

Emotion Regulation in the Face of Loss: How Detachment, Positive Reappraisal, and Acceptance Shape Experiences, Physiology, and Perceptions in Late Life

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How individuals regulate emotions in the face of loss has important consequences for well-being and health, but we know little about which emotion regulation strategies are most effective for older adults for whom loss is ubiquitous. The present laboratory-based study examined effects of three emotion regulation strategies (i.e., detachment, positive reappraisal, or acceptance in response to film clips depicting loss) on subjective emotional experiences, physiology, and perceptions of emotion regulation success and motivation in healthy older adults ($N = 129$, age range = 64–83). Results showed that, first, detachment decreased emotional experiences across the board; positive reappraisal decreased negative and increased positive emotional experiences; while acceptance did not alter emotional experiences. Second, detachment decreased physiological arousal (driven by increases in interbeat interval and decreases in respiration rate) whereas positive reappraisal and acceptance did not alter physiological arousal compared with “just watch” trials. Third, individuals felt most successful and willing to put forth their best effort when implementing acceptance, while they felt least successful and least willing to put forth their best effort for positive reappraisal. These findings illuminate longstanding discussions regarding how individuals can best regulate emotions in the face of loss. They show that older adults can regulate their emotional experiences and (to a lesser extent) their physiology with detachment numbing emotional experiences and decreasing physiological arousal; positive reappraisal brightening emotional experiences; and acceptance resulting in the highest perceptions of success and motivation. Thus, each emotion regulation strategy appears to be most effective in specific domains for older adults.

Keywords: emotion regulation, detachment, positive reappraisal, acceptance, aging

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Individuals experience losses across the life span, and especially so in late life when loved ones pass away, physical health declines, and earlier sources of meaning (e.g., career) lose relevance. Irrevocable loss is a powerful trigger for negative emotions, such as sadness (Lazarus, 1991). Numerous studies show that it is paramount for individuals to regulate negative emotions to maintain well-being and health (Aldao et al., 2010; Gross & John, 2003). However, what is the best way to do so? Philosophers and psychologists have long searched for the best strategies to regulate

negative emotions. Some approaches (cf. Gross, 1998b) emphasize the benefits of adopting an unemotional, neutral perspective (i.e., *detachment*). Other approaches (e.g., cognitive-behavioral therapy; Beck, 2005; see also Ford & Troy, 2019) emphasize the benefits of positively reframing situations (i.e., *positive reappraisal*). Yet, other approaches (e.g., Buddhism; Ekman et al., 2005; Christianity; Grecucci et al., 2015) emphasize the benefits of embracing negative emotional experiences (i.e., *acceptance*). All of these emotion regulation strategies are thought of as effective,

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but we know little about (a) their effects relative to each other and (b) in a population for whom losses are ubiquitous—older adults. The present study is, to our knowledge, the first to comprehensively compare effects of detachment, positive reappraisal, and acceptance in response to film clips depicting loss on emotional experiences, physiology, and perceptions of emotion regulation success and motivation in late life.

Effective Emotion Regulation

What is the best way to regulate negative emotions (e.g., when confronted with loss)? To answer this question, experimental studies (see Table 1) commonly examine effects on specific emotion response systems (e.g., subjective emotional experience, physiology) or perceptions when individuals are instructed to use a specific emotion regulation strategy compared with their “normal” reactions to emotion-eliciting stimuli.

In terms of subjective emotional experience, emotion regulation strategies are often seen as effective when they decrease negative emotions (e.g., sadness) and/or increase positive emotions (e.g., happiness). This reflects views that deem negative emotions undesirable and positive emotions desirable (Larsen, 2000; Fredrickson & Joiner, 2002) and link them to maladaptive and adaptive long-term health outcomes, respectively (Dockray & Steptoe, 2010; Kubzansky & Kawachi, 2000).

In terms of physiology, emotion regulation strategies are often seen as effective when they reduce autonomic physiological arousal (i.e., decrease sympathetic and/or increase parasympathetic activation reflected in a slowing of heart rate or respiration rate; Levenson, 2014). This reflects views that implicate autonomic physiological arousal in emotional responding (e.g., Jamieson et al., 2012; Thayer & Lane, 2009) and physiological arousal in long-term health outcomes (Dockray & Steptoe, 2010; Kubzansky & Kawachi, 2000).

In terms of perceptions, emotion regulation strategies are often seen as effective when individuals perceive that they can successfully implement the strategy and when they are motivated to do so (Shiota & Levenson, 2012; Troy et al., 2018). This reflects views that deem perceived success and motivation as critical for informing emotion regulation interventions (Liang et al., 2017; Urry & Gross, 2010).

Effects of Detachment, Positive Reappraisal, and Acceptance

Detachment, positive reappraisal, and acceptance are emotion regulation strategies that all involve different forms of cognitive change (cf. Gross, 2013), or in other words, different ways of altering your thoughts about an emotional situation. They are all thought of as effective, but there is surprising variation in how they affect emotional experiences, physiology, and perceptions; and surprisingly little research that has compared their effects to one another (for an overview of studies examining at least two of these strategies see Table 1).

Detachment

Detachment involves changing thoughts about a situation to be more unemotional and objective to decrease negative (or overall) emotion (e.g., Gross, 1998a; Shiota & Levenson, 2009). Detach-

ment (originally called “reappraisal”; Gross, 1998a) was the first of the three strategies to be studied experimentally and is still the most commonly studied cognitive change strategy today. Detachment instructions, at their core, ask participants to adopt an unemotional, objective perspective (Gross, 1998a; Shiota & Levenson, 2009), but more recent instructions have also added components of taking a third-person perspective (Ayduk & Kross, 2008). Laboratory-based studies show that detachment (a) reduces negative emotional experiences (e.g., Gross, 1998a; Liang et al., 2017; Shiota & Levenson, 2012; Wolgast et al., 2011) and (b) decreases physiological arousal in some studies (e.g., heart rate, RSA, SCL; Ayduk & Kross, 2008; Denson et al., 2011; Liang et al., 2017; Wolgast et al., 2011) but not others (e.g., Gross, 1998a; see “reappraisal via perspective taking” in Webb et al., 2012). Moreover, (c) individuals perceive themselves as quite successful when implementing detachment (Powers & Labar, 2019).

Positive Reappraisal

Positive reappraisal involves changing thoughts about a situation to be more positive to decrease negative emotion (e.g., Shiota & Levenson, 2009). Laboratory-based studies show that positive reappraisal (a) decreases negative emotional experiences and increases positive emotional experiences (e.g., McRae et al., 2012; Troy et al., 2018); (b) changes physiological arousal in some studies (e.g., McRae et al., 2012; Troy et al., 2018) but not others (e.g., Shiota & Levenson, 2012; see “reappraise emotional stimulus” in Webb et al., 2012); and (c) may be quite difficult to implement (Troy et al., 2018).

Acceptance

Acceptance involves embracing the emotional response while encouraging thoughts about the emotional reaction to be accepting and nonjudgmental (Ford et al., 2018). Laboratory-based studies show that acceptance (a) decreases negative experiences in some studies (e.g., Vishkin et al., 2020; Wolgast et al., 2011) but not others (e.g., Campbell-Sills et al., 2006; Dunn et al., 2009; see Kohl et al., 2012); (b) leads to adaptive physiological responses (e.g., heart rate, RSA, SCL change; Campbell-Sills et al., 2006; Cristea et al., 2014; Dunn et al., 2009; Troy et al., 2018); and (c) may be easier, preferable, and perceived as more effective to implement in sad contexts (Troy et al., 2018; Vishkin et al., 2020).

Open Questions

Despite burgeoning interest in emotion regulation in general and cognitive change strategies specifically, there are several open questions.

What Is the Best Strategy?

