UNDERSTANDING METAREGULATORY SUCCESS:

ASSOCIATIONS WITH HABIT AND VIGILANT MONITORING

by

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ABSTRACT

Self-regulation refers to how individuals manage the conflicting decision-making process between temptations and long-term goal adherence. Those who regularly resist temptations tend to accomplish long-term goals, making successful self-regulation necessary for life-long success. Research suggests that some people implement metaregulatory strategies, or strategies that increase the likelihood of successful self-regulation. One of the most powerful metaregulatory strategies is healthy habit formation. High metaregulators, or people who regularly implement metaregulatory strategies, likely develop healthy habits and thus were expected to be better at inhibiting unwanted habits. The current research investigated individual differences in metaregulation during a habit inhibition task. Overall, metaregulation did not predict the ability to inhibit habits. However, gender was found to be a moderating variable and a better conceptualization of metaregulation was obtained.

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CHAPTER 1: INTRODUCTION

Many aspects of life require resisting temptations to facilitate adherence to long-term goals. However, it is not uncommon for humans to experience lapses in self-control and make short-sighted decisions by succumbing to temptations. For example, although obesity is associated with increased risk of a host of health problems including heart disease, high blood pressure, stroke, and certain cancers, over 30% of adults and 17% of children in the United States today are obese (Centers for Disease Control and Prevention, 2011). Factors including inactive lifestyles and unhealthy eating are short-term pleasures that compete with the goal of being healthy. Similarly, over 20% of Americans smoke cigarettes, which is responsible for "1 of every 5 deaths in the United States each year" (Centers for Disease Control and Prevention, 2011). Again, the immediate gratification derived from cigarette smoking is tempting and can compromise self-control, interfering with long-term goals even at the expense of being healthy and potentially living longer. It is clear that reaching long-term goals can be an arduous task; statistics like these lead one to wonder why certain individuals tend to exhibit successful self-control, whereas others do not experience such success.

One explanation for individual differences in self-regulation (or self-control) is that some people "metaregulate", or implement strategies to achieve self-regulatory success and avoid self-regulatory failure. By using metaregulatory strategies, individuals are better able to adhere to long-term goals and resist temptations. Recent findings suggest that the use of metaregulatory strategies protects college students from risk factors for increasing BMI (body mass index) and lower freshman GPA (Eckard, Corregan, Dillard, & Christensen, 2011).

The broad aim of the current study is to examine how metaregulators are able to protect themselves from self-regulatory failure. One possible explanation is that high metaregulators are better able to harness the power of habits. Since habits are automatic behaviors that occur without cognitive awareness, they are powerful strategies for resisting temptation. However, bad habits can amplify the power of temptation. Therefore, the first research question is whether high metaregulators are better at inhibiting unwanted habits. Second, is the relationship between metaregulation level and the ability to inhibit unwanted habits mediated by differences in "vigilant monitoring", a strategy known to predict the modification of habits (Quinn, Pascoe, Wood, & Neal, 2010)? The current research begins by discussing self-regulation, including its characteristics and how it impacts decision making. Next, the concept of metaregulation is examined and recent findings are discussed. The hypotheses and methodological execution of the study are then presented followed by the data analyses and discussion.

CHAPTER 2: SELF-REGULATION

Self-regulation refers to the process of modifying one's actual behavior to be consistent with one's desired behavior. When an individual's actual behavior or current state differs from the desired behavior or goal state, systems are activated to alter behavior and align the two states. Carver and Scheier's description of the discrepancy-reducing feedback loop is particularly useful in explaining this process (Carver & Scheier, 1982). First, current states and goal states are compared. If the two states are in accordance, homeostasis is intact and no action is needed, however if the two states are found to be incongruent, action is taken to reduce the discrepancy. The system will again compare current and goal states to determine whether the discrepancy was successfully diminished. If the two states become congruent action stops until another discrepancy is noted. This discrepancy-reducing feedback loop system is continuous and plays an integral role in maintaining homeostasis.

The example of body temperature regulation demonstrates the discrepancy-reducing feedback loop system. If an individual's body temperature rises too much, attempts will be made to lower the temperature such as removing clothing or finding a cool area. If this is not enough, reactions such as sweating occur in an attempt to lower temperature. Once these actions reduce the temperature to the appropriate homeostasis level, no more action is needed. In contrast, if an individual is too cold, one may add clothing or seek heat. If this is not enough, reactions such as shivering will occur in attempt to raise the temperature. Again, once the proper body temperature is achieved, action ceases. Homeostasis is maintained in this manner.

Whereas body temperature regulation is an automatic biological occurrence, the same process underlies behavioral decision-making. Take for example an individual who is currently in a bad mood but would like to be in a good mood. The discrepancy-reducing feedback loop notes the differences between current and goal states and takes action to diminish the discrepancy. Therefore, the individual will do something to improve his or her mood, (e.g., exercise). If exercising successfully eradicates the discrepancy then that is the only action that is needed. However, if after exercising the individual remains in a bad mood, then the discrepancy was not reduced enough and further action is needed. The individual must now do something else to elevate mood until the discrepancy is successfully reduced. Once current and goal states are realigned, the discrepancy-reducing feedback loop discontinues action but continues to monitor discrepancies and activates when another discrepancy is detected.

People often struggle to manage multiple goal states or multiple discrepancy-reducing behaviors that conflict with one another. Consider again the example of someone with the goal of elevating mood. There are several options to achieve this goal state, including both exercise and using drugs. Only exercise is also consistent with the long-term goal of being healthy, yet drug administration may be a strong temptation since drugs not only require less effort than exercising, but also provide immediate gratification. This internal conflict between a tempting behavior (i.e., drug use) and behaviors consistent with long-term goals (i.e., exercise) is referred to as the "want/should conflict" (Milkman, Rogers, & Bazerman, 2008). Cognitively speaking, succumbing to temptations or "want" options is influenced by an individual's "hot"

cognitive processing system whereas choosing a desired "should" option is associated with using one's "cool" cognitive processing system (Metcalfe & Mischel, 1999).

