



# The impact of anticipating positive events on responses to stress



Samuel S. Monfort<sup>a</sup>, Hannah E. Stroup<sup>b</sup>, Christian E. Waugh<sup>b,\*</sup>

<sup>a</sup> George Mason University, 4400 University Drive, MSN 3F5, Fairfax, VA 22030-4422, USA

<sup>b</sup> Wake Forest University, P.O. Box 7778 Reynolda Station, Winston-Salem, NC 27109, USA

## HIGHLIGHTS

- We investigate the effect of anticipating a positive event on mood and stress recovery.
- Future positive events increase positive emotion after social stressors.
- Anticipating a positive event is uniquely related to decreased negative emotion.
- Future positive events elicit more positive emotion than past positive events.

## ARTICLE INFO

### Article history:

Received 22 May 2014

Revised 2 December 2014

Available online 24 December 2014

### Keywords:

Positive emotion

Anticipation

Stress

Coping

Recovery

## ABSTRACT

The few studies examining the impact of positive emotions on discrete stressors suggest that positive emotions improve stress responding. We hypothesized that merely anticipating a positive event would be sufficient to harness these benefits. In Study 1, we found that the anticipation of funny (relative to unfunny) cartoons increased positive emotions immediately following the offset of a social stressor. In Study 2, we found that the post-stress mood elevation was greater when anticipating a positive event than when having experienced the same positive event prior to the stressor, but that both positive emotion groups reported more adaptive thoughts during the stressor itself compared to participants receiving a neutral emotion induction. In Study 3, we found that this boost in post-stress positive emotion predicts decreases in concurrent negative emotion. In sum, these findings suggest that anticipating a positive event is uniquely able to induce positive emotions both during and after stress, and that this boost subserves improved coping and recovery.

© 2014 Elsevier Inc. All rights reserved.

Whether it's a future wedding, birthday, or vacation, people tend to enjoy anticipating positive events. People think more extensively about future positive events relative to past ones, which may prompt more intense emotions during anticipation than during recollection (Van Boven & Ashworth, 2007). The presence of positive emotion in particular has been shown to buffer against the onset of stress and to augment an individual's coping repertoire (Fredrickson, 2001). Here, we propose that anticipating positive events may be a convenient and powerful way to induce positive emotion, both during and after stress.

Prolonged experience of stress adversely affects mental and physical well-being (DeLongis, Folkman, & Lazarus, 1988; Trzcieniecka-Green & Steptoe, 1996). Experiencing positive emotions is a powerful way to facilitate successful management of stress. Daily experience of positive emotion has been shown to mitigate the influence of stressful events on next-day anger and depression (Ong, Bergeman, Bisconti, & Wallace, 2006; Viney, 1986). Positive emotions also improve recovery from major life stressors; Fredrickson, Tugade, Waugh, and Larkin

(2003) found that positive emotions fully mediated the relationship between trait psychological resilience (the ability to recover quickly from a negative emotional experience) and frequency of depressive symptoms in the months following the September 11th terrorist attacks. This suggests that positive emotions are the "currency" that resilient individuals spend to regulate emotions during stress.

Although much research has investigated *how* positive emotion inducing events might influence stress (e.g., Folkman & Moskowitz, 2000; Fredrickson & Levenson, 1998), less research has examined *when* during the stress process these might do so most powerfully (Waugh, 2014). Although positive emotions often stem from positive reappraisals or from benefit-finding of the stressor itself (Folkman & Moskowitz, 2000), in cases where positive emotions are instead induced by some unrelated positive event, the timing of that event may influence its impact on stress responding. Indeed, research suggests that the order in which emotional events are experienced may change the way each is interpreted relative to the others (Brendl & Higgins, 1996; Gilbert, Giesler, & Morris, 1995).

Positive emotional events that occur before stressors may help people build physical and psychosocial resources that they can later use as coping resources in times of stress (Fredrickson, 2000). Positive

\* Corresponding author.

E-mail address: [waughce@wfu.edu](mailto:waughce@wfu.edu) (C.E. Waugh).

emotions bolster friendships, improve coping strategies, and boost psychological resilience, all of which can buffer against the negative mental and physical consequences of stress (Algoe & Stanton, 2012; Kok & Fredrickson, 2010; Garland, Gaylord, & Fredrickson, 2011). A positive event experienced immediately before a stressor may also provide a short-term benefit by boosting positive emotion that will bleed over into the stress period itself.

Reliance on past positive events to cope with stress, however, may be difficult under certain circumstances. Negative events tend to have a greater impact on mood and attention than do positive events (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001), so a positive event that has occurred in the past may be easily forgotten in favor of a current or upcoming negative event (Papousek et al., 2010). To overcome this problem, Fredrickson, Mancuso, Branigan, and Tugade (2000) induced positive emotion by presenting a positive event immediately after the conclusion of a stressor rather than before it. Participants who had experienced a positive event exhibited faster recovery from the stressor than those who had experienced a neutral event. It seems that inducing positive emotions concurrently with the termination of a stressor harnesses the recovery benefits of positive emotional experience while avoiding the attention-captivating effects of negative events. However, relying on unexpected positive events that happen to be concurrent with the end of a stressor to improve one's stress responding is only practical in the laboratory. Negative events may occur without warning, and positive events are not always available when they are most needed. Furthermore, positive events that occur after stress forgo any of the beneficial buffering effects associated with the pre-stress experience of positive emotion. Thus, a question that remains is how to best evoke positive emotion when it is most needed—both prior to stress and during recovery from it.

We propose that anticipating a positive event may be particularly effective at evoking positive emotion both before and after stress. Research suggests that anticipating an event is sufficient to induce the emotion associated with it (Vaughn, Fredrickson, & Taylor, 2008), sometimes even more strongly than is felt during the event itself (Wilson & Gilbert, 2003) or when recalling a past event (Van Boven & Ashworth, 2007). Thinking of the future is a fundamental aspect of cognitive processing, and orienting to “what's next” comes naturally to many people (Bubic, Yves von Cramon, & Schubotz, 2010). Indeed, research suggests that there is an attentional bias favoring future events: anticipation and predictive processing are inherent in a variety of information processing systems, including perception, cognitive control, and decision making (Bubic et al., 2010). Given these attentional biases, it may be easier for people to shift attention to future positive events than to past positive events.

Although no experimental research has examined the stress-related impact of anticipating positive events, some research suggests that anticipating positive events is consequential. Loewenstein and Prelec (1993) asked participants to sequence a series of hypothetical pleasurable and unpleasurable weekends, and found that participants preferred to concentrate the experience of pleasurable weekends toward the end of the sequence. The intentional postponement of positive events suggests that people not only enjoy anticipating positive events, but choose to experience them after negative events. There may be a regulatory benefit associated with this preference: anticipating a positive event, or the positive outcome of an event, is the basis for approach motivation (Nes & Segerstrom, 2006), which in turn subserves reward-sensitivity (Gable, Reis, & Elliot, 2003), increases access to interpersonal resources (Herman-Stabl, Stemmler, & Peterson, 1995), and forms the basis of some effective coping styles (Carver, Scheier, & Weintraub, 1989). Furthermore, individuals with a strong approach motivation are better able to maintain happiness in the face of anticipated punishment (Carver & White, 1994). In contrast, hopelessness, the relative absence of the anticipation of positive events in one's future, is a characteristic attributional style of depressed individuals, and the restoration

of hopefulness predicts subsequent recovery from depression (Needles & Abramson, 1990).

Important to our investigation is a conceptualization of ‘successful’ or ‘improved’ stress responding. Successful stress responding is often characterized by reductions in negative emotion (Haynes, Gannon, Orimoto, O'Brien, & Brandt, 1991). However, as our previous literature review highlights, successful stress responding can also be characterized by increases in positive emotions, especially during stress recovery (Tugade & Fredrickson, 2004). Indeed, resilient individuals tend to use positive emotions to supplement negative emotions during stress (Folkman & Moskowitz, 2000), which can lead to more adaptive responses to these stressors (Fredrickson et al., 2003; Segerstrom, Stanton, Alden, & Shortridge, 2003). Therefore, although we assess negative emotions, we prioritize positive emotions in our predictions of the effect of positive anticipation on adaptive stress responding.

## Hypotheses and overview of studies

Our primary hypothesis is that anticipating a positive event will evoke positive emotions both prior to and after a stressful event. We tested this hypothesis experimentally by inducing the anticipation of positive vs. neutral events and assessing their impact on self-reported emotion before, during, and after a social stressor. In Study 2, we examined whether anticipation of a future positive event induces positive emotions at different times than having experienced a recent positive event. In Study 3, we examined whether the effects of positive anticipation is specific to stressors (vs. non-stressors).

### Study 1

Study 1 was designed to test the effects of anticipating a positive event on positive emotion during a stress reactivity and recovery task. All participants were assigned to prepare a speech [stress], which was to be evaluated by a judge. Before preparing their speech, participants were randomly assigned to see funny images [positive event] or unfunny images [neutral event] at the conclusion of the experiment. We hypothesized that individuals anticipating a positive event would report a greater boost of positive emotion prior to and after the stressor, relative to the individuals anticipating a neutral event.

## Method

### Participants

Participants were 74 (47 female) undergraduates at Wake Forest University, aged 18–22 ( $M = 18.82$ ,  $SD = 1.00$ ). Fifty-eight participants were Caucasian, 6 were Asian American, 6 were African American, 2 were Hispanic, and 1 was Pacific Islander. One participant did not report ethnicity. One participant was excluded from data analyses because condition assignment was never recorded, and four participants were excluded because they failed to report their emotional states. The final number of participants included in the data analyses was 69. In this and subsequent studies, the sample size was determined by how many participants from the subject pool could be recruited in one academic semester.

