Journal of Experimental Social Psychology 57 (2015) 87–99

Contents lists available at ScienceDirect

Journal of Experimental Social Psychology

journal homepage: www.elsevier.com/locate/jesp

Revisiting the restorative effects of positive mood: An expectancy-based approach to self-control restoration

Patrick M. Egan [a,*], Joshua J. Clarkson [b], Edward R. Hirt [a]

[a] Indiana University, USA
[b] University of Cincinnati, USA

HIGHLIGHTS

- Examined how expectancies affect the relationship between mood and self-control.
- Found association between positive mood and expectancies of mental restoration.
- Found idiosyncratic expectancies mediate the effect of mood on perceived depletion.
- Manipulated expectancies moderated mood's conventional influence on self-control.
- Expectancies of mental energy change are central in mood's self-control influence.

ARTICLE INFO

Article history:
Received 21 April 2014
Revised 25 August 2014
Available online 6 December 2014

Keywords:
Mood
Expectation
Recovery
Depletion
Self-control
Perception

ABSTRACT

The present research explored the empirical relation between positive mood and self-control restoration. In line with recent work on the perceptual correlates of self-control exertion, we tested whether positive mood's restorative effects could be partly attributable to expectancies of mental energy change. Results showed that positive mood elicited a general expectancy of mental energy restoration and that negative mood elicited a general expectancy of mental energy depletion. Furthermore, these expectancies were shown to alter perceptual and cognitive state in manners predictive of downstream self-control performance. Together, these results compliment emerging work on the importance of perceptual processes in the modulation of self-control performance, and warrant future work on the role of expectancies and subjective fatigue in self-regulatory pursuits.

Introduction

Positive mood is a topic that has received extensive social–psychological inquiry over the past several decades. As a highly ubiquitous (Diener, Sandvik, & Pavot, 1991), desirable (Inglehart, 1990), and malleable (e.g., Tamir & Robinson, 2007) psychological construct, researchers have taken a keen interest in uncovering the consequences associated with positive moods (Fredrickson, 2001; Isen, 2000; Labroo & Patrick, 2009; Lyubomirsky, King, & Diener, 2005). This interest has yielded several intriguing conclusions, with elevated moods promoting enhanced creativity (Hirt, Devers, & McCrea, 2008; Isen, 1987), heightened integration of information (Schwarz & Clore, 1996), improved health outcomes (Lyubomirsky et al., 2005), and decreased stress (Folkman & Moskowitz, 2000). Of interest to the present work, however, are the consequences of positive mood for self-control restoration (Tice, Baumeister, Shmueli, & Muraven, 2007).

Mood and self-control

In a seminal paper on self-control restoration, Tice et al. (2007) demonstrated that positive mood inductions can eliminate the onset of mental depletion when interspersed between two consecutive self-control tasks. In particular, Tice and colleagues had individuals engage in an initial self-control depletion task before completing one of several different positive mood inductions (e.g., watching a comedy video). After the mood induction, participants were asked to engage in a task that required some level of self-control exertion (e.g., handgrip performance). Results indicated that positive mood removed the aversive consequences typically associated with extended self-control exertion, such that depleted individuals induced with a positive (versus neutral or negative) mood demonstrated higher self-control performance on a subsequent task; performance that was equivalent to non-depleted individuals. Thus, it would appear that positive mood can "restore"

* Corresponding author at: Department of Psychological and Brain Sciences, Indiana University, 1101 E. 10th Street, Bloomington, IN 47405, USA.
E-mail address: pmegan@indiana.edu (P.M. Egan).

http://dx.doi.org/10.1016/j.jesp.2014.11.006
0022-1031/

self-control ability back to baseline levels in a rapid and efficient manner (see also Fredrickson, Mancuso, Branigan, & Tugade, 2000; Fry, 1975; Leith & Baumeister, 1996).

The most apparent question stemming from this work is *how* positive mood elicits these restorative effects. One possibility offered from Tice et al. (2007) is that positive mood increases stores of physiological energy available to the individual, thus heightening the availability of these energy stores for subsequent tasks. Indeed, some theorists argue that self-control relies upon a particular set of physiological resources that are depleted with extended use (see Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Muraven, & Tice, 2000; Baumeister & Tierney, 2011; Muraven, Tice, & Baumeister, 1998), and can be recovered through physiological intervention (Baumeister, Vohs, & Tice, 2007; Gailliot et al., 2007; Gailliot & Baumeister, 2007; Gailliot, Peruche, Plant, & Baumeister, 2009; Masicampo & Baumeister, 2008). It follows that if positive mood can evoke heightened physiological arousal (Fredrickson, 2001; Thayer, 1989), mood-induced self-control restoration could provide a veridical "refueling" of physiological resources (see also Tice, Bratslavsky, & Baumeister, 2001).

The present work seeks to explore an alternative explanation for mood-induced self-control restoration grounded in primarily psychological, rather than physiological, processes. That is, even if positive mood affects physiological energy stores in manners predictive of self-control success, it is unlikely that these physiological processes operate in isolation from related psychological processes. Consistent with this reasoning, increasing evidence suggests that motivational (Molden et al., 2012; Muraven & Slessareva, 2003), cognitive (Carter, McCullough, & Carver, 2012; Schmeichel & Vohs, 2009), and perceptual (Clarkson, Hirt, Jia, & Alexander, 2010; Muraven, Gagné, & Rosman, 2008) mechanisms can underlie self-control change in the absence of presumed physiological change. Among these mechanisms, the current paper examines whether positive mood's restorative influence is partially attributable to *expectancies of mental energy restoration*. Specifically, we reasoned that: (1) positive mood may be associated with stronger expectancies of mental energy restoration than is negative mood; (2) these expectations may explain the restorative effects of positive mood and the non-restorative effects of negative mood; and (3) altering these expectancies may facilitate restorative effects from negative mood and non-restorative effects from positive mood.

Mood, expectancies, and behavior

If mood modulates self-control via the operation of expectancies, we would anticipate that positive and negative mood should diverge in terms of energy-relevant expectancies, particularly those that implicate mental energy change. Partial support for this proposition comes from work on expectancies of transient change regarding mood (Clore & Ortony, 1991; Cunningham, 1988; Goldman, Kraemer, & Salovey, 1996; Rimé, Philippot, & Cisamolo, 1990; Shaver, Schwartz, Kirson, & O'Connor, 1987). This work shows that individuals hold relatively consensual expectancies about the energetic implications of particular mood states, such that positive mood states elicit stronger expectancies of energy restoration (e.g., energetic, active) and weaker expectancies of energy depletion (e.g., tired, rundown) in comparison to negative mood states (Cunningham, 1988; Shaver et al., 1987). The initial aim of the present work is to explore whether these polarized expectancies about mood's energetic influence apply to the domain of mental energy specifically. In particular, we test the possibility that positive and negative mood states are associated with divergent expectations of mental energy change, with positive mood activating stronger expectancies of mental restoration and negative mood activating stronger expectancies of mental exhaustion.

Assuming that different mood states activate divergent expectancies of mental energy change, it follows that these expectancies can facilitate divergent behavioral outcomes. Numerous examples of expectancy effects have been observed within the medical and human physiology literatures, such that expectations consistently guide the physiological and behavioral changes associated with a given treatment condition (Colloca & Benedetti, 2005; Finniss, Kaptchuk, Miller, & Benedetti, 2010; Meissner et al., 2011; Morton, El-Deredy, Watson, & Jones, 2010; Stewart-Williams & Podd, 2004). For instance, restorative expectancies concerning a particular medical treatment predict analgesic responses rivaling direct physiological intervention (Aslaksen & Flaten, 2008; Morton et al., 2010). Furthermore, these types of expectancy effects are obtained in myriad domains, ranging from sleep recovery (Draganich & Erdal, 2014) to cardiovascular improvement (Crum & Langer, 2007; Stoate, Wulf, & Lewthwaite, 2012) to pain alleviation (Kam-Hansen et al., 2014) to hunger satiation (Crum, Corbin, Brownell, & Salovey, 2011). Given such far-reaching influences, researchers have begun identifying the operation of expectancies in self-control exertion (Job, Dweck, & Walton, 2010; Job, Walton, Bernecker, & Dweck, 2013; Martijn, Tenbult, Merckelbach, Dreezens, & de Vries, 2002; Vohs, Baumeister, & Schmeichel, 2012). As but one example, individuals who expect willpower to decrease rapidly over time show greater susceptibility to self-control depletion than do individuals who expect willpower to remain stable and/or increase over time (Job et al., 2010; Martijn et al., 2002).

Taken together, the work reviewed thus far suggests that positive and negative mood states are associated with divergent expectancies of energy change, and that expectancies of energy change influence behavioral outcomes inside and outside the domain of self-control. The present work seeks to apply these findings to the phenomenon of mood-induced self-control restoration by examining whether mood is associated with divergent expectancies of mental energy change, and whether such expectancies influence the emergence of improved self-control behavior following an experimental mood induction.

From expectancies to self-control

In addition to exploring *if* expectancies impact mood-induced self-control restoration, the present work also explores *how* such expectancies might exert this impact. Based on previous work, we anticipate perceptual mechanisms to play a key mediating role in the association between expectancies and self-control performance. Research within the medical domain suggests that expectancies influence treatment outcomes through the operation of perceptual changes (e.g., decreased pain, increased optimism; Meissner et al., 2011). These perceptual changes not only reinforce the benefits of active treatments (Aslaksen & Flaten, 2008); they also mobilize other processes that emerge irrespective of treatment condition (Crum & Langer, 2007). These general findings converge with recent work suggesting that changes in perceived mental depletion (i.e., the extent to which individuals feel less able to focus or concentrate at a given moment) underlie the influence of expectancies within self-control contexts. Using informational manipulations concerning the perceived source (Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011) or malleability (Job et al., 2010) of mental energy fluctuation, researchers have shown that expectancy information indirectly modulates self-control exertion through corresponding changes in perceived mental depletion. For instance, Clarkson et al. (2010) found that task feedback following self-control exertion led to divergences in perceived mental depletion, and these perceptual changes explained the feedback's behavioral influence in a manner that was independent of prior self-control exertion (see also Muraven et al., 2008).

Based upon these findings, we hypothesized that expectancies of mental energy change concerning mood could catalyze expectancy-congruent changes in perceived mental depletion. That is, the association of positive mood to mental energy restoration and negative mood to mental energy exhaustion should lead these mood states to promote divergent perceptions of mental depletion. Furthermore, given that perceived mental depletion shows a direct correspondence with working memory capacity (Clarkson, Hirt, Chapman, & Jia, 2011; Muraven et al., 2008), and working memory capacity shows a similar correspondence with self-control exertion (Hofmann, Gschwender, Friese, Wiers, & Schmitt, 2008; Schmeichel, 2007; Schmeichel, Volokhov, & Demaree, 2008; Shamosh & Gray, 2007), these mood-relevant expectancies should not only drive discrepancies in perceived mental depletion, but should also catalyze subsequent changes in working memory capacity and self-control exertion.

