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THE EFFECTS OF MOTIVATION AND COMPUTER USAGE POLICIES AND PROCEDURES ON TASK PERFORMANCE

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Abstract

Self-regulation is the situation where an individual attempts to control or alter his/her behavior. Research in social psychology has demonstrated that the act of self-regulation during one task can lead to impaired performance on a subsequent, unrelated task, because individuals have limited cognitive resources. In situation where companies are trying to limit the effect of interruptions due to persistent conversation by establishing workplace policies and regulations, the employees' performance might be thus adversely affected. This state of fatigue which results from the depletion of cognitive resources is termed ego depletion. The current study analyzes the effects of self-regulating behavior and motivation on task performance in a simulated organizational setting. Consistent with the findings in social psychological research, the results of this experiment support an adverse effect of self-regulating behavior on task performance. Although the directions of the means suggest a moderating role of motivation, no statistical support was found. However, ego-depleted participants in the high-motivation condition did not display weaker performance than participants in the non-depleted conditions. The implications of these results on organizational computer use policy and future research are discussed.

Keywords: Self-Regulation, Motivation, Task Performance, Workplace policies and regulations

1 INTRODUCTION

Have you ever tried to concentrate on writing or reading on your computer while trying to ignore incoming e-mails or instant messages? In today's work environments, task interruptions are a common phenomenon (Speier, Vessey, & Valacich 2003). Further, networked workspaces offer ample opportunities for engaging in non-task-related activities, such as receiving breaking news, while working on a particular task. To limit this behavior, companies try to set up policies and procedures, which fall into two categories: first, procedures which allow blocking access to websites or instant messaging in a technical way and second, policies and rules prohibiting or limiting this behavior. In the latter case, the decision to engage in non-task-related behavior is left to the employees, who have to self-regulate their behavior in order to comply with these policies.

Self-regulation (or self-control) is the "attempt to control or alter one's responses" (Muraven, Tice, & Baumeister 1998, p.774). A knowledge worker will, for instance, self-regulate by deciding not to engage in instant messaging, or he/she may decide to disregard the rules and policies. In either case, there are consequences associated. Failure of self-regulation can lead to a wide range of negative consequences, such as decreases in task performance (Vohs and Baumeister 2004). On the other hand, the act of self-regulating on one task can lead to impaired performance on a subsequent, unrelated task (e.g., Muraven et al. 1998). Therefore, employees engaged in self-regulation of their non-task-related activities might display impaired performance on the primary tasks. However, it has recently been suggested that given the right motivation, the act of self-regulation might not affect performance adversely (Muraven & Slessareva 2003). The self-regulation perspective can be used to understand how distractions affect the performance of knowledge workers.

Studies in the area of self-regulation have primarily used self-regulation tasks, which are not typical to office settings, such as suppressing one's emotions while watching a movie or choosing radishes instead of chocolate chip cookies (Baumeister, Bratslaysky, Muraven, & Tice 1998). Moreover, the motivation to perform well on the tasks was held constant in all of the studies, with the exception of Muraven (1998) and Muraven and Slessareva (2003), who manipulated motivation and found a differential effect for participants in the different motivation conditions. However, these studies also used tasks that might ordinarily not be encountered in usual workplace settings.

This paper will address these limitations by examining the influence of self-regulation of non-task-relevant behaviors and motivation on task performance in a simulated workplace setting. The next section will provide a brief overview of the current state of research in the field of self-regulation, followed by the development of the hypotheses; next, the experiment's methodology is outlined. The penultimate section will summarize the proposed data analysis strategies, and the paper will conclude with a discussion of the expected results and potential interpretations of these, and a presentation of directions for future research.

2 THEORETICAL FRAMEWORK AND HYPOTHESES

2.1 Strength Model of Self-Regulation

A primary basis for the strength model of self-regulation is a feedback loop that can be seen as a test-operation-test-exit (TOTE) model (Carver 2004) (see Figure 1). In the initial *test* phase, a person determines whether or not there is a discrepancy between his/her current state and a desired state. The current state can be a situation where an employee is engaged in a non-task-related chat, while the desired state is exiting the chat room and performing a work-related task instead. If a discrepancy exists, the person exerts self-regulatory actions to move closer to the desired state, which is the *operate* phase. There are further *test* phases to monitor progress toward the desired state. If a subsequent test reveals that the desired state has been reached, the person *exits* the loop. While all phases of the feedback loop can cause self-regulation failure, the model focuses on the operation phase, in which actions are performed to reach the desired state (Schmeichel & Baumeister 2004).