### Materials<sup>1</sup>

#### Positive and neutral stimuli

Positive and neutral images were funny and unfunny single-panel cartoons, respectively (Vaughn & Gotlib, 2008). Most of the funny

<sup>1</sup> We have elected to exclude data from several physiological reactivity measures from this manuscript (collected for Studies 1 and 2). There were a number of equipment issues that degraded the reliability of these data, and we therefore do not feel confident that valid conclusions can be drawn from them.

cartoons were originally provided by Bob Mankoff, the cartoon editor of the New Yorker, and can now be found at The Cartoon Bank (Condé Nast Collection, 2014). Wake Forest University undergraduates had previously rated 202 funny cartoons and 83 unfunny cartoons according to how much they liked them. The present study used the 40 highest-rated cartoons from the funny deck and the 40 lowest-rated cartoons from the unfunny deck. Importantly, the unfunny cartoons were rated in a pilot study as ‘not particularly liked’ rather than ‘disliked.’ The arbitrary labels “LUM” and “GUP” were used for the decks to avoid potential confounds arising from deck names. The assignment of these labels to each of the decks was counterbalanced.

#### *Cartoon preference*

To verify that participants preferred the funny cartoons to the unfunny ones, they viewed five pairs of cartoons, with one cartoon from each deck presented on each side of the screen. They indicated their cartoon preference using a 7-point Likert scale, ranging from 1 (extremely prefer “LUM”) to 7 (extremely prefer “GUP”), with a rating of 4 indicating no preference.

#### *Cartoon enjoyment*

To verify that participants’ preferences corresponded to feelings of enjoyment, participants then rated the cartoons one at a time, indicating how much they liked each cartoon. Ratings were completed using a visual analogue scale that extended along the bottom half of the monitor, ranging from 0 pixels (extremely disliked) to 1920 pixels (extremely liked), with a 30 pixel-wide zone in the center of the scale indicating neither disliked nor liked.

#### *Anticipation of future cartoons*

To provide a check that the funny cartoon deck evoked more anticipatory positive emotion than the unfunny deck, participants were told that they would be seeing more cartoons from one of the two decks later in the experiment, and were then asked to rate their excitement related to seeing more cartoons from each of the decks. Responses were recorded using a visual analogue scale, ranging from 0 pixels (not at all) to 1920 pixels (very much).

#### *Current positive and negative emotion*

At five intervals throughout the experiment, participants rated their current positive and negative emotion using the visual analogue scale (the far left of the screen reading “not (un)pleasant” and the far right reading “very (un)pleasant”). The order of positive and negative emotion probes was randomly generated at each interval. We used single-item affect probes to minimize the intrusiveness of the measurement given repeated assessments.

#### *Procedure*

##### *Anticipation induction*

After providing informed consent, participants rated how pleasant and unpleasant they felt. They then viewed 10 cartoons (labeled by deck) from each of the two cartoon decks, rated their preference and enjoyment of those cartoons, and how they would feel viewing additional cartoons from the two decks at the end of the experiment. Next, the experimenter flipped a coin in front of the participants to randomly assign them to be shown more cartoons from either the “LUM” or “GUP” decks at the conclusion of the experiment. Because a substantial proportion of participants (12/69) reported greater excitement to see the normed ‘unfunny’ than the normed ‘funny’ cartoons at the end of the experiment, we formed two condition assignments. In the ‘normative’ assignment, participants were considered to be in the positive anticipation condition ( $n = 31$ ) if they were assigned to see the funny cartoons and in the neutral anticipation condition ( $n = 38$ ) if they were assigned to see the unfunny cartoons. To ensure that each condition most accurately reflected positive and neutral anticipation, we

also formed an ‘idiographic’ assignment in which participants were deemed to be in the positive anticipation condition if they were assigned the deck that they were most looking forward to seeing at the conclusion of the experiment (29 participants; 22 of whom had been assigned the previously normed ‘funny’ deck and 7 of whom had been assigned the previously normed ‘unfunny’ deck) and deemed to be in the neutral anticipation condition if they were assigned the deck that they were not looking forward to seeing at the conclusion of the experiment (40 participants; 35 of whom had been assigned the previously normed ‘unfunny’ deck and 5 of whom had been assigned the previously normed ‘funny’ deck).<sup>2</sup> Participants were told that they would see more cartoons from this deck at the conclusion of the experiment. For the remainder of the experiment, the name of the deck to which the participants were assigned was displayed in the upper right corner of the monitor.

#### *Pre-preparation period*

After being assigned to a condition, participants rated how pleasant and unpleasant they felt.

#### *Social evaluative threat (SET)*

The experimenter then told participants that they would have 5 min to prepare a five-minute speech on why they are a good friend (Fredrickson et al., 2000; Waugh, Panage, Mendes, & Gotlib, 2010). They were told that they would present their speech to a judge, who would evaluate the clarity, coherence, and persuasiveness of their argument. Participants were told that after preparing the speech, the experimenter would flip a coin to decide if they had to deliver it. Participants rated how pleasant and unpleasant they felt four-and-a-half minutes into the speech preparation period. After the speech preparation period, the experimenter flipped a double-sided coin so that no participant was assigned to the speech group. The mere anticipation of a stressor has been shown to be sufficient to produce elevated stress responses (Waugh et al., 2010).

#### *Recovery and post-stressor*

Participants were reminded that they would be viewing cartoons at the conclusion of the experiment, and were asked to wait quietly for 5 min. During the 5 min recovery period, participants reported how pleasant and unpleasant they felt twice: 60 s (early recovery) and 240 s (late recovery) into recovery. After the recovery period, participants viewed 30 cartoons from their assigned deck. Each cartoon was presented for 6 s for a total cartoon viewing time of 3 min.

## **Results**

#### *Manipulation checks*

##### *Cartoon preference, enjoyment, and anticipation*

We first examined participants’ self-reported preferences regarding the two groups of cartoons. Consistent with our expectations, when presented one cartoon from each deck side-by-side, participants significantly preferred those from the funny deck,  $t(73) = 9.70, p < .001, d = 1.84$ . Shown each of the cartoons individually, participants reported liking the funny cartoons significantly more ( $M = 1292.26, SD = 189.02$ ) than they did the unfunny cartoons ( $M = 786.44, SD = 239.23$ ),  $t(73) = 8.92, p < .001, d = 2.36$ . Also consistent with our expectations, on average, participants reported being more excited to view more cartoons from the funny deck ( $M = 1168.17, SD = 440.42$ ) than from the unfunny deck ( $M = 414.36, SD = 416.82$ ),  $t(73) = 11.74, p < .001, d = 1.76$ .

<sup>2</sup> The idiographic condition assignment still retains some properties of random assignment. Regardless of their eventual preference for the funny or unfunny deck, each participant still had the same probability of being put into the positive and neutral anticipation conditions.

These results indicate that, relative to the unfunny cartoons, participants enjoyed the funny cartoons more and were more excited to see them at the end of the study.

#### SET check

To determine whether the SET task was sufficiently stressful, we examined changes in self-reported emotion in response to the stress task. As expected, the SET task elicited a significant increase in self-reported unpleasantness from pre-task baseline to speech preparation,  $t(73) = 8.53$ ,  $p < .001$ , and a parallel decrease in self-reported pleasantness from pre-task baseline to speech preparation,  $t(73) = -5.85$ ,  $p < .001$  (Table 1). These findings confirm that the speech preparation task was sufficiently stressful.

#### Anticipatory positive events and emotional recovery

We hypothesized that, relative to those anticipating a neutral event, participants anticipating a positive event would experience higher positive emotion during the pre-preparation, speech preparation, and recovery periods. To test this hypothesis, we conducted a 2 (Event Valence: positive, neutral)  $\times$  4 (Period: pre-preparation, speech preparation, early recovery, late recovery) mixed ANOVA, with Event Valence as the between-subjects variable, Period as the within-subjects variable, and self-reported pleasantness and unpleasantness as the dependent variables. To capture our conceptualization of recovery as a return to baseline, we subtracted each participant's baseline emotion value from each of the four periods in the analysis. We conducted each of these ANOVAs twice, one with the normative condition assignments and one with idiographic condition assignments. To address sphericity, we report the Greenhouse–Geisser corrected  $p$ -values and associated corrected degrees of freedom (with original degrees of freedom in brackets).