Certain individuals frequently experience successful self-control and consistently choose "should" options. These individuals have a high capacity to self-regulate and are referred to as high "self-regulators." Those with a high self-regulatory capacity experience better decision-making and lifelong success compared to individuals with a low capacity to self-regulate. High self-regulators tend to have better high school and college grades, more satisfying relationships, better emotional stability, less aggression, and fewer pathologies (Tangney, Baumeister, & Boone, 2004). Clearly, successful self-regulation is associated with a host of positive long-term outcomes (despite losing whatever satisfaction he or she may have obtained from a "want" option).

Given that individuals with a high self-regulatory capacity experience substantial benefits compared to their counterparts, one might wonder why everyone is not a high self-regulator. Indeed, successful self-regulation is effortful and challenging, making resisting temptations no easy task. The Strength Theory of self-regulation (Muraven & Baumeister, 2000) has been widely used in recent years and provides the basic principles of self-regulation. This model likens self-regulation to a muscle in two key ways. First, the capacity to self-regulate is limited (Muraven, Tice, & Baumeister, 1998); individuals have a finite amount of self-regulatory resources at any given moment. Because self-regulatory failure is inevitable without sufficient self-regulatory resources, these resources are considered valuable. Second, much like a muscle that becomes exhausted as it is used, effortful self-regulation depletes self-regulatory resources, leaving less self-regulatory capacity for subsequent tasks (Muraven & Baumeister, 2000). For example,

when doing 100 push-ups, the first 10 are easier than the last 10 and each subsequent push-up gets a little harder. Similarly, as individuals use and thus deplete self-control resources, temptations become increasingly harder to resist. How can people overcome the limited capacity of self-regulation in order to achieve long-term goals?

Metaregulation

Effortful self-regulation indeed depletes self-regulatory resources. However, some individuals implement metaregulatory strategies, or strategies designed to circumvent reliance on self-regulatory resources and increase the likelihood of self-regulatory success. There are likely a wide range of metaregulatory strategies that could be used, however recent research suggests that metaregulatory strategies typically address at least one of the two factors that are known to increase self-regulation: motivation or capacity (Eckard, 2011). For instance, self-regulatory success is possible even after self-regulatory resources are depleted if the individual is sufficiently motivated (Muraven & Slessareva, 2003); therefore, certain metaregulatory strategies may be effective by increasing motivation (e.g. goal setting). The capacity factor refers to the amount of available self-regulatory resources an individual has. Metaregulatory strategies that increase the capacity to self-regulate may be implemented (e.g. forming healthy habits). Therefore, successful self-regulation ought to be able to occur through metaregulatory strategies that positively affect self-regulatory capacity, motivation, or both.

A recent study developed a measure of individual differences in metaregulation (Eckard et al., 2011). These researchers constructed a questionnaire specifically addressing motivation and capacity factors. Findings indicated that college students with high metaregulatory capacity maintained constant BMI levels from ages 18-21 whereas

students with low meta-regulatory capacity experienced about a 3-point BMI increase during these years. Furthermore, of the participants reporting low high-school GPA's, those with high meta-regulatory capacity experienced significantly more of an increase in their college-freshman GPA compared to students with low metaregulatory capacity (Eckard, et al., 2011). Since the capacity but not the motivation factor protected people from risk factors for increasing BMI and lower freshman GPA, the current research focused on metaregulatory strategies involving capacity.

There are numerous metaregulatory strategies that can increase self-regulatory capacity. For example practicing effortful self-regulation will strengthen one's ability to self-regulate (Muraven, Baumeister, & Tice, 1999). When instructed to perform self-control exercises in everyday life (i.e. using good posture) over a two week period, participants' baseline self-regulatory capacity improved compared to participants who did not perform self-control exercises. Although self-regulatory tasks initially deplete self-regulatory resources, with time, the repeated practice of successful self-regulation improves one's basic ability to self-regulate (Muraven et al., 1999). Other metaregulatory strategies increase capacity by replenishing blood glucose levels. Effortful self-regulation decreases blood glucose levels as self-regulatory resources are depleted. However through food ingestion, individuals can restore blood glucose levels and increase the likelihood of self-regulatory success (Gailliot et al., 2007). Therefore, maintaining sufficient blood glucose levels through a healthy diet may serve as a metaregulatory strategy.

The aforementioned strategies are useful; however one of the most important metaregulatory strategies, healthy habit formation, is the focus of the current research.

Habits are learned, automatic responses that are cued by a particular context (Neal, Wood, & Quinn, 2006). Individuals unconsciously associate certain stimuli with specific behaviors and with repeated exposure they form habits. Habits are particularly powerful because habitual behaviors can occur without one's conscious awareness. When individuals develop unhealthy habits, or habits that are inconsistent with a long-term goal, effortful self-regulation is needed to reduce discrepancies between unhealthy habitual behavior and long-term goal-consistent behavior. By developing healthy habits, want/should conflicts are avoided because behaviors consistent with the long-term goal ("should" decisions) become automatic, thus circumventing the need for effortful self-regulation. In addition, since habitual responding is especially common when self-regulatory capacity is low (Wood & Neal, 2007), healthy habit formation is particularly useful for resisting temptations after self-regulatory resources have been depleted. Forming healthy habits is a powerful metaregulatory strategy since it allows individuals to automatically make decisions that lead to long-term goal attainment.