Overview

We present four studies that examine (1) the extent to which positive and negative mood are associated with expectancies of mental energy restoration, and (2) the extent to which such expectancies cause depleted participants to exhibit perceptual, cognitive, and behavioral evidence of self-control restoration. To begin, we predicted positive mood would be associated with stronger expectancies of mental restoration than would negative mood (Studies 1–2). Next, we predicted that these expectancies would catalyze a perceptually-driven process of self-control change, such that positive mood would promote decreased perceived mental depletion and increased working memory capacity, whereas negative mood would promote increased perceived mental depletion and decreased working memory capacity (Studies 2–3). Finally, we predicted that manipulating these mood-related expectancies would moderate the typical relationship between mood and self-control persistence, such that participants whose mood state was explicitly associated with mental recovery would show evidence of self-control restoration, whereas participants whose mood state was explicitly associated with mental exhaustion would show evidence of self-control depletion (Study 4). In all experimental studies, we utilized participants who were initially exposed to a depletion manipulation, given our interest in self-control restoration effects (e.g., Fredrickson et al., 2000; Tice et al., 2007).

Study 1

Although previous work has shown a strong relation between mood and expectancies of generalized energy change (Cunningham, 1988; Rimé et al., 1990; Shaver et al., 1987), minimal work has explored whether such patterns apply to expectancies of mental energy change specifically. Accordingly, Study 1 assessed participants' beliefs concerning how either positive or negative mood would affect their subsequent mental capabilities. We predicted that positive mood would be associated with expectancies of mental energy restoration, and negative mood would be associated with expectancies of mental energy depletion.

Method

Sixty-nine undergraduates (37 females) received partial course credit for completing one of two questionnaires about the effects of mood on mental energy. Participants were randomly assigned to receive five questions concerning their expectations of mood (e.g., "Positive (Negative) mood gives me more mental energy than normal"). Items were identical across conditions with the exception that they considered the experience of either a positive or negative mood (see Appendix 1). Responses were given on a 9-pt scale anchored at 1 (*Strongly disagree*) to 9 (*Strongly agree*) with 5 (*Neither agree nor Disagree*) as a neutral reference point. Items for the positive ($\alpha = .77$) and negative ($\alpha = .71$) mood scales were averaged separately, with higher values indicating a greater expectancy towards mental restoration.

Results/discussion

We submitted the expectancy data to a *t*-test, with mood as the independent variable. The analysis revealed a significant main effect of mood ($t(67) = 14.00$, $p < .001$); consistent with predictions, participants who considered the experience of a positive mood ($M = 7.33$, $SD = 0.88$) reported a stronger expectancy of mental restoration than did participants who considered the experience of a negative mood ($M = 3.69$, $SD = 1.21$). Furthermore, the grand mean for participants who considered positive mood was significantly above the scalar midpoint ($t(30) = 14.81$, $p < .001$), whereas the grand mean for participants who considered negative mood was significantly below the scalar midpoint ($t(37) = -6.67$, $p < .001$). These findings suggest that participants had relatively polarized expectancies regarding the mental energy changes resulting from positive and negative mood states, with positive mood invoking expectancies of mental restoration and negative mood invoking expectancies of mental depletion.[1]

Study 2

Given the role of perceptual change in facilitating expectancy-driven effects both outside (Meissner et al., 2011) and inside (Clarkson et al., 2010; Job et al., 2010) the domain of self-control exertion, Study 2 examined whether the expectancies identified in Study 1 modulate mood's influence on perceived mental depletion. To this end, we assessed participant's mood-relevant expectancies of mental energy change in an initial measurement session, and then used these expectancies to predict mood-induced changes in perceived mental depletion in a subsequent experimental session. Consistent with Study 1, we predicted that participants would associate positive mood with mental restoration and negative mood with mental depletion. Furthermore, we predicted that participants who endorsed these associations most strongly would be those individuals most likely to show mood-induced changes in perceived mental depletion.

Method

Participants and design

132 undergraduates (95 females) participated for partial course credit. As part of a larger initial survey, participants reported their expectancies concerning the association between mood and mental energy. Two to four weeks later, participants from this initial session completed a subsequent experimental session. In order, this experimental session involved a mental depletion induction, a mood manipulation, and self-report assessments of mood, motivation, and perceived mental depletion. Non-depleted and depleted control conditions were included for comparison purposes.

Independent variables

Depletion manipulation. Participants were asked to write a story about their day yesterday for 5 min while withholding the use of common (i.e., A and N; depletion condition) or uncommon (i.e., X and Z; non-depletion condition) letters. This procedure has been shown to elicit differential amounts of self-control depletion, such that withholding the use of more common letters requires greater inhibitory processing (Schmeichel & Vohs, 2009).

[1] This conclusion is further strengthened via examining the distribution of responses for the expectancy index. In particular, only 1 participant reported an expectancy of positive mood that fell below the scalar midpoint, and only 3 participants reported an expectancy of negative mood that fell above the scalar midpoint. In other words, only 6% of our sample reported expectancies that qualitatively differed from the notion that positive mood is restorative and negative mood is depleting.

Mood manipulation. Participants were asked to write for 5 min about a recent positive or negative emotional experience. This procedure has been shown to induce corresponding changes in mood (Bless et al., 1996; Fishbach & Labroo, 2007; Schwarz & Clore, 1983; Tamir & Robinson, 2007). Depleted and non-depleted controls did not complete this recall task.

Dependent variables

Expectancies. In the initial survey session, participants completed two items concerning their beliefs about the mental energy impact of positive and negative mood. For each item, participants indicated the extent to which this mood state (i.e., positive mood, negative mood) would influence their subsequent level of mental energy, using a scale ranging from 1 (*Very mentally depleting*) to 7 (*Very mentally restorative*) with 4 (*Neither restorative nor depleting*) as a neutral reference point.

Mood. Participants reported their current mood on two 9-point semantic differential scales ranging from 1 (*Very bad/Very negative*) to 9 (*Very good/Very positive*). These items, adapted from prior research (Schwarz & Clore, 1983), were combined to form an overall index of mood ($r = .78$, $p < .001$).

Motivation. Given the role of explicit motivation in moderating the effects of mental depletion (Muraven & Slessareva, 2003), we included assessments of motivation in the remainder of our studies to account for this alternative mechanism. In the present study, participants reported their prospective motivation to engage in an ambiguous upcoming experimental task (i.e., "How willing are you to complete the next task in the experiment?") on a 9-point scale ranging from 1 (*Not at all*) to 9 (*Very much*).

Perceived mental depletion. Participants reported their current level of perceived mental depletion by indicating the extent to which they could concentrate at the present moment (i.e., "How well can you concentrate right now?") on a 9-point scale ranging from 1 (*Not well at all*) to 9 (*Very well*). Responses were reverse-coded such that higher values indicated greater perceived mental depletion (Clarkson, Hirt, Chapman, & Jia, 2011; Smets, Garssen, Bonke, & De Haes, 1995).

Results

The analytic procedures utilized in Study 2 assessed participants' expectancies towards positive and negative mood, the effects of experimental condition on our dependent measures of interest, and the moderating impact of expectancies as a function of experimental condition. Means and standard deviations of each dependent measure in each condition can be found in Table 1.

Expectancies

We first examined the nature of participants' expectancies regarding positive and negative mood. Consistent with Study 1, we found that participants held mentally restorative expectancies concerning positive mood, as well as mentally depleting expectancies concerning negative mood. Specifically, participant's expectancies towards these two mood states were significantly different from one another in a paired-sample comparison ($t(131) = 42.92$, $p < .001$), with expectancies towards positive mood falling significantly above the scalar midpoint ($t(131) = 35.80$, $p < .001$), and expectancies towards negative mood falling significantly below the scalar midpoint ($t(131) = -30.49$, $p < .001$).

We next examined the extent to which expectancies regarding positive and negative mood correlated with one another. Interestingly, these expectancies showed a reliable negative correlation ($r = -.19$, $p = .03$), such that more restorative expectancies of positive mood were associated with more depleting expectancies of negative mood. Given this negative relationship, responses concerning expectancies about negative mood were reverse-coded and combined with expectancies concerning positive mood to form an overall expectancy index, with higher values indicating more polarized expectancies concerning the restorative influence of positive mood and the depleting influence of negative mood.

Finally, to ensure the adequacy of our random assignment procedures, we examined the extent to which our expectancy index data varied as a function of condition. An omnibus Analysis of Variance (ANOVA) showed that there was no significant differences in expectancies across conditions ($F < 1$, $p = .87$, $\eta_p^2 = .01$).

Between-subjects analyses

Mood. We first examined the effect of condition on self-reported mood. For one, we conducted a pairwise comparison of mood as a function of mood condition. These data revealed a significant effect ($t(63) = 2.11$, $p = .04$); participants who wrote about a positive experience reported a more positive mood than did participants who wrote about a negative experience. In addition, we compared the mood data in our depleted and non-depleted controls. This analysis revealed no differences in self-reported mood between our control groups ($t < 1$, $p = .60$).

Motivation. Next, we examined the effect of condition on participants' motivation to engage in a subsequent experimental task. Motivation did not vary significantly as a function of mood condition (i.e., positive vs. negative; $t < 1$, $p = .70$), control condition (i.e., depleted vs. non-depleted; $t < 1$, $p = .97$), or overall experimental condition ($F < 1$, $p = .97$, $\eta_p^2 = .00$).

Perceived mental depletion. Finally, we examined the effect of condition on perceived mental depletion. First, a pairwise comparison of perceived mental depletion as a function of mood condition revealed a significant effect ($t(63) = -2.22$, $p = .03$); participants who wrote about a positive experience reported less perceived mental depletion than did participants who wrote about a negative experience. Second, a pairwise comparison of perceived mental depletion as a function of control condition revealed a significant effect ($t(65) = 2.23$, $p = .03$); non-depleted controls reported lower levels of perceived mental depletion than did depleted controls.

To assess whether these mood-induced changes in perceived mental depletion represented evidence of perceptual restoration, we compared our perceived depletion data across the experimental and control conditions using a one-way omnibus ANOVA, which revealed a significant main effect ($F(3,128) = 3.58$, $p = .02$, $\eta_p^2 = .08$). Planned contrasts indicated that the perceived mental depletion of positive mood participants significantly differed from depleted controls ($t(128) = 2.89$, $p = .01$), the perceived mental depletion of negative mood participants was not significantly different from depleted controls ($t < 1$, $p = .43$), and the combined perceived mental depletion of non-depleted controls and positive mood participants was significantly lower than the combined perceived mental depletion of depleted controls and negative mood participants ($t(128) = 3.14$, $p = .002$). Thus, positive mood participants

Table 1
Dependent measurements from Study 2.

