Regulating the Effects of Depletion through Monitoring

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Abstract

A robust finding is that participants who perform a depleting initial self-regulatory task are less persistent on a contiguous second task than those who perform a less arduous initial self-regulatory task. We explain this regulatory depletion effect in terms of a monitoring process. According to this view, depleted individuals focus on the resources they have devoted to a second task, neglect to monitor their performance against their standards for such activities, and prematurely suspend their performance. Consistent with this view, we demonstrate that the regulatory depletion effect can be eliminated when individuals are encouraged to monitor their performance against some standard (Studies 1, 2 and 4), or when they have a proclivity to engage in such monitoring (Studies 3 and 4).

Key words: regulatory depletion, monitoring, resource allocation, elongation, persistence

Self-regulation involves corrective adjustments that a person determines are needed to make progress toward a goal (Carver, 2004). A common observation is that behaviors requiring self-regulation cause people to reduce the effort devoted to a subsequent task. After exerting effort to suppress their thoughts about a white bear, people who intend to regulate their drinking often indulge in excessive alcohol consumption (Muraven, Collins, & Nienhaus, 2002). Similarly, individuals who are trying to stop smoking to enhance their health commonly have difficulty maintaining healthy food consumption habits. We use the term *regulatory depletion effect* (Muraven, Tice, & Baumeister, 1998) to refer to the reduced control on a self-regulatory task after using significant resources to self-regulate during an immediately preceding task.

Substantial evidence documenting the regulatory depletion effect has been reported in the literature (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, DeWall, Ciarocco, & Twenge, 2005; Muraven et al., 2002; Muraven et al., 1998; Schmeichel, Vohs, & Baumeister, 2003; Vohs & Schmeichel, 2003; Webb & Sheeran, 2003). Typical of these studies, participants initially are asked to engage in a task where effortful self-regulation is required or where such regulation is not required. This variation in the initial self-regulatory task is followed by an unrelated resource-demanding persistence task that also requires self-regulation. For example, in one study, participants initially took part in a food-tasting task (Baumeister et al., 1998; Study 1). Self-regulation for those in the depletion condition involved refraining from eating chocolate chip cookies when performing the initial task, whereas this restriction was not imposed in the non-depletion control group. Subsequently, all participants were asked to work on an unsolvable puzzle. Those asked to refrain from eating the cookies exhibited less persistence in attempting to solve the subsequent puzzle than did those who did not have to allocate significant resources to exert self-control when performing the initial task. Similar findings have been reported, regardless of whether the initial self-regulatory task required crossing off the letter ‘e’ in a text presentation when certain conditions occurred (Baumeister et al., 1998: Study 4) or suppressing the thought of a white bear when writing down thoughts (Muraven et al., 1998: Study 1); or whether the persistence task involved solvable anagrams (Baumeister et al., 1998: Study 3), unsolvable anagrams (Muraven et al., 1998: Study 1) or unsolvable puzzles (Muraven & Slessareva, 2003).

The prevailing explanation for the regulatory depletion effect is offered by the strength model, which suggests that the operation of self-control is similar to that of exercising a muscle (Baumeister et al., 1998; Muraven & Baumeister, 2000). When a muscle becomes fatigued, there is a reduction in the effort that can be exerted (Muraven et al., 1998). Similarly, the self is viewed as having a limited resource that is consumed in the performance of volitional regulatory activities. This would account for the reports of fatigue following depleting acts of self-control (Baumeister et al., 1998). Moreover, because all acts of self-control are thought to draw on the same resource pool, its use in one task undermines the immediate performance of a second task, even if the tasks are seemingly unrelated. The result is a regulatory depletion effect.

The strength model not only predicts a regulatory depletion effect, but also suggests how this effect might be offset. The contention is that like a muscle, self-control can be strengthened by repeated practice. Support for this prediction is reported in a longitudinal study where participants were given self-regulatory regimens for a period of two weeks that involved activities such as improving posture (Muraven, Baumeister, & Tice, 1999). Participants who practiced posture improvement demonstrated an enhanced self-regulation on a subsequent unrelated persistence task after initial depletion as compared with participants who had not engaged in such practice. Apparently, practicing self-regulation in a manner that did not exceed individuals' resource availability enhanced subsequent self-regulation when resources were limited.

There is also emerging evidence that depleted individuals often have the resources necessary to overcome the effects of regulatory depletion. The depletion effect was shown to be eliminated when participants were offered a monetary incentive for greater performance (Baumeister et al., 2005), were informed that persistence would improve their skill in an important game (Muraven & Slessareva, 2003), or believed that persistence was warranted because the issue requiring persistence was of substantial importance (Muraven & Slessareva, 2003). Having respondents perform the persistence task in front of a mirror also eliminated the regulatory depletion effect observed when the mirror was absent (Baumeister et al., 2005: Experiment 6). Finally, providing participants with the expectation that performing an initially depleting task would enhance performance on a subsequent persistence task resulted in greater persistence than that found among those who were not given this expectation and performed either a depleting or a less arduous initial task (Martijn, Tenbult, Merckelbach, Dreezens, & de Vries, 2002). These observations raise questions as to why people sometimes fail to sustain their effort despite the apparent availability of sufficient resources to do so, and when they are likely to allocate sufficient resources to offset the effects of their depletion. The strength model does not seem adequate to address these issues without being bolstered by additional theorizing.

One promising approach to accounting for when the regulatory depletion effect occurs is to interpret self-regulation in terms of a monitoring process. Monitoring entails comparing a person's behavior to a salient performance standard with the goal of adjusting the behavior so as to minimize the discrepancy between current performance and the standard (Carver, 2004; Carver & Scheier, 1998). This depiction of self-regulation is endorsed by Baumeister and his co-investigators: "Effective self-regulation requires a certain degree of self-awareness to supervise the process of monitoring and changing the self…It is difficult to alter the self to bring it into line with goals and standards if one cannot be aware of where the self stands in relation to those standards" (Baumeister et al., 2005, p. 601). Viewed from this perspective, a regulatory depletion effect can occur because depleted individuals suspend the monitoring process. The depletion caused by an initial self-regulatory task prompts individuals to focus on the effort they are allocating to the persistence task and to thereby lose sight of their performance standard. The result of this failure to monitor is a premature quitting of the persistence task that is manifested as a regulatory depletion effect.

A recent study reported by Vohs and Schmeichel (2003) provides a starting point for understanding why depleted individuals may fail to monitor their self-regulatory activity. Vohs and Schmeichel (2003) replicated the finding that performing an arduous initial self-regulatory task resulted in diminished performance on a subsequent persistence task as compared with a less depleting initial task. More importantly, they documented that this effect was mediated by the perception of the amount of time spent in performing the persistence task: Participants who were initially depleted estimated that they had spent more time performing the persistence task than those who were not initially depleted, when in fact the opposite was true.

Vohs and Schmeichel (2003) explain their results by making a critical observation about the effect of performing an initial self-regulatory task on individuals' focus while engaging in a persistence task. They suggest that performing a resource-depleting self-regulatory task prompts a focus on the expenditure of time in task performance, which results in an elongation in the perception of time. Elongation refers to the subjective experience that "each moment is drawn out so that the present feels longer than it would normally" (Vohs & Schmeichel, 2003, p. 219). Vohs and Schmeichel's finding that participants who performed a depleting initial task overestimated their persistence on the subsequent task to a greater extent than did those who did a non-depleting initial task provides evidence that depletion stimulates elongation. Further, it is contended that elongation in the perception of time increases the perception of fatigue and prompts a focus on current feelings and impulses that leads to losing sight of distal goals. As Vohs and Schmeichel (2003) state: “When one is depleted, durations seem longer, and the present becomes prolonged; current impulses overshadow goal-oriented responses …” (p. 219).