It is certainly advantageous for individuals to form healthy habits and inhibit unwanted habits as a metaregulatory strategy. Unfortunately, given their automatic nature, habits are relatively hard to change. Automatic behaviors are beneficial when an individual has established healthy habits, but automaticity also makes inhibiting and changing unhealthy habits especially difficult. When attempting to inhibit unwanted habits, a particular technique, "vigilant monitoring" (consciously thinking "don't do it" and "watching carefully for mistakes or slipups"), has been shown to successfully inhibit strong habits compared to the "focus on success" technique (thinking "do your best" and "focusing on correct responses") and not using any technique (Quinn, et al., 2010).

Vigilant monitoring is thought to be most effective because it brings highly automatic, habitual responses to one's conscious awareness. Perhaps individual differences in metaregulatory capacity (Eckard et al., 2011) are not only due to high metaregulators forming healthy habits as a metaregulatory strategy, but also because they use the vigilant monitoring technique to inhibit unwanted habits.

CHAPTER 3: PRESENT RESEARCH

Why might some people (high meta-regulators) be better able to achieve self-regulatory success? The proposed research explored individual differences in metaregulation, or the use of strategies that reduce the likelihood of self-regulatory failure. Those with high metaregulatory capacity likely harness the power of healthy habits and therefore may be especially adept at inhibiting unwanted habits. Research indicates that "vigilant monitoring," or consciously thinking "don't do it" is an effective technique that helps people inhibit strong habits (Quinn et al., 2010). Therefore, this vigilant monitoring technique was expected to mediate the relationship between metaregulatory capacity and performance on a habit inhibition task. Radford University undergraduate students participated in the current research. Participants completed demographic, trait self-control, and metaregulation questionnaires, completed a habit inhibition task, and answered a brief questionnaire on specific habit inhibition techniques.

It was hypothesized that:

H1: Individuals with high metaregulatory capacity would perform significantly better on the habit inhibition task compared to individuals with low metaregulatory capacity.

H2: Vigilant monitoring would mediate the relationship between metaregulatory capacity and habit inhibition.

a. Individuals with high metaregulatory capacity would use the vigilant monitoring technique significantly more often than individuals with low metaregulatory capacity.

Method

Participants

Sixty-four undergraduate students (23 males and 41 females) at Radford University participated in the current study. Two participants were excluded from analyses due to deviations from the script. Participants were recruited through SONA, an online study participant program, and received either partial course credit or extra credit for participation. The mean age for the current sample was 19.44. The majority of the sample was Caucasian (75.8%) and the next largest ethnic category was African-American (14.5%). Most participants indicated that they were not Hispanic (80.6%). Almost half of the sample were freshmen (48.4%), 24.2% were sophomores, 17.7% were juniors, and 9.7% were seniors.

Materials

Metaregulation questionnaire. The metaregulation questionnaire (Eckard, 2011) consists of 16 items that ask participants to report the frequency of metaregulatory behaviors on a scale ranging from 0 (*never*) to 3 (*often*). Items address both motivation (e.g., "I set long-term goals for myself") and capacity (e.g., "I try to limit the number of temptations that I encounter") factors of metaregulation. Cronbach's alpha was conducted to assess internal consistency for the current sample. The capacity factor demonstrated lower than expected internal consistency ($\alpha = .67$) as did the motivation factor ($\alpha = .65$).

Brief self-control scale. This scale contains 13 items that measure trait self-control (Tangney et al., 2004). Items include, "I wish I had more self-discipline" and "I am able to work effectively toward long-term goals." Responses range on a scale from 1

(*not at all*) to 5 (*very much*). Internal consistency was acceptable in the current sample (α = .79).

Habit inhibition task. This task measured participants' ability to inhibit unwanted habits and is similar to habit inhibition tasks used in past research (Quinn et al., 2010; Hay & Jacoby, 1996; Hay & Jacoby, 1999). The task was completed on a computer and consisted of three phases: 1) habit formation 2) exposure to inhibition items 3) habit inhibition. Performance during the third phase of the task was the dependent measure. Below is a description of the entire habit inhibition task.

During phase one, participants formed habits though word pair associations. Participants were informed that a series of cue words would appear on the left side of the screen along with a word fragment on the right side of the screen (i.e., belly ⟶ f_o_). Participants were told that there were two words that could complete each word fragment, that the two fragment completion words both had a related meaning to the cue word, and that one completion word may appear more than the other. Each cue word and word fragment pairing was presented for two seconds and participants were asked to silently guess and complete the word fragment while the pairings appeared. Next, one fragment completion word was presented in the middle of the screen for one second and participants were instructed to say this word aloud (i.e., flop). After a 500-ms inter-trial rest, the next cue word and word fragment automatically appeared.

Phase one began with seven practice trials to ensure participants understood task instructions. After the practice trials, the first of five habit-forming sessions began. During each session, 20 cue word and word fragment pairings were randomly presented four times followed by one completion word. Therefore, each session included a total of

80 trials. There were breaks between sessions which required the participant to press any key when ready to continue to the next session.

As mentioned, each word fragment could be completed with two words which were associatively related to the cue word. One fragment completion word was presented after the cue word and word fragment 75% of the time. This completion word created habitual responding and will be referred to as the "habitual word." The other fragment completion word was presented after the cue word and word fragment 25% of the time which produced non-habitual responding and will be referred to as the "non-habitual word." Care was taken to ensure that both completion words were in the middle range of association frequencies (i.e., belly→ flop; belly→ food; Jacoby, 1996). Determining which fragment completion word was used for habitual and non-habitual responding was arbitrary. This procedure is similar to habit formation in the real world (e.g., one's workplace cueing cigarette smoking) since the current habits were formed through repetitively presenting the cue word with the habitual word.