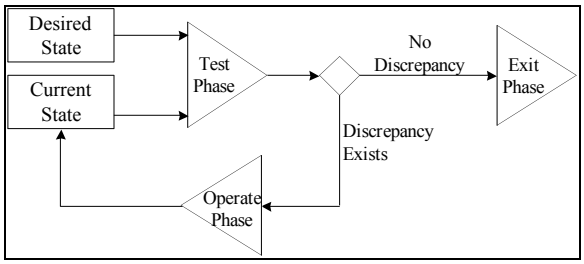

Figure 1 TOTE Model (Carver 2004)

The act of self-regulation implies effort and exertion as such actions depend on the availability of specific limited self-control resources (Schmeichel et al. 2004). When self-regulating, a person makes extensive use of these resources, which get used up and stay in a depleted state for a period of time (Schmeichel, Vohs, & Baumeister 2003). This state of fatigue is termed ego depletion (Baumeister et al. 1998). It has been demonstrated, in a wide variety of settings, that ego depletion leads to diminished performance on subsequent tasks related to self-regulation (e.g., Baumeister et al. 1998, Vohs & Schmeichel 2003). In addition, it has been shown that ego depletion can influence perceptions of time and performance on complex tasks (Vohs et al. 2003) and may result in diminished performance on complex cognitive tasks as well (Schmeichel et al. 2003).

To explain why ego depletion leads to poor performance on subsequent tasks, the role of the central executive of Baddeley's (1996, 2000) multicomponent model of working memory must be understood. Working memory has been defined as "a system for the temporary holding and manipulation of information during the performance of a range of cognitive tasks such as comprehension, learning, and reasoning" (Baddeley 1986, p.34). An important component of the working memory is the central executive, which controls awareness of the information being held and manipulated in the working memory (Baddeley 1996, 2000). Complex cognitive processes, such as self-regulation or decision making, require extensive use of the central executive (Schmeichel et al. 2004). Therefore, self-regulation is likely to use up this limited resource and cause significant impairments on subsequent performance on another complex cognitive task (Schmeichel et al. 2003).

The self-regulatory strength model is different from other attention models. Attention models typically explain the situation where different tasks are performed concurrently (Schmeichel et al. 2004). In such situations, an overload results, leading to impaired performance on the concurrent task. If the number of tasks being attended to is reduced, there will be an improvement in task performance (Schmeichel et al. 2004). In contrast, according to the self-regulatory strength model, self-regulation operates very much like a muscle (Vohs et al. 2004). The individual's level of self-regulatory strength decreases during the process of exerting self-control and remains scarce for a period of time, after which it builds up again (Muraven et al. 1998). In studies that focus on ego depletion, subjects perform different tasks one after the other. These studies show that the performance on later tasks is impaired because the resources have been depleted while doing the earlier tasks (Vohs et al. 2004).

2.2. The Role of Motivation

Based on research on self-regulation, the general assumption is that decreased self-regulatory strength will lead to decreased performance on a subsequent task. However, there are cases where people exceed their own expectations and outperform their abilities, depending on incentives for exerting self-control (Whitman, Hendrickson, &Townsend 1999). People who are highly motivated may be able to overcome the effects of ego depletion (Muraven et al. 2003). In most studies on self-regulation, motivation has been held constant. Lately, there has been some interest in studying the role of motivation in self-regulation. For instance, Muraven and Slessareva (2003) carried out a series of experiments which demonstrate that both extrinsic and intrinsic motivation moderated the effect of ego depletion on performance on a subsequent task. Self-regulation is therefore a product of the individual's motivation to exert self-control and his or her regulatory resources (Muraven et al. 2003). It has been suggested that monetary compensation, which is a common incentive in the workplace (Ambrose and Cropazano 2003), can be a driving force in efforts to self-regulate.