The contention that depletion results in a focus on the perceived effort or resource allocation to a persistence task rather than goal-oriented responses is consistent with Duncan’s notion of “goal neglect,” which is defined as a temporary disregard of a goal that is retrievable when people are queried about it directly (Duncan, 1990). Duncan suggests that individuals may neglect their goal in contexts lacking strong external cues for goal-oriented action. Evidence for this view emerges in studies documenting goal neglect when individuals have a limited working-memory capacity (Kane & Engle, 2003) or are distracted by competing stimuli (De Jong, Berendsen, & Cools, 1999). These findings suggest that individuals are more likely to disregard the task goal in situations where resources are limited. At the same time, the observation that individuals are able to articulate their target goals when asked directly indicates that these goals are temporarily neglected rather than not represented in memory. When goals are neglected, the standards individuals would normally evoke to meet these goals are not salient.

In essence, the monitoring model interprets the depletion effect in terms of a breakdown in the monitoring process: depleted individuals focus on the effort they devote to the persistence task. Such a focus leads to an elongation in their perception of that allocation, a neglect of their standards for the performance of such tasks, and a reliance on the current feeling of fatigue in performing the task that is manifested by a premature cessation of the task. The result is a regulatory depletion effect. The implication of this model is that prompting individuals to monitor by comparing their performance with their standard is likely to sustain their performance of a subsequent persistence task. Because individuals’ goals and standards are thought to be neglected rather than not represented in memory (Duncan, 1990), one way to stimulate this comparison among depleted individuals is to make the consideration of a standard salient. This cue is not expected to affect the performance of non-depleted individuals, who are thought to engage in monitoring spontaneously.

The viability of the monitoring model is suggested by the fact that it can account for the recent demonstrations documenting conditions under which the regulatory depletion effect is eliminated. As described earlier, this outcome occurs when persistence is motivated by a monetary incentive, an important issue, or the belief that persistence would improve performance. All of these inductions are likely to enhance the salience of a target goal, prompt individuals to engage in a comparison of their activity to their standard for achieving the goal, and thus maintain their performance despite their initial depletion (Baumeister et al., 2005; Muraven et al., 1999; Muraven & Slessareva, 2003). Similarly, the demonstration that having people monitor their posture for several weeks enhanced depleted individuals' persistence in an unrelated task can be interpreted as evidence that creating a monitoring mindset encouraged the comparison of performance against a standard, and thus eliminated the regulatory depletion effect that would otherwise occur (Muraven et al., 1999). Finally, the demonstration that performing the depletion task in front of a mirror eliminated the depletion effect can be explained by noting that a mirror has been shown to enhance the extent to which individuals compare their performance to their standard (Scheier & Carver, 1983). These observations suggest that the monitoring model offers a plausible account for the regulatory depletion effect and its elimination. We provide tests of the monitoring predictions in the present research.

Overview of the Present Research

We report four studies that test predictions related to the monitoring account for the regulatory depletion effect. For this purpose, we adopted the two-task procedure developed by Baumeister and his colleagues (Baumeister et al., 1998; Muraven et al., 1998). Research participants initially were given either a self-regulatory task that consumed substantial resources (i.e., a depletion task) or a task that imposed more modest resource demands (i.e., a non-depletion task). This task was followed immediately by a second self-regulatory task that tested participants' persistence. The difference in the time spent performing the persistence task by participants in the non-depletion and depletion conditions served as the indicator of whether or not a regulatory depletion effect had occurred. The influence of mood on participants' persistence was evaluated in all studies to ascertain whether this factor was implicated in regulatory depletion effects.

The initial two studies were intended to test the monitoring prediction that the regulatory depletion effect could be eliminated by encouraging a comparison between an individual's performance on a persistence task and a performance standard. For this purpose, participants were given feedback updating them on an ongoing basis about the time they had allocated to the performance of the persistence task. The expectation was that presenting this feedback would induce depleted participants to monitor their performance by comparing their persistence against their standard for such activities as a basis for deciding how long to persist at the task. In contrast, providing feedback was not expected to influence the persistence of non-depleted participants because they were already engaged in such monitoring.

In Studies 3 and 4, we used an individual difference measure to assess the impact of monitoring on the regulatory depletion effect. This entailed administering Snyder's (1974) Self-Monitoring Scale. High self-monitors are attuned to the demands of the social situation. These individuals are sensitive to social comparison information: they focus on what the situation demands and how they can be that person (Snyder, 1974; 1979). In contrast, the behavior of low self-monitors is guided by their attitudes and affective states rather than the demands imposed by the situation: low self-monitors focus on who they are and they attempt to represent that person in their behavior (Snyder, 1974; 1979). These characterizations suggest that even when initial task demands are substantial, high self-monitors would be unlikely to lose sight of the standard activated by the demands of the situation. Rather, they would compare their performance on the persistence task to the standard spontaneously, and thus would not exhibit a regulatory depletion effect. Low self-monitors were expected to focus on their feelings of mental fatigue when they were depleted and neglect to monitor their performance of the persistence task. As a result, low self-monitors were expected to exhibit a regulatory depletion effect (Studies 3 and 4). Further, if this analysis is correct, it should be possible to eliminate the regulatory depletion effect exhibited by low self-monitors by giving them a cue that prompts monitoring.

Study 1: Providing Accurate Feedback about Resource Allocation

In Study 1, we tested the monitoring model prediction that a regulatory depletion effect occurs because people focus on the effort devoted to a persistence task and neglect the comparison of their performance against their standard. Some participants were provided with accurate moment-to-moment feedback about the time they had spent on the persistence task. The intent of this feedback was to encourage depleted participants to compare their persistence against their standard rather than focus on the effort they were devoting to the persistence task. If this occurred, it would be manifested by an elimination of the depletion effect observed in the absence of the feedback. In contrast, providing feedback about the time allocated to the persistence task was not expected to affect the responses of non-depleted participants because they were likely to compare their resource allocation to a standard spontaneously.

Method

Participants. Fifty undergraduate students (28 women) from a Midwestern university were recruited to participate in this study for which they were each paid $10.

Procedure. Prior to performing the experimental procedures, all participants were asked to remove accessories, including their watches. They were told that they would perform a series of experimental tasks that would last one hour, but they were not aware of how many tasks they would have to complete during the session. Each participant was seated in front of a computer and asked to complete a "cross-off-the-letter" task that has been used successfully to vary depletion (Baumeister et al., 1998: Study 4). In the non-depletion condition, the task was to cross off all instances of the letter "e" on a page of meaningless text presented on the computer screen. Most participants were able to perform this task easily. In the depletion condition, participants were given the same text and asked to cross off all instances of the letter 'e' when the context in which the letter 'e' appeared met several criteria (i.e., the letter 'e' was not adjacent to another vowel, and it was not one letter removed from another vowel). Because this task required thinking about the criteria for crossing off the letter 'e' and inhibiting the impulse to cross off each letter 'e,' it was likely to consume substantial self-regulatory resources.

After finishing the cross-off-the-letter task, participants were asked to evaluate their mood on the BMI Scale (Mayer & Gaschke, 1988). This scale includes eight pleasant mood items (active, calm, caring, content, happy, lively, loving, and peppy) and eight unpleasant ones (drowsy, fed up, gloomy, grouchy, jittery, nervous, sad, and tired). Responses to these items were anchored on seven-point scales ranging from 1 (*definitely do not feel*) to 7 (*definitely feel*).

This mood measure was followed by the administration of the persistence task. Participants were asked to solve a puzzle, which was a 4 x 4 matrix that had fifteen numbers ranging from one to fifteen. There was one free space at the bottom right of this matrix that allowed for movement of the adjacent numbers. Participants' task was to reorder these numbers so that the four rows represented a numerical progression from one to fifteen. The puzzle is described in detail at: http://mathworld.wolfram.com/15Puzzle.html.

For the practice trial, the numbers in the puzzle were arranged so that solving the puzzle was easy for all participants. The intent was to ensure that participants understood the procedures involved in the task and that they would exhibit at least some persistence in the belief that the puzzle could be solved. Once participants demonstrated an ability to solve the practice puzzle, they were given instructions patterned after those used by Baumeister et al. (1998): "You can take as much time and as many trials as you want. You will not be judged on the number of trials or the time you will take. You will be judged on whether or not you solve the puzzle. If you wish to stop before solving the puzzle, click the 'next' button below." Because participants had the latitude to decide how long to persist, the puzzle task was one that required self-regulation. Unknown to the participants, the fifteen numbers in the puzzle were arranged in a way that made them impossible to reorder in the manner requested.