Phase two of the task began immediately after phase one. During phase two, a list of eight cue words were presented alongside the non-habitual completion word. Participants were instructed to quietly study these word pairs as they appeared on the screen and were informed that they would be tested on these word associations. The cue word was presented on the left side of the screen and the corresponding non-habitual word appeared on the right side of the screen. Each word pairing was presented for one second with a 500 ms inter-trial rest. Next, the number 98 appeared on the screen and participants were asked to count backwards by 3's aloud for 30 seconds to prohibit rehearsal of the word associations.

Finally, phase three began and participants were tested on the ability to inhibit unwanted habits. Each cue word and word fragment from phase one appeared. If the cue word was presented in the word list in phase two, participants were asked to respond aloud with the (non-habitual) completion word that appeared with it. If the cue word was not part of the word list in phase two, participants were to respond aloud with the habitual word from phase one. The cue word and word fragment remained on the screen until the participant responded aloud. Once a verbal response was given, the participant pressed any key to view the next word pair. Responses were recorded by the test administrator. Participants completed three habit inhibition sessions with 80 trials per session.

In total, phase three consisted of 240 total trials with 144 requiring habitual responding and 96 requiring habit inhibition. The ability to inhibit unwanted habits is of interest; however, there are 2 ways to calculate habit inhibition task performance. One way habit inhibition was calculated was to examine performances on the 96 habit inhibition trials only. Calculations performed in this manner will be referred to as the "absolute" performance. Another way to measure habit inhibition is to examine the total correct habit inhibition trials relative to the total number of correct responses (on both habitual and habit inhibition trials). Calculating task performance this way will be referred to as the "relative" performance. Past research (Quinn et al., 2010; Hay & Jacoby, 1996; 1999) only considered absolute performance in analyses. Therefore, analyses conducted comparing current results to past findings can only examine absolute performance.

Technique questionnaire. The technique questionnaire was used to determine whether participants used any specific technique when completing the habit inhibition

task. Past research (Quinn et al., 2010) indicates that "vigilant monitoring" and "focus on success" techniques aid in habit inhibition; therefore these techniques were investigated in the current research. This measure asked participants to indicate on a scale form 1 (*never*) to 5 (*almost always*) how often they used the vigilant monitoring technique (i.e., thinking "don't do it" or "watching carefully for mistakes or slipups") or the focus on success technique (i.e., thinking "do your best"), when attempting to inhibit unwanted habits.

Procedure

Students registered for study participation times through the SONA system and completed the study individually. Once at the testing site, students read and signed informed consent forms, completed a demographic questionnaire, the brief self-control scale, and the metaregulation questionnaire. Participants then completed the habit inhibition task. Finally, participants completed the technique questionnaire, were debriefed, and thanked for their participation.

CHAPTER 4: RESULTS

Initially, descriptive statistics and correlations were calculated for each variable. To test the first hypothesis, linear regression analyses were conducted with metaregulation predicting task performance. If Hypothesis 1 was supported, the data analysis included steps outlined by Baron and Kenny (1986) to test for mediation.

Descriptive Statistics

Table 1 lists the means and standard deviations for each variable in the current study and previous studies. The current study's mean scores for capacity and motivation were found to be higher than the sample in which the metaregulation questionnaire was validated (Eckard, 2011). To examine whether the current sample's scores were significantly higher than past research, a one-sample *t*-test was conducted for each factor. Results indicated that the current sample's scores were significantly higher than past research for capacity $t(63) = 28.29$, $p < .01$ and motivation $t(63) = 22.22$, $p < .01$. It was also found that the average self-control score obtained in the current study was higher than past findings (Tangney et al., 2004). To examine whether the current sample's self-control scores were significantly higher than past research, a one-sample *t*-test was conducted and found that the difference was significant $t(63) = 6.41$, $p < .01$.

Mean scores on the vigilant monitoring and focus on success techniques were above the midpoint range. Absolute task performance was notably lower compared to past research (Quinn et al., 2010). To determine if current task performance was significantly lower than past research, a one-sample *t*-test was conducted comparing the current sample's absolute performance to past findings. Results indicated that the current sample's performance was significantly lower $t(63) = -9.09$, $p < .01$. Standard deviations

for the current sample for capacity, motivation, and self-control were notably lower compared to past research (Eckard, 2011; Tangney et al., 2004).

Table 1 – *Descriptive Statistics for Metaregulatory Capacity, Metaregulatory Motivation, Self-Control, Vigilant Monitoring Technique, Focus on Success Technique, Absolute Performance, and Relative Performance*

	Current Study		*Previous Studies*	
Variable	*M*	*SD*	*M*	*SD*
Measure				
Metaregulatory Motivation	23.60	3.34	14.47	4.13
Metaregulatory Capacity	27.23	2.81	17.34	3.56
Self-Control	45.55	7.20	39.85	8.61
Strategy				
Vigilant Monitoring	3.61	.95	-	-
Focus on Success	3.82	1.06	-	-
Task Performance				
Absolute Performance	.46	.16	.64	-
Relative Performance	.37	.12	-	-

Table 2 lists correlations between each variable in the study. Consistent with past findings on metaregulation (Eckard, 2011), the capacity factor was found to be significantly correlated with the motivation factor. A significant correlation was also found between the capacity factor and self-control which also corroborates previous findings (Corregan, 2011). The significant correlation found between the vigilant monitoring and focus on success techniques suggests that participants tended to use both strategies rather than one or the other.

