SELF-CONTROL AND THE USE OF THE MUSCLE METAPHOR

By

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Abstract:

Metaphors are helpful cognitive tools that people use every day to make sense of abstract concepts. Previous research has shown that use of certain metaphors can affect attitudes and cognitions by providing greater understanding of these abstract concepts through priming a framework for these thought processes. One abstract concept that metaphors may help us understand is self-control, which can be described to function like a muscle. The present research examined the impact of priming the metaphor of self-control as a muscle on self-control performance. Additionally, this study examined if individuals differences in Personal Need for Structure (PNS) moderated the effect on self-control performance. Results indicated that priming of the muscle metaphor had no effect on self-control performance and did not interact with PNS.

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CHAPTER I

INTRODUCTION

Sometimes a good metaphor can help sum up an otherwise complex sentiment. For example, in the beloved movie Forrest Gump, Forrest recounts a metaphor his mother used to use, stating she said, "Life was like a box of chocolates. You never know what you're gonna get." This metaphor makes an otherwise difficult concept, life, easier to comprehend by linking it with a simple concept, chocolates. In this way, metaphors are excellent cognitive tools, because they encourage us to compare a complex, abstract, or unfamiliar concept with an easy to understand, familiar concept.

Since many of the processes of the mind are also somewhat abstract and complex, metaphors are often used to enable comprehension. For example, William James used the metaphor of a flowing stream to represent our consciousness (James, 1890). This metaphor allows us to grasp how our conscious thoughts present themselves and transition to the next continuously, at a steady pace, just as we already hold on to an understanding of how a river flows.

The concept of self-control also presents itself nicely for the use of a metaphor. How one is able to regulate one's behavior, thoughts, and emotions, and how repeated use of self-control makes subsequent self-control failure more likely, are concepts difficult to easily picture in our minds.

However, we are able to comprehend the performance of our physical muscles in response to activity. Most people easily understand that repeated use of our physical muscles leads to a greater likelihood of inability to perform future tasks. This explanation of physical muscles in our bodies seems to nicely parallel with our ability to regulate our behaviors, thoughts and emotions. For this reason, researchers have often used the muscle metaphor in the empirical literature when describing the nature of self-control (Muraven, Baumeister, & Tice, 1999, Muraven & Baumeister, 2000). The present study attempted to explore if the "self-control is like a muscle" metaphor allowed people to better comprehend the self-control concept, resulting in better self-control performance.

Metaphor Theory

Conceptual metaphors are metaphors that are used in thought processes. Such metaphors are highly influential because they cause our thoughts and behaviors to fall in line with the metaphors (Lakoff & Johnson, 1980). For example, when we think of an athletic competition as a battle, our behaviors and language might fall more in line with this metaphor. Those using such a metaphor might be more inclined to refer to the opponent as the enemy or describe the playing surface as a battlefield.

Metaphor research has yielded a number of findings suggesting that when people are exposed to a particular metaphor they are likely to alter their thoughts and behaviors to match with said metaphor (Laundau, Meier, & Keefer, 2010). For example, one series of studies examined the metaphor that immigration in the U.S. is like an infectious disease (Landau, Sullivan, & Greenberg, 2009). In this study, participants read essays that primed the concept of infectious diseases by describing how diseases spread. Participants then were exposed to one of two essays about the United States. One of these

essays included the metaphor that the U.S. is like a living body by using phrases such as "shook free from Britain's grip" and ""there was a fear that communism had infected the national consciousness." The other essay did not reference this metaphor. Participants then indicated their views on immigration. The results indicated that those primed with the metaphor that a country is like a body and therefore can be infected, held stronger negative attitudes toward immigration then those not primed. Thus, the metaphor caused participants' motivation in one domain (protect one's body from disease) to influence their motivation in an unrelated domain (protect the country from immigrants).

The influence of metaphors can also be seen in the growing literature on embodied cognition. Embodied cognition asserts that stimuli from the outside world, via our physical body, have influences on our thoughts and perceptions. For example, in one study, participants who held warm beverages perceived others as more friendly, welcoming and overall "warmer" than those holding cold beverages (Williams & Bargh, 2008). Thus, the physical experience of temperature primed the metaphor that people can have "cold" or "warm" personalities, and this subsequently affected the way the individual perceived others. Additionally, research on embodied cognition has already shown a link between muscles and self-regulation (Hung & Labroo, 2011). Specifically, participants who were asked to firm their muscles during self-control tasks performed better than those who did not firm their muscles.