As can be seen in Table 1, no study to date has examined detachment, positive reappraisal, and acceptance together. Moreover, those studies that have compared two of these strategies have sometimes yielded mixed findings. In terms of effects on *experience*, some studies find that detachment is more effective at decreasing negative emotions than positive reappraisal (Shiota & Levenson, 2012) or acceptance (Wolgast et al., 2011), while other studies find that detachment is less effective than (Liang et al., 2017) or not different from (McRae et al., 2012) positive reappraisal. Similarly, some studies find that acceptance is less effective

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Table 1
List of Experimental Studies Comparing Effects of Detachment, Positive Reappraisal, and/or Acceptance on Emotion Response Systems

Study	Strategy	Design	Sample	Emotion response systems			Effects of emotion regulation strategies			
				Emotion elicitor	Experience	Physiology	Perception	Other	Direct comparisons	Differences from just watch/baseline
Liang et al. (2017)	Detach and PosReap	Within	N = 41 older adults; $M_{age} = 62.65$	Negative IAPS images	Valence	HR, EDA	—	—	(Exp) <i>Detach</i> and <i>PosReap</i> : NA ↓ Δ ↓	(Exp) <i>Detach</i> and <i>PosReap</i> : NA ↓ (Phys) <i>Detach</i> : HR and EDA ↑ (Exp) <i>Detach</i> : Intensity ↓ (Phys) n.s. (Other) n.r.
Shiota and Levenson (2009, 2012)	Detach and PosReap	Mixed	N = 146 (~49 per strategy group) young, middle-aged, older adults; age range = 20–69	Sad and disgust film clips	Valence, intensity, sadness, disgust, amusement, compassion	Composite of IBI and arterial pressure	Success	Facial expressions	(Exp) <i>Detach</i> > <i>PosReap</i> : Combined sadness, disgust, amusement, compassion Δ ↓ (Phys) n.s. (Per) n.s. (Other) <i>Detach</i> > <i>PosReap</i> : Facial expressions Δ ↓	(Exp) <i>Detach</i> > <i>PosReap</i> : PA ↑, NA ↓, arousal ↓ (Phys) <i>Detach</i> and <i>PosReap</i> (combined): SCL ↓ (effect driven by <i>Detach</i>)
McRae et al. (2012)	Detach (“decrease negative”) and PosReap (“increase positive”)	Mixed	N = 58 (~29 per strategy group) female college students; $M_{age} = 23.2$	Negative IAPS images	Negative, positive, arousal	SCL	—	—	(Exp) <i>Detach</i> and <i>PosReap</i> : PA ↑, NA ↓, arousal ↓ (Phys) <i>Detach</i> and <i>PosReap</i> (combined): SCL ↓ (effect driven by <i>Detach</i>)	(Exp) <i>Detach</i> and <i>PosReap</i> : PA ↑, NA ↓, arousal ↓ (Phys) <i>Detach</i> and <i>PosReap</i> (combined): SCL ↓ (effect driven by <i>Detach</i>)
Ochsner et al. (2004)	Detach (“self-focused”) and PosReap (“situation focused”)	Mixed	Ns = 24 (12 per strategy group) females; $M_{age} = 20.6$	Negative IAPS images	Negative	—	—	Brain activation	(Exp) <i>Detach</i> and <i>PosReap</i> : NA ↓ (other) <i>Detach</i> and <i>PosReap</i> : prefrontal/anterior cingulate regions ↑, amygdala ↓	(Exp) <i>Detach</i> and <i>PosReap</i> : NA ↓ (other) <i>Detach</i> and <i>PosReap</i> : prefrontal/anterior cingulate regions ↑, amygdala ↓
Wolgast et al. (2011)	Detach (“reappraisal”) and Accept	Between	N = 94 (~31 per strategy group) college students; $M_{age} = 20$	Sad, disgust, and fear film clips	Disgust, sadness, fear	SCL	Success	EMG, avoidance tendency	(Phys) <i>Detach</i> > <i>Accept</i> : SCL ↓ for disgust film clips; else = n.s. (Perc) n.r. (other) <i>Detach</i> > <i>Accept</i> : EMG ↓ for disgust film clips; else = n.s. <i>Detach</i> and <i>Accept</i> : Avoidance tendencies ↓	(Exp) <i>Detach</i> > <i>Control</i> : Sadness and fear ↓ <i>Detach</i> vs. <i>Accept</i> > <i>Control</i> : Disgust ↓, else = n.s. (Phys) <i>Detach</i> and <i>Accept</i> > <i>Control</i> : SCL ↓ for disgust and EMG activation ↓

(table continues)

Table 1 (continued)

Study	Strategy	Design	Sample	Emotion elicitor	Emotion response systems				Effects of emotion regulation strategies	
					Experience	Physiology	Perception	Other	Direct comparisons	Differences from just watch/baseline
Troy et al. (2018)	PosReap ("reappraisal") and Accept	Within	Sample 1: $N = 77$ first-year college students; $M_{age} = 18.3$ Sample 2: $N = 65$ adults; $M_{age} = 26.6$	Sad film clips	Sadness, negative, positive	SCL	Effort (similar to motivation), difficulty, success	—	Sample 1: (Exp) $PosReap >$ $Accept$; Sadness $\Delta \downarrow$, Positive emotion $\Delta \uparrow$, NA = n.s. (Phys) $PosReap >$ $Accept$; SCL $\Delta \downarrow$ (Per) $PosReap >$ $Accept$; Difficulty $PosReap <$ $Accept$; Success; effort = n.s. Sample 2: (Exp) $PosReap >$ $Accept$; Sadness $\Delta \downarrow$, negative emotion $\Delta \downarrow$, positive emotion $\Delta \uparrow$ (Phys) n.s. (Per) $PosReap >$ $Accept$; Difficulty $PosReap <$ $Accept$; Success; effort = n.s.	—
Cristea et al. (2014)	PosReap ("reappraisal") and Accept	Mixed	$N = 193$ (~30 per strategy group) socially anxious participants; $M_{age} = 20.19$	Speech task	—	HR, RSA	—	—	(Phys) $PosReap$ = effort = n.s. $PosReap = Accept$: n.s.	(Phys) $PosReap$ and $Accept$: \downarrow HRV and \uparrow HR
Szasz et al. (2011)	PosReap ("reappraisal") and Accept	Mixed	$N = 73$ (~24 per strategy group) college undergraduates; $M_{age} = 22.3$	Anger memory recall	Anger	—	—	Frustration tolerance	(Exp) $PosReap >$ $Accept$; Anger $\Delta \downarrow$ (Other) $PosReap >$ $Accept$; Persistence on frustrating task	(Exp) $PosReap$ and $Accept$: Anger \downarrow

(table continues)

Table 1 (*continued*)

Study	Strategy	Design	Sample	Emotion elicitor	Emotion response systems				Effects of emotion regulation strategies	
					Experience	Physiology	Perception	Other	Direct comparisons	Differences from just watch/baseline
Hofmann et al. (2009)	PosReap ("reappraisal") and Accept	Between	N = 201 (~67 per strategy group) college undergraduates; M _{age} = 19.6	Speech task	Anxiety	HR	—	—	(Exp) PosReap = Accept: n.s. (Phys) PosReap = Accept: n.s.	—
Vishkin et al. (2020)	PosReap ("reappraisal") and Accept	Within	Sample 1 (Study 3): N = 66 college undergraduates; M _{age} = 23.98 Sample 2 (Study 4b): N = 98 MTurk workers; M _{age} = 36.77 Sample 3 (Study 4c): N = 98 MTurk workers; M _{age} = 34.50	Sad and fear vignettes	Composite of fear, sadness, anger, and disgust	—	Efficacy, effort	—	Sample 1: (Exp) PosReap > Accept: negative composite during fear vignettes Δ ↓ PosReap = Accept: Negative composite during sad vignettes Δ ↓ Sample 2: (Per) PosReap > Accept: Efficacy for fear vignettes PosReap < Accept: Efficacy for sad vignettes Sample 3: (Per) PosReap > Accept: Effort for fear vignettes PosReap < Accept: Effort for sad vignettes	Sample 1: (Exp) PosReap and Accept: ↓ negative composite for sad and fear vignettes

Note. Detach = detachment; PosReap = positive reappraisal; Accept = acceptance; Δ = change in; n.s. = nonsignificant; n.r. = not reported; (Exp) = experience; (Phys) = physiology; (Per) = perceptions; NA = Negative Affect; PA = Positive Affect; HR = heart rate; RSA = respiratory sinus arrhythmia; SCL = skin conductance level; EMG = electromyography; IAPS = International Affective Picture System; MTurk = Amazon Mechanical Turk. This table includes all studies (to our knowledge) that compared at least two emotion regulation strategies of interest (i.e., detachment, positive reappraisal, or acceptance) with each other. Strategies were categorized based on definitions used in the present study. Strategy names in parentheses and quotes indicated what the strategies were called in the original study.

tive in decreasing negative target emotions and increasing positive emotions than positive reappraisal (Troy et al., 2018; Szasz et al., 2011), while other studies show no differences (Hofmann et al. 2009). In terms of effects on *physiology*, some studies show that detachment is more effective at downregulating physiological arousal (compared with positive reappraisal, Liang et al., 2017; McRae et al., 2012; acceptance, Wolgast et al., 2011), but not others (Shiota & Levenson, 2012). Similarly, acceptance has been shown to be more effective in altering physiological arousal in some studies (compared with positive reappraisal; Troy et al., 2018), but not others (equivalent to positive reappraisal, Cristea et al., 2014; Hofmann et al., 2009). In terms of effects on *perceptions*, participants have reported more success and less difficulty when implementing acceptance in comparison with positive reappraisal (Troy et al., 2018), while other research has reported no differences in perceived success between positive reappraisal and detachment (Shiota & Levenson, 2012). Thus, while we know these strategies are effective compared with nothing, we know little about how effective they are relative to one another.