Table 2 – *Summary of Correlations for Metaregulatory Motivation, Metaregulatory Capacity, the Brief Self-Control Scale, the Vigilant Monitoring Technique, and the Focus on Success Technique, the Mean Correct on Inhibition Trials, and the Mean Correct on Inhibition Trials Relative to the Mean Correct on all Trials*

Variables	1	2	3	4	5	6	7
Measures							
1. Metaregulatory Motivation	-						
2. Metaregulatory Capacity	.60**	-					
3. Self-Control	.22	.53**	-				
Strategy							
4. Vigilant Monitoring	-.08	-.12	-.06	-			
5. Focus on Success	.04	.22	.29*	.53**	-		
Task Performance							
6. Absolute Performance	-.01	-.02	-.09	.00	-.09	-	
7. Relative Performance	-.13	-.03	-.15	-.04	-.08	.89**	-

Note. ** $p < .01$, *two-tailed.* * $p < .05$, *two tailed.*

Demographic Analyses

Before testing the main hypotheses, various analyses were conducted to detect potential differences within demographic characteristics (gender, race, year in college, and age). Since the majority of the sample was white, race analyses compared white participants to participants in all other racial categories. Table 3 summarizes the results of *t*-tests (conducted for gender and race), analysis of variance (conducted for year in college), and correlation (conducted for age) for each variable. The independent samples *t*-tests revealed that white participants obtained significantly higher self-control scores (M = 46.62, SD = 7.14) compared to all other racial groups (M = 42.20, SD = 6.50). Independent samples *t*-tests also revealed marginally significant gender differences for motivation. Men obtained lower motivation scores (M = 22.50, SD = 3.70) than women (M = 24.20, SD = 3.01). Additionally, independent samples *t*-tests revealed marginally significant gender differences for relative task performance. Men performed worse on the habit inhibition task (M = .34, SD = .10) compared to women (M = .39, SD = .12) when examining relative performance.

Table 3 – Summary of Independent Samples t-Tests, ANOVA, and Pearson's Correlation for Gender, Race, Year in College, and Age for Motivation, Capacity, Self-Control, Absolute Performance, and Relative Performance

Variables	*Motivation*	*Capacity*	*Self-Control*	*Absolute*	*Relative*
Gender (*t*)	-1.96†	-1.33	-.81	-1.33	-1.82†
Race/Ethnicity (*t*)	-.18	1.21	2.13*	-.50	-1.41
Year in College (*F*)	.40	1.50	.47	.94	.68
Age (*r*)	-.10	-.07	-.05	-.17	-.12

Note. ** $p < .01$, *two-tailed.* * $p < .05$, *two tailed.* $^{\dagger}p < .10$

Analyses Predicting Habit Inhibition Task Performance with Metaregulation

To test the main hypothesis that metaregulation would predict habit inhibition, a multiple linear regression analysis was conducted including capacity and motivation as predictors and self-control as a covariate predicting task performance. Results were not significant when examining absolute performance, $R^2 = .01$, $F(3, 58) = .16$, $p = .92$ or relative performance, $R^2 = .052$, $F(3, 58) = 1.06$, $p = .19$. Table 4 includes the specific effects for motivation, capacity, and self-control predicting task performance, none of which were significant.

Table 4 – Unstandardized Regression Coefficients for Motivation, Capacity, and Self-Control Predicting Absolute and Relative Habit Inhibition Task Performance

	Absolute Performance			*Relative Performance*		
	B	*t-value*	*p-value*	*B*	*t-value*	*p-value*
Motivation	.04	-.06	.95	-.01	-1.01	.32
Capacity	-.11	-.15	.88	-.00	-.22	.83
Self-Control	-.18	-.66	.51	-.00	-1.15	.25

Given the null effects for hypothesis one, a frequency table was generated to detect outliers on task performance. The frequency distribution revealed that several participants obtained questionably low scores. One possibility is that the low performers did not fully understand task directions and may have been guessing rather than attempting to provide correct responses during the task. Therefore, a multiple linear regression analysis including capacity and motivation as predictors and self-control as a covariate was conducted to exclude participants performing in the bottom 10% on the inhibition task. These participants had less than 25% of the items correct. Results were still not significant when examining absolute performance, $R^2 = .05$, $F(3, 52) = .87$, $p = .46$, or relative performance, $R^2 = .09$, $F(3, 52) = .1.64$, $p = .19$.

The main hypothesis that metaregulation would predict habit inhibition was not supported when examining all participants or when low performing participants were excluded. Since the initial hypothesis yielded no significant results, the second hypothesis that the vigilant monitoring technique would mediate the relationship between capacity and habit inhibition was not tested. The third hypothesis stated that there would be a significant positive correlation between capacity and vigilant monitoring; however, the correlation between capacity and vigilant monitoring was not significant (see Table 2).

Exploratory Analyses

Exploratory analyses were conducted to examine possible unexpected relationships. Recall from the demographic analyses that gender and race differences were found for several variables. Therefore, gender and race were examined as moderating variables for capacity, motivation, and self-control predicting absolute or relative performance. Each regression analysis with metaregulation as a predictor included self-control as a covariate. Likewise, all regression analyses that used self-control as the predictor included metaregulation as a covariate.