Although metaphors exert a strong influence, their effectiveness likely depends on certain individual difference factors. For example, the more a metaphor resonates with the participant, the greater the metaphor's effect (Ottati, Rhodes, & Graesser, 1999). Furthermore, some researchers suggest that metaphors are more effective for people with

a preference for structured information (Landau, Meier, & Keefer, 2010). One common measure of this preference is personal need for structure (Neuberg & Newsom, 1993; Thompson, Naccarato, Parker, & Moskowitz, 2001). Need for structure refers to the degree to which individuals need to make sense of the world around them and prefer structured explanations of abstract concepts. People high in need for structure are uncomfortable with uncertainty, prefer concrete over abstract information, and are more likely to engage in actions designed to restore certainty (Neuberg, Judice, & West, 1997). Because metaphors aid us in understanding abstract information in concrete ways, people high in need for structure may be more likely to prefer the use of metaphors (Laundau, Meier, & Keefer, 2010). Although no studies have directly tested this assertion, research has found a link between high epistemic motives and effective metaphor use (Landau, Keefer, & Rothschild, 2014). Given that need for structure is considered to be one type of individual difference associated with epistemic motives, this research hoped to provide some support to the idea that people high in need for structure would be more influenced by metaphors. It was predicted that personal need for structure would moderate the effect of the muscle metaphor on self-control performance.

Self-Control Theory

Self-control can be defined as the inhibition of automatic responses (Bargh & Kirsch, 1999). For example, right-handed people automatically reach for most things and do tasks with their right hand. If they were to force themselves to use their left hand instead, they would require self-control to do so. This same principle applies to a wide range of actions, including quitting smoking, restricting food intake, sticking with a financial budget, or controlling one's emotions.

An important distinguishing aspect of self-control is that it is a limited resource. This was first demonstrated by Muraven, Tice, and Baumeister (1998), who showed that when participants performed a self-control task (e.g., suppressing emotions during a film, suppressing the thought of a white bear) they performed worse on a subsequent measure of self-control (i.e., were depleted), relative to a control group. The fact that earlier exertion of self-control led to decreased self-control strength led researchers to surmise that self-control was like a muscle (Muraven & Baumeister, 2000). Although these researchers were the first to explicitly use the muscle metaphor when describing self-control, this metaphor can also be seen in everyday language. For instance, people with high self-control are often described as "strong willed" in the same way that people with good morals are considered to have "strength" of character. This metaphor can also be seen in the fact that many people physically clench their fists or teeth when attempting to exert self-control (Hung & Labroo, 2010).

In addition to this early research on self-control, later studies continued to support and extend the muscle metaphor. These studies assumed, since we can train muscles to be bigger and stronger, self-control could be trained just as a muscle would be. One study had participants participate in one of several self-control regimens over a two-week period, such as performing posture exercises, controlling their mood, or keeping a food diary (Muraven et al., 1999). These researchers found that after the two-week period, participants performed better on a measure of self-control compared to a control group. Later researchers showed a similar effect in a 2 month exercise program that also improved self-control performance compared to a control group (Oaten & Cheng, 2006).

These studies again show the parallels between the way self-control behaves and the way muscles behave, providing more support for the muscle metaphor.

A recent series of studies by Hung and Labroo (2010) also provides evidence of a link between muscles and self-control. Researchers had participants firm their muscles by either squeezing a pen to contract the muscles of their hand and forearm, or lifting their heels off the floor to contract their calf muscles. Participants continued to keep these muscles contracted while participating in different measures of self-control. Specifically, participants with firmed muscles held their hand in ice water for longer, a common measure of self control (Hagger et al., 2010), were more willing to donate to disaster relief, an act that would require self-control, and consumed more of a beverage with a disgusting taste compared to control groups. This research provided evidence of a cognitive link between our physical muscles and self-control performance.

As final evidence for the muscle metaphor of self-control, research suggests that self-control may rely upon the same physiological nutrient that drives physical muscles. Research on physical muscles indicates that they perform better after the consumption of carbohydrates. For example, participants that consumed carbohydrates were able to cycle at a high intensity for a longer duration than those in a control group that did not consume carbohydrates (Hargreaves, Costill, Coggan, Fink, & Nishibata, 1984). Interestingly, research on self-control shows that a common carbohydrate used by muscles (i.e., glucose), not only replenishes muscles, but has similar effects on self-control. Blood tests were taken from participants before and after performing a self-control task. These tests showed that those in the self-control condition used glucose at a faster rate compared to a control group (Galliot et al., 2007). This suggested that the use of self-control requires

glucose (Gailliot & Baumeister, 2007). Subsequent studies examined the consumption of glucose following a depletion of self-control resources. These studies found that glucose consumption improved performance on subsequent tests of self-control, compared to those who consumed a sugar substitute (Galliot et al., 2007).