What Works Best in Late Life?

The vast majority of existing studies have focused on emotion regulation in younger adults (e.g., seven out of the nine studies summarized in Table 1 included samples with an average age under 30). Understanding emotion regulation in young adults is important, but there is a critical need to understand what emotion regulation strategies might work best for older adults who experience losses regularly and need to regulate the resulting emotions (Heckhausen et al., 2019). Older adults are highly motivated to regulate emotions to minimize negative and maximize positive emotion (Carstensen et al., 2003) and avoid highly arousing emotional states (Charles, 2010). At the same time, emotion regulation can be quite difficult for older adults because of cognitive decline and reduced physiological plasticity (Charles, 2010) and the consequences of ineffective or maladaptive emotion regulation can be dramatic in late life (e.g., predicting increased mortality; Chapman et al., 2013).

How Do Detachment, Positive Reappraisal, and Acceptance Shape Emotional Experiences, Physiology, and Perceptions?

Existing studies have provided important insights (see Table 1), but they have often been limited in their scope of emotional experience assessments (e.g., measuring just the target emotion), have often examined one or two physiological measures (e.g., measuring just SCL), and have rarely assessed perceptions of emotion regulation success and motivation. Perhaps, more comprehensive assessments might be able to reconcile the mixed findings from earlier studies (see Table 1).

The Present Study

The present laboratory-based study examined effects of detachment, positive reappraisal, and acceptance in response to film clips depicting loss on emotional experiences, physiology, and perceptions in 129 healthy older adults (age 64–83). Based on prior research (see Table 1), we expected all strategies to be effective in (a) decreasing negative and/or increasing positive emotional experiences and (b) decreasing physiological arousal

in comparison with trials where individuals were not instructed to regulate emotions (i.e., just watch). We also expected individuals to (c) feel successful and motivated to implement these strategies. Given the limited and mixed findings (see Table 1), we did not formulate a hypothesis as to which strategy would be most effective but instead sought to comprehensively compare them in terms of effects on experience, physiology, and perceptions.

The study had several methodological strengths by (a) comparing the effects of detachment, positive reappraisal, and acceptance to each other as well as just watch trials; (b) examining emotion regulation in response to well-established film clips depicting loss (Gross & Levenson, 1995); (c) comprehensively assessing a breadth of positive and negative emotional experiences (i.e., anger, disgust, fear, compassion, happiness, calm, and excitement); (d) assessing physiological arousal sampling across major organ systems (i.e., via measures of heart rate, respiration rate, skin conductance, parasympathetically mediated heart rate variability, sympathetically mediated ventricular contraction, stroke volume, and cardiac output; defined by decreased sympathetic and increased parasympathetic activation, Levenson, 2014); (e) assessing perceptions of emotion regulation success and motivation; and (f) using a within-subjects design in a sizable sample ($N = 129$) of healthy older adults.

Method

Participants

The study was approved by the Institutional Review Board (IRB) of Northwestern University (IRB ID: STU00205547) and included a sample of 129 healthy older adults (age range = 64–83) from the greater Chicago area (age: $M = 71.56$ years, $SD = 4.42$; 51.16% female; 79.84% White; 10.85% African American; 0.78% Hispanic; 2.34% Asian American; 93.80% with at least 2 years of higher education; 69.78% with an annual income of \$50,000 to \$75,000 or less). Analyses using Gpower (Faul et al., 2007) revealed that, with this sample size, an alpha level of .05, statistical power of .80, and two-tailed testing, we were able to detect small to medium-sized effects in repeated-measures (multivariate) analysis of variances ([M]ANOVAs). Telephone screening excluded participants who (a) scored <16 on the Adult Lifestyle Functional Interview-Mini Mental State Examination (Mini-MMSE); (b) scored >17 on the Center for Epidemiological Studies Depression Scale (CES-D); (c) scored >3 on the short Michigan Alcoholism Screening Test–Geriatric Version (MSAT); (d) had any vision or hearing issues severe enough to impair ability to complete study tasks; and (f) had a medical condition that would prevent their sitting comfortably in a laboratory chair for 2 hr (see Supplemental Table S1 for screening references).

Procedure

After participants arrived at the laboratory, they reviewed and signed a consent form, were seated in a comfortable chair facing a 40-in. TV monitor (ca. 3 feet away) and attached to noninvasive physiological sensors, and instructed on how to use the study keyboard positioned on a tray in front of them. At the

beginning of the study, participants completed an emotion checklist measuring their emotions “right now” (i.e., experience baseline). As shown in Figure 1, they then completed six experimental trials (three just watch and three regulation trials), which were administered via the stimulus presentation program PsychoPy (Peirce, 2007). Following established procedures (e.g., Shiota & Levenson, 2009), within each trial, participants watched (a) an “X” on the screen for 1 min (i.e., physiological baseline) and (b) a film clip depicting loss (length: $M = 2.56$ min, range = 1.43–3.35) under just watch or regulation instructions; and (c) rated their emotional experiences in response to the film clip as well as perceptions (after regulation trials). Participants also completed cognitive tasks within each trial (not analyzed here). Each trial was followed by a 20-s resting period.

Just Watch Trials

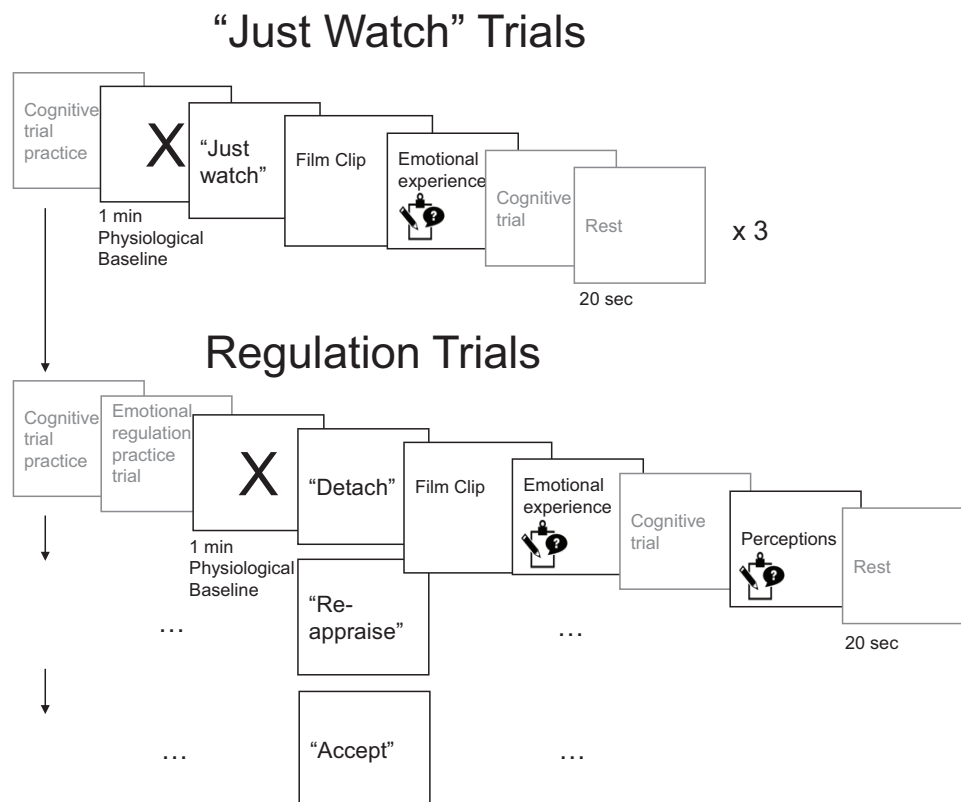
Following recommended procedures (Gyurak et al., 2009), participants first completed just watch trials to get a relatively pure and robust measure of emotional reactivity before they received any emotion regulation instructions. Participants were simply informed that they would be watching a film clip and to pay attention while watching.

Emotion Regulation Trials

For the emotion regulation trial, participants were instructed (see Appendix A for verbatim instructions) to use (a) *detachment* (i.e., mentally distance themselves from any emotional aspects of the film clip to feel less negative emotion; instruction from Shiota & Levenson, 2009); (b) *positive reappraisal* (i.e., reframe what they were watching in a more positive light to feel less negative emotion; instruction from Shiota & Levenson, 2009); or (c) *acceptance*, (i.e., let their feelings happen without struggling against them, judging them, or trying to control them; instruction from Ford et al., 2018).