Study 2	PM	NM	D	ND
Expectancy index	6.23^a (0.62)	6.26^a (0.58)	6.23^a (0.52)	6.15^a (0.67)
Mood	6.27^a (1.88)	5.35^b (1.65)	$6.06^{a,b}$ (1.82)	6.26^a (1.29)
Perceived depletion	3.58^a (1.80)	4.62^b (1.94)	5.00^b (2.06)	$3.88^{a,b}$ (2.04)
Motivation	6.81^a (2.02)	6.62^a (1.95)	6.61^a (2.09)	6.59^a (2.00)

Note: PM = positive mood; NM = negative mood; D = depleted control; ND = non-depleted control.
Scores represent mean response values, with standard deviations in parentheses.
Means sharing the same subscript do not significantly differ from one another.

exhibited evidence of perceptual restoration from the initial depletion manipulation, whereas negative mood participants did not.

Condition × expectancy interaction. To further explore the role of expectancies in the relationship between mood condition and perceived mental depletion, we conducted a linear regression analysis predicting perceived mental depletion as a function of mood condition (1 = Positive Mood, −1 = Negative Mood), expectancies, and their interaction term. The regression equation assessed main effects in an initial step, followed by the interaction term in a subsequent step.

The overall equation was significant, $F(3, 64) = 5.20$, $p = .003$, $R^2 = .20$. There was no main effect of expectancies ($\beta = -.02$, $b = -.07$, $SE = .40$, $t(62) = -0.18$, $p = .86$, $\Delta R^2 = .00$), but there was a significant main effect of condition ($\beta = -.27$, $b = -.52$, $SE = .24$, $t(62) = -2.21$, $p = .03$, $\Delta R^2 = .07$), such that participants in the positive mood condition reported lower mental depletion than did negative mood participants. This main effect was qualified by a significant interaction between expectancies and condition ($\beta = -4.45$, $b = -1.18$, $SE = .37$, $t(61) = -3.16$, $p = .002$, $\Delta R^2 = .13$). To further explore this interaction, we utilized separate regression equations within each mood condition to predict perceived mental depletion as a function of expectancies. Within the positive mood condition, there was a significant negative effect of expectancies, such that stronger restorative expectancies towards positive mood predicted lower perceived mental depletion ($\beta = -.42$, $b = -1.23$, $SE = .49$, $t(29) = -2.50$, $p = .02$, $R^2 = .18$). Within the negative mood condition, there was a significant positive effect of expectancies, such that stronger depleting expectancies towards negative mood predicted higher perceived mental depletion ($\beta = .34$, $b = 1.12$, $SE = .56$, $t(32) = 2.01$, $p = .05$, $R^2 = .11$). These findings suggest that expectancies of mood's energetical influences bias one's perceptions of mental depletion in an expectancy-congruent manner.

Discussion

The findings of Study 2 demonstrate the impact of idiosyncratic expectancies of mental energy change on perceived mental depletion. In addition to replicating the findings from Study 1, in which participants expected positive mood to restore mental energy and negative mood to deplete mental energy, we found that individual-level variability in these expectancies predicted the extent to which a mood manipulation subsequently influenced perceived mental depletion. That is, participants who endorsed the strongest association between mood and mental energy change were those participants most likely to report corresponding changes in perceived mental depletion following a mood manipulation. Thus, positive mood was more likely to decrease perceived mental depletion among participants who expected positive mood to elicit mental restoration, and negative mood was more likely to increase perceived mental depletion among participants who expected negative mood to elicit mental exhaustion. Given the large time gap between our initial survey assessment of expectancies and our experimental assessment of mood-induced perceived mental depletion (i.e., 2–4 weeks), our findings suggest that mood-relevant expectancies of mental energy change are both stable and consequential to the immediate influence of positive and negative mood.

In addition to highlighting the consequences of holding particular expectancies towards positive and negative mood, Study 2 also extends work on the self-regulatory influence of positive and negative mood. Irrespective of expectancies, our experimental mood induction led to changes in perceived mental depletion, such that participants reported subjective changes in mental ability that correspond with documented associations between mood and behavioral self-control restoration (Tice et al., 2007). Furthermore, we found that these perceptual changes were relatively robust, in that they differed from control conditions that were not exposed to any type of mood induction. From these findings, it follows that mood may not only have direct effects on behavioral self-control exertion, it may also indirectly exert such effects via perceptual processes (Clarkson et al., 2010; Muraven et al., 2008).

Study 3

To continue exploring the perceptual pathway between mood and self-control behavior, Study 3 measured both subjective and objective indicators of self-control ability following an experimental mood induction. We reasoned that if positive and negative mood are associated with differential expectancies of mental energy change (Studies 1–2), and these expectancies moderate mood's impact on perceived mental depletion (Study 2), then mood-induced changes in perceived mental depletion should predict objective indicators of self-control ability (e.g., working memory capacity). Thus, Study 3 exposed depleted individuals to an experimental mood manipulation, and then assessed how this manipulation impacted both perceived mental depletion and working memory capacity. In line with the results of Study 2, we hypothesized that participants would report lower levels perceived mental depletion when exposed to a positive mood manipulation and higher levels of perceived mental depletion when exposed to a negative mood manipulation. Furthermore, we hypothesized that participants would exhibit higher working memory performance when exposed to a positive mood manipulation and lower working memory performance when exposed to a negative mood manipulation (Fredrickson et al., 2000; Hofmann et al., 2008; Schmeichel et al., 2008; Tice et al., 2007). Third, we hypothesized that mood's impact on working memory performance would be mediated by changes in perceived mental depletion (Clarkson et al., 2010; Job et al., 2010; Muraven et al., 2008).

In addition to exploring the role of perceived mental depletion in mood-induced self-control change, Study 3 also attempted to expand the generalizability of our findings by foregoing the direct measurement of participants' mood-relevant expectancies. Although we included expectancy measurements in Study 2, collecting these measures prior to a mood induction procedure heightens the potential for demand characteristics to emerge. To minimize the potential influence of demand effects, Study 3 assessed mood-induced changes in perceived depletion and working memory performance in the absence of prior expectancy measurements. This method affords a more naturalistic test of whether positive mood catalyzes perceptual and cognitive changes associated with self-control restoration (Tice et al., 2007), and whether perceptual metrics predict cognitive assessments of self-control capability (Clarkson, Hirt, Chapman, & Jia, 2011).[2]

Method

Participants and design

One-hundred sixty-six undergraduates (88 females) participated for partial course credit. Participants were initially depleted and then randomly assigned to either the positive or negative mood condition. Non-depleted and depleted control conditions were included for comparison purposes.

Procedure

Participants reported to the lab for a study on memory and judgment. Seated at individual computer stations, participants were initially asked to complete a writing assessment that required differing levels of self-control exertion (see depletion manipulation). Following the writing assessment, participants in the experimental conditions completed an experiential recall task in which they were asked to describe either a positive or negative experience in their life (see mood manipulation). After the recall task (or directly after the writing assessment for

[2] Given that Studies 1 and 2 showed that energetical expectancies concerning positive and negative mood were relatively polarized, we reasoned that such expectancies should also be polarized among additional participant samples taken from this student population (Cunningham, 1988; Rimé et al., 1990; Shaver et al., 1987).

controls), participants reported their current mood and mental depletion before completing an index of working memory capacity.

Independent variables

Depletion manipulation. Participants were asked to list their thoughts on a piece of paper for 5 min. Depleted participants were instructed to think freely about anything, *except* for a white bear, whereas non-depleted participants were instructed to think freely about anything, *including* a white bear (Wegner, Schneider, Carter, & White, 1987). This procedure has been shown to differentially require self-control, as the act of thought suppression increases cognitive inhibition processes towards the suppressed thought (Clarkson et al., 2010; Muraven et al., 1998).

Mood manipulation. We used the same mood induction as Study 2, in which participants wrote for 5 min about a positive or negative experience.

Dependent variables

Mood. We assessed participants' mood using the same semantic differential scales from Study 2 ($r = .73$, $p < .001$).

Perceived mental depletion. We assessed perceived mental depletion using the same concentration item from Study 2. Responses were again reverse-coded, with higher values indicating greater perceived mental depletion.

Working memory capacity. Participants were presented with a variant of the widely-used Operation Span Task (*OSPAN*; Turner & Engle, 1989) to assess their current working memory capacity. This computerized task presented a series of sentences, each of which required participants to count the number of vowels as quickly and accurately as possible. Interspersed between sentences, participants were presented with a single word (e.g., 'DRESS') and asked to keep the word in memory while performing the vowel-counting task. After a block of sentences and intervening words (blocks ranged from 3–5 sentences), participants were asked to recall the words presented with the block, in the exact order they were originally presented. Participants completed eight blocks total, and an OSPAN score was calculated for each participant by adding up the total number of correct words recalled in the correct order. OSPAN scores ranged from 0 to 36, with higher values indicating greater working memory capacity.

Motivation

Because Study 2 showed no differences *prospective* motivation (i.e., one's willingness to exert effort on an upcoming task) as a function of our experimental mood manipulation, we chose to include measures of *retrospective* motivation (i.e., one's recalled willingness to exert effort on a previous task) in Study 3 to assess an alterative relationship between mood and task motivation. Specifically, participants indicated the extent to which they were motivated on the OSPAN task (i.e., "How motivated were you to work hard on the previous task?") on a 9-point scale ranging from 1 (*Not at all*) to 9 (*Very much*).

Conservation

In addition to the importance of effort motivation (i.e., one's motivation to exert effort on a given task, Muraven & Slessareva, 2003), research suggests that self-control exertion varies as a function of conservation motivation (i.e., one's motivation to conserve resources for future tasks, Muraven, Shmueli, & Burkley, 2006). As such, we utilized subjective measurements of conservation in our remaining studies to address this alternative mechanism. In the present study, participants indicated the extent to which they conserved energy during the OSPAN task (i.e., "How much were you trying to conserve your energy during the previous task?") on a scale ranging from 1 (*Not at all*) to 9 (*Very much*).

Table 2
Dependent Measurements from Study 3.

Study 3	PM	NM	D	ND
Mood	6.50^{a} (1.72)	5.32^{b} (1.44)	5.99^{a} (1.25)	6.19^{a} (1.28)
Perceived depletion	3.59^{a} (1.99)	4.79^{b} (1.60)	4.50^{b} (1.70)	3.63^{a} (1.71)
Working memory capacity	30.90^{a} (4.02)	28.64^{b} (6.41)	27.59^{b} (8.22)	$30.50^{a,b}$ (4.93)
Motivation	$6.07^{a,b}$ (2.27)	$6.36^{a,b}$ (1.99)	5.98^{a} (2.12)	6.85^{a} (1.70)
Conservation	4.05^{a} (2.46)	4.74^{a} (2.53)	4.52^{a} (2.11)	4.65^{a} (2.49)

Note: PM = positive mood; NM = negative mood; D = depleted control; ND = non-depleted control.
Scores represent mean response values, with standard deviations in parentheses.
Means sharing the same subscript do not significantly differ from one another.