Participants were then given the opportunity to solve the puzzle. For those in the clock present condition, the accumulated time participants had spent in trying to solve the puzzle was represented to the right of the puzzle and was updated every second. This information was not provided to participants in the no clock condition. For those who persisted in trying to solve the puzzle, an instruction appeared on their monitors after thirty minutes asking them to stop working on the task. The amount of time participants spent in attempting to solve the puzzle served as the indicator of persistence.

When participants stopped working on the puzzle, they were administered some additional questions, including the manipulation check question that asked them: "How effortful was it to cross off all the instances of 'e'?" Response to this question was anchored on a seven-point scale ranging from 1 (*not at all*) to 7 (*very much*). Finally, participants were debriefed and thanked for their participation.

Results

Manipulation check. The adequacy of the experimental manipulations was examined first. A 2 (initial self-regulation: depletion vs. non-depletion) x 2 (feedback: clock present vs. no clock) ANOVA indicated that only the main effect of initial self-regulation on perceived task effort was significant: the initial self-regulatory task was perceived to be more effortful by participants in the depletion condition (M = 5.41, SD = 2.04) than it was by those in the non-depletion condition (M = 3.70, SD = 1.39), $F(1, 46) = 11.26$, $p < .01$. Neither the main effect of feedback nor the interaction between initial self-regulation and feedback was significant, $Fs < 1$.

Persistence. A 2 (initial self-regulation: depletion vs. non-depletion) x 2 (feedback: clock present vs. no clock) ANOVA indicated that the main effect of feedback condition was not significant, $F(1, 46) = 1.15$, *ns*, the main effect of the initial self-regulation condition was marginally significant, $F(1, 46) = 3.51$, $p < .08$, and the interaction between the two variables shown in Figure 1 was significant, $F(1, 46) = 5.06$, $p < .03$. These outcomes were such that when there was no clock, participants in the non-depletion condition persisted longer (M = 13.94, SD = 8.00) than did those in the depletion condition (M = 6.30, SD = 2.93), $F(1, 46) = 8.55$, $p < .005$, replicating the regulatory depletion effect reported in the literature. In contrast, when the clock was present, there was no difference in persistence between those in the non-depletion (M = 11.76, SD = 6.38) and the depletion (M = 12.46, SD = 7.57) conditions, $F < 1$. Moreover, these outcomes were such that when the cross-off-the-letter task was depleting, participants in the clock present condition persisted significantly longer than did those who were not informed about the time they had allocated to the persistence task, $F(1, 46) = 6.00$, $p < .02$.

Figure 1 about here

Mood. To assess whether the mood of participants affected the regulatory depletion effect, we composed a pleasant mood score by averaging the eight pleasant mood items ($\alpha = .89$) and an unpleasant mood score by averaging the eight unpleasant mood items ($\alpha = .78$) (Mayer & Gaschke, 1988). First, we examined the treatment effect on mood. Because mood was measured before the clock manipulation, we conducted a one-way ANOVA to test separately the effect of initial depletion on the pleasant mood and unpleasant mood scores. Participants in the depletion condition ($M = 3.30$, $SD = 1.14$) and those in the non-depletion condition ($M = 3.60$, $SD = 1.09$) did not differ in their pleasant mood, $F(1, 48) = 1.57$, *ns*. However, participants in the depletion condition reported a more unpleasant mood ($M = 3.30$, $SD = 1.05$) than did those in the non-depletion condition ($M = 2.72$, $SD = .95$), $F(1, 48) = 4.11$, $p < .05$. This outcome raises the possibility that the regulatory depletion effect was due to different levels of unpleasant mood induced by the depletion conditions.

To examine the role of unpleasant mood in explaining the regulatory depletion effect, we conducted a regression analysis in which persistence on the puzzle task was regressed on the unpleasant mood score, feedback about the time spent on the persistence task, and the interaction between these factors. None of these factors had a significant impact on persistence, $ts < 1$. These outcomes suggest that although initial depletion affected participants' unpleasant mood, this disposition did not account for the persistence observed in Study 1. This result replicates findings regarding the effect of mood found in the literature (Baumeister et al., 1998; Muraven et al., 1998).

Discussion

Study 1 provides evidence for the regulatory depletion effect and suggests that this effect can be eliminated by making accessible accurate information about the resource allocation to the persistence task. Under this condition, depleted participants did not exhibit the regulatory depletion effect that was observed in the absence of information about resource allocation. Non-depleted participants were unaffected by making accurate information about the time spent on the persistence task available, presumably because they monitored their performance spontaneously.

These findings are consistent with the view suggested by the monitoring model that an elongation in the perception of the time spent on the persistence task and the attendant lack of comparison to the standard against which to assess persistence is an important determinant of the depletion effect. Consistent with this view, persistence was enhanced when comparison was encouraged by providing a clock that accurately indicated the time spent performing the puzzle task. However, it is uncertain what it was about the clock that increased persistence. It is plausible that having a clock within sight served as a motivational prompt for participants in the depletion condition, and thus they persisted longer in performing the puzzle task than they did in the absence of this cue. Or, it might be that by presenting accurate information about persistence, the clock provided information to participants about their resource allocation that they could compare against their standard in determining how long to sustain their activity. To determine whether it was the clock or the information provided by the clock that was responsible for the elimination of the depletion effect, we varied the information presented on the clock in Study 2.

Another plausible explanation for our findings is offered by the expectancy theory proposed by Martijn and his colleagues (Martijn, Alberts, & de Vries, 2006; Martijn et al., 2002). According to this view, people have the naïve theory or expectancy that acts of self-control require substantial effort. Thus, they approach the second task with the expectation that their performance on this task would be impaired by the resource demands imposed by the initial task. Consistent with the expectancy view, participants who were led to believe that people actually perform better in a subsequent task after exerting self-control in an initial task persisted longer than did non-depleted controls (Martijn et al., 2002: Study 1).

In the current study, the elimination of the depletion effect in the clock present condition might have been caused by a change in participants' expectations. Having an accurate clock in view might have challenged participants' expectations about feeling tired when performing the persistence task (e.g., "I've only been working for ten minutes. I am not tired yet. I shall keep going!"). We examine the role of expectancy in Study 2 by administering measures of participants' expectancies.

Study 2: Documenting the Nature of the Monitoring Process

The goal of Study 2 was to document further the nature of the monitoring process that we have introduced to account for the presence and absence of the regulatory depletion effect. This entailed replicating the procedures used in the previous study to vary the resource demands imposed by the initial task and examining persistence on an unsolvable puzzle in the presence and absence of a clock. As in Study 1, the prediction is that a regulatory depletion effect would be found in the absence of an accurate clock and eliminated in its presence. We also introduced a fast clock condition, which indicated that more time had elapsed than actually was the case. As was found for the accurate clock, we expected that for depleted participants the clock would stimulate a comparison between their allocation to the persistence task and their standard for such activities. If participants made use of the information presented on the clock rather than used the presence of the clock *per se* as a cue, a fast clock was likely to lead to the premature belief that they had met their standard, which would result in a regulatory depletion effect. Non-depleted participants were not expected to be influenced by the clock because they were already monitoring their performance against their standard.

Study 2 also documented the mediating role of elongation in the monitoring process by having participants estimate the amount of time they had spent performing the persistence task. The measurement of both the estimates of the time participants had spent on the persistence task and the actual time spent enabled us to compute participants' elongation of time. The prediction is that this measure of elongation would mediate the effect of an initial task on persistence when no feedback about the time spent was provided, an outcome that would replicate Vohs and Schmeichel's (2003) finding. Time estimates in the clock conditions were not expected to be informative because participants might simply rely on the time shown on the clock when reporting their time estimates. Moreover, the measure of elongation was not expected to mediate the regulatory depletion effect in the accurate clock condition because in the absence of a depletion effect, no elongation was anticipated.

We also measured participants' expectations about how the initial self-regulatory task would affect their performance on the persistence task. This measure provided a means of examining the prediction derived from expectancy theory that the presence of a clock would change participants' expectancies about how tired they would feel after the initial depletion task and thereby affect their persistence in performing the second task.