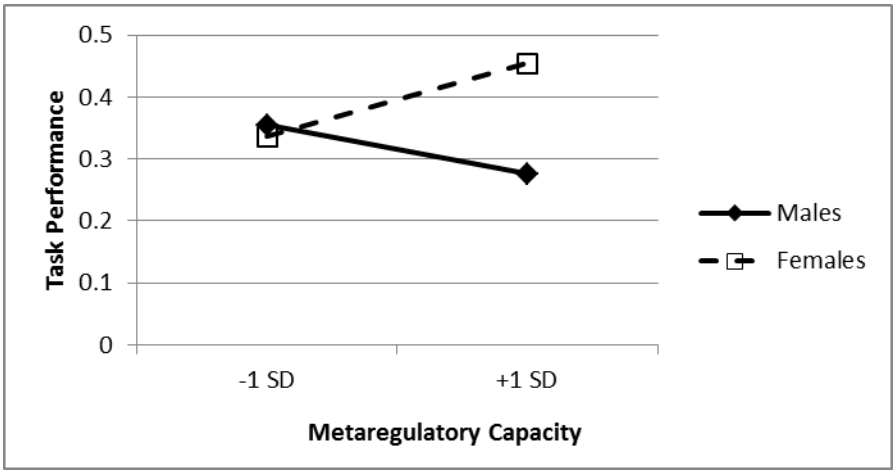
To determine whether gender moderated metaregulatory capacity on absolute or relative task performance, multiple linear regression analyses were conducted. Results were significant for absolute performance, $R^2 = .24$, $F(5, 56) = 3.56$, $p = .01$ and relative performance $R^2 = .28$, $F(5, 56) = 4.41$, $p = .00$. The significant interactions were further investigated by examining the simple effects for each gender. Table 5 includes the individual effects for gender moderating capacity predicting task performance.

Table 5 – Interaction Between Gender and Capacity Predicting Absolute and Relative Habit Inhibition Task Performance

	Absolute Performance			*Relative Performance*		
	B	*t-value*	*p-value*	*B*	*t-value*	*p-value*
Males	-8.22	-3.45	.01	-.05	-2.71	.01
Females	2.07	1.98	.05	.02	2.71	.01

Both simple slopes were found to be significant. Findings indicated that capacity predicted better task performance for females and worse task performance for males. Figure 1 below displays the gender interaction for capacity predicting relative performance.

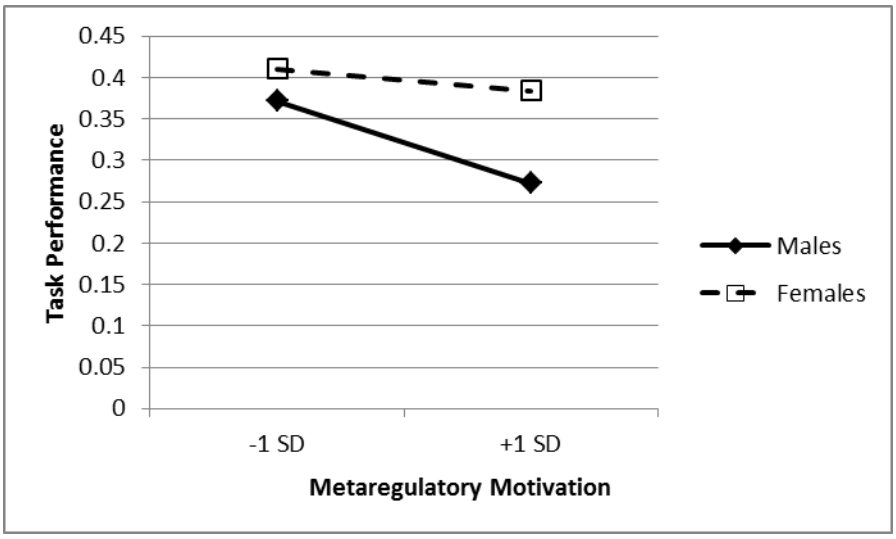
Figure 1. Gender Interaction for Metaregulatory Capacity Predicting Relative Habit Inhibition Task Performance



To examine whether gender would moderate motivation predicting absolute or relative task performance, multiple linear regression analyses were performed. Test results revealed no significant interaction for absolute performance, $R^2 = .10$, $F(5, 56) = 1.28$, $p = .29$ and a marginally significant interaction for relative performance, $R^2 = .15$, $F(3, 58) = 2.00$, $p = .09$. Simple slopes for each gender were then examined for relative performance and revealed a significant simple slope for males, $B = -.02$, $t(61) = -2.11$, p

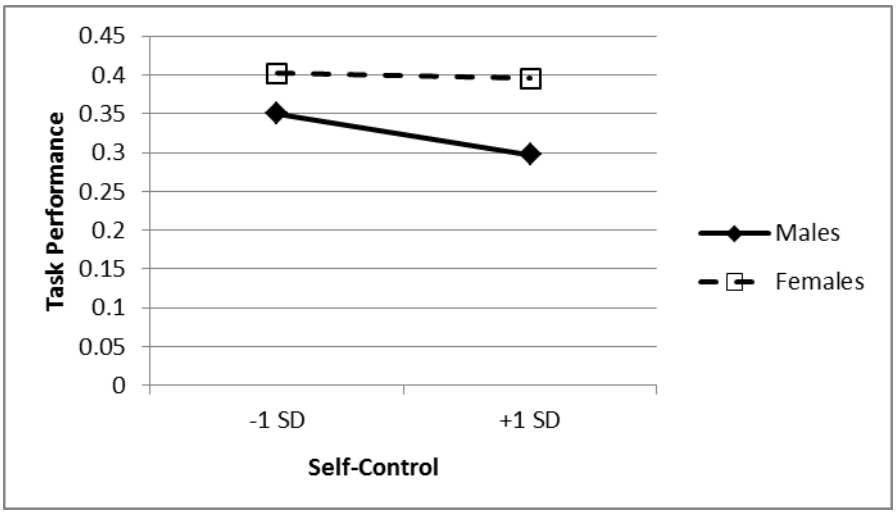
= .04 but not for females, B = -.00, $t(61)$ = -.63, p = .53. These findings indicated that motivation affected men and women's task performance differently. For males but not females, increased motivation predicted worse relative task performance. Figure 2 below displays the gender interaction for motivation predicting relative task performance.