2.3. Proposed Model

Our research model (see Figure 2) replicates and extends previous work by Schmeichel and colleagues (2003) and Muraven and Slessareva (2003) within the context of knowledge workers in a computer based setting. Based on previous research, the availability of the self-regulatory resources will determine performance on a subsequent task (e.g., Baumeister et al. 1998, Schmeichel et al. 2003). Further, motivation plays a moderating role on the relationship between resource availability and performance (Muraven 1998, Muraven et al. 2003).

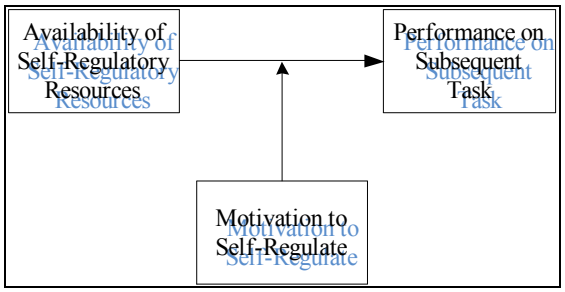

Figure 2 Proposed Model

It is hypothesized that under conditions of low motivation, when self-regulatory resources are unavailable (i.e., ego depletion state) following a self-regulatory task, lower performance would result on a subsequent task.

> *Hypothesis 1: Under conditions of low motivation, participants in a state of ego depletion will display weaker performance on a problem-solving task than participants who are not in a state of ego depletion.*

However, given the right motivation, the limitations imposed by the state of ego depletion might be overcome. Therefore, it is hypothesized that motivation will moderate the effect of ego depletion on task performance.

> *Hypothesis 2: In a state of ego depletion, individuals who are highly motivated will perform better than individuals who have low motivation.*

As motivation can help to overcome the limitations imposed by ego depletion, highly motivated people in a state of ego depletion will perform equally well as highly motivated people not being in a state of ego depletion. Muraven and Slessareva (2003) noted that "depleted individuals who were high in motivation performed as well as nondepleted individuals who were high in motivation" (p. 904). Therefore, we propose the following:

> *Hypothesis 3: The performance of highly-motivated individuals who are in a state ego depletion will not differ from that of highly-motivated individuals who are not in a state of ego depletion.*

3. METHODS

3.1. Research Design

The aim of this study was to examine the influence of self-regulation of non-task-relevant behaviors and motivation on task performance in a simulated workplace setting. A laboratory experiment with 3 x 2 (self-regulation x motivation) full factorial design was conducted in a controlled laboratory environment.

Three self-regulation conditions were used. In the first condition, subjects were in a state of ego depletion, which is similar to a knowledge worker self-regulating his/her behavior at work. In the second condition, subjects did not have to self-regulate their behavior, which resembles a situation where the knowledge worker can engage in any behavior as desired. The third condition was the depletion control, which resembles the effects of technical procedures blocking access to non-task-related activities. The two motivation conditions were high and low motivation. The participants were randomly assigned to one of six treatments (see Table 1).

	Ego Depletion	No Depletion	Depletion Control
Low motivation	1	2	3
High motivation	4	5	6

Table 1 Experimental Conditions

3.2. Participants

56 participants were recruited from an introductory information systems class[1]. Subjects received course credit for this scheduled research. Due to technical difficulties during the experiment, 2 subjects were dropped from the study, leaving a total sample size of 54. The average age of this sample was 21.1 years, with a ratio of males to females of about 3:2. No differences for age and gender accrued across treatments.

3.3. Materials and procedure

Each participant was randomly assigned to one of the six conditions (see Table 1). The experiment was conducted in a computer lab, with each participant having access to one computer, which was used for the administration of all tasks and measures. Figure 3 displays the sequence of the experimental tasks.