Method

Participants. Eighty-one undergraduate students (47 women) from a Midwestern university were recruited to participate in this study for which they were each paid $10.

Procedure. Participants completed the study individually on a computer. As in Study 1, all participants completed the cross-off-the-letter task that varied the extent of their depletion and responded to the BMI Scale. They were then asked to solve the same puzzle as that used in Study 1. At this stage, three experimental conditions were introduced. In the two clock conditions, a clock positioned on the screen to the right of the puzzle provided feedback indicating the elapsed time spent on the puzzle. For those in the accurate clock condition, the feedback about time spent was veridical. In the fast clock condition, the time reported was four seconds faster than the actual time spent for every fifteen seconds that had elapsed. Thus, when participants saw the clock displaying “15 seconds,” the actual time they had spent on the puzzle task was eleven seconds; when the clock showed that the time spent was “30 seconds,” the actual time participants had spent on the puzzle was twenty-two seconds, and so on. In both clock conditions, the feedback about the time spent was updated every fifteen seconds. Elapsed time was presented in this manner to limit the chance that participants in the false feedback condition would detect the inaccuracy in the information they were presented. For participants in the control condition, no information about time was provided. As in the previous study, a time limit of thirty minutes was given to solve the puzzle. The amount of time participants spent attempting to solve the puzzle served as the indicator of persistence.

When participants stopped working on the puzzle, they were administered a series of questions. First, they were asked to estimate the amount of time they thought they had spent on the puzzle task. Next, they completed the same manipulation check measure as was administered in Study 1 regarding the effort exerted in performing the initial task. Finally, participants were asked to indicate their agreement with the following two statements: “After working hard on the cross off the ‘e’ task, I coasted a little on the puzzle task,” and “I would have worked longer on the puzzle task if it were the only task I had to do.” Responses to the two questions were reported on nine-point scales ranging from 1 (*strongly disagree*) to 9 (*strongly agree*). This measure provided a means of assessing whether participants’ expectations about the effect of the initial cross-off-the-letter task influenced their resource allocation to the persistence task.

Results

Manipulation check. First, we examined the manipulation of initial self-regulation. A 2 (initial self-regulation: depletion vs. non-depletion) x 3 (feedback: no clock vs. accurate clock vs. fast clock) ANOVA indicated that neither the main effect of feedback about the time spent performing the persistence task, $F(2, 75) = 2.07$, $p < .14$ nor the interaction between initial self-regulation and feedback was significant, $F < 1$. However, the main effect of initial self-regulation was significant, $F(2, 75) = 4.73$, $p < .04$: participants in the depletion condition perceived the cross-off-the-letter task to be more effortful ($M = 4.95$, $SD = 2.63$) than did those in the non-depletion condition ($M = 3.83$, $SD = 1.79$). This result suggests that the manipulation of the resource demands imposed by the initial task was successful.

Persistence. An ANOVA indicated that the main effect of time feedback was not significant, $F(2, 75) = 1.37$, *ns*, whereas the main effect of the initial self-regulatory task was significant, $F(2, 75) = 9.35$, $p < .005$. More central to our theorizing, the interaction between these factors shown in Figure 2 was significant, $F(2,75) = 3.17$, $p < .05$.

Figure 2 about here

Contrasts were examined to assess the nature of this interaction. When no clock was present, a depletion effect was observed: those in the non-depletion condition ($M = 12.73$, $SD = 6.08$) persisted significantly longer on the puzzle task than did those in the depletion condition ($M = 6.59$, $SD = 3.09$), $F(1, 75) = 7.93$, $p < .01$. In contrast, when the clock provided accurate feedback about the time allocated to the persistence task, persistence in performing the puzzle task did not differ between participants in the depletion ($M = 10.94$, $SD = 6.74$) and non-depletion conditions ($M = 10.37$, $SD = 4.83$), $F < 1$. This latter outcome occurred because those in the accurate clock condition persisted longer than did those in the no clock condition when the initial self-regulatory task was depleting, $F(1, 75) = 4.14$, $p < .05$, replicating the results reported in Study 1.

Of particular interest was the effect of feedback presented in the fast clock condition. Here, a regulatory depletion effect was observed: participants in the depletion condition (M = 5.28, SD = 3.32) were significantly less persistent than those in the non-depletion condition (M = 11.07, SD = 7.27), $F(1, 75) = 7.24$, $p < .01$. Moreover, when the initial self-regulatory task was depleting, participants in the fast clock condition were less persistent than were those in the accurate clock condition, $F(1, 75) = 6.70$, $p < .02$.

Self-regulation and time estimation. To assess how self-regulation affected participants' estimate of the time they had spent on the persistence task, we followed the convention of using the ratio of participants' subjective estimations of time to the actual time spent as the time estimate (Block & Zakay, 1997; Vohs & Schmeichel, 2003). A ratio of one indicates an accurate estimation of duration, a ratio greater than one indicates an overestimation, and a ratio less than one indicates an underestimation of duration. An ANOVA revealed that the main effect of the initial self-regulation, $F(2, 75) = 11.34$, $p < .001$, the main effect of feedback about time spent, $F(2, 75) = 17.92$, $p < .001$, and the interaction between these factors were significant, $F(2, 75) = 8.96$, $p < .001$.

To evaluate the nature of this interaction, we examined the time estimates within each of the feedback conditions. When the feedback about the time spent performing the persistence task was accurate, participants in the depletion condition (M = 1.00, SD = .19) and those in the non-depletion condition (M = .98, SD = .24) did not differ in their time estimates, $F < 1$. When no feedback was presented, participants' estimates about the time they had spent on the puzzle task were significantly longer when they were in the depletion condition (M = 1.63, SD = .51) than when they were in the non-depletion condition (M = .87, SD = .26), $F(1, 75) = 33.50$, $p < .001$, replicating Vohs and Schmeichel's (2003) observation of an elongation in the perception of time when participants were depleted. Finally, when the first task was depleting, those in the no clock condition estimated the time spent to be significantly longer than did those in the accurate clock condition, $F(1, 75) = 49.02$, $p < .001$.

A pattern similar to the one observed in the no clock condition was found in the fast clock condition. Here, the time estimates in the depletion condition ($M = 1.51$, $SD = .46$) were longer than those in the non-depletion condition ($M = 1.34$, $SD = .29$), although the difference was only marginally significant, $F(1, 75) = 2.74$, $p < .08$. Moreover, in the non-depletion condition, participants' time estimates in the fast clock condition ($M = 1.34$) were significantly longer than those in the no clock condition ($M = .87$), $F(1, 75) = 28.64$, $p < .001$, and those in the accurate clock condition ($M = .98$), $F(1, 75) = 17.43$, $p < .001$). In the depletion condition, the time estimates in the fast clock condition ($M = 1.51$) were significantly longer than those in the accurate clock condition ($M = 1.00$), $F(1, 75) = 17.43$, $p < .001$, but were not different from those in the no clock condition ($M = 1.63$), $F(1, 75) = 1.59$, $p = .21$. Apparently, participants used the time indicated on the fast clock when asked to estimate the time they had spent, whether or not they were depleted by the initial self-regulatory task.

Time estimate as a mediator. To determine whether participants' elongation of time influences the regulatory depletion effect, we followed the procedures proposed by Baron and Kenny (1986) to examine the role of time estimates in mediating persistence in the no clock condition (Figure 3)[2]. First, we regressed participants' persistence in performing the puzzle task on the initial self-regulatory task. This analysis revealed a significant relationship between these variables, $\beta = -.55$, $t(24) = -3.24$, $p < .01$. Those in the depletion condition were significantly less persistent than those in the non-depletion condition. Next, we regressed participants' time estimates on the initial self-regulatory task. The results indicated that participants' time estimation was predicted by whether this task was depleting or non-depleting, β = .71, $t(24) = 4.85$, $p < .01$: the greater the exertion required in performing the initial self-regulatory task, the longer was the perception of the time spent on the persistence task. Furthermore, a regression of persistence on participants' time estimates indicated a significant negative relationship between these variables, β = -.74, $t(24) = -5.32$, $p < .01$: greater estimates of the time spent on the persistence task were associated with less actual time spent. Finally, when both the initial self-regulatory task and the time estimates were used to predict persistence, time estimates were still significantly related to persistence, β = -.69, $t(23) = -3.47$, $p < .01$, but the relationship between the initial self-regulatory task condition and persistence was no longer significant, β = -.07, $t(23) = -.34$, *ns*. These results indicate that the time estimate mediated the relationship between the resources allocated to self-regulation during the initial task and persistence on the subsequent task.

