerged beyond the main effects of age and sex as described previously.

Discussion

In these supplemental analyses, we also observed significant main effects of baseline symptomatology and sex on changes in both depressive and anxiety symptoms over time. We observed that those with more severe symptoms at the baseline visit were more likely to have worse symptoms at the follow-up visit compared to youth who less severe symptoms at baseline. These findings match previous findings showing that more severe cases of most disorders are often less responsive to treatment. For instance, research on different patterns of symptom severity indicate that weakest responders to treatment report greater levels of baseline symptoms, less coping skills, and lower well-being (Terrill et al., 2023). Findings in adolescents observed similar patterns as well (Brière et al., 2016; Fiorini et al., 2022). Given that the current sample drew from youth who experienced extreme emotional reactions and potentially chronic suicidality, these symptoms are likely

persistent and enduring, resembling chronic conditions. These are typically treated using third-wave therapies such as DBT (Linehan, 1993).

These supplemental findings also revealed age-related effects for anxiety, but not depressive symptoms. We found that youth who were older at baseline were more likely report improvements in symptom severity at the baseline. These age-related differences may be attributed to the fact that older youth are more likely to be engaged in treatment, have been in treatment for a longer period of time, and have more life experiences. Therefore, they are more effective at using a variety of regulation strategies. Meta-analytic findings support developmental changes in the ability to use different regulation strategies, as youth begin to adopt more cognitive, relaxation, and peer support with age (Compas et al., 2017b). Due to the heavy emphasis on cognition, peer perspective-taking and acknowledgement, and more, self-compassion may be a strategy that emerges later than others developmentally without specific training or experiences (Neff, 2003).

We also observed a significant effect of sex on symptom change in both males and females. In this sample, males reported worsening depressive and anxiety symptoms compared to females. These findings also mirror previous findings in which males have greater odds of falling into a persistent, high-symptom trajectory (Brière et al., 2016; Fiorini et al., 2022). One explanation for this difference may come from the onset of symptoms across males and females. Females often begin to experience symptoms at younger ages than their male counterparts, which may prompt beginning treatment earlier. By engaging in treatment earlier, females begin to stabilize their symptoms earlier, while males are just beginning to experience symptoms and may just be entering treatment.

Another important factor when examining symptom change is the amount of therapy sessions attended, as many treatments have a dosage-response effect to maximize therapeutic benefits (Robinson et al., 2020). This is particularly relevant for the present study, as aspects of specific approaches of psychotherapy may influence our variables. More specifically, engagement in Cognitive Behavioral Therapy (CBT) may influence the ability to use reappraisal as an emotion regulation strategy, since the cognitive reappraisal tactics emphasized in CBT and the regulation strategy have considerable overlap, and CBT tends to increase trait reappraisal (Jazaieri et al., 2017). Third-wave approaches to CBT, such as Dialectical Behavior Therapy (DBT) and Acceptance and Commitment Therapy (ACT) emphasize acceptance are also likely to influence the use of engagement-related strategies through decreased avoidance (Neacsiu et al., 2014). While we collected information regarding the number of sessions a participant attended over the course of the study, we did not use this data in our analyses. We did not get much detail about what approaches a participant's therapist took toward treatment (meaning a CBT-based approach, or third-wave approach), which makes generating inferences about this information challenging. In addition, we were hesitant to incorporate the number of sessions as an additional covariate in sensitivity analyses given the difficulty we experienced in achieving model convergence. However, we acknowledge that this is an important variable that should be considered in research in this area, and future research could incorporate this into their models.

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