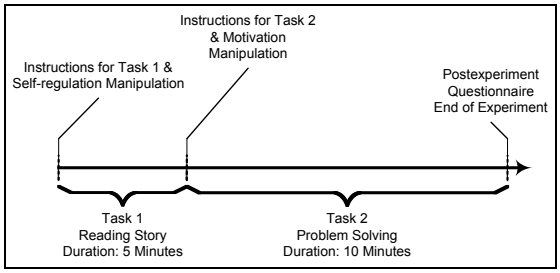

Figure 3 Sequence of Tasks

The study consisted of reading an article (Task 1) followed by a problem-solving task (Task 2). All participants were first given 5 minutes to read a text concerning the Sarbanes-Oxley Act's implications for nonprofit organizations (BoardSource and Independent Sector 2003) (Task 1). In the ego depletion (1 & 4) and no depletion conditions (2 & 5), a chat window showing a simulated brainstorm about potential solutions to the university's parking problem was displayed on the left side of the screen (see Figure 4). Participants in the depletion control conditions (3 & 6) were not shown this chat window. All participants were instructed to focus on the text as follow-up questions would be asked about the text (no follow-up questions were actually posed). In order to elicit self-regulating behavior of the participants in the two ego-depletion conditions (1 & 4), these participants were explicitly told to direct their attention to the text and not to the chat session.

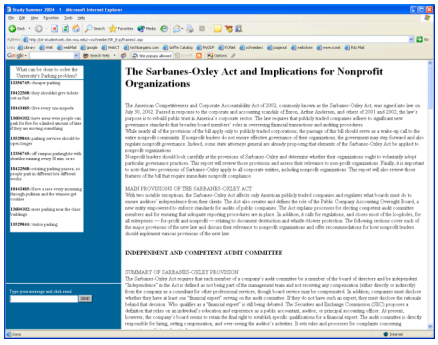

Figure 4 Screenshot of Task 1

[1] Schmeichel et al. (2003) found large effect sizes. Based on a power analysis, 90 subjects are needed to achieve a power of .80 to detect large effects. Additional data will be collected during Summer 2006 and the results will be presented at the conference.

Following the completion to Task 1, participants were automatically directed to the instructions for Task 2 as well as the motivation manipulation. In the high motivation conditions (4, 5, 6), the instructions contained a statement indicating that prizes of $15, $10, and $5 would be awarded to the best, second, and third performer, respectively. In the low motivation conditions (1, 2, 3), this statement was not included. All participants were instructed to solve as many problems (taken from the analytical section of the Graduate Management Admissions Test [GMAT]) as possible. In order to avoid potential ceiling effects, the number of problems has been chosen in a way that the time required for solving these by far exceeded the allotted time. All participants were given 10 minutes to work on the problems, after which they were redirected to the final web page to complete a brief post-experiment survey containing questions about demographics.

3.4. Dependent Variables

To measure performance on the problem-solving task, the total number of correct items and the overall score (ratio of correct items per items attempted) were recorded to determine whether different strategies were used for these (i.e., increasing overall performance or accuracy (Schmeichel et al. 2003)). Furthermore, a combined performance index (PI) was derived by multiplying the number of correct items by the overall score. Thereby, the differences in the number of items attempted can be accounted for when analyzing performance.

4. DATA ANALYSIS

Planned contrasts were used for hypothesis testing. Based on the directionality of the hypotheses, one-tailed significance tests were used for H1 and H2. According to H1, it was expected that participants in condition 1 would perform worse than those in conditions 2 and 3. The results partly support this hypothesis (see Table 2). For the number of problems solved correctly, the difference between group 1 and the mean of groups 2 and 3 approached significance. On the overall score, group 1 mean differed significantly from the mean of groups 2 and 3. On the combined PI, the difference between group 1 mean and the mean of groups 2 and 3 approached significance. Please refer to Figure 5 and Table 3 for the means for dependent variables.