Figure 3 about here

Mood. As in Study 1, a pleasant mood score was obtained by averaging the eight pleasant mood items (α = .90), and an unpleasant mood score was obtained by averaging the eight unpleasant mood items (α = .75). One-way ANOVAs were performed separately on the pleasant mood score and the unpleasant mood score. Consistent with the results in Study 1, these analyses indicated that participants in the depletion condition ($M = 3.37$, $SD = 1.16$) and those in the non-depletion condition ($M = 2.97$, $SD = 1.21$) did not differ in their pleasant mood, $F(1, 79) = 2.20$, $p < .15$, and participants in the depletion condition reported a more unpleasant mood ($M = 3.44$, $SD = 1.04$) than did those in the non-depletion condition did ($M = 2.94$, $SD = .84$), $F(1, 79) = 5.68$, $p < .03$.

Follow-up analyses examined the possibility that the observed effects could be attributed to a difference in unpleasant mood between depleted and non-depleted participants. Because the feedback about time spent on the persistence task moderated the depletion effect, we conducted a regression analysis in which persistence on the puzzle task was regressed on the unpleasant mood score, feedback, and the interaction between the two variables. The results indicated that neither of these factors nor the interaction between them had significant effects on persistence, *Fs* < 1. These outcomes suggest that although initial depletion affected participants' unpleasant mood, the presence or absence of the depletion effect was independent of the mood effect, which replicates previous findings.

Expectancy. A 2 (initial self-regulation: depletion vs. non-depletion) x 3 (feedback: accurate clock vs. fast clock vs. no clock) ANOVA was conducted to assess participants' expectancies regarding the impact of the initial self-regulatory task on their subsequent persistence. Those in the depletion condition reported greater agreement with the statement that they coasted a little on the puzzle task ($M = 4.67$, $SD = 2.47$) than did those in the non-depletion condition ($M = 3.19$, $SD = 2.17$), $F(2, 75) = 7.84$, $p < .01$. But their agreement with this statement was not affected by the feedback about the amount of time spent ($F < 1$), or by the interaction between initial depletion and feedback ($F(2, 75) = 1.48$, *ns*). Similarly, participants in the depletion condition agreed more with the assertion that they would have worked longer on the puzzle if it had been the only task ($M = 6.72$, $SD = 2.43$) than did those in the non-depletion condition ($M = 5.55$, $SD = 2.84$), $F(2,75) = 4.42$, $p < .04$. Again, their agreement with this assertion was not affected by feedback ($F < 1$), or the interaction between initial depletion and feedback, $F(2, 75) = 1.48$, *ns*.

Discussion

Study 2 provides additional evidence for the role of elongation in the monitoring process that produces and eliminates the regulatory depletion effect. When elongation is prompted by a depleting task, a regulatory depletion effect is observed. The finding that participants' time estimates in the no time feedback condition mediated the regulatory depletion effect provides additional evidence documenting the role of elongation in the monitoring process (Vohs & Schmeichel, 2003). When elongation is limited by the presence of a clock that accurately depicts persistence, the regulatory depletion effect is eliminated. This outcome was not due simply to the presence of the clock because a regulatory depletion effect was found in the presence of a fast clock. It appears that the clock serves a cue that not only prompts people to engage in monitoring their performance against a standard, but also provides information that is used to determine when a standard has been reached. The accurate clock resulted in participants persisting until they had met their standard, whereas the fast clock induced premature cessation of the persistence task because it led participants to believe that they had reached their standard when they had not.

Study 2 also indicates that participants exposed to a non-depleting task were not influenced by the presence of an accurate or a fast clock. Apparently, in the absence of depletion, participants monitored their resource allocation in relation to their standard and thus persisted regardless of whether they were encouraged by a clock to engage in comparison. Indeed, for non-depleted respondents, persistence in the fast clock condition (M = 11.07) did not differ from that in the no clock condition (M = 12.73), or that in the accurate clock condition (M = 10.37), Fs < 1.

The results of Study 2 offer evidence relevant to the expectancy view. According to this view, people hold the naïve theory that acts of self-control require substantial effort that impairs subsequent performance (Martijn et al., 2002). Our finding that depleted participants perceived that the initial depleting task reduced their resource allocation to the persistence task to a greater extent than did non-depleted individuals is consistent with this prediction. However, we also observed that participants in the accurate clock condition sustained their expectations about the effect of depletion despite the fact that depleted participants were as persistent in performing the second task as non-depleted participants. This finding is at odds with the expectancy view. Furthermore, these outcomes occurred even though participants' expectations were measured after the persistence task, which would have enabled them to use their hindsight about their persistence in reporting their expectations and in this way enhance the correspondence between their expectancy and persistence.

Study 3: Self-Monitoring and the Depletion Effect

The findings reported in Studies 1 and 2 suggest that when individuals are depleted, they can be induced to monitor their performance by the presence of a cue such as information about the time they have spent on the persistence task. As we have shown, participants' interpretations of such monitoring can lead to the same level of persistence (accurate clock) or less persistence (fast clock) than is exhibited by non-depleted participants. If these outcomes are attributable to a comparison of one's performance to some standard, it should be possible to document that people who differ in their proclivity to monitor their performance exhibit the same outcomes as we observed by varying the presence of feedback.

This prediction is tested in Study 3. Our premise is that individual differences in self-monitoring would moderate the regulatory depletion effect. To test this view, we administered Snyder's (1974) Self-Monitoring Scale. As noted earlier, high self-monitors regulate their behavior by being attuned to the standard appropriate for the situation, whereas low self-monitors self-regulate by representing how they feel in the actions they take (Snyder, 1974;

1979). These orientations suggest that high self-monitors will determine their persistence by comparing their performance to some standard that they deem appropriate for the situation. If this occurs, it would be manifested by the absence of a regulatory depletion effect. In contrast, low self-monitors are expected to focus on their feelings about the initial task as a basis for deciding on their subsequent persistence. This would lead to less persistence when depleted than when non-depleted, that is, a regulatory depletion effect.

A study reported by Seeley and Gardner (2002) provides evidence for the moderating role of self-monitoring in the depletion effect. Using the other-directedness subscale of self-monitoring (Briggs, Cheek, & Buss, 1980), they observed that participants scoring low on the other-directness subscale exhibited a regulatory depletion effect, whereas those scoring high did not. In the present study, we use the full self-monitoring scale to test our predictions because all items are relevant to the measurement of self-monitoring.

Method

Participants. Fifty undergraduate students (27 women) from a Midwestern university were recruited to participate in this study. Participants were each paid $10 for their participation.

Procedure. Each participant completed the initial cross-off-the-letter and unsolvable puzzle tasks as were used in previous studies. After finishing the cross-off-the-letter task, participants evaluated their mood on the BMI Scale. The amount of time participants spent in attempting to solve the puzzle served as the indicator of persistence. When participants had finished the puzzle, they were administered some additional questions and completed some filler tasks that took about ten minutes. These items included one pertaining to the perceived effort required to perform the initial task, which was used in previous studies as a check on the adequacy of the depletion manipulation. All participants then completed the 25-item Self-Monitoring Scale (Snyder, 1974). Response to each item was anchored on a true-false bipolar scale. High self-monitors were expected to endorse items such as “I would probably make a good actor,” whereas low self-monitors were expected to endorse items such as “I find it hard to imitate the behavior of other people.”