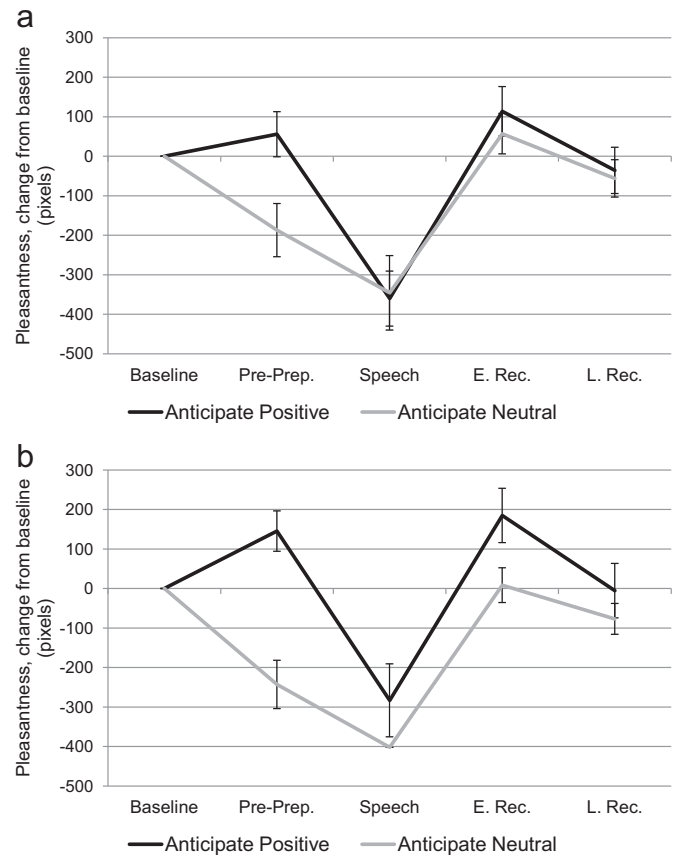
#### Self-reported pleasantness

##### Normative condition assignment

Consistent with the manipulation check, this analysis yielded a main effect of Period,  $F(2.34[3], 156.42[201]) = 26.72$ ,  $p < .001$ ,  $\eta^2 = .25$ , indicating that participants reported a decrease in pleasantness during the speech preparation period and a subsequent return to baseline during early and late recovery. There was not a main effect of Event Valence,  $F(1, 67) = 1.12$ ,  $p = .294$ , but there was a marginally significant interaction of Event Valence and Period,  $F(2.34[3], 156.42[201]) = 2.46$ ,  $p = .08$ ,  $\eta^2 = .031$  (Fig. 1a).

##### Idiographic condition assignment

Using the idiographic condition assignments, there was again a main effect of Period,  $F(2.30[3], 154.10[201]) = 27.00$ ,  $p < .001$ ,  $\eta^2 = .25$ . This analysis, however, also yielded a main effect of Event Valence,  $F(1, 67) = 7.71$ ,  $p = .007$ ,  $\eta^2 = .10$ , in which participants anticipating a positive event reported higher positive emotions than participants anticipating a neutral event as well as the hypothesized interaction of Event



**Fig. 1.** a. The effect of anticipating a positive event on self-reported pleasantness for Study 1 with normative condition assignment. This figure shows change from baseline self-reported pleasantness in five periods. Error bars represent standard errors. b. The effect of anticipating a positive event on self-reported pleasantness for Study 1 with idiographic condition assignment. This figure shows change from baseline self-reported pleasantness in five periods. Error bars represent standard errors.

Valence and Period,  $F(2.30[3], 154.10[201]) = 3.91$ ,  $p = .017$ ,  $\eta^2 = .065$  (Fig. 1b). The interaction was primarily due to participants in the positive anticipation condition reporting higher pleasantness in the pre-preparation,  $F(1, 69) = 20.60$ ,  $p < .001$ ,  $\eta^2 = .24$ , and early recovery periods,  $F(1, 69) = 5.12$ ,  $p = .027$ ,  $\eta^2 = .071$ , compared to participants in the neutral anticipation condition. Additionally, only the positive anticipation group reported pleasantness that was significantly higher than baseline during early recovery,  $t(28) = 2.69$ ,  $p = .012$ ,  $d = 1.02$ . There were no significant differences in pleasantness between the anticipation groups during the speech preparation period or late recovery period,  $F_s(1, 69) = .953, .919$ ,  $p_s = .333, .341$ ,  $\eta^2_s = .002, .004$ , respectively.

**Table 1**

Emotional reactivity during pre-task baseline and speech preparation for Study 1.

	Time Period		<i>t</i>	<i>df</i>	<i>d</i>
	Pre-task baseline	Speech preparation task			
Pleasantness	1020.16 (502.90)	668.03 (481.57)	−5.85***	68	.72
Unpleasantness	272.04 (334.45)	790.49 (523.26)	8.53***	68	1.18

Note. Standard deviations appear in parenthesis below means.

\*\*\*  $p \leq .001$ .



## Self-reported unpleasantness

### Normative condition assignments

Consistent with the manipulation check, this analysis yielded a main effect of Period,  $F(2.23[3], 149.58[201]) = 26.25, p < .001, \eta^2 = .29$ . There was also a significant main effect of Event Valence,  $F(1, 67) = 5.14, p = .027, \eta^2 = .071$ , such that participants in the neutral anticipation condition reported more unpleasantness across the task than those in the positive anticipation condition. There was not a significant interaction of Event Valence and Period,  $F(2.23[3], 149.58[201]) = 1.2, p = .308, \eta^2 = .018$ . (Fig. 2a).

### Idiographic condition assignments

As with normative condition assignments, there was a main effect of Period,  $F(2.21[3], 148.82[201]) = 26.13, p < .001, \eta^2 = .29$ . However, there was not a main effect of Event Valence,  $F(1, 67) = .47, p = .496, \eta^2 = .007$ , nor a significant interaction of Event Valence and Period,  $F(2.21[3], 148.82[201]) = 2.00, p = .134, \eta^2 = .023$  (Fig. 2b).

## Discussion

In Study 1, we found that participants anticipating a positive event, relative to those anticipating a neutral event, reported increased positive emotions after being assigned to the positive anticipation condition and immediately following the conclusion of the speech preparation task. This boost of post-stress positive emotion was apparent during early, but not late recovery; research suggests that positive emotion

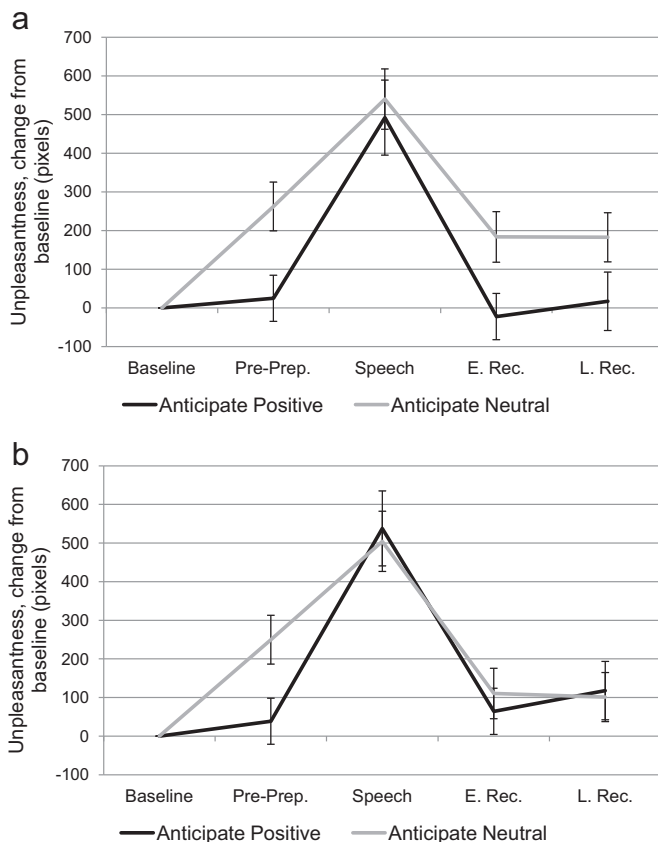
experienced immediately after stress can help with emotional processing of the event and with responses to similar future stressors (Fredrickson, 2000; Ong et al., 2006). That this emotion faded somewhat toward the end of the recovery period may suggest that participants' positive anticipatory emotion was harnessed when it was needed most—immediately after a stressful event—and was less present after they had some time to recover. This post-stress boost was also evident for those participants assigned to see their favorite cartoons regardless of the normed ratings, suggesting that this effect was due to anticipation of a positive event rather than just anticipation of a certain type of cartoon. In Study 2, we examined whether anticipating a positive event is critical to this recruitment of pre-stress positive emotions during recovery, or if it can be induced by recently experienced positive events as well.

The anticipation of a future positive event only influenced negative emotion across all the periods (including the pre-stress period) and only did so when using the normative condition assignments. Therefore, it does not appear that anticipating a positive event differentially influences mood during stress or stress recovery, but rather that being assigned to see the unfunny cartoons simply put people in a negative mood. That both groups experienced a similar increase in negative emotion during the stress task supports the formulation that positive anticipation may primarily influence a redirection of thoughts and associated emotional responses after a stressor. It was surprising, however, that there were no idiographic group differences on negative emotion during recovery. This finding raises the possibility that the anticipation of a positive event may act primarily on positive emotion, a formulation that will need to be replicated in Study 2.

## Study 2

Study 2 was designed to replicate the findings of Study 1 as well as to test whether anticipation of a positive event has a greater effect on positive emotionality than does a recently experienced positive event. Research is clear that attention to past positive events carries a number of benefits (Algoe & Stanton, 2012; Garland et al., 2011; Kok & Fredrickson, 2010). Indeed, the benefits observed in Study 1 may have resulted from the pre-stress experience of positive emotion. However, we expect that the recruitment of pre-stress positive emotions during recovery from a stressor is specific to anticipating a positive event: for these events, the initially-felt positive emotions become relevant again once the stressor is over. In contrast, positive emotions induced by a recently experienced positive event may be less relevant once the stressor is over compared to that elicited by a future positive event. Furthermore, pre-stress positive emotion may be more susceptible to being reduced by the attention-demanding stressor than emotions induced by a future positive event, and therefore less likely to resurge afterward.