Figure 2. Gender Interaction for Metaregulatory Motivation Predicting Relative Habit Inhibition Task Performance



To test whether gender moderated the relationship between self-control and absolute or relative task performance, multiple linear regression analyses were conducted. Results for absolute performance were not significant, R^2 = .10, $F(5, 56)$ = 1.27, p = .29; however, results for relative performance were significant, R^2 = .17, $F(5, 56)$ = 2.35, p = .05. Therefore, simple slopes were examined for males and females for relative performance. Significant results were obtained for males, B = -.01, $t(61)$ = -2.35, p = .02 but not for females B = -.00, $t(61)$ = -.32, p = .75. These findings indicate that as men's self-control increased, relative task performance tended to decrease. Figure 3 depicts the gender interaction for self-control predicting relative task performance.

Figure 3. Gender Interaction for Self-Control Predicting Relative Habit Inhibition Task Performance



Analyses were also conducted examining race as a moderating variable. To examine whether race moderated capacity on absolute or relative task performance, multiple linear regression analyses were conducted. Results were not significant for absolute, $R^2 = .01$, $F(5, 56) = .14$, $p = .98$ or relative task performance, $R^2 = .08$, $F(5, 56) = .97$, $p = .44$. To determine whether race moderated the relationship between motivation and absolute or relative task performance, multiple linear regression analyses were conducted. Results were not significant when examining absolute performance, $R^2 = .04$, $F(5, 56) = .41$, $p = .84$ or relative performance, $R^2 = .12$, $F(5, 56) = 1.56$, $p = .19$. To determine whether race moderated self-control predicting relative or absolute task performance, multiple linear regression analyses were conducted and no significance was found for absolute performance, $R^2 = .01$, $F(5, 56) = .12$, $p = .99$ or relative performance, $R^2 = .09$, $F(5, 56) = 1.11$, $p = .37$. Overall, there was no evidence that race moderated the relationship between metaregulation or self-control predicting absolute or relative task performance.

CHAPTER 5: DISCUSSION

The premise of the current study was that metaregulators tend to develop healthy habits as a strategy to avoid temptations in daily life. Therefore, it was hypothesized that metaregulation would predict the ability to inhibit unwanted habits. Since past research (Quinn et al., 2010) demonstrated that individuals who use the vigilant monitoring technique were most successful at habit inhibition, vigilant monitoring was expected mediate the relationship between metaregulation and task performance. Although the hypotheses were not supported, several unexpected results were found and a better conceptualization of metaregulation was obtained.

Juxtaposing the habit inhibition task with habit inhibition processes in daily life provides a possible explanation as to why the main hypothesis was not supported. In everyday life, people attempt to inhibit current habitual behaviors because those behaviors contradict some goal behavior (Carver & Scheier, 1982). For example, an individual who regularly eats fast food must first perceive that behavior to be undesired and then establish a new goal behavior before an attempt at habit inhibition occurs. That is, in daily life individuals are typically motivated to adjust an undesired behavior toward a desired state. In the current research, participants formed habits through word associations and were given the goal of inhibiting those habits. This task is similar to real world habit inhibition scenarios since habits were formed through repetitive pairings and then inhibited. However, in the lab procedure the goal behavior of inhibiting certain word associations was provided and not generated by participants. For some participants this may have resulted in a lack of motivation to put substantial effort into inhibiting unwanted habits in the lab as they would in regular life. In this respect, the habit

inhibition task may not have been fully indicative of the ability to inhibit habits in daily life.

The second prediction was an extension of the initial hypothesis. It was expected that participants with high capacity would exhibit better task performance by using the vigilant monitoring technique. However, using a particular technique did not predict task performance and participants who used the vigilant monitoring technique also used the "focus on success" technique during the task. This finding seems to contradict the literature on self-regulatory focus theory. Past research (Higgins, 1997) on self-regulatory focus suggests that some people are prevention focused and are motivated to achieve goals in order to avoid failure. Other individuals are promotion focused and are motivated to achieve goals to obtain success. An individual using the vigilant monitoring technique who concentrates on avoiding mistakes by thinking "don't do it," would theoretically be prevention focused. Someone using the focus on success technique, who emphasizes providing correct responses and thinks "do your best," is more likely to be promotion focused. Previous findings (Corregan, 2011; Higgins et al., 2001) have demonstrated that there is almost no correlation between prevention and promotion self-regulatory focus which directly contradicts the significant correlation found in the current research. This finding may call into question the validity of the technique questionnaire.

Anticipated study results were not substantiated; however, interesting and unanticipated gender differences were found. Overall, gender moderated the relationship between each variable (capacity, motivation, and self-control) predicting task performance. A negative relationship between the three variables and habit inhibition was observed for men. For women, a positive relationship was found for capacity predicting

habit inhibition and no relationship was apparent for motivation or self-control predicting task performance. This pattern of results suggests that men who are good at habit inhibition are not using metaregulatory strategies (neither capacity nor motivation), whereas men who are inept at inhibiting habits are metaregulating. The opposite trend is observed for women. Women who are adept at inhibiting habits use capacity (but not motivation) strategies and women who are not good at habit inhibition are not metaregulating.

The gender interactions may not be surprising considering past findings which indicate there are gender differences in attitudes regarding the ability to inhibit unwanted habits. One past study (Stockton, McMahon, & Jason, 2000) examined gender differences in a smoking cessation program. Gender did not predict quitting rates after completing the program. However, men were more likely to report that it required less effort to stop smoking and that they could have successfully stopped smoking without participating in the program. It makes sense then, for some men to not feel the need to implement metaregulatory strategies since men display more confidence in the ability to inhibit habits without aid. Another study (Branstetter, Blosnich, Dino, Nolan, & Horn, 2012) examined gender differences in smoking cessation among adolescents and found that confidence in quitting predicted cessation success for females only. It is possible that overall men have an inflated confidence in the ability to inhibit habits without using strategies since that confidence does not affect actual habit inhibition behaviors.