Results and Discussion

Manipulation Check. The adequacy of the manipulations was examined first. We submitted the perceived effort required to perform the cross-off-the-letter task to a regression analysis in which perceived effort was regressed on initial self-regulation (a dummy variable: 0 = non-depletion, 1 = depletion), self-monitoring (a continuous variable calculated on the basis of participants’ responses to each item on the Self-Monitoring Scale), and the interaction of these two factors. A significant main effect of initial self-regulation was found. The positive direction of this relationship suggests that participants in the depletion condition perceived the initial task to be more effortful than did those in the non-depletion condition, $\beta = .99$, $t(46) = 2.04$, $p < .05$. Other effects were not significant, *ts* < 1. These outcomes suggest that the cross-off-the-letter task was more depleting when it imposed complex decision rules than when following such rules was not required, regardless of whether self-monitoring was high or low.

Persistence. Persistence was regressed on initial self-regulation, self-monitoring, and the interaction of these two factors. The results indicated that the main effect of initial self-regulation was significant, $\beta = -1.54$, $t(46) = -3.15$, $p < .005$, whereas the main effect of self-monitoring was not significant, $\beta = -.09$, $t(46) = -.63$, *ns*. More central to our interest, the interaction effect of the two factors was significant, $\beta = 1.05$, $t(46) = 2.12$, $p < .04$.

We conducted a simple slope test to examine the nature of the interaction. Following Aiken and West (1991), we designated low self-monitoring at one standard deviation below the mean and high self-monitoring one standard deviation above the mean, and then contrasted the difference between low and high self-monitors. The results, shown in Figure 4, indicate that the initial level of depletion had a significant effect on the persistence of low self-monitors: they were less persistent in attempting to solve the puzzle when the initial task was depleting than when it was non-depleting, $t(46) = -4.65$, $p < .001$. In contrast, the initial level of depletion did not significantly affect the persistence of high self-monitors, $t(46) = -1.49$, $p < .15$. These outcomes were such that when the initial task was depleting, high self-monitors were more persistent than low self-monitors, $t(46) = 2.15$, $p < .04$, whereas when the initial task was non-depleting, self-monitoring was not significantly associated with persistence, $t < 1$.

Figure 4 about here

Mood. We composed a pleasant mood score by averaging the eight pleasant mood items ($\alpha = .89$), and an unpleasant mood score by averaging the eight unpleasant mood items ($\alpha = .75$). We regressed the pleasant mood score on initial self-regulation, the self-monitoring score, and the interaction between these factors. The results indicated the presence of a significant main effect of initial self-regulation ($\beta = -1.54$, $t(46) = -2.84$, $p < .01$), a significant main effect of self-monitoring ($\beta = -.39$, $t(46) = -2.47$, $p < .02$), and a significant interaction effect ($\beta = -1.30$, $t(46) = -2.38$, $p < .03$). Simple slope tests indicated that for low self-monitors initial depletion had a significant effect on their pleasant mood: they reported a less pleasant mood when the initial task was depleting than when it was non-depleting, $t(46) = -3.66$, $p < .001$. These results suggest that the presence or absence of a depletion effect may be mediated by the pleasant mood of low self-monitors. In contrast, initial depletion did not significantly affect the persistence of high self-monitors, $t < 1$. For unpleasant mood, neither initial self-regulation ($t(46) = 1.60$, $p < .13$) nor self-monitoring ($t < 1$), nor the interaction of the two factors, was significantly related to persistence ($t(46) = -1.37$, $p = .18$).

To examine whether positive mood mediated the treatment effects on persistence, we regressed persistence on the pleasant mood score, self-monitoring, and the interaction between these factors. None of these factors was significantly related to persistence, *ns*. We also regressed persistence on the unpleasant mood score, self-monitoring, and the interaction between these factors because some of the effects on unpleasant mood, although not significant, were substantial. The results indicated that the effects of these factors on persistence were not significant, *ns*. These outcomes suggest that participants' mood is unlikely to account for the depletion effect.

Study 3 documents the presence of a regulatory depletion effect among low self-monitors. They persisted less when the initial task was more depleting. Presumably, this outcome occurred because low self-monitors relied on their own affective states, which prompted them to reduce their persistence following a depleting initial task. In contrast, high self-monitors were likely to be sensitive to the standard implied by the situation, which did not vary regardless of the resource demands imposed by the initial task. Thus, their persistence was not affected by the initial task.

If the regulatory depletion effect occurred among low self-monitors because they focused on the resource allocation demanded by the persistence task rather than compare their allocation against some performance standard, the effect might be eliminated by a prompt to monitor their performance against a standard. As the results of Study 2 suggest, accurate feedback about the time allocated to the persistence task is one device that stimulates monitoring and thus eliminates the regulatory depletion effect. High self-monitors, who spontaneously monitor their performance by making comparisons to their standards, were not expected to be influenced by such feedback. We tested these predictions in Study 4 by varying whether or not participants were given accurate feedback about the time spent performing the persistence task.

Study 4: Influencing Low Self-Monitors' Persistence

Method:

Participants. Eighty-three undergraduate students (48 women) from a Midwestern university were recruited to participate in this study. Participants were each paid $10 for their participation.

Procedure. Each participant completed the study individually on a computer. The procedures were similar to those used in previous experiments. All participants were given either the easy or difficult cross-off-the-letter task and the sixteen mood items from the BMI Scale. Next, they attempted to complete the same (unsolvable) puzzle task that was used in previous studies. For those in the clock present condition, accurate information about the accumulated time participants had spent in trying to solve the puzzle was presented to the right of the puzzle and was updated on a continuous basis. This information was not provided to participants in the no clock condition.

After participants had ceased their efforts to solve the puzzle, they were administered some additional questions that took about ten minutes to complete. These included a question about how effortful they found the initial self-regulatory task and some filler tasks. Finally, they completed the Self-Monitoring Scale (Snyder, 1974).

Results and Discussion

Manipulation check. A regression analysis was conducted to examine the effects of initial self-regulation, self-monitoring, and the interaction of these two factors on participants' perceptions of the effort required by the cross-off-the-letter task. The results indicated the presence of a significant main effect of initial self-regulation: participants in the depletion condition reported that the cross-off-the-letter task was more effortful than did those in the non-depletion condition, $\beta = .84$, $t(79) = 2.22$, $p < .04$. Neither the main effect of self-monitoring, β

= .07, $t < 1$ nor the interaction effect between initial self-regulation and self-monitoring was significant, $\beta = -.50$, $t(79) = -1.32$, *ns*. These outcomes suggest that the manipulation of initial depletion by the cross-off-the-letter task was successful.

Persistence. We regressed the independent variables on the amount of time participants spent attempting to solve the puzzle. These factors included initial self-regulation, self-monitoring, feedback about the time spent performing the persistence task (a dummy variable: 0 = no clock; 1 = clock present), the interaction between initial self-regulation and self-monitoring, the interaction between initial self-regulation and feedback, the interaction between the self-monitoring and feedback, and the three-way interaction. This analysis indicated the presence of a significant main effect of initial self-regulation, $\beta = -1.62$, $t(75) = -2.99$, $p < .005$, a significant interaction between the initial self-regulation and self-monitoring, $\beta = 1.16$, $t(75) = 2.19$, $p < .04$, and a significant interaction between the initial self-regulation and feedback, $\beta = 1.68$, $t(75) = 2.55$, $p < .02$. The three-way interaction was marginally significant, $\beta = -1.25$, $t(75) = -1.94$, $p < .07$. Other effects were not significant, *ts* < 1.

Figure 5 about here

To examine the nature of the possible three-way interaction, we conducted simple slope tests using the same one-standard deviation designation as that employed in Study 3 (see Figure 5). The results indicated that initial depletion had a significant effect on the persistence of low self-monitors in the absence of a clock during the persistence task: participants exhibited less persistence on the puzzle task when the initial task was depleting than when it was non-depleting ($t(75) = -3.83$, $p < .005$), replicating the finding reported in Study 3. However, initial depletion did not affect the persistence of low self-monitors when an accurate clock was provided ($t < 1$), suggesting that the clock helped low self-monitors overcome the depletion effect. The results also indicated that initial depletion did not affect the persistence of high self-monitors regardless of whether an accurate clock was present during the persistence task (*ts* < 1). These *post hoc* analyses suggest that the interaction between initial self-regulation and feedback is due primarily to the depletion of low self-monitors when the clock was absent. High self-monitors appeared to compare their performance against a standard spontaneously, and did not exhibit the depletion effect in either feedback condition.