In Study 1, we found that anticipating a positive event did not influence negative emotional responses to the stressor. Although we still need to replicate this finding in Study 2, one potential reason for this null effect is that when confronted with controllable stressors, it may not be adaptive for positive emotions to reduce negative emotional responses, but rather to shape how people prepare (Waugh, 2014). Specifically, research suggests that attempting to problem-solve is more adaptive and leads to fewer deleterious outcomes than focusing on one's emotional state (Lazarus & Folkman, 1984). To capture the cognitive dimension of stress-responding in Study 2, we assessed participants' post-stress recollection of the thoughts that they had during the preparation of the speech. We conceptualized problem-solving as thoughts that were related to the actual preparation of the speech, whereas emotional responses were classified as thoughts that were about the participants' emotional responses to the prospect of giving a speech (e.g., "I'm so stressed!"). This procedure allowed us to examine whether anticipating a positive event, in addition to boosting pre- and post-stressor positive affect, promotes adaptive responding to the stressor itself.



**Fig. 2.** a. The effect of anticipating a positive event on self-reported unpleasantness for Study 1 with normative condition assignment. This figure shows change from baseline self-reported unpleasantness in five periods. Error bars represent standard errors. b. The effect of anticipating a positive event on self-reported unpleasantness for Study 1 with idiographic condition assignment. This figure shows change from baseline self-reported unpleasantness in five periods. Error bars represent standard errors.

In Study 2, participants were randomly assigned to one of four groups. Like Study 1, some participants anticipated the presentation of funny or unfunny cartoons at the conclusion of the experiment. In the other two groups, participants viewed funny or unfunny cartoons prior to preparing their speech. Thus, groups varied by the *valence* (positive/neutral) and *timing* (before speech/after speech) of their inductions. All participants were then assigned to prepare a speech, which was to be evaluated by a judge. At the end of the experiment, participants recorded the thoughts that they had during the preparation of the speech.

Drawing from the results of Study 1, we hypothesized that participants in the funny cartoon conditions would experience a boost of positive emotion after being assigned to their group (pre-stress period) and immediately after stress (early recovery period). We also hypothesized that participants in the funny cartoon conditions would report a higher proportion of thoughts devoted to preparation during the speech task than thoughts related to emotional distress. Lastly, we hypothesized that the boosts of positive emotion and adaptive thought processes would be stronger for participants anticipating funny cartoons at the end of the experiment than for the participants who had viewed the same funny cartoons earlier in the experiment.

The lack of differential effects of positive anticipation on negative emotion on stress and stress recovery in Study 1 suggests that anticipation of a future positive event may operate primarily on increasing positive emotions rather than decreasing negative emotions. We sought to replicate this effect, and hypothesized that there would be no group differences in unpleasantness.

## Method

### Participants

Participants were 90 (53 female) undergraduates at Wake Forest University, aged 18–24 ( $M = 18.86$ ,  $SD = .960$ ). Sixty-nine participants were Caucasian, 4 were Asian-American, 10 were African-American, and 6 were Hispanic. One participant did not report sex, age, or ethnicity.

### Materials

#### Positive and neutral stimuli

Positive and neutral stimuli were the same single-panel cartoons used in Study 1. The arbitrary labels “LUM” and “GUP” were again used and counterbalanced.

#### Preference, enjoyment, and anticipation of cartoons

To verify that participants preferred the funny cartoons to the unfunny ones, that participants’ preferences corresponded to feelings of enjoyment, and that the funny cartoon deck evoked more anticipatory positive emotion than the unfunny deck, participants completed the same three cartoon tasks described in Study 1.

#### Current positive and negative emotion

At five intervals<sup>3</sup> throughout the experiment, participants rated their current positive and negative emotion using the visual analogue scale (the far left of the screen reading “not (un)pleasant” and the far right reading “very (un)pleasant”).

<sup>3</sup> Study 2 originally had seven affective rating periods, including the five reported here as well as two other periods. These two other periods were administered prior to any group assignment, and were collected to ensure that the somewhat tedious task of cartoon rating did not substantially hurt participant mood (it did not,  $ps > .05$ ). We only report on the five measurement periods that mirror those of Study 1 because these are the most relevant to our hypotheses.

### Thought-listing task

At the conclusion of the experiment, participants were provided with the following prompt: “We are interested in the thoughts you had while preparing your speech. For as many or as few things about the situation that you were thinking, describe each one below. Please try to recall your thoughts while you were preparing the speech, do not list additional thoughts that occur to you for the first time now.” The thoughts that participants provided were coded by two independent raters who were blind to the participants’ conditions. The thoughts were rated as being related to either the preparation of the speech, their emotional responding to the prospect of giving a speech, or other (either unrelated to the speech or unable to be classified, e.g., “I’m hungry”). Coders rated thoughts as related to speech preparation if the thoughts contained specific ideas for the speech, thoughts regarding organization of the speech, or more vague statements that implied that the participants were thinking about preparing their speech. Coders rated thoughts as related to an emotional response to the speech if the thoughts contained statements about anxiety, nervousness, or other emotions. Although participants were provided with discretely numbered lines, many participants listed single thoughts spread over multiple lines. Additionally, some participants tended to provide single-word thoughts (e.g., nervous, scared) onto separate lines, while others tended to provide similarly single-word thoughts onto a single line, separated by commas instead. For these reasons, we avoided rating each thought individually, but instead opted to provide a single, gestalt rating for each participant. This practice bypasses potential problems arising from differences in participant response style (i.e., whether they tended to clump thoughts together on a single line or spread them out over several). Rating agreement for the two primary raters was Cohen’s Kappa = .674, indicating a substantial level of agreement (Landis & Koch, 1977). Disagreements were subsequently resolved by a third independent rater. Participants whose thoughts were classified as ‘other’ ( $n = 7$ ) were excluded from analyses on the thoughts ( $n = 83$ ).

### Procedure

#### Anticipation induction

Participants rated how pleasant and unpleasant they felt (baseline), then completed the enjoyment, rating, and anticipation tasks described in Study 1. A random number generator then assigned participants to a *valence* condition in which participants saw either the funny (positive) or unfunny (neutral) cartoons and a *timing* condition in which they saw their cartoons either before (prior) or after (anticipation) the social stressor. Due to an error in our experimental software, the ‘excitement to see more cartoons’ data were only collected for 33 (37%) participants, therefore, we could only form the ‘normative’ condition assignments based on the normed cartoon ratings. Unlike Study 1, however, a substantially smaller proportion of the participants who did complete the rating endorsed more excitement for the unfunny than funny cartoons (1/33), suggesting that these normed condition assignments more accurately reflect people’s positive and neutral anticipatory preferences than in Study 1. This produced four groups: the anticipation positive group ( $n = 22$ ), the anticipation neutral group ( $n = 19$ ), the prior positive group ( $n = 26$ ), and the prior neutral group ( $n = 22$ ).

#### Pre-preparation period

The participants in the prior conditions immediately viewed 30 cartoons for 60 s each from their assigned deck. The participants in the anticipation conditions were told that they would be shown more cartoons from their assigned deck at the conclusion of the experiment, and the deck to which these participants were assigned was displayed in the upper right corner of the monitor for the remainder of the experiment. These participants waited quietly for 3 min. After the three minute cartoon viewing/quiet wait period all participants rated how pleasant and unpleasant they felt.

**Table 2**  
Emotional Reactivity during Pre-task Baseline and Speech Preparation for Study 2.

	Time Period		<i>t</i>	<i>df</i>	<i>d</i>
	Pre-task baseline	Speech preparation task			
Pleasantness	880.51 (401.57)	565.07 (465.06)	−5.71***	89	.73
Unpleasantness	269.17 (323.41)	765.98 (522.51)	8.58***	89	1.14

Note. Standard deviations appear in parenthesis below means.

\*\*\*  $p \leq .001$ .

### Social evaluative threat (SET)

The speech instructions were similar to Study 1, except that to be more consistent with past research (Fredrickson & Levenson, 1998), the speech preparation time was shortened to 2 min. Participants reported how pleasant and unpleasant they felt 90 s into the two-minute speech preparation period. After the speech preparation period, the experimenter flipped a double-sided coin so that no participant was assigned to the speech group.

### Recovery and post-stress thought-listing

Participants in the anticipation conditions were reminded that they would be viewing cartoons at the conclusion of the experiment, and all participants were asked to wait quietly for 3 min. During the 3 min recovery period, participants reported how pleasant and unpleasant they felt twice: 30 s (early recovery) and 150 s (late recovery) into recovery. After the recovery period, participants in the anticipation timing conditions viewed 30 cartoons for 6 s each from their assigned deck. Participants in the prior timing conditions waited quietly for 3 min. Participants then listed the thoughts that they had while preparing their speech.

## Results

### Manipulation checks

#### Cartoon preference, enjoyment, and anticipation

Consistent with Study 1, when presented one cartoon from each deck side-by-side, participants significantly preferred those from the funny group,  $t(88) = 11.25$ ,  $p < .001$ ,  $d = 2.40$ . Shown each of the cartoons individually, participants reported enjoying the funny cartoons ( $M = 1337.49$ ,  $SD = 182.23$ ) significantly more than they enjoyed the unfunny cartoons ( $M = 838.45$ ,  $SD = 220.69$ ),  $t(89) = 16.23$ ,  $p < .001$ ,  $d = 3.44$ . Also consistent with Study 1, participants reported being more excited to view more cartoons from the funny cartoon deck ( $M = 1096.12$ ,  $SD = 401.98$ ) than the unfunny deck ( $M = 369.33$ ,  $SD = 368.68$ ),  $t(89) = 6.04$ ,  $p < .001$ ,  $d = 1.28$ .