Results

The analytic procedures utilized in Study 3 assessed the effects of condition on our dependent measures of interest, as well as the mediating impact of perceived depletion on working memory performance. Means and standard deviations of each dependent measure as a function of condition are found in Table 2.

Between-subjects analyses

Mood. To assess the veracity of our mood manipulation, we conducted a pairwise comparison of participants' self-reported mood in the two experimental conditions, which revealed a significant effect ($t(81) = 3.39$, $p = .001$); participants who wrote about a positive experience reported a more positive mood than did participants who wrote about a negative experience. There were no differences in mood among depleted and non-depleted controls ($t < 1$, $p = .47$). Both of these findings parallel the results reported in Study 2.

Perceived mental depletion. First, we conducted a pairwise comparison of perceived mental depletion among the two experimental conditions, which revealed a significant effect ($t(81) = 3.30$, $p = .01$); participants in the positive mood condition reported lower mental depletion than did participants in the negative mood condition. Second, we conducted a similar comparison among the two control conditions, which also revealed a significant effect ($t(82) = -2.35$, $p = .02$); non-depleted controls reported lower mental depletion than did depleted controls. Both of these findings parallel the results reported in Study 2.

Third, we compared perceived mental depletion levels across all conditions using an omnibus ANOVA, which was significant ($F(3,163) = 5.03$, $p = .002$, $\eta_p^2 = .09$). Planned contrasts indicated that the perceived mental depletion of positive mood participants significantly differed from depleted controls ($t(163) = 2.40$, $p = .02$), the perceived mental depletion of negative mood participants did not significantly differ from non-depleted controls ($t < 1$, $p = .45$), and the combined perceived mental depletion of non-depleted controls and positive mood participants was significantly lower than the combined perceived mental depletion of depleted controls and negative mood participants ($t(163) = 3.82$, $p = .001$). Thus, consistent with Study 2, positive mood participants exhibited evidence of perceptual restoration from an initial depletion manipulation, whereas negative mood participants did not.

Working memory performance. First, we conducted a pairwise comparison of working memory capacity among the two experimental conditions, which revealed a marginally significant effect ($t(81) = -1.92$, $p = .06$); participants in the positive mood condition tended to perform better on the working memory assessment than did participants in the negative mood condition. Second, we conducted a similar pairwise comparison among the two control conditions, which also revealed a significant effect ($t(82) = 1.98$, $p = .05$); non-depleted controls exhibited greater levels of working memory capacity than did depleted controls.

Third, we compared working memory performance across all conditions using an omnibus ANOVA, which was significant ($F(3,163) = 2.77$, $p = .04$, $\eta_p^2 = .05$). Planned contrasts indicated that the working memory performance of positive mood participants was significantly higher than depleted controls, ($t(163) = 2.49$, $p = .01$), the working memory performance of negative mood participants did not differ from depleted controls ($t < 1$, $p = .42$), and the combined working memory performance of non-depleted controls and positive mood participants was significantly higher than the combined working memory performance of depleted controls and negative mood participants ($t(163) = 2.74$, $p = .01$). Thus, our data indicate that positive mood participants exhibited evidence of working memory restoration following an initial depletion manipulation, whereas negative mood participants did not.

Motivation. The only notable effect of condition on our motivational index was a significant difference between our control conditions ($t(82) = 2.07$, $p = .04$); non-depleted controls were significantly more motivated than were depleted controls. The difference between mood conditions ($t < 1$, $p = .55$), as well as the overall effect of experimental condition ($F(3,163) = 1.52$, $p = .21$, $\eta_p^2 = .03$), were both non-significant.

Conservation. There were no notable effects of condition on our conservation index, such that the difference between mood conditions ($t(81) = 1.26$, $p = .21$), the difference between control conditions ($t < 1$, $p = .80$), and the overall effect of experimental condition ($F < 1$, $p = .57$, $\eta_p^2 = .01$), were all non-significant.

Mediation analysis. Given the similar effects of mood condition on perceived mental depletion and working memory performance, we assessed the mediational impact of perceived mental depletion on the association between the mood induction and working memory performance by conducting a series of regression analyses. For one, the mood manipulation marginally predicted working memory capacity ($\beta = .21$, $t(81) = 1.92$, $p = .06$), and significantly predicted perceived depletion ($\beta = -.32$, $t(81) = -3.03$, $p = .01$). Additionally, perceived depletion significantly predicted working memory performance ($\beta = -.26$, $t(81) = -2.42$, $p = .02$), such that greater perceived depletion led to decreased working memory performance. When the mood manipulation and perceived mental depletion were simultaneously entered into a regression predicting working memory performance, the mood manipulation was no longer associated with working memory performance ($\beta = .14$, $t(81) = 1.24$, $p = .22$; see Fig. 1). To test the extent of this mediating pathway, we computed a

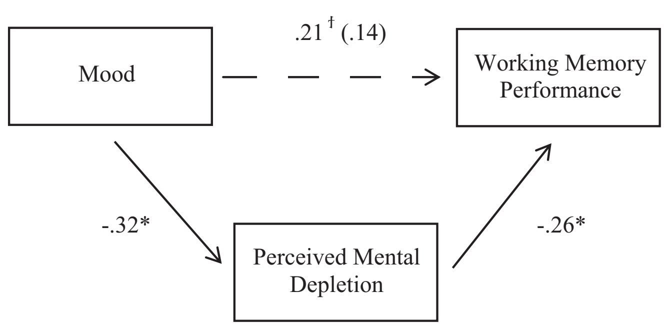

Fig. 1. Perceived mental depletion as a mediator of the effects of mood on working memory performance in Study 3. Values in parentheses refer to standardized beta coefficients after controlling for other variables in the model. $^*p < .05$.

95% CI around the indirect effect (Shrout & Bolger, 2002), and found that the pathway from the mood manipulation to working memory performance through perceived mental depletion did not include zero (CI: .11 to 1.89).

Discussion

Study 3 demonstrated that a mood induction modulated one's capacity for self-control capabilities. That is, a positive mood manipulation increased working memory performance following an initial mental depletion task whereas a negative manipulation did not; a pattern that both replicates previous work on the relation between mood and self-control change (Fredrickson et al., 2000; Tice et al., 2007), and expands such work into the domain of working memory capacity. More important to the present work, however, we found that mood-induced changes in working memory performance were driven by changes in perceived mental depletion, such that participants who perceived themselves as less depleted (i.e., participants in the positive mood condition) exhibited greater working memory performance than did participants who perceived themselves as more depleted (i.e., participants in the negative mood condition).[3]

These findings demonstrate the centrality of psychological processes in the operation of mood-induced self-control restoration. In particular, they highlight the potential for expectancies of mental energy change concerning positive and negative mood to modulate downstream self-control exertion. That is, if most people expect positive mood to be mentally restorative as well as negative mood to be mentally depleting (Studies 1–2), and these expectancies can alter mood's influence on perceived mental depletion (Study 2), the results of Study 3 suggest that these expectancies indirectly contribute to mood-induced self-control restoration via their direct influence on perceived mental depletion.

Study 4

Thus far, our studies have demonstrated the existence of expectations concerning the effect of mood on mental energy (Studies 1–2), and provided indirect evidence that these expectancies impact self-control capability via the modulation of perceived mental depletion and working memory capacity (Studies 2–3). Nonetheless, a more stringent test of this pathway from expectancies to self-control exertion involves the orthogonal manipulation of both mood and mood-relevant expectancies. Considerable research documents the malleability of both mood (Bless et al., 1996; Fishbach & Labroo, 2007; Schwarz & Clore, 1983; Tamir & Robinson, 2007) and lay beliefs (Job et al., 2010; Molden & Dweck, 2006; Nussbaum & Dweck, 2008), such that it should be possible to manipulate these constructs independently within a single experimental paradigm. We predicted that expectations of mental restoration, whether associated with a positive or negative mood, would be sufficient to decrease perceived mental depletion (Study 2), increase working memory performance (Study 3) and ultimately improve self-control performance (Fredrickson et al., 2000; Hofmann et al., 2008; Schmeichel et al., 2008; Tice et al., 2007) following an initial depletion manipulation.

[3] Although the effects of positive mood aligned with the non-depleted controls, the effects of negative mood aligned with the depleted controls. Given that all participants were initially depleted, these data suggest that positive mood had a restorative effect on individuals' self-control capabilities, whereas negative mood had no effect on these capabilities. Yet if negative mood exerts an expectation of mental depletion (see Studies 1–2), it could be argued the performance of those in the negative mood condition should have been significantly worse than depleted controls. Although we agree with this reasoning, a lack of further decreased performance among negative mood participants may simply be due to a floor effect for perceived mental depletion following the initial depletion task.

Method

Participants and design

One-hundred and fifty undergraduates (98 females), participating for course credit, were initially depleted and then randomly assigned to conditions in a 2 (Mood: Positive vs. Negative) × 2 (Expectancy: Positive Mood is Restorative vs. Negative Mood is Restorative) between-subjects design. As in Studies 2 and 3, non-depleted and depleted controls were included for comparison purposes.

Procedure

The procedure of Study 4 was very similar to the procedure of Study 3, with three important exceptions. First, we altered our manipulation of initial self-control depletion. Second, we included a manipulation of expectancies by varying participants' beliefs about the mental energy impact of positive and negative moods. Third, we included an open-ended persistence task after assessing working memory capacity in order to provide a behavioral assessment of self-control. In order, participants completed a depletion manipulation, a mood manipulation, an expectancy manipulation, and the dependent measurements (i.e., mood, perceived mental depletion, working memory capacity, self-control exertion). Depleted and non-depleted control participants did not receive the mood manipulation, the expectancy manipulation, or the working memory assessment.

Independent variables

Depletion manipulation. To manipulate self-control depletion, participants were first provided with a packet consisting of two unrelated pages of text from a graduate level statistics book, labeled "Task 1" and "Task 2," respectively. Task 1 instructed participants to cross out the letter "e" each time it appeared in the text for 5 min. Next, they proceeded to Task 2, for which the instructions varied as a function of condition. For non-depleted controls, Task 2 included the same instructions as Task 1: cross out every "e" for 5 min. However, for depleted controls and all of the experimental conditions, the instructions for Task 2 asked participants to only cross out an "e" if it was two or more letters removed from another vowel in the text. This manipulation has been utilized in numerous studies on self-control, with individuals required to alter their responding in the second task showing greater evidence of mental depletion than individuals who retain their response pattern across both tasks (Baumeister et al., 1998; Clarkson et al., 2010; Egan, Hirt, & Karpen, 2012).