		Problems Solved		Overall Score		Combined PI	
	Difference Between	t(48)	p	t(48)	p	t(48)	p
H1	Conditions 1 and 2 & 3 (1-tailed)	1.39	.09	1.77	.04	1.42	.08
H2	Conditions 1 and 4 (1-tailed)	0.41	.34	1.10	.14	0.42	.33
H3	Conditions and 2 & 3 (2-tailed)	0.89	.38	0.34	.73	0.74	.46

Table 2 Planned Contrasts

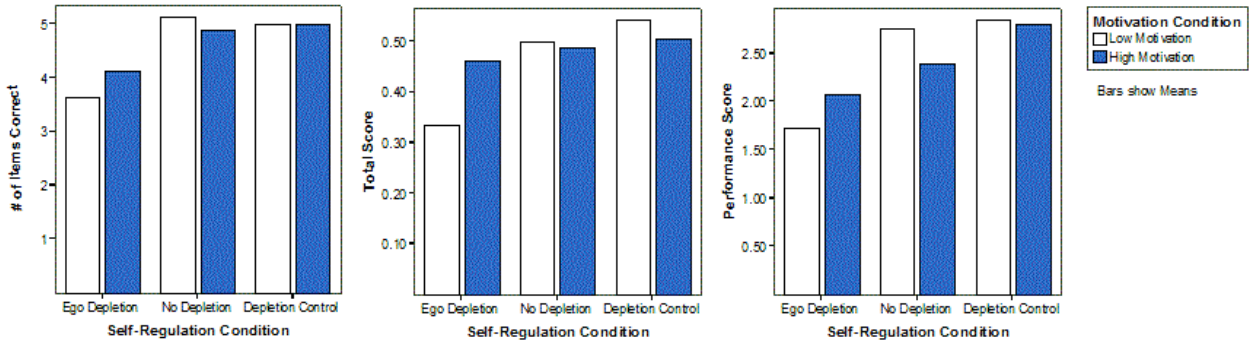

Figure 6 Charts Showing Means of Dependent Variables

H2 suggested that participants in condition 4 would outperform than those in condition 1. Although H2 is not supported (see Table 2), the means nevertheless point in the predicted direction (see Table 3). Contrary to our initial prediction, effect sizes turned out to be very small. Additional subjects is needed to detect smaller effects.

	Problems Solved			Overall Score			Combined PI		
	ED	ND	DC	ED	ND	DC	ED	ND	DC
Low Motivation	3.63	5.13	5.00	0.33	0.50	0.54	1.72	2.76	2.84
High Motivation	4.10	4.89	5.00	0.46	0.49	0.50	2.08	2.40	2.79

ED: Ego Depletion, ND: No Depletion, DC: Depletion Control

Table 2 Table of means

H3 proposed that the performance of participants in condition 4 would not significantly differ from the performance of those in conditions 5 and 6. Our results show that there was no significant difference between group 4 and the mean of groups 5 and 6 for all dependent variables. Thus, H3 was not rejected. We do acknowledge that there might in fact be a difference that cannot be detected due to our low power.

5. DISCUSSION

The present study examined the effects of self-regulation on one task on performance on a subsequent task. Specifically, Hypothesis 1 predicted that under conditions of low motivation, participants in the ego depletion condition would perform worse than participants in the no depletion conditions. This hypothesis was partially supported. For the total number of problems correctly answered, participants in the self-regulation conditions solved fewer problems than those in the other conditions. Furthermore, participants in the ego depletion condition displayed weaker overall task performance as measured by the product of number of items solved correctly and overall score. Although the results for both the total number of problems solved correctly and the performance index only approached significance, the direction of the means support our initial hypothesis. The present number of subjects, however, did not provide sufficient power to reliably detect the effect[2].

H2 predicted that motivation would moderate the effect of self-regulation on performance on a subsequent task. Specifically, within the ego depletion conditions, participants with increased motivation would perform better than those in the low motivation condition. Although this hypothesis was not supported, the means for the dependent variables point in the predicted directions. These nonsignificant findings could be attributed to the strength of our motivation manipulation. Possibly, the motivation was not strong enough to overcome the ego depletion resulting from the self-regulating behavior. As this might have led to a reduction in effect size, the low number of subjects per cell might have prevented us from finding statistically significant results.

Finally, H3 predicted that in high motivation conditions, the performance of subjects in the ego depletion condition would not differ from that of the non-depleted subjects. This hypothesis was supported for the three dependent variables. However, our results merely suggest that we did not find a large effect; there might be differences between the ego depletion and non-depletion conditions. A stronger motivation manipulation might help the subjects overcome the limits imposed by the state of ego depletion (Muraven et al. 2003).