It would be interesting to examine whether different attitudes toward habit inhibition abilities existed between the participants who were successful and unsuccessful at habit inhibition; however, the aforementioned studies (Stockton et al., 2000;

Branstetter et al., 2012) did not examine potential differences between men and women who quit smoking post-program and those who continued to smoke. Perhaps different attitude trends would have been observed for those who displayed better or worse habit inhibition abilities. Coupling past and current findings on habit inhibition reveals an overall trend in gender differences for how habit inhibition abilities are perceived. For example, men who are already good at inhibiting habits may be confident in their ability to do so which results in no strategy use whereas men who are not good at habit inhibition realize that strategies are useful.

Another study (Ablard & Lipschultz, 1998) examined self-regulated learning (SRL) strategy use in high achieving seventh-grade students. There are numerous SRL strategies that can be implemented and overall, female students reported using more SRL strategies than males. Furthermore, results indicated that girls were more likely than boys to use strategies when they were at risk of self-regulatory failure and "have difficulty completing homework assignments because there are more interesting things that they would rather do (Ablard & Lipschultz, 1998, p. 99)." Implementing a SRL strategy to avoid distractions while doing homework would also be considered a metaregulatory strategy since the goal is self-regulatory success. This past finding corroborates the current research since the high achieving females used strategies whereas boys achieved the same academic success without the use of such strategies.

The current study expands upon past research on metaregulation (Corregan, 2011; Eckard et al., 2012) which indicated that metaregulation is most useful for individuals at risk of self-regulatory failure. Increasing age is a risk factor for weight gain and it was found that students with high capacity did not experience a BMI increase throughout the

college years whereas students low in capacity experienced a steady BMI increase (Eckard et al., 2012). Individuals at risk of self-regulatory failure would benefit most from metaregulatory strategies; however, the current findings indicate that men and women are implementing strategies differently. Women at risk of continuing an unwanted habit are not metaregulating; however men in the same predicament are using strategies.

The current research explored whether metaregulation could predict individuals' behavioral responses in habit inhibition. However, there were several limitations that may have influenced study results. The analyses included 62 participants, all of which were college students. This makes the study underpowered and demographically limited, which hinders the ability to generalize results to the population. Also, the current sample had notably less variability for metaregulation and self-control compared to previous research (Eckard, 20011; Tangney et al., 2004). This reduces the ability to predict outcomes and may have influenced the null findings. The metaregulation, self-control, and strategy technique assessments used in the current research were self-report measures. This presents an issue since participants may have wanted to present themselves in a manner which is socially desirable, independent of actual behaviors. Direct behavioral observation and third-party behavioral reports may help gain a more accurate depiction of individuals' daily behaviors. Finally, the extent to which the habit inhibition task mimics habit inhibition behaviors in everyday life is questionable and was previously discussed.

Future research should improve upon the limitations present in the current study. Additionally, habit inhibition abilities should be measured in a different manner. Habit

inhibition has also previously been measured through diary samples (Quinn et al., 2010). Using this alternate habit inhibition procedure may more accurately represent habit inhibition behaviors in daily life. To determine whether a particular technique is utilized during habit inhibition, it may be useful to use the Regulatory Focus Questionnaire (Higgins, 2001) rather than a habit inhibition technique questionnaire. Theoretically, successfully inhibiting a habit would entail a prevention focus.

In everyday life, there are a number of unwanted behaviors that an individual may attempt to inhibit. Past research (Quinn et al., 2010) categorized unwanted acts into a number of behavioral domains such as sleeping, eating, procrastinating, and unwanted thoughts. Future research may examine whether the specific type of unwanted behavior moderates metaregulation predicting habit inhibition and whether gender differences exist in this respect. Additionally, research should examine whether metaregulation predicts long-term goal attainment. In fact, the relationship between metaregulatory strategy use and long-term success would be particularly useful in advancing the current literature on metaregulation.

Successful self-regulation is indeed difficult and developing a healthy lifestyle is an effective way to avoid facing temptations and thus risking self-regulatory failure. Metaregulatory capacity strategies are designed to facilitate long-term goal attainment by making healthy, desired behaviors occur automatically. However, the current research suggests that the relationship between metaregulation and habit inhibition is more complex than originally hypothesized. Study results did not support the notion that metaregulators overall are better at inhibiting habits. Gender differences were found and

expected findings were obtained for females whereas opposite effects were apparent for men. Clearly, men and women are using metaregulatory strategies differently.

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APPENDIX: TECHNIQUE QUESTIONNAIRE

How often did you use each strategy (if any) to help you respond correctly <u>in the second phase of the task</u>?

1. Thinking "don't make mistakes," watching carefully for mistakes and slipups

   Never Seldom Sometimes Often Almost Always

2. Thinking "do your best," focusing on correct responses

   Never Seldom Sometimes Often Almost Always

3. I did not use a strategy

   Never Seldom Sometimes Often Almost Always

4. I used a strategy other than the ones listed. Please describe the strategy you used:

   _____

How often do you use each strategy (if any) to change unwanted habits <u>in everyday life</u>?

5. Thinking "don't make mistakes," watching carefully for mistakes and slipups

   Never Seldom Sometimes Often Almost Always

6. Thinking "do your best," focusing on correct responses

   Never Seldom Sometimes Often Almost Always

7. Removing myself from the situation

   Never Seldom Sometimes Often Almost Always

8. Distracting myself

   Never Seldom Sometimes Often Almost Always

9. I do not use strategies

   Never Seldom Sometimes Often Almost Always

10. I use a strategy other than the ones listed. Please describe the strategy you use:

    _____