Mood manipulation. As in Studies 2 and 3, participants were asked to write for 5 min about a positive or negative experience.

Expectancy manipulation. Following the mood manipulation, all participants read a passage concerning the relationship between mood and mental energy. Specifically, the passage provided empirical evidence that mood strongly predicts of how much mental energy a person can exert. In the *positive mood is restorative* condition, participants read about research showing positive mood is beneficial for mental energy and negative mood is detrimental for mental energy. In the *negative mood is restorative* condition, participants read about research showing negative mood is beneficial for mental energy and positive mood is detrimental for mental energy. This manipulation was adopted from similar manipulations shown to vary expectations (Martijn et al., 2002).

Dependent variables

Mood. We assessed participants' mood using the same semantic differential scales from Studies 2 and 3 ($r = .70$, $p = .001$).

Perceived mental depletion. In addition to the singular item utilized in Studies 2 and 3 ("How well can you concentrate right now?"), an additional item was included in Study 4 to assess this construct in a slightly different manner ("How well can you keep your thoughts on the current task?"). Again, responses were anchored on 9-point scales ranging from 1 (*Not at all*) to 9 (*Very much*). Because of high inter-item correlation ($r = .58$, $p < .001$), responses for these questions were averaged, and then reverse-coded such that higher scores indicated greater perceived mental depletion (Clarkson, Hirt, Chapman, & Jia, 2011; Smets et al., 1995).

Working memory performance. Participants completed the same working memory task described in Study 3. Again, values can range from 0 to 36, with higher values indicating greater working memory performance.

Anagram performance. After completing the working memory task, participants were presented with a test of their problem-solving abilities that took the form of a multiple-solution anagram. Specifically, they were presented with a 7-letter anagram (i.e., L C R A E K G) and asked to produce as many real English words as they could from the provided letters. Participants were further instructed that the words had to be at least three letters in length, that no letter could be used twice in the same word, and that they should list as many solutions as possible. Participants were explicitly encouraged to spend as much time on the task as needed, and that they should press the Escape key to end the task when they were no longer capable of generating solutions. Consistent with previous research, the number of valid words generated was our primary index of self-control performance (Clarkson et al., 2010; Muraven et al., 2006).

Motivation. Consistent with Study 3, participants were asked about their retrospective motivations, such that they indicated the extent to which they were motivated on both the OSPAN and anagram tasks (i.e., "How motivated were you to work hard on memory/problem-solving task?") on 9-point scales ranging from 1 (*Not at all*) to 9 (*Very much*). Due to high interitem correlation ($r = .35$, $p < .001$), we combined these items to form an overall motivation index.

Conservation. Consistent with Study 3, participants were also asked about their conservation motivations, such that they indicated the extent to which they conserved energy on both the OSPAN and anagram tasks (i.e., "How much were you trying to conserve your energy on the memory/problem-solving task?") on a scale ranging from 1 (*Not at all*) to 9 (*Very much*). As with our motivation items, these conservation items were combined to form an overall conservation index ($r = .70$, $p < .001$).

Results

All dependent measures were submitted to a two-way ANOVA, with mood and expectancy as independent variables.

Between-subjects analyses

Mood. Analysis of the mood index revealed only a main effect of mood ($F(1,96) = 17.46$, $p = .001$, $\eta_p^2 = .15$); participants who wrote about a positive experience were in a more positive mood than were participants who wrote about a negative experience. Both the expectancy main effect ($F < 1$, $p = .84$, $\eta_p^2 = .00$), and the Mood × Expectancy interaction ($F(1,96) = 1.63$, $p = .21$, $\eta_p^2 = .02$), were non-significant. In addition, and consistent with Studies 2 and 3, there was no difference in mood between depleted and non-depleted controls ($t(48) = 1.33$, $p = .19$).

Perceived mental depletion. Analysis of the perceived mental depletion data showed a significant effect of expectancy, $F(1,96) = 3.97$, $p = .05$, $\eta_p^2 = .04$; participants induced to believe negative mood is

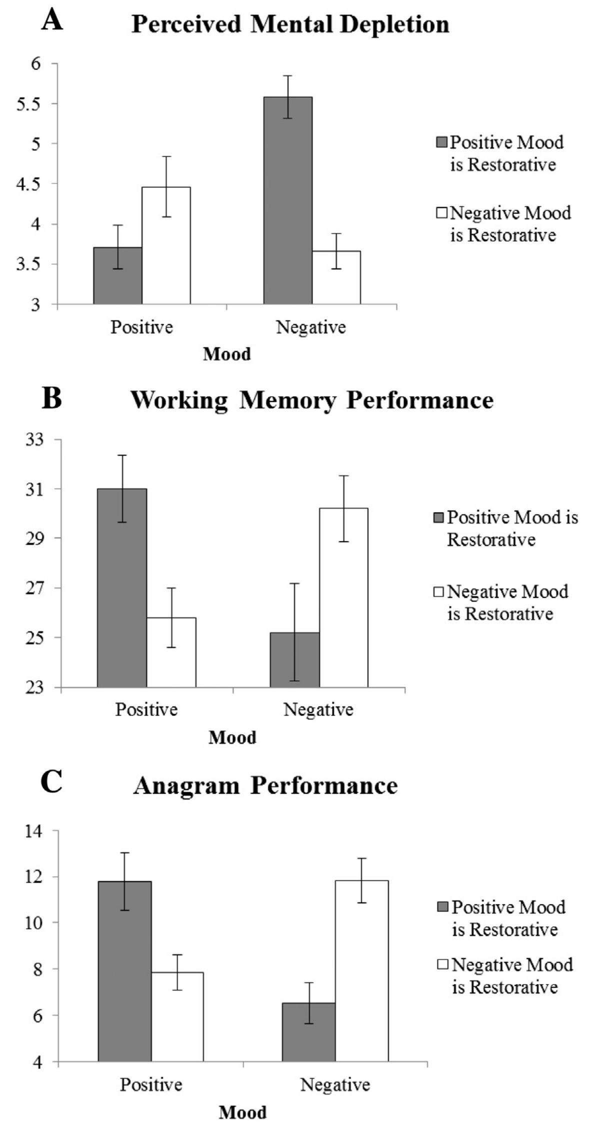

Fig. 2. Perceived mental depletion (Panel A), working memory performance (Panel B), and anagram performance (Panel C) as a function of mood and expectancy in Study 4. In Panel A, higher values indicate greater perceived mental depletion. In Panel B, higher values indicate more correct responses on the working memory task. In Panel C, higher values indicate more words produced on the anagram task.

restorative reported more mental depletion than did participants induced to believe positive mood is restorative. Additionally, there was a marginal effect of mood ($F(1,96) = 3.36$, $p = .07$, $\eta_p^2 = .03$); consistent with Studies 2 and 3, participants in the positive mood condition reported somewhat less mental depletion than did participants in the negative mood condition. However, both of these main effects were qualified by the predicted Mood × Expectancy interaction ($F(1,96) = 20.76$, $p = .001$, $\eta_p^2 = .18$; *see Panel A of* Fig. 2). That is, participants in the positive mood condition reported marginally lower mental depletion after receiving information that positive mood is restorative ($t(51) = 1.66$, $p = .10$), whereas participants in the negative mood condition reported lower mental depletion after receiving information that negative mood is restorative ($t(45) = 5.47$, $p < .001$).

Working memory performance. Analysis of the working memory performance data revealed no main effect of either mood ($F < 1$, $p = .63$, $\eta_p^2 = .00$) or expectancy ($F < 1$, $p = .94$, $\eta_p^2 = .00$), but did reveal the predicted Mood × Expectancy interaction ($F(1,96) = 12.71$, $p = .001$, $\eta_p^2 = .12$; *see Panel B of* Fig. 2). As such, participants in the positive mood condition demonstrated greater working memory performance after receiving information that positive mood is restorative ($t(51) = 2.91$, $p = .01$), whereas participants in the negative mood condition demonstrated greater working memory performance after receiving information that negative mood is restorative ($t(45) = 2.20$, $p = .03$).

Anagram performance. Analysis of the anagram performance data revealed no main effect of either mood ($F < 1$, $p = .51$, $\eta_p^2 = .00$) or expectancy ($F < 1$, $p = .53$, $\eta_p^2 = .01$), but again revealed the predicted Mood × Expectancy interaction ($F(1,96) = 19.69$, $p < .001$, $\eta_p^2 = .17$; *see Panel C of* Fig. 2). Specifically, participants in the positive mood condition showed better anagram performance after receiving information that positive mood is restorative ($t(51) = 2.57$, $p = .01$), whereas participants in the negative mood condition showed better anagram performance after receiving information that negative mood is restorative ($t(45) = 3.85$, $p = .001$).[4]

To examine the extent of self-control restoration across conditions, we conducted a series of analyses comparing the anagram performance of our experimental conditions with depleted and non-depleted controls. First, we assessed the anagram performance of our control conditions, which showed a significant effect ($t(49) = -2.25$, $p = .03$); non-depleted controls ($M = 11.08$, $SD = 5.87$) performed significantly better than did depleted controls ($M = 8.08$, $SD = 3.14$). Second, we submitted the anagram performance for all six conditions to a one-way ANOVA, which was significant ($F(5,144) = 5.12$, $p < .001$, $\eta_p^2 = .15$). A series of planned contrasts showed that participants whose current mood was associated with restoration performed significantly better than depleted controls ($t(144) = 3.12$, $p = .002$), participants whose current mood was not associated with restoration did not differ in performance from depleted controls ($t < 1$, $p = .49$), and the performance of the two aforementioned groups (i.e., those whose mood was associated vs. unassociated with restoration) significantly differed from one another ($t(144) = 2.52$, $p = .01$).

Motivation. Analysis of the motivation index revealed no effect of mood ($F(1,96) = 1.08$, $p = .30$, $\eta_p^2 = .01$), expectancy ($F < 1$, $p = .76$, $\eta_p^2 = .00$), or the Mood × Expectancy interaction ($F < 1$, $p = .40$, $\eta_p^2 = .01$).

Conservation. Analysis of the conservation index revealed no effect of mood ($F < 1$, $p = .47$, $\eta_p^2 = .01$), expectancy ($F < 1$, $p = .47$, $\eta_p^2 = .01$), or the Mood × Expectancy interaction ($F(1,96) = 1.63$, $p = .21$, $\eta_p^2 = .02$).