#### SET check

To determine whether the SET task was sufficiently stressful, we examined changes in self-reported emotion measures in response to the stress task. The SET task elicited a significant increase in self-reported unpleasantness from pre-task baseline ( $M = 269.17$ ,  $SD = 323.41$ ) to speech preparation ( $M = 765.98$ ,  $SD = 522.51$ ),  $t(89) = 8.58$ ,  $p < .001$ ,  $d = 1.82$ , and a parallel decrease in self-reported pleasantness from pre-task baseline ( $M = 880.51$ ,  $SD = 401.57$ ) to speech preparation ( $M = 565.07$ ,  $SD = 465.06$ ),  $t(89) = -5.71$ ,  $p < .001$ ,  $d = -1.21$  (Table 2).

### Positive anticipation and emotional responses

We hypothesized that experiencing positive events would induce positive emotion prior to and after a stressful event. We further hypothesized that positive emotion would be induced most powerfully during

recovery among individuals anticipating a positive event rather than those who had just experienced one. To test these hypotheses, we conducted a 2 (Event Valence: positive, neutral)  $\times$  2 (Event Timing: prior, anticipation)  $\times$  4 (Period: pre-preparation, speech preparation, early recovery, late recovery) mixed ANOVA, with Event Valence and Event Timing as the between-subjects variables, Period as the within-subjects variable, and self-reported pleasantness and unpleasantness as the dependent variables. For these analyses, each participant's baseline emotion value was subtracted from the emotion values of subsequent periods.

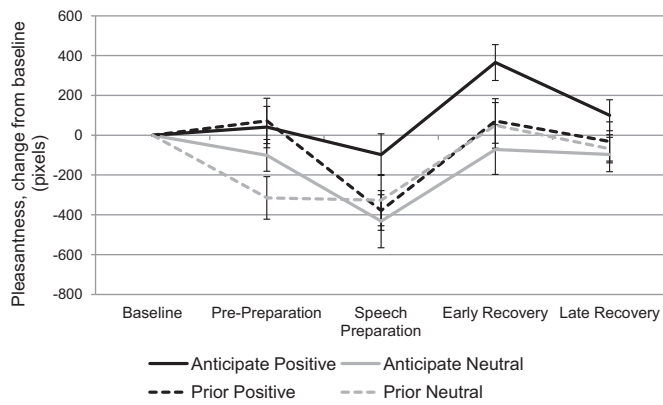
#### Self-reported pleasantness

Consistent with the manipulation check, this analysis yielded a main effect of Period,  $F(2.55[3], 216.50[255]) = 29.92$ ,  $p < .001$ ,  $\eta^2 = .21$ , indicating that participants reported a decrease in pleasantness during the speech preparation period and a subsequent return to baseline during early and late recovery (Fig. 3). The main effect was not qualified by a two-way interaction of Period and Event Valence,  $F(2.55[3], 216.50[255]) = 1.51$ ,  $p = .219$ ,  $\eta^2 = .016$ , or Period and Event Timing,  $F(2.55[3], 216.50[255]) = .194$ ,  $p = .872$ ,  $\eta^2 = .002$ . The analysis yielded, however, the expected three-way interaction of Period, Event Valence, and Event Timing,  $F(2.55[3], 216.50[255]) = 5.59$ ,  $p = .003$ ,  $\eta^2 = .062$  (Fig. 3).

Follow-up 2 (Event Valence: positive, neutral)  $\times$  2 (Event Timing: prior, anticipation) ANOVAs at each period revealed that this 3-way interaction was at least partly due to the hypothesized 2-way interaction of Event Valence and Event Timing during the early recovery period,  $F(1, 85) = 4.08$ ,  $p = .043$ ,  $\eta^2 = .047$ . Consistent with our hypothesis, the anticipated positive event group exhibited significantly greater increases in pleasantness from baseline to early recovery ( $M = 365.05$ ,  $SD = 592.54$ ) than did the prior positive event group ( $M = 75.60$ ,  $SD = 457.16$ ),  $t(85) = 2.18$ ,  $p = .032$ ,  $d = .47$ , the prior neutral event group ( $M = 37.78$ ,  $SD = 374.36$ ),  $t(85) = 2.32$ ,  $p = .023$ ,  $d = .50$ , and the anticipated neutral event group ( $M = -72.00$ ,  $SD = 395.35$ ),  $t(85) = 3.01$ ,  $p = .003$ ,  $d = .65$ . Furthermore, the anticipated positive event group was the only group to report pleasantness that was significantly higher during early recovery than during baseline,  $t(21) = 2.89$ ,  $p = .009$ ,  $d = 1.26$ .

The 2-way interaction of Event Valence and Event Timing was not significant during the pre-preparation,  $F(1, 85) = 1.61$ ,  $p = .347$ ,  $\eta^2 = .019$ , speech preparation,  $F(1, 85) = 2.59$ ,  $p = .112$ ,  $\eta^2 = .029$ , or late recovery periods,  $F(1, 85) = 1.55$ ,  $p = .217$ ,  $\eta^2 = .015$ . There was a main effect of Event Valence during the pre-preparation period,

<sup>4</sup> Although there was not a significant interaction of Event Valence and Event Timing during the speech preparation period, visual inspection of the data prompted us to compare pleasantness levels between groups during this period. The anticipated positive event group reported a non-significant, but marginally smaller decrease in pleasantness ( $M = -97.73$ ,  $SD = 565.96$ ) than participants in the other three groups,  $F(1, 88) = 3.30$ ,  $p = .073$ , and was the only group whose reported pleasantness was not significantly lower than baseline during this period,  $t(21) = -1.05$ ,  $p = .307$ . Visually consistent with Study 1, this tentatively suggests that the effect of positive emotion on pleasantness during early recovery began during the speech preparation period.

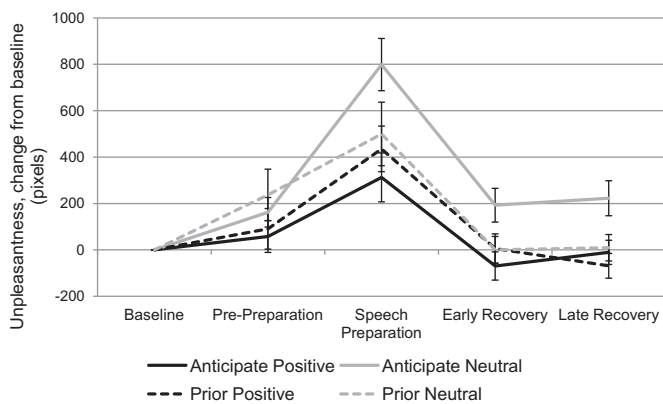


**Fig. 3.** The effect of Event Valence and timing on self-reported pleasantness for Study 2. This figure shows change from baseline self-reported pleasantness in five periods. Error bars represent standard errors.

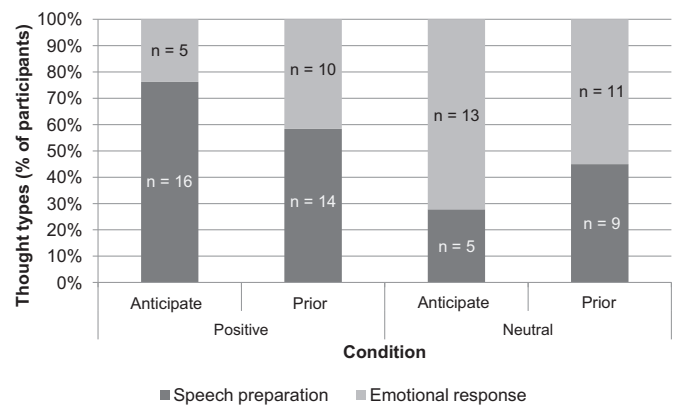
however, whereby anticipating/having experienced a positive event was associated with higher pleasantness than anticipating/having experienced a neutral event,  $F(1, 85) = 7.57, p = .007, \eta^2 = .082$ . There was no difference in positive emotions during the pre-preparation period for people anticipating a positive event and those who had already experienced a positive event,  $t(46) = .25, p = .807, d = .073$ .

#### Self-reported unpleasantness

Consistent with the manipulation check, this analysis yielded a main effect of Period,  $F(2.11[3], 178.97[255]) = 49.28, p < .001, \eta^2 = .35$ , due to participants reporting an increase in unpleasantness during the speech preparation period and a subsequent return to baseline during the early and late recovery periods. The analysis did not yield a significant interaction of Period and Event Valence,  $F(2.11[3], 178.97[255]) = .877, p = .418, \eta^2 = .012$ , or of Period and Event Timing,  $F(2.11[3], 178.97[255]) = 1.79, p = .168, \eta^2 = .021$ . There was a marginally significant interaction of Period, Event Valence, and Event Timing,  $F(2.11[3], 178.97[255]) = 2.57, p = .076, \eta^2 = .029$  (Fig. 4), which was due to participants in the anticipated neutral event group reporting significantly higher unpleasantness during the speech preparation,  $t(85) = 2.81, p = .006, d = .61$ , early recovery,  $t(85) = 2.83, p = .006, d = .61$ , and late recovery periods,  $t(85) = 3.22, p = .002, d = .70$ , than the participants in the other three groups.



**Fig. 4.** The effect of Event Valence and timing on self-reported unpleasantness for Study 2. This figure shows change from baseline self-reported unpleasantness in five periods. Error bars represent standard errors.



**Fig. 5.** The effect of Event Valence and timing on thought content.

#### Thought-listing task

To examine the effect of Valence and Timing on Thought Ratings, we conducted a 2 (Event Valence: positive, neutral)  $\times$  2 (Event Timing: prior, anticipation) binary logistic regression with thought pattern (0 = emotion response to speech, 1 = speech preparation) as the outcome and Event Valence (positive = 1, neutral = 0) and Event Timing (prior = 1, anticipation = 0) as the predictors. There was no significant interaction of Event Valence and Timing,  $B = -1.58, e^B = .21, p = .098$ . There was, however, a main effect of Event Valence,  $B = 1.28, e^B = 3.60, p = .007$ , suggesting that participants in the positive emotion conditions were over twice as likely to respond to the speech task with thoughts related to its preparation compared to participants in the neutral emotion conditions (Fig. 5). There was no main effect of Event Timing,  $B = -.103, e^B = .902, p = .830$ .