Mood. We composed a pleasant mood score by averaging the eight pleasant mood items ($\alpha = .91$) and an unpleasant mood score by averaging the eight unpleasant mood items ($\alpha = .75$). A regression analysis indicated that initial self-regulation had a marginally significant effect on pleasant mood ($\beta = -.71$, $t(79) = -1.78$, $p < .09$). A similar regression analysis for unpleasant mood indicated that the initial self-regulation was significantly related to unpleasant mood ($\beta = .76$, $t(79) = 1.98$, $p = .051$), and that self-monitoring had a marginally significant effect on unpleasant mood ($\beta = .23$, $t(79) = 1.74$, $p < .10$). To examine whether the effects observed in this study could be due to differences in participants' mood across conditions, we regressed persistence on the pleasant mood score, self-monitoring, and the interaction between pleasant mood and self-monitoring. None of these factors was significantly related to persistence, *ns*. Similarly, we used the unpleasant mood score, self-monitoring, and the interaction between unpleasant mood and self-monitoring to predict persistence in a regression analysis. None of these factors predicted persistence, *ns*. These outcomes suggest that mood is unlikely to account for the effects found in this study.

Study 4 replicated the regulatory depletion effect observed previously for low self-monitors, and documented that the presence of a clock eliminated this effect. Apparently, the clock provided a cue that prompted low self-monitors to compare their performance against their standard rather than relying on their feelings about their allocation to the depleting task. In contrast, the persistence of high self-monitors was not affected either by the initial self-regulation or by the presence or absence of a clock. These outcomes are consistent with the view that high self-monitors engage spontaneously in a comparison of their performance against a standard they deem appropriate for the situation.

General Discussion

The present research adds to the substantial evidence documenting the robustness of the regulatory depletion effect. In four studies, we observed that participants who were depleted on an initial task persisted less diligently on a subsequent unrelated task than did those who were not depleted. Our findings also demonstrate that the regulatory depletion effect can be eliminated, and that this outcome occurs even when participants are not provided with time to replenish their resources. Providing information that accurately represented the time participants spent on the persistence task (Studies 1, 2 and 4) eliminated the depletion effect. In addition, the depletion effect was observed among those who were low but not high on self-monitoring (Studies 3 and 4).

These findings can be explained in terms of a monitoring process. According to this view, a regulatory depletion effect can occur when depletion on an initial task prompts a focus on the resources allocated to the subsequent persistence task. This focus induces an elongation in the perception of the resource allocation to the persistence task, a failure to compare performance to the standard for such tasks, and a reliance on current feelings of fatigue in performing the persistence task to decide when to quit. The result is a cessation of the persistence task earlier than those who were not depleted by the initial task.

This explanation suggests that a regulatory depletion effect can be eliminated by prompting individuals to monitor their resource allocation to the persistence task in relation to their standard for such tasks. Consistent with this view, we found that providing an accurate clock eliminated the regulatory depletion effect (Studies 1, 2 and 4). Further, we documented that this effect was mediated by elongation in the perception of the resources allocated to the persistence task (Study 2). The regulatory depletion effect prompted an overestimation in the time spent on the persistence task, whereas providing an accurate estimate of the time spent was associated with the absence of this outcome.

The premise that limitations in monitoring account for the regulatory depletion effect is also evidenced by the fact that low but not high self-monitors exhibited a regulatory depletion effect. High self-monitors are thought to be sensitive to performance standards, and thus spontaneously engage in a comparison of their resource allocation to a standard they perceive to be appropriate. Such monitoring results in the absence of a regulatory depletion effect. In contrast, low self-monitors are likely to focus on the effects of the persistence task rather than the monitoring of their performance in relation to a standard. Thus, they exhibit a regulatory depletion effect (Studies 3 and 4). However, when prompted to monitor by the presence of an accurate clock, they engage in comparison to the degree necessary to eliminate the depletion effect (Study 4).

Although the monitoring model accounts for the data reported here and in the literature, it would seem that norms of reciprocity also offer an explanation for these outcomes. According to this view, participants persist until they feel they have done enough to please the experimenter or to earn credit. Reciprocity implies less persistence on the second task when the initial task is depleting. Performing an arduous initial task requires only modest effort on the second task in order to meet the experimenters' expectations. It also suggests that interventions designed either to enhance participants' knowledge about the effort appropriate to reciprocate (e.g., accurate clock), or to increase their motivation to reciprocate with a high level of performance (e.g., high self-monitors) would eliminate the regulatory depletion effect.

We view the notion of reciprocity as a version of the monitoring model. Both accounts involve a comparison of one's performance against a standard as a means of self-control. If the two views differ, it is in how they represent the standard against which performance is judged in explaining the regulatory depletion effect. The norms of reciprocity notion views the activity required to meet the obligations to the experimenter as the standard against which performance is judged, whereas the monitoring model suggests that this is but one of the standards that may be invoked. This distinction warrants further investigation.

Conclusion

The view emerging from our analysis is that the regulatory depletion effect often occurs not because individuals do not have the resources necessary to persist at a task, but because they fail to monitor their resource allocation by comparing it to some standard of performance they have for such activities. When an initial task imposes heavy demands on self-regulation, individuals focus on their resource allocation. This focus results in an overestimation of the resources perceived to be allocated to a subsequent self-regulatory task and a neglect of the goals and attendant standards that would otherwise guide persistence. This scenario implies that regulatory depletion can be managed by interventions that enhance self-monitoring. Along these lines, we document the elimination of the regulatory depletion effect by using an accurate clock to prompt a comparison between individuals' resource allocation to a depleting task and their standard for performance of the activity. We also have shown that those with a proclivity to self-monitor are less inclined to exhibit a regulatory depletion effect. Whether other interventions that stimulate a comparison between individuals' actual resource allocations and a standard for performance moderate the regulatory depletion effect awaits investigation.

Endnotes

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2. A mediation analysis is not reported for the accurate and fast clock conditions because the initial self-regulatory task did not affect time estimates in those two conditions. Estimates were based on the time posted on the clock.

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Figure 1: Persistence as a Function of Initial Self-Regulation and Feedback (Study 1)

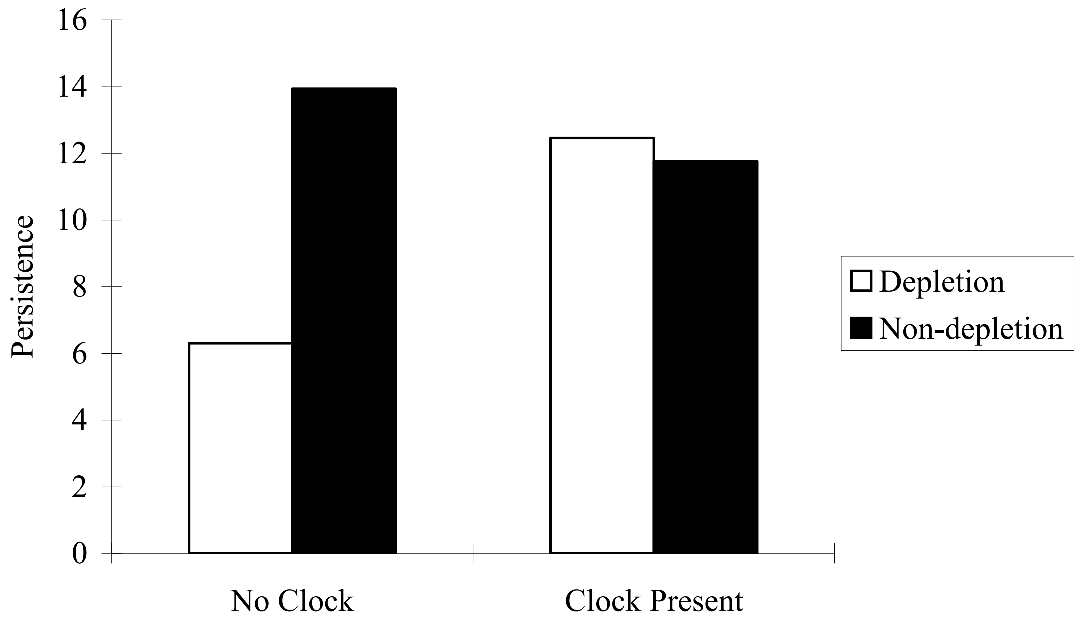


Figure 2: Persistence as a Function of Initial Self-Regulation and Feedback (Study 2)