Within each emotion regulation trial, participants completed a practice trial at the beginning to ensure they understood the instructions. Specifically, participants were (a) shown a picture of a woman in a hospital bed; (b) instructed to use detachment, positive reappraisal, or acceptance; and (c) asked to apply and verbalize the respective strategy in response to the picture. (d) The experimenter then entered the room to evaluate participant responses and, if the participant did not apply the strategy correctly (e.g., “I am just looking at the wall/away from the sick person.”), provided appropriate examples following a standardized protocol (e.g., detachment: “She [the woman in the hospital bed] is just an actress.”;

Figure 1
Study Design



Note. Participants completed three “just watch” and three regulation trials. Physiological measures were continuously monitored throughout the study. Baseline emotional experiences were assessed at the beginning of the study (not shown here). Trials in gray were not analyzed in the present study.

positive reappraisal: “She is just resting and may be recovering.”; acceptance: “This picture makes me sad, but that is okay.”). Once participants understood the strategy, the experimenter exited the room and the trial began. At the end of the study, participants were detached from physiological sensors, completed questionnaires, were debriefed, and received compensation.

Film Clips

Participants watched six film clips portraying irrevocable loss that had been validated in previous studies to elicit sadness, including film clips from (a) *Titanic*—a woman stranded at sea wakes up to find her love interest dead; (b) *The Champ*—a young boy watches his father’s death after a boxing match; (c) *Terms of Endearment*—two parents watch their daughter pass away in a hospital; (d) *Fatal Attraction*—a woman cries as her husband reveals to her that he cheated and impregnated another woman, as their child watches; (e) *21 Grams*—a mother learns that her two young daughters died in a car accident; and (f) *The Notebook*—two older adult lovers die in a hospital together (see [Supplemental Table S1](#) for film clip references).

Counterbalancing

The order of emotion regulation strategies and film clips was counterbalanced so that each participant implemented each strategy and watched each film clip. Specifically, emotion regulation strategies were counterbalanced following a 3×3 Latin square and film clips were counterbalanced by splitting them into two sets (set 1: *Titanic*, *Champ*, *Terms of Endearment*; set 2: *Fatal Attraction*, *21 Grams*, *Notebook*) with 50% watching the first set of film clips in the just watch trials and the second set of film clips in the regulation trials, and vice versa, resulting in six conditions total with $N = 21$ – 22 per condition. Order effects were tested by adding counterbalancing condition as a between-subjects factor into all analyses. All findings remained stable and no significant main effects of counterbalancing condition were found, $\eta_p^2 = .02$ – $.04$, $ps > .05$, showing that order effects did not influence the results. Therefore, we collapsed across conditions in our analyses.

Measures

Emotional Experience

Emotional experience was assessed at baseline (right now) and after each film clip (“during the last film clip”) using emotion checklists. Participants rated their experience of different emotions (i.e., sadness, anger, disgust, fear; compassion, happiness, calm, love, gratitude, excitement, awe; surprise; “please indicate how strongly you felt this emotion”; 0 = *not at all*, 8 = *strongest ever felt*) as well as valence (i.e., “please indicate how positive or negative you felt overall”; 0 = *negative*, 8 = *positive*) and intensity (i.e., “please indicate the overall intensity of emotion you felt”; 0 = *not intense at all*, 8 = *strongest intensity ever felt*).

To provide a focused yet comprehensive assessment of emotional experiences, our main analyses focused on sadness (the target emotion) as well as a number of other emotions that have been commonly assessed in response to film clips depicting loss (e.g., [Gross & Levenson, 1995](#); [Stellar et al., 2012](#); [Troy et al., 2018](#)), including anger, disgust, fear (as other negative emotions), compassion (as a prosocial emotion; see [Goetz et al., 2010](#)),

happiness (as a hedonic positive emotion), calm (as a low-arousal positive emotion), and excitement (as a high-arousal positive emotion). Analyses for love, gratitude, awe, surprise, valence, and intensity are reported in the [online supplemental materials](#). All results remained stable when these additional emotions were included in omnibus tests.

Physiology

Electrocardiography (ECG), respiration, electrodermal activity (EDA), and impedance cardiography (ICG) were measured through MindWare’s BioNex 8-slot chassis and recorded using Biolab Acquisition Software (MindWare Technologies LTD, Gahanna, OH). All electrode placement followed standard recommendations of MindWare Technologies LTD. All raw signals were sampled at 1,000 Hz and analyzed for artifacts using MindWare HRV Analysis 3.1.5, IMP Analysis 3.1.6, and EDA Analysis 3.1.6. All physiological measures were cleaned for artifacts (e.g., because of motion) by trained research assistants, corrected if necessary, and subsequently aggregated across the respective baseline and film clip periods. ECG, ICG, and respiration recordings were excluded for three participants because of technical difficulties.

Interbeat Interval (IBI). To capture IBI, MindWare disposable, pregelled medical ECG electrodes were placed in a lead II configuration. One electrode was placed on the bottom-left side of the ribcage, and another was placed on the right collar bone. A ground for the lead was placed on the bottom-right rib. IBI was calculated as the average time (in milliseconds) between successive R peaks.

Respiration Rate (RR). To capture respiration, an Ambu Sleepmate Piezo belt was snugly fastened below the chest. Respiration rate was calculated as the number of respiration peaks per minute.

Skin Conductance Level (SCL). To capture SCL, two MindWare disposable, pregelled EDA electrodes were placed on the palms of participants’ nondominant hands. Mean SCL was measured in microsiemens.

Respiratory Sinus Arrhythmia (RSA) and Root Mean Square of Successive Differences (RMSSD). RSA and RMSSD are indexes of heart rate variability (HRV) commonly used to measure parasympathetic activation. IBIs were extracted from the ECG signal, and HRV measures were then calculated from the IBIs using MindWare HRV Analysis. Spectral frequency bands were calculated via autoregressive techniques to assess parasympathetic influence on the heart ([Malik et al., 1996](#)), which splits ECG signals into cardiac rhythms (very low frequency, low frequency, and high frequency). RSA, a frequency domain measure of HRV, was represented by high frequency rhythms (i.e., 0.15–0.40 Hz) associated with respiration. RMSSD, a time domain measure HRV, was calculated by taking the root mean square of differences between successive R-peak to R-peak intervals.

Preejection Period (PEP) and Left Ventricular Ejection Time (LVET). PEP and LVET are measures of ventricular contraction commonly used to measure sympathetic activation ([Williams et al., 2017](#)) and were derived from ICG measures. To capture ICG signals, MindWare disposable, pregelled medical electrodes were placed in a four-lead configuration. One spot electrode was placed on the jugular notch, while another was placed just below the sternum. On the back, a third ICG electrode

was placed 1.5 in. above the upper ICG torso electrode on the jugular notch, and another was placed 1.5 in. below the lower ICG torso electrode on the sternum. ICG signals were manually examined for artifacts. B, Z, and X points were first identified from the first derivative of pulsatile changes in transthoracic impedance (dz/dt). In combination with the ECG signal (i.e., Q, R, and S points), an ensemble average was manually created by MindWare Impedance Analysis 3.1.5 software. Misidentified points on the ensemble average were manually corrected. ECG and dz/dt signal artifacts/poorly recorded data were detected and removed before the inspection of the ensemble average. Measures derived from the ensemble included PEP and LVET. PEP was calculated as the time interval from the Q-point of the ECG (i.e., the start of electrical stimulation of the heart) to the B-point of dz/dt (i.e., the mechanical opening of the aortic valve). LVET was calculated as the time period between the B-point (i.e., the opening of the aortic valve) and X-point (i.e., the closing of the aortic valve) of the dz/dt, or the length of time the left ventricle has to eject blood.

Stroke Volume (SV) and Cardiac Output (CO). Stroke volume (SV) and cardiac output (CO) were derived from the ICG measures. SV represented the amount of blood (in milliliters) pumped from the left ventricle each beat and was calculated using the Kubicek equation, which factored in a blood resistivity constant (ρ), the distance between ICG electrodes on the front torso, and average impedance. Cardiac output, which is the amount of blood pumped by the heart in liters per minute, was then calculated by multiplying stroke volume and heart rate.

Data Reduction. For each film clip that participants watched under just watch or regulation instructions, physiological arousal was measured using difference scores (i.e., to index changes in autonomic physiology from a baseline immediately preceding the film clip to the film clip, see, e.g., [Shiota & Levenson, 2012](#)). To reduce the number of statistical tests (see, e.g., [Shiota & Levenson, 2009](#), p. 894), all physiological arousal measures were combined into a composite measure of physiological arousal for the main analyses. Select physiological measures (i.e., IBI, RSA, RMSSD, PEP, or LVET) were recoded (i.e., multiplied by -1) so that higher values always represented greater physiological arousal. All physiological measures were then z -scored and averaged. Follow-up analyses then examined specific physiological measures.