We next examined whether these two patterns of thought predicted different emotional responses to the task. We conducted a 2 (Thought Pattern: speech preparation, speech emotion)  $\times$  4 (Period: pre-preparation, speech preparation, early recovery, late recovery) mixed ANOVA with Thought Pattern as the between-subjects variable and Period as the within-subjects variable, and positive and negative affective change from baseline (separate ANOVAs) as the dependent variables. There was no main effect of Thought Pattern on positive affect,  $F(1, 81) = .001, p = .977, \eta^2 < .001$ , nor an interaction of Thought Pattern and Period on positive affect,  $F(3[2.61], 243[211.69]) = .815, p = .473, \eta^2 = .01$ . There was, however, a main effect of Thought Pattern on negative affect,  $F(1, 81) = 7.44, p = .008, \eta^2 = .084$ , which was qualified by an interaction with Period,  $F(3[2.21], 243[178.97]) = 5.66, p = .003, \eta^2 = .065$ . Follow-up  $t$ -tests revealed that this interaction was due to participants who reported thoughts related to preparing the speech reporting substantially less negative affect during the speech preparation period ( $M = 317.23$ ) than participants who reported thoughts related to their emotional responses to the speech ( $M = 734.41$ ),  $t(81) = 3.63, p < .001, d = .81$ . There were no significant differences in negative affective responses during the pre-preparation, early recovery, or late recovery periods between the participants reporting thoughts about preparing the speech and participants reporting thoughts about their emotional responses to the speech.

#### Discussion

In Study 2, we replicated the findings from Study 1 that anticipating positive events induces positive emotion both before and after a stressor. We also compared these effects to those induced by having experienced the positive event before the stressor. Before the stressor, anticipating and having just experienced a positive event were equally effective at inducing positive emotions. In fact, both positive event groups also reported a comparable degree of adaptive cognitive



responding to stress. Participants in these conditions, relative to participants in the neutral event conditions, were more likely to respond to the speech task with thoughts related to its preparation rather than thoughts characterized by an emotional reaction to the task. This pattern of responding, however, was not the same after the stressor.

Participants anticipating a positive event reported higher positive emotions after the speech preparation task than participants who had already experienced a positive event and participants who were anticipating/had experienced a neutral event. This nonequivalence of future positive and past positive events is consistent with our formulation that events in the future are more salient and/or relevant than those in the past. In addition, this pattern of findings suggests that the advantage of anticipating a positive event, relative to having already experienced one, is that it induces positive emotions both before a stressor, facilitating a more adaptive response to the stressor (Folkman & Moskowitz, 2000), and after the stressor, possibly facilitating emotional recovery.

Again consistent with Study 1, the anticipation of a future positive event did not prevent the onset of negative emotion during stress or improve negative emotional recovery after stress. Participants in all conditions reported elevated levels of negative emotion during the speech preparation task, and very little lingering negative emotion during recovery. As discussed previously, negative emotions experienced at the right time can serve an adaptive purpose (Carver, Lawrence, & Scheier, 1996; Waugh, 2014). However, the participants in the anticipation neutral group reported higher negative emotion during the speech and recovery periods than the participants in the other three groups. With the findings from Study 1, this finding does raise the possibility that participants were not looking forward to seeing more unfunny cartoons. Thus, negative anticipation may influence negative emotions during stress recovery akin to how positive anticipation influences positive emotions.

Because positive anticipation only predicted increased positive affect and not decreased negative affect, it is not clear whether participants exhibited this positive emotion boost during recovery because they are using it to regulate their stress responding, as we have suggested, or because it is only a byproduct of anticipating the upcoming cartoons. Some indirect evidence for a stress-regulatory mechanism stems from the finding that, relative to anticipating a neutral event, anticipating a positive event led to a greater likelihood of reporting adaptive (than maladaptive) thoughts related to the speech, which in turn predicted less negative emotion during speech preparation. In Study 3, we more explicitly test whether the positive emotion boost during recovery for those anticipating a positive event is stress-regulatory.

### Study 3

In Studies 1 and 2, we found that anticipating a positive event increases positive emotion during early recovery from stress. Although we interpreted this finding as participants recruiting positive anticipatory emotions to regulate their stress responses during recovery, it is also possible that this response was simply due to the excitement that they felt when reminded of the upcoming cartoons. In Study 3, we addressed this alternative interpretation by comparing post-task positive emotions of participants who anticipated a positive event after a stressor (like in Studies 1 and 2) to those of participants who anticipated a positive event after a non-stressor. We hypothesized that positive anticipation would facilitate stress regulation/recovery, but only when there is a stressor from which to recover. Otherwise, positive anticipation just reflects the excitement for the upcoming positive event. Therefore, increases in positive emotions during recovery should be differentially predicted across conditions: by decreases in negative emotion after a stressor, and by the excitement to see the upcoming cartoons after a non-stressor. We also tested the possibility that there may be a greater increase in positive emotions after a stressor than after a non-stressor due to either an additive effect of stress regulation and anticipatory excitement, or to greater feelings of relief, in the post-stressor group.

## Method

### Participants

Participants were 50 undergraduates (33 female) at Wake Forest University, aged 18–22 ( $M = 19.02$ ,  $SD = 1.11$ ). One participant did not report age.

### Materials

#### Positive stimuli

The positive stimuli used were the same ‘funny’ cartoons used in Studies 1 and 2. “GUP” and “LUM” were used as arbitrary labels to signify the funny and unfunny cartoons, respectively.

#### Preference and anticipation of cartoons

Participants completed the preference and anticipation of cartoon tasks described in Study 1. Participants did not complete the enjoyment task because of its redundancy with the preference task. Instead, participants just rated their preference of cartoons to confirm that they preferred the funny cartoons to the unfunny ones and reported how excited they were to see the funny cartoons at the end of the study.

#### Current positive and negative emotion

At five intervals throughout the experiment, participants rated their current positive and negative emotion using the visual analogue scale (the far left of the screen reading “not (un)pleasant” and the far right reading “very (un)pleasant”).

### Procedure

#### Anticipation induction

Participants first provided a baseline rating of how pleasant and unpleasant they felt. Participants then completed the cartoon preference task and then rated how excited they were to see the funny and unfunny cartoons at the end of the study. Unlike the previous studies, all participants were assigned to see the funny (positive) cartoons at the end of the study.

#### Pre-preparation period

After being assigned to see the funny cartoons, participants rated how pleasant and unpleasant they felt.

#### Social evaluative threat (SET)

Participants were randomly assigned to prepare either a speech on ‘Why are you a good friend?’ (stressor used in Studies 1 and 2;  $n = 24$ ), or to read a passage aloud (non-stressor;  $n = 26$ ). In the reading preparation condition, participants were told that that they would have 5 min to read a passage out loud that someone else wrote on the topic ‘Why are you a good friend?’ To justify the preparation period and to make it as similar in content as possible to the speech preparation task, participants were told that before they read the passage, they would spend 2 min thinking about the topic that the author wrote about. All participants were told that a coin flip would determine whether they had to speak or not. Participants rated how pleasant and unpleasant they felt 90 s into the two-minute preparation time. At the end of the 2 min, as in the previous studies, the participants were all told that they would not have to speak.

#### Recovery

Participants were reminded that they would see the funny cartoons at the end of the session and asked to sit quietly for 3 min. Participants reported how pleasant and unpleasant they felt 30 s (early recovery) and 150 s (late recovery) into the recovery period. After this period, all participants viewed 30 funny cartoons for 6 s each. Participants were then thanked for their participation and debriefed.

## Results

### Cartoon preference and excitement

Consistent with Studies 1 and 2, when presented one cartoon from each deck side-by-side, participants significantly preferred those from the funny group ( $M = 2.67$ ,  $SD = 1.06$ ),  $t(49) = -8.92$ ,  $p < .001$ ,  $d = .30$ . Participants' reported excitement to view more cartoons from the funny cartoon deck at the end of the study was around the mid-point of the scale reflecting medium levels of excitement ( $M = 888.80$ ,  $SD = 526.14$ ; mid-point = 960),  $t(48) = .947$ ,  $p = .348$ ,  $d = .14$ .

### Differences in affect between speech and reading preparation

We tested the efficacy of our stressor in inducing greater negative emotion and less positive emotion than the non-stressor, as well as the possibility that those anticipating a positive event after a stressor would exhibit a greater boost in positive emotion during the early recovery period than those anticipating a positive event after a non-stressor.

We conducted a 2 (Stressor Type: speech preparation, reading preparation)  $\times$  4 (Period: pre-preparation, preparation, early recovery, late recovery) mixed ANOVA, with Stressor Type as the between-subjects variable, Period as the within-subjects variable, and self-reported pleasantness and unpleasantness as the dependent variables. To capture our conceptualization of recovery as a return to baseline, we subtracted each participant's baseline emotion value from each of the four periods in the analysis.