Mediation analyses. We first assessed the mediational impact of the Mood × Expectancy interaction on working memory performance through perceived mental depletion by conducting a series of regression analyses. As noted, the Mood × Expectancy interaction significantly predicted both working memory performance ($\beta = .63$, $t(96) = -3.57$, $p = .001$) and perceived mental depletion ($\beta = -.76$, $t(96) = 4.56$, $p = .001$). Additionally, perceived mental depletion predicted working memory performance ($\beta = -.28$, $t(98) = -2.88$, $p = .01$), such that greater perceptions mental depletion were related to decreased working memory performance. When the interaction term and perceived mental depletion were simultaneously entered in a regression predicting working memory performance, the interaction term continued to predict working memory performance ($\beta = .50$, $t(95) = -2.57$, $p = .01$). However, the mediating pathway from the interaction term to working memory performance through perceived depletion did

[4] We also assessed the amount of time participants spent on the anagram task as a secondary index of self-control behavior, as task persistence has been demonstrated in prior research to require self-control exertion. Analyses revealed a significant Mood × Expectancy interaction ($F(1,96) = 10.59$, $p = .002$, $\eta_p^2 = .10$), in a pattern that paralleled the qualitative performance index.

not include zero (CI: 0.16 to 2.34), suggesting that the effect of the interaction was mediated by perceived mental depletion.

To assess the influence of working memory performance on anagram performance, we entered the Mood × Expectancy interaction, perceived mental depletion, and working memory performance into a simultaneous regression model predicting anagram performance (for a similar procedure, see Clarkson, Tormala, & Leone, 2011). The analysis revealed a significant effect of working memory performance ($\beta = .24$, $t(95) = 2.38$, $p = .02$), no effect of perceived depletion ($\beta = -.11$, $t(95) = 1.07$, $p = .29$), and a significant interaction between mood and expectancy ($\beta = .68$, $t(94) = 3.48$, $p = .001$). Moreover, the mediating pathway from the interaction term to anagram performance through working memory performance while controlling for perceived mental depletion did not include zero (CI: .02 to 1.30). Combined with the previous mediation analysis, these findings suggest that the effects of the Mood × Expectancy interaction on anagram performance were due to perceived mental depletion's influence on working memory performance.

Discussion

The data from Study 4 demonstrate that mood-induced self-control restoration depends on the activation of a restorative expectancy. Indeed, the activation of a restorative expectancy led to evidence of self-control restoration on perceptual (i.e., decreased perceived depletion), cognitive (i.e., increased working memory capacity), and behavioral (i.e., increased task performance) metrics. These data therefore reinforce the role of positive mood in self-control restoration (Tice et al., 2007), but suggest that these effects depend upon conventional expectancies concerning mood's influence on mental energy. Specifically, when participants expected positive mood to elicit mental restoration (i.e., an expectancy endorsed by the majority of participants in Studies 1 and 2), our data support the notion that positive mood improves perceptual, cognitive, and behavioral responding relevant to self-control exertion. However, when participants expected *negative* mood to elicit mental restoration (i.e., an expectancy held by nearly no participants in Studies 1 and 2; see Footnote 1), this pattern of data was reversed, and instead showed that negative mood led to self-control restoration.

In addition to demonstrating the moderating influence of expectancies on mood-induced self-control restoration, Study 4 underscores the process by which such expectancies exert their behavioral impact: via changes in perceived mental depletion and working memory capacity. Participants who believed that their current mood state, whether positive or negative, was associated with mental restoration perceived themselves as less mentally depleted. This change in perceived depletion, in turn, expanded the availability of participants' working memory capacity, which ultimately produced improvements in behavioral performance. These findings overlap considerably with extant work on expectancies both within and outside the domain of self-control exertion, such that if expectancies can influence perceptual experience, then altered perceptions can directly impact subsequent cognitive and behavioral outcomes (Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011; Job et al., 2010; Meissner et al., 2011).

General discussion

Four studies suggest that, although positive mood has the potential to improve self-control exertion following mental depletion, this improvement is contingent upon one's expectancies of mental energy change. Across a variety of empirical approaches, we found that individuals hold robust expectancies regarding the mental effects of positive and negative mood states (Studies 1–2), and found that these expectancies modulate the downstream perceptual, cognitive, and behavioral consequences associated with these mood states (Studies 2–4). Thus, positive mood was conducive to self-control restoration when naturally or experimentally associated with mental restoration, whereas negative mood was not conducive to self-control restoration when naturally or experimentally associated with mental depletion.

Implications

Taken together, the present findings expand theory on the influences of mood, expectancies, and perceived mental depletion in the domain of self-control change. For one, they offer novel evidence concerning the operation of expectancies in the self-regulatory consequences of positive and negative mood states. That is, because these mood states are associated with divergent expectancies of general energy change (Cunningham, 1988; Rimé et al., 1990; Shaver et al., 1987), we found that they are also associated with divergent expectancies of mental energy change. More specifically, participants expected positive mood states to facilitate mental energy restoration, whereas they expected negative mood states to facilitate mental energy depletion (Studies 1–2). Furthermore, these expectancies of mental energy change modulated the influence of mood on subjective mental fatigue, such that participants who most strongly endorsed the conventional relationship between positive mood and mental energy restoration were those participants most likely to experience recovery from subjective mental fatigue after a positive mood manipulation (Studies 2 and 4). These findings are representative of emerging work on the importance of psychological processes in modulating mental depletion and restoration effects (Clarkson et al., 2010; Inzlicht & Schmeichel, 2012; Job et al., 2010; Job et al., 2013; Kurzban, 2010; Muraven et al., 2008), and overlap considerably with other research suggesting that restorative expectancies mobilize perceptual changes predictive of corresponding restoration (Aslaksen & Flaten, 2008; Crum & Langer, 2007; Crum et al., 2011; Draganich & Erdal, 2014).[5]

The present work also extends the breadth of expectancy effects within the domain of self-control. Indeed, just as people hold general expectancies concerning the nature of mental energy (Job et al., 2010, 2013; Martijn et al., 2002), we found that people hold specific expectancies concerning the mental energy influence of particular psychological experiences (e.g., positive and negative mood). Given the dearth of research on these specific expectancies of mental energy change, we further explored one potential pathway by which they can ultimately impact self-control. Our results suggest that expectancies of mental energy change exert their primary impact on perceived mental depletion (Study 2), and perceived depletion then modulates cognitive and behavioral responding in manners predictive of self-control outcomes (Studies 3–4). This process evidence expands empirical work on expectancy effects within self-control exertion, such that expectancies can alter both the extent to which an individual feels mentally depleted (Clarkson et al., 2010), as well as the extent to which such feelings impact behavioral performance (Job et al., 2010).

Because our findings highlight the role of expectancies and perceived mental depletion in self-control change, they are difficult to rectify with a strict resource-contingent theory of self-control exertion. That is, although there certainly exist physiological mechanisms capable of explaining the relationship between mood and self-control exertion (Thayer, 1989; Fredrickson, 2001), such mechanisms do not easily explain the role of personally-endorsed (Study 2) or experimentally-manipulated (Study 4) expectancy information in moderating mood's self-control consequences. Rather, this type of psychological moderation suggests an interactive process of self-control, in which internal physiological states and ongoing information processing systems communicate dynamically to alter the availability, mobilization, and

[5] Although we did not find support for motivation or conservation as mechanisms underlying the effects under study, these and other psychological constructs clearly have a role in self-control change within particular contexts. For instance, motivation (DeWall, Baumeister, Mead, & Vohs, 2011; Muraven & Slessareva, 2003), construal level (Schmeichel & Vohs, 2009), and self-awareness (Otten et al., 2014) have been implicated as catalysts of self-control change following particular experimental manipulations.

expenditure of executive functioning resources (Beedie & Lane, 2012; Inzlicht & Schmeichel, 2012, 2013; Inzlicht, Schmeichel, & Macrae, 2014; Kurzban, 2010; Kurzban, Duckworth, Kable, & Myers, 2013). As such, even if a particular experience catalyzes physiological processes predictive of self-control exertion, cognitive factors at both the individual and situational level can modulate these processes in ways that substantially alter subjective and behavioral responding (Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011; Job et al., 2010, 2013; Martijn et al., 2002; Muraven et al., 2006; Muraven & Slessareva, 2003).[6]

Limitations

Although the present findings offer evidence for expectancy-driven self-control exertion, it is important to note some limitations of our approach. For one, like much research on the role of expectancies in cognitive and behavioral change (Enck, Benedetti, & Schedlowski, 2008; Meissner et al., 2011; Stewart-Williams & Podd, 2004), our findings are open to questions of demand effects. Anticipating this potential issue, we took several precautionary measures to limit the influence of such effects in our studies. For instance, Study 1 measured expectancies regarding positive and negative mood among separate participant groups, Study 2 measured expectancies in a pre-testing session several weeks prior to a mood manipulation protocol, and Study 3 excluded the use of expectancy measures entirely. Finally, because Study 4 manipulated expectancies explicitly, the operation of demand characteristics is relatively indistinguishable from the effectiveness of the manipulation itself. Nonetheless, given that expectancy effects are ultimately reliant upon the activation of explicit information (Colloca & Benedetti, 2005; Finniss et al., 2010; Meissner et al., 2011), we feel confident that our methodological approach adequately balanced concerns associated with experimental demand and external validity.

Second, our findings align with self-control research that has observed perceptual and behavioral assimilation towards expectancy information (Job et al., 2010; Martijn et al., 2002), yet other research in this domain has observed perceptual and behavioral contrast effects from similar types of expectancy information. One particularly relevant set of contrast effects is outlined by Clarkson et al. (2010) who find that depleted participants exert greater self-control after reading that a previous experience was mentally depleting. We believe that a critical difference between their approach and ours, and one that explains corresponding differences in perceptual and behavioral outcomes, concerns the type of experimental tasks for which participants received feedback. On one hand, previous work observed contrast effects when the mental energy feedback concerned a *discrete* stimulus that was removed from the subsequent situation (e.g., the color of paper the depletion task was completed on), such that participants distinguished their current state from the influence of a distinct previous experience (Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011). On the other hand, the present work observed assimilation effects when the mental energy feedback concerned a *continuous* stimulus that persisted into the subsequent situation (i.e., an ongoing mood state), such that participants associated their current state with the influence of an enduring experience. This discrepancy in perceptual reactions to discrete and continuous experiences is supported by research suggesting that self-regulatory exertion varies as a function of an experience's temporal features (Labroo & Mukhopadhyay, 2009; Tice et al., 2001; Winterich & Haws, 2011), such that more persistent experiences exert a stronger assimilative influence on subsequent outcomes.

[6] The relative spontaneity by which we observed self-control changes within Studies 3 and 4 provides additional evidence against a physiological explanation for our findings. That is, a 5 min mood manipulation (Study 3) or this manipulation combined with a short expectancy manipulation (Study 4) led to immediate changes in self-regulatory performance, whereas previous work suggests that physiological processes underlying self-regulatory performance should require at least 10–20 min to impact participant responding (Dvorak & Simons, 2009; Gailliot et al., 2007, 2009; Masicampo & Baumeister, 2008; Molden et al., 2012; Schimmack, 2012).