Perceptions

At the end of each emotion regulation trial, participants reported on their *perceptions of emotion regulation success* (i.e., “I was successful at reappraising/accepting/detaching from my emotions during the last film clip.”; 0 = *strongly disagree*, 8 = *strongly agree*) and *motivation* (i.e., “I tried my best to reappraise/accept/detach from my emotions during the last film clip.”; 0 = *strongly disagree*, 8 = *strongly agree*).

Data Analyses

Analyses were conducted using SPSS Version 25; alpha was set at .05. We corrected for multiple testing within classes of tests by relying on Bonferroni post hoc comparisons (where p values are already Bonferroni-corrected for the number of tests; see [SPSS, 2020](#))¹. In a few instances, Bonferroni post hoc comparisons were not automatically conducted by SPSS. Instead, we manually ap-

plied equivalent Bonferroni corrections to all follow-up t tests. [Table 2](#) provides an overview on the key study variables that were analyzed for each outcome (emotional experience, physiological arousal, and perceptions) in the just watch and regulation trials, following prior work (e.g., [Muhtadie et al., 2019](#)).

Preliminary Analyses

Preliminary analyses examined emotional experience and physiology in the just watch trials to (a) provide a manipulation check and (b) examine the experiential and physiological profile of loss responding using dependent t tests.

Main Analyses

Effects of Detachment, Positive Reappraisal, and Acceptance. Main analyses examined effects of detachment, positive reappraisal, and acceptance on experience and physiology by (a) directly comparing the strategies and (b) comparing each strategy to the just watch trials.

Emotional Experience. To (a) compare effects between strategies, we conducted an omnibus 3 (strategy) \times 8 (emotion term) repeated-measures ANOVA. Follow-up one-way repeated-measures ANOVA analyses with three levels (strategy) examined effects on each emotion term (e.g., sadness) with Bonferroni post hoc comparisons. To (b) compare effects between each strategy and just watch trials, we conducted an omnibus 2 (just watch, emotion regulation strategy) \times 8 (emotion term) repeated measures ANOVA for each strategy. Follow-up Bonferroni-corrected dependent t tests then examined effects for each emotion term (e.g., detachment vs. just watch).

Physiology. To (a) compare effects between strategies, we conducted a one-way repeated-measures ANOVA with Bonferroni post hoc comparisons with compare z -scored physiological arousal variables that were centered on the mean just watch trials (i.e., these scores represented differences between just watch trials and a given strategy; see [Appendix B](#)). To (b) compare effects between each strategy and just watch trials on overall physiological arousal, we conducted Bonferroni-corrected dependent t tests comparing the same just-watch-centered physiological variables for a given strategy to a just watch variable that was standardized normally and, therefore, represented zero (e.g., the deviation of mean detachment from just watch/zero vs. just watch/zero; see [Appendix B](#)).

Follow-up analyses then probed effects on each physiological measure separately. For (a) direct comparisons, an omnibus one-way 3 (strategy) \times 9 (physiology measure) repeated measures MANOVA was conducted. Follow-up one-way repeated-measures ANOVAs with three levels (strategy) examined effects on each physiological measure (e.g., IBI) with Bonferroni post hoc comparisons following each ANOVA. To (b) compare effects between each strategy and just watch trials, omnibus 2 (just watch, strategy) \times 9 (physiological measure) one-way repeated measures MANOVA were conducted. Follow-up Bonferroni-corrected dependent t tests then examined effects for each physiological measure (e.g., detachment vs. just watch).

¹ Data are available upon request.

Table 2
Overview of Key Study Variables for “Just Watch” and Regulation Trials

Outcome	Trials		Variables	
	Just watch	Regulation	Just watch	Regulation
Emotional experience	Just watch	Detachment Positive reappraisal Acceptance	Just watch ^a -baseline ^b	Detachment-just watch Positive reappraisal-just watch Acceptance-just watch
Physiology	Just watch	Detachment Positive reappraisal Acceptance	Just watch-baseline ^c	Detachment-just watch ^d Positive reappraisal-just watch ^d Acceptance-just watch ^d
Perceptions	—	Detachment Positive reappraisal Acceptance	—	Detachment Positive reappraisal Acceptance

^a Scores were averaged across the three just watch trials. ^b Emotional experience baseline scores were assessed at the beginning of the study. ^c Physiology variables for just watch trials were derived by averaging physiology scores *before* each film clip in the “just watch” trials and subtracting them from the averaged physiology scores *during* the film clip in the just watch trials (i.e., prefilm-to-film-clip difference scores). ^d Physiology variables in the regulation trials were derived by subtracting prefilm-to-film clip difference scores in the just watch trials from prefilm-to-film clip difference scores in the respective regulation trial.

Perceptions. Two omnibus one-way ANOVAs with three levels (strategy) were run to examine effects on success and motivation, followed by Bonferroni-corrected post hoc comparisons.

Results

Preliminary Analyses

First, to determine how just watching loss-themed film clips affected emotional experiences and physiological arousal (i.e., akin to a manipulation check), we examined changes in emotional experience and physiology from baseline to the just watch trials (see Supplemental Table S2 and S3).² In terms of emotional experience, sadness, anger, disgust, fear, and compassion increased, while happiness, calm, and excitement decreased, $ps < .05$. The largest effect ($d = 2.41$) was found for sadness. In terms of physiology, overall physiological arousal increased, $t(123) = -4.34, p < .001, d = 0.39$. Follow-up analyses for specific physiological measures showed increases in IBI, increases in RR, and decreases in SCL, $ps < .05$. Effect sizes for significant physiological effects ranged from small to moderate.

Effects of Emotion Regulation on Emotional Experience

Comparisons Between Strategies

First, we compared the three strategies with each other. A repeated-measures ANOVA revealed main effects of emotion regulation, $F(2, 210) = 46.68, p < .001, \eta_p^2 = .31$ (90% confidence interval, CI [.22, .38]), and emotion term, $F(7, 735) = 21.66, p < .001, \eta_p^2 = .17$ (90% CI [.13, .20]), which were qualified by a significant interaction effect between emotion regulation and emotion term, $F(14, 1470) = 10.32, p < .001, \eta_p^2 = .09$ (90% CI [.06, .10]). All follow-up one-way ANOVA showed significant main effects of emotion regulation strategy ($ps < .001$ for sadness, anger, fear, compassion, happiness; $ps < .05$ for disgust and excitement), except for calm ($p > .05$). As shown in Figure 2, follow-up Bonferroni-corrected post hoc comparisons for signifi-

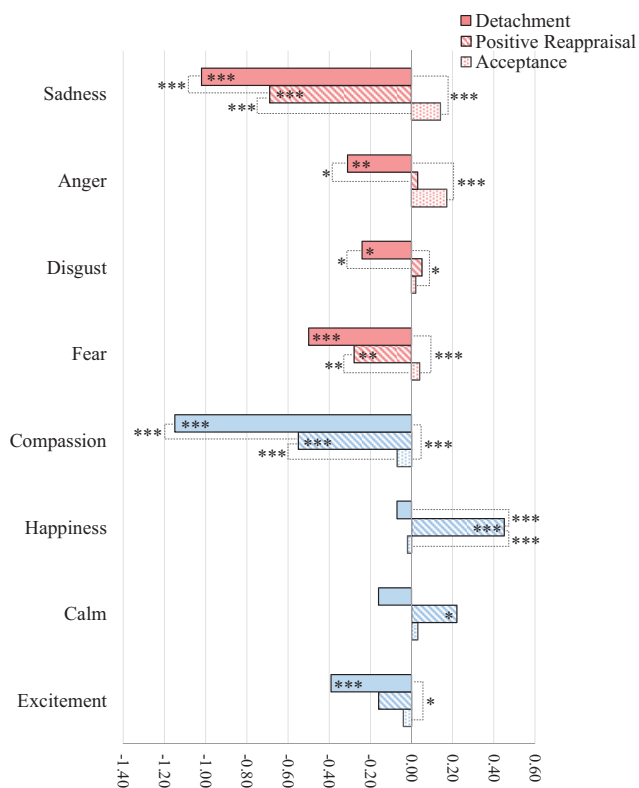
cant follow-up ANOVA revealed that each strategy had specific effects on emotional experiences when comparing the strategies directly with each other, $ps < .05$. Specifically, detachment *decreased* sadness, anger, and disgust more than positive reappraisal and acceptance. Detachment and positive reappraisal showed greater decreases in fear than acceptance. Positive reappraisal *increased* happiness more than detachment and acceptance, while happiness did not differ between detachment and acceptance. In terms of compassion, detachment and positive reappraisal *decreased* compassion more than acceptance, with detachment showing the largest decrease (i.e., significantly larger than reappraisal). Detachment also showed significantly *decreased* excitement in comparison with acceptance, with positive reappraisal falling in the middle at a nonsignificant distance from each. No differences between strategies were found for calm.