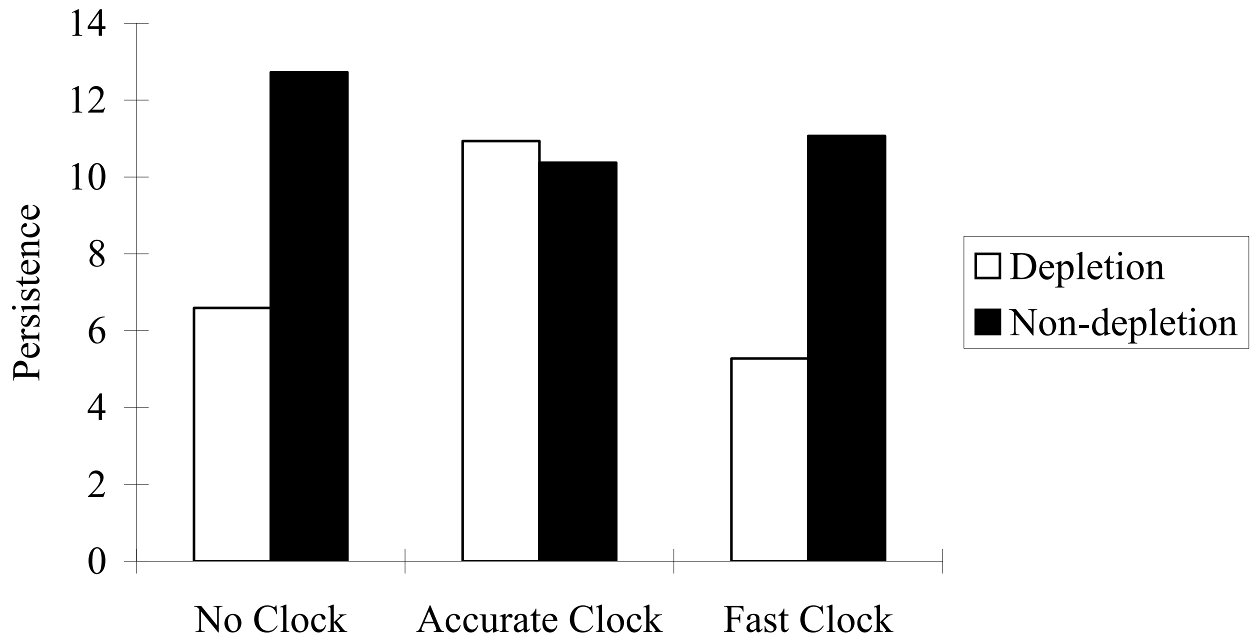
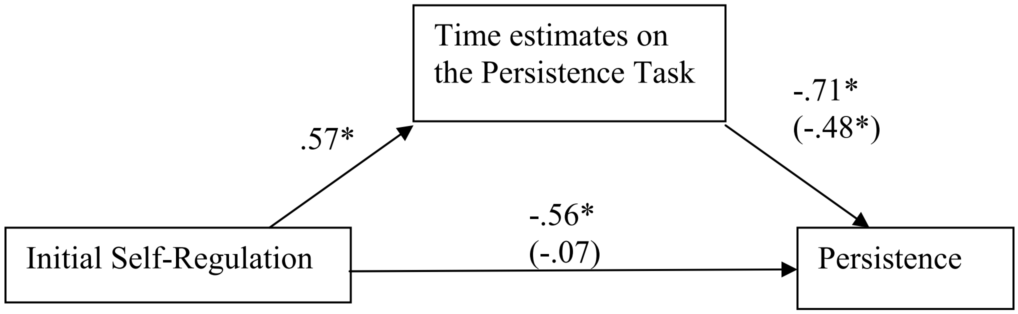


Figure 3: Mediation Model in the No Clock Condition (Study 2)



**p*< .01.

Figure 4: Persistence as a Function of Initial Self-Regulation and Self-Monitoring (at +1 *SD* and -1 *SD* of the means of the self-monitoring score) (Study 3)

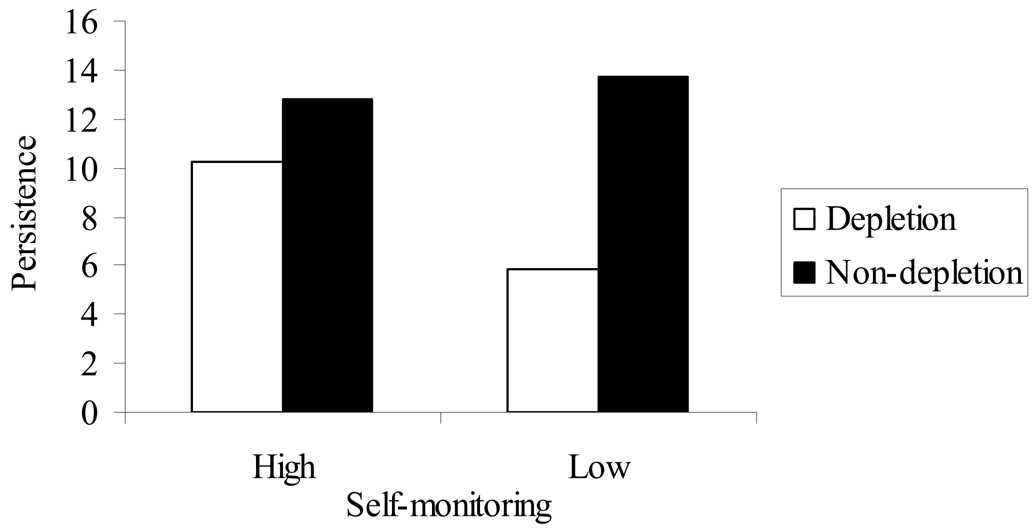
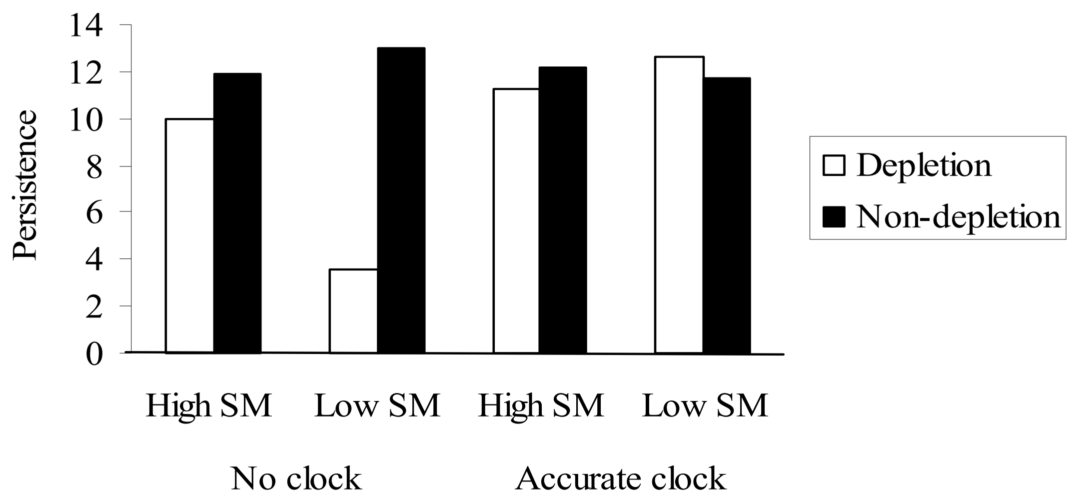


Figure 5: Persistence as a Function of Initial Self-Regulation, Self-Monitoring (at +1 *SD* and -1 *SD* of the means of the self-monitoring score) and Feedback (Study 4)



Note: In the above figure, SM refers to "self-monitoring."