### Self-reported pleasantness

This analysis yielded a main effect of Period,  $F(3[2.79], 144[133.77]) = 11.50$ ,  $p < .001$ ,  $\eta^2 = .19$ , which was qualified by the expected interaction of Stressor Type and Period,  $F(3[2.79], 144[133.77]) = 7.94$ ,  $p < .001$ ,  $\eta^2 = .14$ . Supporting our use of reading preparation as a non-stressor, the interaction was primarily due to participants in the speech condition reporting greater decreases in pleasantness from baseline during the preparation period ( $M = -339.92$ ,  $SE = 91.12$ ) than people in the reading condition ( $M = 75.65$ ,  $SE = 86.29$ ),  $t(48) = 3.31$ ,  $p = .002$ ,  $d = .94$ . There were no significant differences in pleasantness between the speech and reading groups during any of the other periods ( $ts(48) < .7$ ,  $ps > .492$ ). Consistent with Studies 1 and 2, anticipating a positive event induced an overall increase in positive affect during early recovery relative to baseline ( $M = 190.04$ ,  $SE = 61.60$ ),  $t(49) = 3.09$ ,  $p = .003$ ,  $d = 0.88$ .

### Self-reported unpleasantness

Similar to the above findings with pleasantness, this analysis yielded a main effect of Period,  $F(3[2.06], 144[99.09]) = 16.78$ ,  $p < .001$ ,  $\eta^2 = .26$ , which was qualified by the expected interaction of Stressor Type and Period,  $F(3[2.06], 144[99.09]) = 14.77$ ,  $p < .001$ ,  $\eta^2 = .24$ . Supporting our use of reading preparation as a non-stressor, the interaction was primarily due to participants in the speech condition reporting greater increases in unpleasantness from baseline ( $M = 403.08$ ,  $SE = 94.18$ ) than people in the reading condition ( $M = 43.12$ ,  $SE = 44.64$ ) during the preparation period,  $t(48) = 3.54$ ,  $p = .001$ ,  $d = 0.99$ . There were no significant differences in unpleasantness between the speech and reading groups during the recovery periods ( $ts < 1.51$ ,  $ps > .14$ ). Unlike pleasantness, but consistent with Studies 1 and 2, anticipating a positive event did not induce less negative affect during early recovery relative to baseline ( $M = -56.86$ ,  $SE = 41.73$ ),  $t(49) = 1.12$ ,  $p = .267$ ,  $d = 0.32$ .

### Predicting positive affect during early recovery as a function of stress vs. no stress

Our primary hypothesis was that positive affect reported during early recovery would be differentially associated with negative affect

across conditions. That is, for participants in the stress condition, we hypothesized that positive affect during early recovery would be correlated with concurrent levels of negative affect. For participants in the non-stress condition, we hypothesized that positive affect during early recovery would be unrelated to concurrent negative affect, and would instead be predicted primarily by their excitement to see the cartoons. To test this hypothesis, we conducted a multiple regression with positive affect during recovery predicted by stressor type, cartoon excitement, changes in negative affect from baseline to early recovery, an interaction term for stressor type and excitement, and an interaction term for stressor type and negative affect recovery (Table 3).

Excitement was significantly associated with positive affect recovery,  $\beta = .44$ ,  $t(43) = 2.84$ ,  $p = .007$ , but this effect was qualified by a significant interaction of excitement and condition,  $\beta = .33$ ,  $t(43) = 2.21$ ,  $p = .033$ . There was also a significant interaction of negative affect recovery and condition,  $\beta = .30$ ,  $t(43) = 2.07$ ,  $p = .045$ .

To decompose the interactions, we conducted separate multiple regressions for each of the two stressor types with positive affect recovery as the dependent variable and excitement and negative affect recovery as the predictors. As hypothesized, for the participants who prepared a speech (stressor), positive affect during recovery was related to decreases in negative affect during recovery,  $\beta = .48$ ,  $t(43) = -2.51$ ,  $p = .021$ , and not to excitement for upcoming cartoons,  $\beta = .11$ ,  $t(43) = .568$ ,  $p = .576$ , suggesting that the boost in positive affect during recovery from a stressor after anticipating a positive event was stress-regulatory and not just about the in-the-moment excitement about seeing the cartoons. Also as hypothesized, the reverse was true for the reading preparation condition (non-stressor); positive affect during recovery was related to increases in excitement for the cartoons,  $\beta = .59$ ,  $t(43) = 2.86$ ,  $p = .009$ , and not concurrent negative affect recovery,  $\beta = .15$ ,  $t(43) = .731$ ,  $p = .472$ .

## Discussion

In Study 3, we replicated and extended upon the findings from Studies 1 and 2. Participants anticipating a positive event experienced a boost in positive emotion after the conclusion of a stressor comparable to those from the previous studies, which was related to concurrent decreases in negative affect, but not to their excitement to see the upcoming cartoons. In contrast, participants anticipating a positive event after a non-stressor reported positive affect levels that were related to their excitement to see the upcoming event but not to concurrent negative affect. This finding confirms our formulation that positive anticipation does indeed induce people to use positive emotions during recovery to regulate their post-stress responses, and that these post-stress positive emotions do not just reflect their excitement for the upcoming positive event.

## General discussion

The primary finding from these studies is that anticipating positive events is a reliable and convenient way to induce positive emotion

**Table 3**  
Multiple regression predicting positive affect during early recovery.

Variable	B	SE	$\beta$	<i>t</i>	<i>p</i>
Main effects					
Excitement	185.87	65.55	.44	2.84	.007
NA	-47.20	61.30	-.11	-.77	.446
Condition	-15.09	56.47	-.035	-.27	.791
Interactions					
Excitement $\times$ Condition	143.54	65.06	.33	2.21	.033
NA $\times$ Condition	126.50	61.22	.29	2.07	.045

Note. NA = Negative Affect; Excitement = Excitement for upcoming cartoons.

and to facilitate recovery from stress. Participants anticipating a positive event experienced a boost of positive emotion after being made aware of the positive event and again immediately after the conclusion of the social stressor, and this boost was uniquely related to the regulation of negative affect after the stress task. These participants also displayed an improved ability to manage stress-related cognitions. Importantly, the anticipation of a positive event was equally effective at inducing an adaptive cognitive response as was the recent experience of a positive event.

Past research has shown that habitual experience of positive emotions both before and after stress is a critical factor in building resilience during crises (Algoe & Stanton, 2012; Fredrickson, 2000). People who tend to adapt well to both chronic and acute stress also tend to experience a host of positive emotions throughout their stress experiences (Folkman & Moskowitz, 2000; Fredrickson et al., 2003). The present findings add to this literature to suggest that one potentially effective way to benefit from these positive emotions is to plan and anticipate future positive events. Anticipating a positive event has the potential to be a long-lasting source of intermittent positive emotions because anticipation can occur far in advance of when the event actually takes place. Indeed, the findings of the present studies suggest that anticipating a positive event is a more potent source of positive emotions after stress than experiencing a positive event before the stressor. If one is worried about that upcoming meeting with the boss, it may be a more effective coping strategy to plan to go out with friends afterward than the night before. Past research suggests that people already understand this: when given the choice, they prefer to experience positive events after negative events (Loewenstein & Prelec, 1993).

Positive emotions can facilitate adaptive stress responding in several ways. Our findings suggest that one of these ways is to help individuals better marshal cognitive resources to prepare for an incoming stressor. Segerstrom et al. (2003) argued that positive emotion co-occurring with negative emotion can promote more favorable stress-related outcomes by facilitating certain kinds of thought processes. Stress-related thoughts, which might otherwise be dominated by the ruminative focus of negative emotion, can instead be broadened by positive emotion, leading to more flexible and adaptive responses. For example, Isen, Daubman, and Nowicki (1987) found that positive emotionality improved performance on two problem-solving tasks generally regarded as requiring creative ingenuity. Other research has shown positive emotion to augment general problem-solving skills (Fredrickson & Branigan, 2005), as well as to improve performance in visuospatial flexibility tasks (Rowe, Hirsh, Anderson, & Smith, 2007). Positive emotions are also associated with increased approach motivation (Nes & Segerstrom, 2006), which may induce people to use problem-solving techniques to cope with a stressor (Carver et al., 1989). Our study represents an empirical instantiation of this idea. Thoughts characterized by elevated negative emotion have been shown to interfere with successful coping and problem solving (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). In contrast, and as demonstrated by the present study, thoughts that are characterized by positive emotion promote successful coping and problem solving. This finding is further supported by the close association of positive and negative affect only for participants recovering from a stress task: the boost of positive affect was used to reduce levels of negative affect. One caveat to this formulation, however, is that low-arousal non-approach positive emotions have been shown to more reliably broaden cognition (Gable & Harmon-Jones, 2008), and the positive emotions that we induced in this study were most likely approach-related, given the focus on positive anticipation (Gable & Harmon-Jones, 2008). It will be important for future investigations to tease apart the broadening effects of non-approach positive emotions from the potential attention-capturing effects of approach-related positive emotions (Gable & Harmon-Jones, 2008; Van Boven & Ashworth, 2007) in their influence on stress responding.

We used the preparation of a speech as the stressor from which people recovered. Research suggests that stress experienced after an anticipated stressor is comparable to that of an active stressor (Vaughn et al., 2010). It is not clear, however, whether delivering the speech would have changed the impact that anticipating a positive event had on positive emotions during and after stress. For example, given our finding that positive emotions influence adaptive thoughts during the speech preparation, it is possible that they would also influence the actual performance of that speech. Also, positive anticipation may have differential effects on the relief that one feels after avoiding a potentially aversive event than on the relief felt after completing a stressful task (Sweeny & Vohs, 2012). Future investigations should also consider the moderating role of certain individual differences in reactivity to social stressors. Research suggests that individuals with social anxiety, for example, are particularly averse to interactions characterized by intimate conversation (such as a speech explaining why you are a good friend) (Kashdan et al., 2014). Relatedly, it remains to be seen whether the effect of positive anticipation on stress generalizes to other types of stressors besides just social evaluative threat and to other measures of stress responding, including behavior and/or physiology. For example, it is not clear how effective positive anticipation would be for stressors in which people benefit by experiencing negative emotions beforehand (Tamir, Mitchell, & Gross, 2008).