A final limitation of the present study concerns our focus on positive and negative mood valence. Although most explorations of mood-driven effects within the domain of self-control have relied upon a valence-based approach (e.g., Fredrickson et al., 2000; Labroo & Mukhopadhyay, 2009; Tice et al., 2007), there is nonetheless other work that has benefitted from exploring the influence of more specific transient states (e.g., mindfulness, Friese, Messner, & Schaffner, 2012; aggressiveness, DeWall, Baumeister, Stillman, & Gailliot, 2007). As such, our findings provide evidence regarding the role of expectancies towards general mood states (i.e., positive or negative), but they are relatively silent regarding the role of expectancies towards specific emotional states (e.g., joy, anger, depression). Because emotions vary in terms of both affective valence and arousal, the present approach represents only one step towards understanding the operation of expectancies within a larger class of emotional experiences. We would anticipate that emotions differing in arousal are also likely to differ in terms of their presumed mental energy influence, such that those associated with high arousal will be those most likely to activate expectancies of mental energy restoration.

Future directions

The present work offers a promising starting point for exploring the role of expectancies within self-control change more generally. To begin, our approach readily applies to other experiences associated with self-control change, such that future work could examine whether experiences predictive of mental depletion (e.g., dietary restraint, Kemps, Tiggemann, & Grigg, 2008; interracial interactions, Richeson & Shelton, 2003; social ostracism, Ciarocco, Sommer, & Baumeister, 2001) or mental restoration (e.g., interpersonal power, DeWall et al., 2011; short breaks, Tyler & Burns, 2008; self-affirmation, Schmeichel & Vohs, 2009) are associated with corresponding expectancies of energy change. In the case that explicit expectancies of energy depletion or restoration exist towards such experiences, future work could also examine the features that cause such expectancies to most strongly predict subjective and behavioral outcomes. That is, even if most people endorse a similar energetical expectancy towards a given experience, the association between this expectancy and subsequent behavior may vary according to the extent expectancies are consciously activated within a particular context. For instance, less explicit positive mood inductions (e.g., gift receipt, Tice et al., 2007; funny videos, Fedorikhin & Patrick, 2010) may be decreasingly likely to activate expectancies about mood's cognitive effects when compared to more explicit positive mood inductions (e.g., experiential recall, Studies 2–4).

Just as expectancies of mental energy change can vary as a function of the stimulus and context under study, these expectancies may also vary as a function of individual differences. For one, given the centrality of willpower beliefs in the emergence of self-control depletion and restoration effects (Job et al., 2010, 2013; Vohs et al., 2012), future work could explore the extent to which these general beliefs about mental energy depletion interact with domain-specific beliefs of mental energy change to produce novel patterns of responding. Additionally, this type of individual-difference perspective can be broadened to assess whether various person-level factors associated with self-regulatory exertion (e.g., trait self-control, Tangney, Baumeister, & Boone, 2004; anxiety, Maner, Gailliot, Menzel, & Kunstman, 2012) predict energetical expectancies within particular cognitive and behavioral domains (Egan & Hirt, in press). Such examinations would afford a better understanding of how expectancies are formed and changed as a function of an individual's beliefs, experiences, and social surroundings (e.g., Augustine & Larsen, 2011).

Finally, although our findings suggest that working memory capacity plays a critical role in the downstream influence of perceived mental depletion (see also Clarkson et al., 2010; Clarkson, Hirt, Chapman, & Jia, 2011; Job et al., 2010), the pathway linking perceptions of fatigue and cognitive performance is relatively unspecified. One possibility is that perceived mental depletion modulates internal monitoring processes, such that an attribution of fatigue increases the monitoring of mental resource availability or upcoming task demands (Job et al., 2010; Muraven et al., 2006), either of which has the potential to restrict higher-order mental functioning (Wegner et al., 1987). Another possibility is that perceptions of mental depletion modulate the opportunity costs of difficult cognitive ability tasks (Kurzban et al., 2013), such that the experience of mental depletion shifts implicit or explicit motivation towards less cognitively taxing actions (Hofmann, Rauch, & Gawronski, 2007; Muraven & Slessareva, 2003), either of which can diminish one's performance on challenging cognitive tasks. Regardless of the veracity of these possibilities, the direct link between subjective fatigue and cognitive/behavioral performance remains an elusive, yet highly valuable, objective of scientific inquiry (Hockey, 2011).

Conclusion

An individual's mood is a highly influential state with implications for a host of behaviors, including self-control. Our intent was to understand why positive and negative mood states elicit differential consequences for self-control exertion. Across four studies, we explored the possibility that positive and negative mood states elicit differential expectancies of mental energy change. Our findings suggest that these expectancies are relatively robust, and that they are capable of activating perceptual and cognitive processes relevant to self-control change. We believe such results offer a novel perspective on mood-induced changes in self-control, and we hope they spur novel theoretical and empirical approaches towards the understanding of self-control more broadly.

Author note

Patrick M. Egan, Department of Psychological and Brain Sciences, Indiana University; Joshua J. Clarkson, Department of Marketing, Lindner School of Business, University of Cincinnati; Edward R. Hirt, Department of Psychological and Brain Sciences, Indiana University. Portions of this work were supported by a National Science Foundation Graduate Research Fellowship awarded to the first author. We thank attendees of the Indiana University Social Seminar Series, as well as several anonymous reviewers for helpful feedback on this work. We also thank Katie O'Connor, Daniel Smedema, Mimi Jong, Kevin Goldberg, Olivia Cole, and Olivia Pavlov for their assistance running the experiments described in this work.

Appendix 1

Questions regarding expectancies of restoration for positive or negative mood (Study 1).

1. Being in a positive (negative) mood gives me more mental energy than normal.
2. Being in a positive (negative) mood makes me work harder than I would normally work.
3. Being in a positive (negative) mood has beneficial effects on my mental state.
4. Being in a positive (negative) mood makes me more mentally tired than normal (RC).
5. Being in a positive (negative) mood makes me less mentally tired than normal.

References

Aslaksen, P. M., & Flaten, M. A. (2008). The roles of physiological and subjective stress in the effectiveness of a placebo on experimentally induced pain. *Psychosomatic Medicine*, *70*, 811–818.

Augustine, A. A., & Larsen, R. J. (2011). Affect regulation and temporal discounting: Interactions between primed, state, and trait affect. *Emotion*, *11*, 403–412.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, *74*, 1252–1265.

Baumeister, R. F., Muraven, M., & Tice, D. M. (2000). Ego depletion: A resource model of volition, self-regulation, and controlled processing. *Social Cognition*, *18*, 130–150.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science*, *16*, 351–355.

Beedie, C. J., & Lane, A. M. (2012). The role of glucose in self-control: Another look at the evidence and an alternative conceptualization. *Personality and Social Psychology Review*, *16*, 143–153.

Bless, H., Clore, G. L., Schwarz, N., Golisano, V., Rabe, C., & Wölk, M. (1996). Mood and the use of scripts: Does a happy mood really lead to mindlessness? *Journal of Personality and Social Psychology*, *71*, 665–679.

Carter, E. C., McCullough, M. E., & Carver, C. S. (2012). The mediating role of monitoring in the association of religion with self-control. *Social Psychological and Personality Science*, *3*, 691–697.

Ciarocco, N. J., Sommer, K. L., & Baumeister, R. F. (2001). Ostracism and ego depletion: The strains of silence. *Personality and Social Psychology Bulletin*, *27*, 1156–1163.

Clarkson, J. J., Hirt, E. R., Chapman, D. A., & Jia, L. (2011). The impact of illusory fatigue on executive control: Do perceptions of depletion impair working memory capacity? *Social Psychological and Personality Science*, *2*, 231–238.

Clarkson, J. J., Hirt, E. R., Jia, L., & Alexander, M. B. (2010). When perception is more than reality: The effects of perceived versus actual resource depletion on self-regulatory behavior. *Journal of Personality and Social Psychology*, *98*, 29–46.

Clarkson, J. J., Tormala, Z. L., & Leone, C. (2011). A self-validation perspective on the mere thought effect. *Journal of Experimental Social Psychology*, *47*, 449–454.

Clore, G. L., & Ortony, A. (1991). What more is there to emotion concepts than prototypes? *Journal of Personality and Social Psychology*, *60*, 48–50.

Colloca, L., & Benedetti, F. (2005). Placebos and painkillers: Is mind as real as matter? *Nature Reviews Neuroscience*, *6*, 545–552.

Crum, A. J., Corbin, W. R., Brownell, K. D., & Salovey, P. (2011). Mind over milkshakes: Mindsets, not just nutrients, determine ghrelin response. *Health Psychology*, *30*, 424–429.

Crum, A. J., & Langer, E. J. (2007). Mind-set matters: Exercise and the placebo effect. *Psychological Science*, *18*, 165–171.

Cunningham, M. R. (1988). What do you do when you're happy or blue? Mood, expectancies, and behavioral interest. *Motivation and Emotion*, *12*, 309–331.

DeWall, C. N., Baumeister, R. F., Mead, N. L., & Vohs, K. D. (2011). How leaders self-regulate their task performance: Evidence that power promotes diligence, depletion, and disdain. *Journal of Personality and Social Psychology*, *100*, 47–65.

DeWall, C. N., Baumeister, R. F., Stillman, T. F., & Gailliot, M. T. (2007). Violence restrained: Effects of self-regulation and its depletion on aggression. *Journal of Experimental Social Psychology*, *43*, 62–76.

Diener, E., Sandvik, E., & Pavot, W. (1991). Happiness is the frequency, not the intensity, of positive versus negative affect. In F. Strack, M. Argyle, & N. Schwarz (Eds.), *Subjective well-being: An interdisciplinary perspective* (pp. 119–139). Oxford, England: Pergamon Press.

Draganich, C., & Erdal, K. (2014). *Placebo sleep affects cognitive functioning. Journal of Experimental Psychology: Learning, Memory, and Cognition*Advance online publication.

Dvorak, R. D., & Simons, J. S. (2009). Moderation of resource depletion in the self-control strength model: Differing effects of two modes of self-control. *Personality and Social Psychology Bulletin*, *35*, 572–583.

Egan, P. M., & Hirt, E. R. (2014). Flipping the switch: Power, social dominance, and expectancies of mental energy change. *Personality and Social Psychology Bulletin* (in press).

Egan, P. M., Hirt, E. R., & Karpen, S. C. (2012). Taking a fresh perspective: Vicarious restoration as a means of recovering self-control. *Journal of Experimental Social Psychology*, *48*, 457–465.

Enck, P., Benedetti, F., & Schedlowski, M. (2008). New insights into the placebo and nocebo responses. *Neuron*, *59*, 195–206.