Comparisons Between Each Strategy and Just Watch Trials

Next, we examined the effects of each strategy when compared with the just watch trials. Repeated-measures ANOVAs showed significant interaction effects between emotion trial and emotion term for detachment and positive reappraisal ($ps < .001$), but not acceptance, ($ps > .05$). Follow-up t tests (Figure 2; Supplemental Table S3) revealed that, compared with just watch trials, detachment led to significant *decreases* in all emotion terms, apart from happiness and calm; positive reappraisal led to *decreases* in sadness and fear (but not anger or disgust) and to *increases* in happiness and calm; and acceptance did not significantly increase/decrease any emotion terms. Remaining effects were nonsignificant, $ps > .05$.

² For emotional experience, correlations between levels of the emotion regulation factor were $r = 0.28$ on average, while correlations between levels of emotion type were $r = 0.18$ on average. For physiology, correlations between levels of the emotion regulation factor were $r = 0.28$ on average, while correlations between different physiological variables were $r = 0.10$ on average. For perceptions, average correlations between levels of the emotion regulation factor were $r = 0.27$ for success and $r = 0.41$ for motivation.

Figure 2
Effects of Detachment, Positive Reappraisal, and Acceptance on Emotional Experiences



Note. Effect sizes (Cohens d) of differences in emotional experiences between “just watch” and regulation trials shown. Positive values indicate increases and negative values indicate decreases in comparison with just watch trials. Asterisks above dotted lines indicate differences between two strategies. Asterisks within bars indicate differences between just watch and regulation trials. Negative emotions are indicated by red bars. Positive emotions are indicated by blue bars. See the online article for the color version of this figure.

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

Effects of Emotion Regulation on Physiology

Comparisons Between Strategies

First, we compared the three strategies with each other. For overall physiological arousal (see Figure 3), a one-way repeated measures ANOVA showed no significant differences between strategies, $F(2, 244) = 0.82, p = .443, \eta_p^2 = .01$ (90% CI [.00, .03]), while Bonferroni-corrected follow-up tests also revealed no significant differences, $ps > .05$. Similarly, for individual physiological measures, a one-way repeated measures MANOVA, Wilks' $\lambda = 0.91, F(18, 452) = 1.27, p = .206, \eta_p^2 = .05$ (90% CI [.00, .04]), and Bonferroni-corrected tests, $ps > .05$, revealed no differences between emotion regulation strategies either.

Comparisons Between Each Strategy and Just Watch Trials

Next, we examined the effects of each strategy when compared with the just watch trials. For overall physiological arousal (Figure

3 and Supplemental Table S5), t tests showed that detachment led to significant decreases in overall physiological arousal in comparison with just watch trials ($p < .05$), while other strategies did not show significant effects in comparison with just watch trials, $ps > .05$. For individual physiological measures, repeated-measures MANOVAs revealed significant effects for detachment and acceptance ($ps < .05$), but not positive reappraisal ($ps > .05$) when compared with just watch trials. Bonferroni-corrected dependent t tests (Figure 4 and Supplemental Table S6) revealed that, compared with just watch trials, detachment led to significant increases in IBI and significant decreases in RR; and acceptance led to significant increases in IBI. Remaining effects were nonsignificant, $ps > .05$.

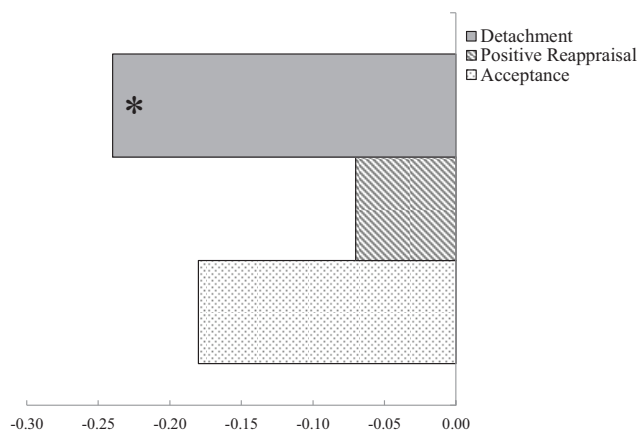
Effects of Emotion Regulation on Perceptions

Participants reported relatively high levels of success at implementing each strategy (M across strategies = 5.71 out of 8.0, $SD = 2.01, Ns = 125$) and high levels of motivation (M across strategies = 6.67 out of 8.0, $SD = 1.57, Ns = 127$).

Success

A repeated-measures ANOVA revealed a significant effect of emotion regulation strategy on perceived emotion regulation success, $F(2, 248) = 25.27, p < .001, \eta_p^2 = .17$ (90% CI [.10, .23]). As shown in Figure 5 (Panel A), Bonferroni-corrected post hoc tests indicated that participants reported the lowest levels of success when implementing positive reappraisal ($M = 4.96, SD = 2.29, N = 125$) and the highest level of success when implement-

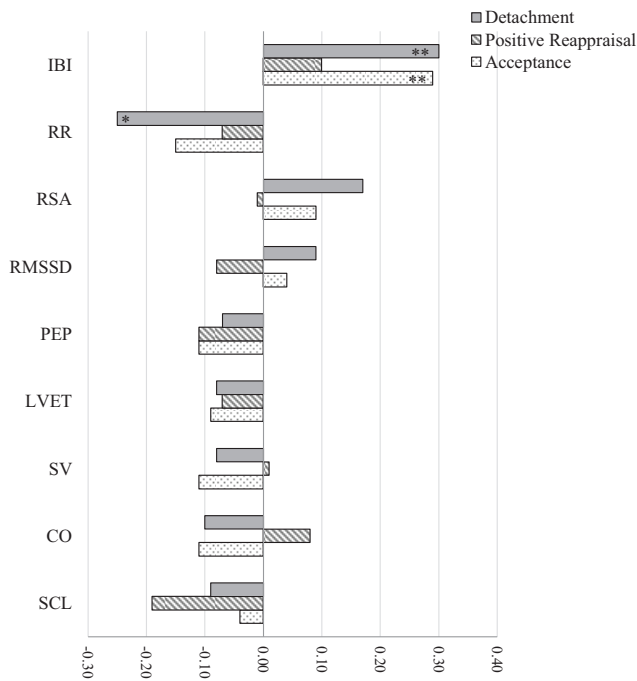
Figure 3
Effects of Detachment, Positive Reappraisal, and Acceptance on Physiological Arousal



Note. Effect sizes (Cohens d) of differences in physiological arousal between “just watch” and regulation trial (derived from t tests reported in Supplemental Table S5) shown. Negative values indicate decreases compared with just watch trials. Asterisks within bars indicate differences between just watch and regulation trials.

* $p < .05$.

Figure 4
Effects of Detachment, Positive Reappraisal, and Acceptance on Specific Physiological Measures



Note. Effect sizes (Cohens d) of differences in physiological measures between “just watch” and regulation trial shown. Positive values indicate increases and negative values indicate decreases in comparison with just watch trials. Asterisks indicate differences between just watch and regulation trials.

* $p < .05$. ** $p < .01$.

ing acceptance ($M = 6.50$, $SD = 1.78$, $N = 125$), with detachment falling in the middle ($M = 5.67$, $SD = 1.96$, $N = 125$), $ps < .01$.

Motivation

A repeated-measures ANOVA revealed a significant effect of emotion regulation strategy on perceived emotion regulation motivation, $F(2, 252) = 6.10$, $p = .003$, $\eta_p^2 = .05$ (90% CI [.01, .09]). As shown in Figure 5 (Panel B), Bonferroni post hoc tests indicated that participants reported less motivation for implementing positive reappraisal ($M = 6.37$, $SD = 1.61$, $N = 127$) compared with acceptance ($M = 6.87$, $SD = 1.56$, $N = 127$) and detachment ($M = 6.76$, $SD = 1.53$, $N = 127$), $ps < .05$. Motivation ratings between acceptance and detachment were not significantly different.

Discussion

The present study shows that detachment, positive reappraisal, and acceptance in response to film clips depicting loss have specific effects on emotional experiences, physiology, and perceptions in older adults. Regarding emotional experiences, detachment numbered (i.e., decreased all negative emotions more so than the other strategies and also some positive emotions), positive reappraisal brightened (i.e., increased happiness and calm, with

smaller decreases in negative emotions), and acceptance did not alter emotional experiences. Regarding physiology, the strategies did not differ from each other in their effects, but compared with just watch trials detachment decreased overall physiological arousal (that was primarily driven by changes in IBI and RR), while acceptance and positive reappraisal did not. Regarding perceptions, participants felt most successful and motivated when implementing acceptance and least successful and motivated when implementing positive reappraisal.