The timing of the anticipated positive event may also be critical. The design of the current study (i.e., a relatively short-term laboratory experiment) did not allow participants the time to reflect on the positive event, nor did the event result in any interpersonal support to be used during the speech preparation task. Indeed, Fredrickson's (2000) buffering model posits that positive events facilitate management of subsequent stressors through the build-up of cognitive and interpersonal resources. Future investigations that examine the timing of positive events in daily life will illuminate whether pre-event buffering and post-event emotional management processes both influence stress recovery. Relatedly, daily experiences of positive anticipation likely involve future positive events that occur days, if not weeks, after the conclusion of a stressor. Generating positive emotion from more distant positive events may require more effort or a more powerful future positive event. Future investigations should examine whether anticipating a more distant positive event, such as a reminder of an upcoming weekend or holiday, induces similar boosts of positive emotion as did anticipating the funny cartoons immediately after the stressor in the present study.

## Conclusion

The experience of positive emotion throughout the stress process is integral to good physical and mental health. We showed that anticipating a positive event is sufficient to induce a positive emotional state and to facilitate a more adaptive cognitive response. These beneficial effects arise prior to and during recovery from a stressor, and this recovery boost is greater for those anticipating the positive event than for those who had recently experienced the positive event. Decades of research have illustrated the power of anxiety, dread, and negative anticipation (Barlow, 1988; Clark & Wells, 1995), but ours represents the first foray into understanding how people can use future positive events to cope with current stress.

## References

- Algoe, S. B., & Stanton, A. L. (2012). Gratitude when it is needed most: Social functions of gratitude in women with metastatic breast cancer. *Emotion*, 12(1), 163–168. <http://dx.doi.org/10.1037/a0024024>.
- Barlow, D. H. (1988). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. New York: Guilford Publications, Inc.
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5(4), 323–370.
- Brendl, C. M., & Higgins, E. T. (1996). Principles of judging valence: What makes events positive or negative? *Advances in Experimental Social Psychology*, 23, 95–160.



- Bubic, A., Yves von Cramon, D., & Schubotz, R. I. (2010). Prediction, cognition, and the brain. *Frontiers in Human Neuroscience*, 4(25), 1–15.
- Carver, C. S., Lawrence, J. W., & Scheier, M. F. (1996). A control-process perspective on the origins of affect. In L. L. Martin, & A. Tesser (Eds.), *Striving and feeling: Interactions among goals, affect, and self-regulation* (pp. 11–52). Hillsdale, NJ: Erlbaum.
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, 56(2), 267–283.
- Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, 67(2), 319–333.
- Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. Heimberg, M. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York: Guilford Press.
- Condé Nast Collection (2014). The cartoon bank. <http://www.cartoonbank.com>
- DeLongis, A., Folkman, S., & Lazarus, R. S. (1988). The impact of daily stress on health and mood: Psychological and social resources as mediators. *Journal of Personality and Social Psychology*, 54, 486–495.
- Folkman, S., & Moskowitz, J. T. (2000). Positive affect and the other side of coping. *American Psychologist*, 55, 647–654.
- Fredrickson, B. L. (2000). Cultivating positive emotions to optimize health and well-being. *Prevention and Treatment*, 3. <http://dx.doi.org/10.1037/1522-3736.3.1.31a>.
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218–226.
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, 19, 313–332.
- Fredrickson, B. L., & Levenson, R. W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition and Emotion*, 12(2), 191–220.
- Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, 4, 237–258.
- Fredrickson, B. L., Tugade, M. M., Waugh, C. E., & Larkin, G. R. (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *Journal of Personality and Social Psychology*, 84, 365–376.
- Gable, P. A., & Harmon-Jones, E. (2008). Approach-motivated positive affect reduces breadth of attention. *Psychological Science*, 19(5), 476–482.
- Gable, S. L., Reis, H. T., & Elliot, A. J. (2003). Evidence for bivariate systems: An empirical test of appetit and aversion across domains. *Journal of Research in Personality*, 37(5), 349–372.
- Garland, E. L., Gaylord, S. A., & Fredrickson, B. L. (2011). Positive reappraisal mediates the stress-reductive effects of mindfulness: An upward spiral process. *Behavior Science*, 2(1), 59–67.
- Gilbert, D. T., Giesler, R. B., & Morris, K. A. (1995). When comparisons arise. *Journal of Personality and Social Psychology*, 69(2), 227–236.
- Haynes, S. N., Gannon, L. R., Orimoto, L., O'Brien, W. H., & Brandt, M. (1991). Psychophysiological assessment of poststress recovery. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, 3(3), 356–365.
- Herman-Stabl, M. A., Stemmler, M. S., & Peterson, A. C. (1995). Approach and avoidant coping: Implications for adolescent mental health. *Journal of Youth and Adolescence*, 24(6), 649–665.
- Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology*, 52(6), 1122–1131.
- Kashdan, T. B., Goodman, F. R., Machell, K. A., Kleiman, E. M., Monfort, S. S., Ciarrochi, J., et al. (2014). A contextual approach to experiential avoidance and social anxiety: Evidence from an experimental interaction and daily interactions of people with Social Anxiety Disorder. *Emotion*, 14(4), 769–781.
- Kok, B. E., & Fredrickson, B. L. (2010). Upward spirals of the heart: Autonomic flexibility, as indexed by vagal tone, reciprocally and prospectively predicts positive emotions and social connectedness. *Biological Psychology*, 85(3), 432–436.
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159–174.
- Lazarus, & Folkman (1984). *Stress, appraisal, and coping*. New York: Springer.
- Loewenstein, G. F., & Prelec, D. (1993). Preferences for sequences of outcomes. *Psychological Review*, 100(1), 91–108.
- Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology*, 69, 176–190.
- Lyubomirsky, S., Tucker, K. L., Caldwell, N. D., & Berg, K. (1999). Why ruminators are poor problem solvers: Clues from the phenomenology of dysphoric rumination. *Journal of Personality and Social Psychology*, 77, 1041–1060.
- Needles, D. J., & Abramson, L. Y. (1990). Positive life events, attributional style, and hopefulness: Testing a model of recovery from depression. *Journal of Abnormal Psychology*, 99(2), 156–165. <http://dx.doi.org/10.1037/0021-843X.99.2.156>.
- Nes, L. S., & Segerstrom, S. C. (2006). Dispositional optimism and coping: A meta-analytic review. *Personality and Social Psychology Review*, 10(3), 235–251.
- Ong, A. D., Bergeman, C. S., Bisconti, T. L., & Wallace, K. A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of Personality and Social Psychology*, 91(4), 730–749.
- Papousek, I., Nauschnegg, K., Paechter, M., Lackner, H. K., Goswami, N., & Schuster, G. (2010). Trait and state positive affect and cardiovascular recovery from experimental academic stress. *Biological Psychology*, 83, 108–115.
- Rowe, G. G., Hirsh, J. B., Anderson, A. K., & Smith, E. E. (2007). Positive affect increases the breadth of attentional selection. *PNAS Proceedings of the National Academy of Sciences of the United States of America*, 104(1), 383–388.
- Segerstrom, S. C., Stanton, A. L., Alden, L. E., & Shortridge, B. E. (2003). A multidimensional structure for repetitive thought: What's on your mind, and how, and how much? *Journal of Personality and Social Psychology*, 85(5), 909–921.
- Sweeny, K., & Vohs, K. D. (2012). On near misses and completed tasks: The nature of relief. *Psychological Science*, 23, 464–468.
- Tamir, M., Mitchell, C., & Gross, J. J. (2008). Hedonic and instrumental motives in anger regulation. *Psychological Science*, 19(4), 324–328.
- Trzcieniecka-Green, A., & Steptoe, A. (1996). The effects of stress management on quality of life of patients following acute myocardial infarction or coronary bypass surgery. *European Heart Journal*, 17, 1663–1670.
- Tugade, M. M., & Fredrickson, B. L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*, 86, 320–333.
- Van Boven, L., & Ashworth, L. (2007). Looking forward, looking back: Anticipation is more evocative than retrospection. *Journal of Experimental Psychology*, 136(2), 289–300.
- Viney, L. L. (1986). Expression of positive emotion by people who are physically ill: Is it evidence of defending or coping? *Journal of Psychosomatic Research*, 30(1), 27–34.
- Waugh, C. E. (2014). *The regulatory power of positive emotions in stress: A temporal-functional approach*. Handbook of resilience: Approaches to stress and trauma, 73–85.
- Waugh, C. E., Fredrickson, B. L., & Taylor, S. F. (2008). Adapting to life's slings and arrows: Individual differences in resilience when recovering from an anticipated threat. *Journal of Research in Personality*, 42(4), 1031–1046.
- Waugh, C. E., & Gotlib, I. (2008). Motivation for reward as a function of required effort: Dissociating the 'liking' from the 'wanting' system in humans. *Motivation and Emotion*, 19(4), 443–452.
- Waugh, C. E., Panage, S., Mendes, W., & Gotlib, I. (2010). Cardiovascular and affective recovery from anticipated threat. *Biological Psychology*, 84, 169–175.
- Wilson, T. D., & Gilbert, D. T. (2003). Affective forecasting. In M. P. Zanna (Ed.), *Advances in experimental social psychology*, Vol. 35. (pp. 345–411). San Diego, CA: Academic Press.