Fedorikhin, A., & Patrick, V. M. (2010). Positive mood and resistance to temptation: The interfering influence of elevated arousal. *Journal of Consumer Research*, *37*, 698–711.

Finniss, D. G., Kaptchuk, T. J., Miller, F., & Benedetti, F. (2010). Biological, clinical, and ethical advances of placebo effects. *The Lancet*, *375*, 686–695.

Fishbach, A., & Labroo, A. A. (2007). Be better or be merry: How mood affects self-control. *Journal of Personality and Social Psychology*, *93*, 158.

Folkman, S., & Moskowitz, J. T. (2000). Stress, positive emotion, and coping. *Current Directions in Psychological Science*, *9*, 115–118.

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*, 218–226.

Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, *24*, 237–258.

Friese, M., Messner, C., & Schaffner, Y. (2012). Mindfulness meditation counteracts self-control depletion. *Consciousness and Cognition*, *21*, 1016–1022.

Fry, P. S. (1975). Affect and resistance to temptation. *Developmental Psychology*, *11*, 466–472.

Gailliot, M. T., & Baumeister, R. F. (2007). The physiology of willpower: Linking blood glucose to self-control. *Personality and Social Psychology Review*, *11*, 303–327.

Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., et al. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology*, *92*, 325–336.

Gailliot, M. T., Peruche, B. M., Plant, E. A., & Baumeister, R. F. (2009). Stereotypes and prejudice in the blood: Sucrose drinks reduce prejudice and stereotyping. *Journal of Experimental Social Psychology*, *45*, 288–290.

Goldman, S. L., Kraemer, D. T., & Salovey, P. (1996). Beliefs about mood moderate the relationship of stress to illness and symptom reporting. *Journal of Psychosomatic Research*, *41*, 115–128.

Hirt, E. R., Devers, E. E., & McCrea, S. M. (2008). I want to be creative: Exploring the role of hedonic contingency theory in the positive mood-cognitive flexibility link. *Journal of Personality and Social Psychology*, *94*, 214–230.
Hockey, G. R. J. (2011). A motivational control theory of cognitive fatigue. In P. L. Ackerman (Ed.), *Cognitive fatigue: Multidisciplinary perspectives on current research and future applications* (pp. 167–188). Washington, DC: American Psychological Association.
Hofmann, W., Gschwender, T., Friese, M., Wiers, R. W., & Schmitt, M. (2008). Working memory capacity and self-regulatory behavior: Toward an individual differences perspective on behavior determination by automatic versus controlled processes. *Journal of Personality and Social Psychology*, *95*, 962–977.
Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology*, *43*, 497–504.
Inglehart, R. (1990). *Culture shift in advanced industrial society*. Princeton, NJ: Princeton University Press.
Inzlicht, M., & Schmeichel, B. J. (2012). What is ego depletion? Toward a mechanistic revision of the resource model of self-control. *Perspectives on Psychological Science*, *7*, 450–463.
Inzlicht, M., & Schmeichel, B. J. (2013). Beyond simple utility in predicting self-control fatigue: A proximate alternative to the opportunity cost model. *Behavioral and Brain Sciences*, *36*, 695–696.
Inzlicht, M., Schmeichel, B. J., & Macrae, C. N. (2014). Why self-control seems (but may not be) limited. *Trends in Cognitive Sciences*, *18*, 127–133.
Isen, A. (1987). Positive affect, cognitive processes, and social behavior. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*, *Vol. 20*. (pp. 203–253). San Diego, CA: Academic Press.
Isen, A. M. (2000). Positive affect and decision making. In M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 417–435) (2nd ed.). New York: Guilford Press.
Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego depletion — Is it all in your head? Implicit theories about willpower affect self-regulation. *Psychological Science*, *21*, 1–8.
Job, V., Walton, G. M., Bernecker, K., & Dweck, C. S. (2013). Beliefs about willpower determine the impact of glucose on self-control. *Proceedings of the National Academy of Sciences*, *110*, 14837–14842.
Kam-Hansen, S., Jakubowski, M., Kelley, J. M., Kirsch, I., Hoaglin, D. C., Kaptchuk, T. J., et al. (2014). Altered placebo and drug labeling changes the outcome of episodic migraine attacks. *Science Translational Medicine*, *6*, 218ra5.
Kemps, E., Tiggemann, M., & Grigg, M. (2008). Food cravings consume limited cognitive resources. *Journal of Experimental Psychology: Applied*, *14*, 247–254.
Kurzban, R. (2010). Does the brain consume additional glucose during self-control tasks? *Evolutionary Psychology*, *8*, 244–259.
Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013). An opportunity cost model of subjective effort and task performance. *Behavioral and Brain Sciences*, *36*, 661–726.
Labroo, A. A., & Mukhopadhyay, A. (2009). Lay theories of emotion transience and the search for happiness: A fresh perspective on affect regulation. *Journal of Consumer Research*, *36*, 242–254.
Labroo, A. A., & Patrick, V. M. (2009). Psychological distancing: Why happiness helps you see the big picture. *Journal of Consumer Research*, *35*, 800–809.
Leith, K. P., & Baumeister, R. F. (1996). Why do bad moods increase self-defeating behavior? Emotion, risk tasking, and self-regulation. *Journal of Personality and Social Psychology*, *71*, 1250–1267.
Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin*, *131*, 803–855.
Maner, J. K., Gailliot, M. T., Menzel, A. J., & Kunstman, J. W. (2012). Dispositional anxiety blocks the psychological effects of power. *Personality and Social Psychology Bulletin*, *38*, 1383–1395.
Martijn, C., Tenbult, P., Merckelbach, H., Dreezens, E., & de Vries, N. K. (2002). Getting a grip on ourselves: Challenging expectancies about loss of energy after self-control. *Social Cognition*, *20*, 441–460.
Masicampo, E. J., & Baumeister, R. F. (2008). Toward a physiology of dual-process reasoning and judgment: Lemonade, willpower, and expensive rule-based analysis. *Psychological Science*, *19*, 255–260.
Meissner, K., Bingel, U., Colloca, L., Wager, T. D., Watson, A., & Flaten, M. A. (2011). The placebo effect: Advances from different methodological approaches. *The Journal of Neuroscience*, *31*, 16117–16124.
Molden, D. C., & Dweck, C. S. (2006). Finding " meaning" in psychology: A lay theories approach to self-regulation, social perception, and social development. *American Psychologist*, *61*, 192–203.
Molden, D. C., Hui, C. M., Scholer, A. A., Meier, B. P., Noreen, E. E., D'Agostino, P. R., et al. (2012). The motivational versus metabolic effects of carbohydrates on self-control. *Psychological Science*, *23*, 1137–1144.
Morton, D. L., El-Deredy, W., Watson, A., & Jones, A. K. P. (2010). Placebo analgesia as a case of a cognitive style driven by prior expectation. *Brain Research*, *1359*, 137–141.
Muraven, M., Gagné, M., & Rosman, H. (2008). Helpful self-control: Autonomy support, vitality, and depletion. *Journal of Experimental Social Psychology*, *44*(3), 573–585.
Muraven, M., Shmueli, D., & Burkley, E. (2006). Conserving self-control strength. *Journal of Personality and Social Psychology*, *91*, 524–537.
Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin*, *29*, 894–906.
Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, *74*, 774–789.
Nussbaum, A. D., & Dweck, C. S. (2008). Defensiveness versus remediation: Self-theories and modes of self-esteem maintenance. *Personality and Social Psychology Bulletin*, *34*, 599–612.
Otten, R., Cladder-Micus, M. B., Pouwels, J. L., Hennig, M., Schuurmans, A. A., & Hermans, R. C. (2014). Facing temptation in the bar: Counteracting the effects of self-control failure on young adults' ad libitum alcohol intake. *Addiction*, *109*, 746–753.
Richeson, J. A., & Shelton, J. N. (2003). When prejudice does not pay: Effects of interracial contact on executive function. *Psychological Science*, *14*, 287–290.
Rimé, B., Philippot, P., & Cisamolo, D. (1990). Social schemata of peripheral changes in emotion. *Journal of Personality and Social Psychology*, *59*, 38–49.
Schimmack, U. (2012). The ironic effect of significant results on the credibility of multiple-study articles. *Psychological Methods*, *17*, 551–566.
Schmeichel, B. J. (2007). Attention control, memory updating, and emotional regulation temporarily reduce the capacity for executive control. *Journal of Experimental Psychology: General*, *136*, 241–255.
Schmeichel, B. J., & Vohs, K. (2009). Self-affirmation and self-control: Affirming core values counteracts ego depletion. *Journal of Personality and Social Psychology*, *96*, 770–782.
Schmeichel, B. J., Volokhov, R. N., & Demaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology*, *95*, 1526–1540.
Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513–523.
Schwarz, N., & Clore, G. L. (1996). Feelings and phenomenal experiences. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 433–465). New York: Guilford Press.
Shamosh, N. A., & Gray, J. R. (2007). The relation between fluid intelligence and self-regulatory depletion. *Cognition and Emotion*, *21*, 1833–1843.
Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality And Social Psychology*, *52*, 1061–1086.
Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*, 422–445.
Smets, E. M. A., Garssen, B., Bonke, B., & De Haes, J. C. J. M. (1995). The Multidimensional Fatigue Inventory (MFI) psychometric qualities of an instrument to assess fatigue. *Journal of Psychosomatic Research*, *39*, 315–325.
Stewart-Williams, S., & Podd, J. (2004). The placebo effect: Dissolving the expectancy versus conditioning debate. *Psychological Bulletin*, *130*, 324–340.
Stoate, I., Wulf, G., & Lewthwaite, R. (2012). Enhanced expectancies improve movement efficiency in runners. *Journal of Sports Sciences*, *30*, 815–823.
Tamir, M., & Robinson, M. D. (2007). The happy spotlight: Positive mood and selective attention to rewarding information. *Personality and Social Psychology Bulletin*, *33*, 1124–1136.
Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, *72*, 271–322.
Thayer, R. E. (1989). *The biopsychology of mood and arousal*. New York: Oxford University Press.
Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology*, *43*, 379–384.
Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology*, *80*, 53–67.
Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language*, *28*, 127–154.
Tyler, J. M., & Burns, K. C. (2008). After depletion: The replenishment of the self's regulatory resources. *Self and Identity*, *7*, 305–321.
Vohs, K. D., Baumeister, R. F., & Schmeichel, B. J. (2012). Motivation, personal beliefs, and limited resources all contribute to self-control. *Journal of Experimental Social Psychology*, *48*, 943–947.
Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology*, *53*, 5–13.
Winterich, K. P., & Haws, K. L. (2011). Helpful hopefulness: The effect of future positive emotions on consumption. *Journal of Consumer Research*, *38*, 505–524.