Specific Strategies, Specific Effects

Negative emotions are often elicited in the context of loss—that is an important part of the human experience and becomes ubiquitous in late life (cf. Kunzmann & Grühn, 2005; Seider et al., 2011; Wu et al., 2020). Detachment, positive reappraisal, and acceptance have all been described as beneficial strategies with positive effects on well-being and health (Aldao et al., 2010; Gross & John, 2003). The present study showed that each emotion regulation emerged as “most” effective in a specific domain.

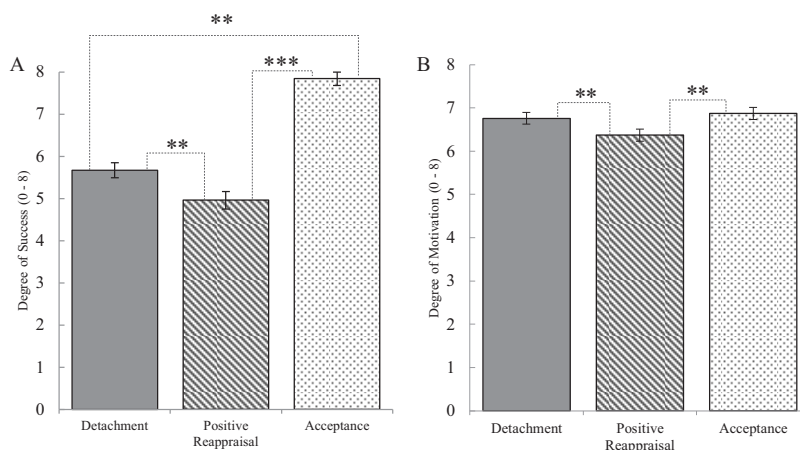
Detachment

Detachment emerged as the strategy that decreased both negative and positive emotional experiences. This experiential “numbing” was accompanied by decreases in physiological arousal, namely, slower heart rate and slower breathing when compared with just watch trials (Denson et al., 2011; Gross, 1998a; Liang et al., 2017; Shiota & Levenson, 2012; Wolgast et al., 2011). These findings converge with prior research that has shown detachment to be effective for downregulating negative emotions at an experiential and physiological level (McRae et al., 2012; Wolgast et al., 2011), although we should note that no significant between-strategy differences for the physiological effects were found (reminiscent of prior work, see Table 1). Finally, compared with positive reappraisal, older adults felt more successful (cf. Shiota & Levenson, 2012) and motivated when implementing detachment.

Detachment is a highly effective (e.g., Webb et al., 2012) and long studied (e.g., Ayduk & Kross, 2010; Gross, 1998b) emotion regulation strategy that shares some similarities with other emotion regulation and coping strategies that have been found to be quite effective when regulating emotions in late life (i.e., attentional avoidance, Scheibe et al., 2015; see also Sheppes & Gross, 2011) and coping with loss (i.e., repressive coping; Bonanno, 2004). Detachment involves cognitive avoidance of perspectives necessary to make the situation emotional (i.e., *avoiding* watching as if the film clip was real), although individuals who are detaching *do* pay attention to the emotion-eliciting situation (and are asked to not distract themselves with irrelevant thoughts).

What is remarkable about detachment is its effectiveness as an emotion regulation strategy (e.g., Ayduk & Kross, 2010; Gross, 1998a), which was also corroborated in the present study. Of particular interest, detachment impacted physiological arousal the most, specifically both IBI (and comparable measures, such as heart rate) and respiration rate, which are key physiological indicators (Cacioppo et al., 2017; Russo et al., 2017; Saul, 1990) that provide powerful visceral signals (e.g., Schandry et al., 1986) and have been found to play important roles in emotional responding (e.g., Wu et al., 2020). Chronically elevated heart rates are documented risk factors for the development of adverse health out-

Figure 5
Effects of Detachment, Reappraisal, and Acceptance on Perceived Emotion Regulation Success (Panel A) and Motivation (Panel B)



Note. M and $SE(M)$ shown.

** $p < .01$. *** $p < .001$.

comes and mortality in late life (Palatini et al., 1999, 2002). Therefore, IBI and (to a lesser extent) RR have been the focus of inquiry in past emotion regulation studies and a recent meta-analysis confirmed an overall effect of cognitive change strategies on reductions in heart rate (Zachringer et al., 2020). The present findings raise the possibility that this effect may be specific to detachment and highlight the importance of differentiating between different cognitive change strategies in future work. At the same time, the experiential numbing that comes with detachment may not always be desirable and reports of heightened detachment in psychopathology (Kotov et al., 2017), which may be fostering psychopathology-sustaining behaviors (e.g., Kerr et al., 2019; Kotsou et al., 2018), suggest possible costs to the long-term or excessive use of detachment.

Positive Reappraisal

Positive reappraisal emerged as the strategy that decreased negative emotional experiences (albeit to a lesser degree than detachment) and as the only strategy that increased positive emotional experiences (i.e., happiness, calm). These findings converge with studies that have found positive reappraisal to be superior at specifically enhancing positive experiences (McRae et al., 2012; Troy et al., 2018). Positive reappraisal did not significantly alter physiology in the present study; thus, converging with previous studies that found positive reappraisal to be the least effective cognitive change strategy in altering autonomic physiology (e.g., McRae et al., 2012; Troy et al., 2018). Finally, older adults felt least successful and least motivated when implementing positive reappraisal, converging with prior work (Troy et al., 2018) and supporting the notion that positive reappraisal may not always be the preferred strategy for older adults (Charles, 2010; Scheibe et al., 2015).

Positive reappraisal has been widely lauded as a highly beneficial emotion regulation strategy (Gross, 2013) and is a key element in many cognitive-behavioral therapy approaches (Brewin, 1996;

Campbell-Sills & Barlow, 2007). Positive reappraisal emerged as the strategy with the clearest benefits for brightening emotional experiences. At the same time, emotion researchers have cautioned that not everyone can use reappraisal successfully (Ford & Troy, 2019) and developmental researchers have argued that especially late life brings with it experiences that cannot be easily reappraised (Charles, 2010). In the present study, individuals were least motivated to implement positive reappraisal—perhaps because it was cognitively taxing to come up with positive reappraisals or perhaps because positive reappraisal seemed like an inappropriate strategy in the face of irrevocable loss.

Acceptance

Acceptance emerged as the strategy that left emotional experiences (e.g., sadness) largely unchanged (converging with Campbell-Sills et al., 2006; Dunn et al., 2009; diverging from Wolgast et al., 2011). Furthermore, although effects on overall autonomic physiology were not significant, acceptance also led to a slower heart rate compared with the just watch trials (converging with Campbell-Sills et al., 2006; Cristea et al., 2014; Dunn et al., 2009; Troy et al., 2018). Finally, regarding perceptions, acceptance clearly emerged as the most effective strategy. Older adults felt most successful (converging with Troy et al., 2018) and most motivated when implementing acceptance.

Acceptance has long had a place in Eastern philosophy and despite much interest in related concepts (e.g., mindfulness), acceptance has received less attention than detachment or positive reappraisal in the emotion literature. From a perspective that views negative emotional experiences as largely undesirable (Larsen, 2000), acceptance may seem like the least effective strategy, as successful implementation of acceptance meant that negative emotion (e.g., sadness) was not decreased; thus, conflicting with common definitions of what makes an emotion regulation strategy “effective.” However, this unaltered of negative emotion also helped acceptance stand out as the only strategy to keep compas-

sion (i.e., a prosocial positive emotion; Goetz et al., 2010) intact. Moreover, there is increasing evidence that sadness can be a beneficial emotion that helps individuals deal with loss (Wu et al., 2020), especially in late life (Haase et al., 2012; Kunzmann et al., 2014). Supporting this view, individuals were most motivated to implement acceptance and “embrace” sadness in the face of loss in the present study, which aligns with research showing that participants prefer and perceive acceptance to be most effective in sad contexts (Vishkin et al., 2020). In this vein, it is interesting that acceptance also slowed down heart rate; thus, pointing to potential physiological benefits.

Strengths and Limitations

The study had several methodological strengths, including use of (a) multiple well-established film clips depicting loss with robust effects; (b) a large array of experiential and physiological measures of emotion; (c) a within-subjects design less prone to variance because of individual differences; and (d) a sizable sample of carefully screened healthy older adults that was larger than most existing samples (see Table 1).