6. CONCLUSION

The results of the present study support our initial hypothesis that self-regulation on one task impairs performance on a subsequent task. The directions of the means further suggest that motivation can compensate for the negative impact of ego depletion on task performance. From an organizational standpoint, this means that giving the responsibility of whether or not to engage in non-task-related behavior to the employee might lead to adverse consequences in the case where the knowledge worker has to expend resources to self-regulate this behavior. On the other hand, if the employees are not limited by rules or policies governing the use of news tickers etc., there will be no negative impact on performance due to ego depletion. However, factors such as attentional limitations might nevertheless negatively affect the knowledge worker's performance. Furthermore,

[2] As mentioned above, additional data collection will take place in Summer 2006 and will be presented at the conference.

factors such as mood (induced by breaking news or sports scores) can influence the performance in negative or positive ways. If workers are not given the choice of engaging in non-task-related behavior (e.g., by restricting access), the impact of ego depletion can be limited (however, the employees might nevertheless have to self-regulate other behaviors, such as wandering off to the water cooler). Therefore, companies should take great care when deciding whether to limit access to persistent conversation tools. If companies decide to limit the employees' access to these tools, technical means (such as blocking ports or uninstalling communication software), rather than policies or regulations should be used, as otherwise, employees have to self-regulate their behavior, which might contribute to impaired task performance.

As with any study, this study is not without limitations. The use of a controlled laboratory experiment allowed us to tease out effects that might not be reliably detected in a field study. However, this controlled setting also limits the generalizability of the present study, as the simulated chat session created a somewhat artificial setting. Previous studies in the area of group brainstorming have shown that the participant population is highly involved in this topic; therefore, we believe that this artificiality is not necessarily a limitation. Furthermore, the results show that self-regulating behavior, even in such artificial setting, can impair subjects' performance on a subsequent task. Nevertheless, a potential limitation of the present study is that the participants did not choose whether or not to engage in the non-task-relevant behavior, rather, they were asked to self-regulate a behavior they might not have engaged in to begin with. Finally, we might have failed to support our hypothesis that motivation moderates the impact of ego depletion on task performance due to a motivation manipulation of insufficient strength. Future studies could focus on teasing out the motivation threshold needed to overcome the condition of ego depletion.

Although the present study has some limitations, it provides valuable insight on the effects of self-regulation on individual performance in a workplace setting by extending previous work on self-regulation. Given that self-regulation has not been applied in an organizational context so far, many factors are still to be explored. As applied to an organizational setting, two implications may be suggested. First, the findings suggest that self-regulation in one area can affect performance on another (unrelated) task. This implies that rules and policies to limit non-task-related activities in a workplace might impair the performance of knowledge workers. Therefore, it is suggested that blocking access to ports, web sites, or instant messaging in a technical way is more favorable than just using rules and policies to limit non-task-related activities. Second, the findings on motivation were encouraging and suggest that ego depletion can be overcome. Providing workers with performance-related rewards, such as monetary incentives, can increase performance in conditions where rules and policies are the only means available to restrict non-task-related activities.

Future research could focus on individual differences in both self-regulation and motivation (intrinsic or extrinsic), rather than on self-regulatory behavior by itself. Tangney, Baumeister, and Boone (2004) have recently attempted to create an omnibus self-control scale, which might be used for future studies. Although high scores on the self-control scale correlated with higher GPA's or less alcohol abuse, anecdotal evidence suggests that people might be able to self-regulate differently when it comes to different activities. People might be high in self-regulation when it comes to drinking alcohol but low in self-regulation when it comes to web surfing. Even though Wallace and Baumeister (2002) have ruled out self-efficacy as an explanation for self-regulation failure, self-regulation can be compared to self-efficacy in terms of its domain-specificity (Bandura 1986). Therefore, the concept of self-regulation as it relates to individual differences rather than behavior should be studied further. Having established the constructs, future studies could examine the differential effects of policies and procedures regarding non-task-related behavior and motivation on the performance of individuals differing in different domains of self-control, such web-surfing self-control.

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