In terms of limitations, first, the present study focused on emotion regulation in response to fictional film clips depicting loss. Film clips have been used very widely in prior research (Westermann et al., 1996), but future studies should probe generalizability of the present findings by studying emotion regulation in the face of personally relevant loss (e.g., death of a loved one). The bereavement and trauma literatures suggest that strategies akin to detachment (e.g., repressive coping; Bonanno, 2004), positive reappraisal (e.g., cognitive-behavioral therapy; Campbell-Sills & Barlow, 2007), and acceptance (e.g., mindfulness; Coffey et al., 2010) may have benefits in these contexts as well. Second, we used 1-min physiological prefilm clip baselines and emotion regulation instructions as in prior work (Shiota & Levenson, 2012). Future research may probe whether findings replicate with different procedural approaches (e.g., using longer physiological baseline at the beginning of the study; instructions with similar length). Third, our sample was from the United States and predominantly highly educated, moderately wealthy, and White. Future research may probe generalizability across different cultural (e.g., Eastern; Qu & Telzer, 2017), socioeconomic (e.g., Hittner et al., 2019), and ethnic (e.g., Perez & Soto, 2011) backgrounds. Finally, future research will also benefit from examining the effects of detachment, positive reappraisal, and acceptance in response to other negative (e.g., disgusting) and positive (e.g., happiness) emotion stimuli; using other paradigms (e.g., spontaneous emotion regulation; Bloch et al., 2014); in physically or cognitively impaired older adults; and among younger age groups to determine generalizability of the present findings.

Future Directions and Applications

Effects on Experience, Physiology, and Perceptions—and Beyond

The present findings showed that older adults were able to successfully alter emotional experiences and felt quite motivated and successful when implementing detachment, positive reappraisal, and acceptance. For detachment and acceptance, some

beneficial effects were also found for autonomic physiology (cf. Charles, 2010), albeit considerably smaller than effects on experience, consistent with prior work (see Table 1). Given the important downstream consequences of emotion regulation on well-being and health (Aldao et al., 2010), it will be important for future studies to examine short-term as well as longer-term well-being and health consequences of detachment, positive reappraisal, and acceptance. Future studies could also specifically examine effects of emotion regulation strategies that directly target autonomic physiology in late life (e.g., acceptance of physiological arousal; see Jamieson et al., 2012). Emotion regulation studies (including the present one) commonly focus on the regulation of emotional experiences (e.g., “that you *feel* [emphasis added] less negative emotion”), not on the regulation of physiology (e.g., through deep breathing), which may be one reason for the smaller effects on physiology compared with experience.

In addition, future research should examine effects of different emotion regulation strategies on the coherence of emotional response systems (i.e., the degree to which different channels, such as subjective emotional experience and physiology, change together while regulating emotion). Based on the present findings, it is possible that coherence may be higher for some strategies (e.g., detachment) in comparison to others (e.g., acceptance). Successful emotion regulation has been marked by less emotional coherence in past studies (Butler et al., 2014; Dan-Glauser & Gross, 2013; Lohani et al., 2018), while highlighted as an indicator of dysregulation in others (Schaefer et al., 2014).

Specific Strategies, Specific Effects

The present findings showed that there was no winner when comparing detachment, positive reappraisal, and acceptance. Instead, each regulation strategy was most effective in a specific domain and each strategy had not only advantages but also disadvantages. Thus, what the best strategy is may depend on the emotion regulation goal. If the goal is to experience less emotion overall while decreasing physiological arousal, detachment may be most effective (but it may also numb experiences across the board). If the goal is to reverse negative into positive emotional experiences, positive reappraisal may be most effective (but it may also be difficult to implement and upregulating positive emotions in response to loss may not always be appropriate). If the goal is to leave emotional experiences intact and make it easy to implement the strategy successfully, acceptance may be most effective (although it may not immediately relieve negative emotional experiences, cf. Troy et al., 2018). Clearly, not every strategy will be adaptive in every context (e.g., Ford & Troy, 2019) and future research may investigate which strategies may fit which contexts the best.

In this vein, future work should also more closely grapple with definitions of effective emotion regulation by further examining when it is best to downregulate emotions through detachment or positive reappraisal versus accepting and potentially making use of them (see Tamir, 2016; Vishkin et al., 2020). Future research could also consider that strategies, such as acceptance, may lead to effective longer-term emotion reg-

ulation when zooming out of the present moment (see Troy et al., 2018). Therefore, effectiveness of emotion regulation may be highly dependent upon emotion regulation goals and context (e.g., Mauss & Tamir, 2014) as well as time course (e.g., Bloch et al., 2014) of emotional responding.

Late-Life Plasticity

Finally, the present findings show that older adults can benefit from a range of cognitive change strategies and illuminate longstanding discussions regarding the effectiveness of specific emotion regulation strategies (cf. Beck, 2005; Ekman et al., 2005). We showed that older adults can modify their emotional responses to loss to a considerable extent, supporting notions of late-life plasticity (e.g., Baltes, 1987). Given the central role of not only emotional experiences but also the autonomic nervous system in long-term well-being and health, the present findings encourage further probing of the degree of plasticity of the autonomic nervous system in late life, ideally sampling broadly across different physiological indicators (cf. Mendes, 2010). Finally, older adults were highly motivated to implement emotion regulation strategies and felt quite successful when doing so. These findings may spur further research and interventions that seek to enhance the well-being and health of an increasingly older population (Carstensen et al., 2018; Charles, 2010; Depp et al., 2010).

Conclusion

Recent estimates suggest that life expectancies will continue to increase, and that half of the babies born in the 2000s will live to see their 100th birthday (Christensen et al., 2009). How should we regulate emotions in the face of loss, which is ubiquitous across the life span and especially common in late life? Is it best to take an unemotional attitude, to find the silver lining, or to embrace negative emotions? The present study shows that detachment is a distancing strategy that seems less difficult to implement and can alter both experience as well as physiological arousal in late life. Positive reappraisal is a reframing strategy that is quite effective at brightening emotional experiences but does not seem to alter physiology and appears to be more difficult to implement. Acceptance is a metacognitive strategy that older adults appear to have the most success with where emotional experiences are not judged but embraced and consequently not altered in the short term. Overall, older adults benefit from detachment, positive reappraisal, as well as acceptance in the context of loss-themed film clips with each of these strategies having unique benefits in terms of emotional experiences, physiology, and perceptions.

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Appendix A

Emotion Regulation Strategy Instructions

Positive Reappraisal

"In a few slides, you will be viewing a film clip. While you are watching the film clip, we want you to try to reframe/REAP-PRAISE what you are watching in a more positive light. Please try to think about positive aspects of what you are seeing. Watch the film clip carefully, but please try to think about what you are seeing in such a way that you feel less negative emotion."

Acceptance

"In a few slides, you will be viewing another film clip. This time, as you watch, ACCEPT your emotions. Simply let your feelings happen, whatever they may be, pleasant or unpleasant. Accept your feelings without trying to get rid of them. In other words, whatever you may experience during the film clip, just let your feelings be, and do not struggle against them. Allow yourself to experience your feelings, without judging them, and without

controlling or changing them. Let your feelings run their course. For example, you could tell yourself that there is no right or wrong way to respond, or that your feelings are like clouds passing by that you don't need to control. Even though a situation may be unpleasant in the moment, simply accept your feelings as a natural response. This can be difficult at times, but it is very important that you try your best."

Detachment

"In a few slides, you will be viewing another film clip. While you are watching the film clip, we want you to try to DETACH from the emotional aspects of the clip. Please try to adopt a DETACHED and unemotional attitude. As you watch the film clip, please try to think about what you are seeing objectively. Watch the film clip carefully, but please try to think about what you are seeing in such a way that you feel less negative emotion."

Appendix B

Physiological Arousal z-Score Calculation Details

For dependent *t* test analyses (or any analysis involving repeated measures), normally computed *z*-scores of each repeated measure cannot be used in the same test (i.e., prescore - presample mean/presample standard deviation; postscore - postsample mean/post-sample standard deviation). This is because the use of such *z*-scores makes the means of both the pre- and postmeasure = zero and standard deviation of both = 1. Thus, any differences in means between the two time periods become neutralized. For this reason, physiological arousal (i.e., the combination of all physiological channels) had to be calculated by centering/standardizing around just watch (for central analyses) or baseline (for preliminary analyses) measures.

To create the physiological arousal composite score (for primary analyses), for each physiological measure, regulation variables in Table 2 were transformed into *z*-scores centered on the mean "just watch" variable (e.g., detachment IBI - *M* just watch IBI/*SD* just

watch IBI). Just watch scores for each physiological measure were then standardized using the normal *z*-score formula (i.e., just watch IBI - *M* just watch IBI/*SD* just watch IBI) so that the mean for baseline *z*-scores would be centered at zero. The result was four (i.e., just watch, detachment, positive reappraisal, or acceptance) physiological arousal composite scores centered on just watch, where higher values for emotion regulation trials indicated increased physiological arousal in comparison with just watch (i.e., zero).

Similar *z*-score procedures were used for preliminary analyses, with the difference being that just watch variables were instead centered on baseline variables.

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