Although self-control is clearly influenced by physical factors, such as prior exertion and glucose consumption, several cognitive factors influence it as well (Hagger, Wood, Stiff, & Chatziarantis, 2010). For example, anticipation of future tasks (Muraven, Shmueli, & Burkley, 2006), self-affirmations (Schmeichel & Vohs, 2009), mood (Fishback & Labroo, 2007), and restoration of the self through positive affect (Tice, Baumeister, Shmueli, & Muraven, 2007), all influence self-control performance. In addition to these, another cognitive variable that has a strong influence on self-control performance is people's self-control beliefs (Job, Dweck, & Walton, 2010). Researchers showed that participants led to believe that self-control was not a limited resource were less depleted than participants led to believe that it was a limited resource. That is, people who did not believe in depletion were actually less depleted by the self-control task. In response to this finding, other researchers conducted a study where participants were severely depleted and found that although beliefs did protect people from depletion at first, this protection was no longer evident after repeated depletion experiences (Vohs, Baumeister, & Schmeichel, 2013). Thus, self-control beliefs appear to protect against mild forms of depletion but not against extreme forms. Importantly, this research on beliefs was particularly relevant to the present study because it suggests that the understanding of how self-control functions has a direct effect on self-control performance.

Present Theory

If self-control acts like a muscle, and metaphors help people to understand abstract concepts, then the muscle metaphor that is so prevalent in the empiricial literature may in fact improve people's self-control performance. Thus, it was predicted that participants primed with the muscle metaphor would perform better on a subsequent self-control task than their non-primed counterparts. This was expected to occur for two reasons. First, priming of strength and power terms was predicted to increase participant's sense of strength and potentially their self-control capacities. Consistent with this assertion, research has shown priming the concept of power leads people to feel more powerful and confident (Briñol, Petty, Valle, Rucker, & Becerra, 2007; Fast, Gruenfeld, Sivanathan, & Galinsky, 2009). As discussed earlier, it has also been shown that physical contractions of muscles leads to better self-control performance (Hung & Labroo, 2011). Second, it was likely that the muscle methaphor would improve participant's understanding of the abstract self-control concept, and this improved understanding could have altered their self-control beliefs in a way that could have facilitated performance (Job et al., 2010; Vohs et al, 2013).

In addition to this main prediction, it was also anticipated that the effect of the muscle metaphor on self-control performance would be moderated by personal need for structure (Laundau et al., 2010; Landau et al., 2014). Based on prior metaphor research, it was predicted that people high in need for structure would show a stronger metaphor effect than those low in need for structure.

CHAPTER II

METHODS

Participants and Design

Fifty-seven participants (47 women) were recruited for course credit from an online sampling pool of college students from Oklahoma State University. This sample size was based on a G*Power sample that indicated a sample of 55 was required to detect a medium-sized effect. Participants were randomly assigned to one of two experimental conditions: metaphor (N = 27) or non-metaphor (N = 30). This was combined with the possible moderator of personal need for structure and resulted in a 2 (high vs. low need for structure) × 2 (muscle metaphor condition vs. non-metaphor condition) design. To measure self-control performance, all participants completed an anagrams task that unbeknownst to them was unsolvable. Time spent on the anagrams task served as a measure of self-control, with longer times indicating better self-control performance.

Procedures and Material

Participants were recruited for the study through the Oklahoma State University SONA system and were compensated for their participation with course credit. Upon arrival, participants were presented with, asked to read, and sign a consent form (Appendix A) detailing the potential risks and rewards for participation as well as information about the primary investigator for the study

Participants were then randomly assigned to read one of two essays that discuss the concepts of self-control and willpower (Appendix B). The two essays are identical except for the fact that one essay included terms specific to the muscle metaphor of self-regulation such as “muscle”, ”strength”, and “power”. The other essay instead used terms such as “great deal of energy”, “energy” or “used up” that conveyed the same information but did not reference the muscle metaphor. These essays were based on ones utilized in previous research on metaphors (Landau, Sullivan, & Greenberg, 2009).

After reading the essays, participants answered a short series of questions designed to test the participant’s attention and their felt understanding of the topic (α = .88)(e.g., “How much did this article help you learn about willpower?”) and a few questions regarding the content of the essay. Next, participants were given a list of anagrams to solve that, unbeknownst to them, were unsolvable (Appendix C). Participants were told to work on them for as long as they like and to open the door to the testing room when they have attempted them for long enough. Participants were timed for the length of time they persisted on the anagrams, with a maximum cap of 10 minutes. The unsolvable anagrams task is a commonly used and effective measure of self-control performance (Hagger, Wood, Stiff, & Chatzisarantis, 2010). Finally, participants were asked to fill out a series of personality scales that may potentially moderate the metaphor effect (Appendix D). First in this set was the personal need for structure (α = .23)(PNS; Thompson, Naccarato, Parker, & Moskowitz, 2001). Additional ancillary measures were also included, such as the Self-Control Scale, which is a measure of trait self-control (α = .87)(Tangney, Baumeister, & Boone, 2004), and the Need for (Cognitive) Closure Scale (NFCS; α = .83), which is considered to be a different type of individual difference in

epistemic motives (Kruglanski, Webster, & Klem, 1993). Lastly, participants were asked a series of basic demographic questions and questions about their previous knowledge and participation (Appendix E) before being fully debriefed (see Appendix F for debriefing details). Following this, participants were free to ask any questions they might have regarding the experiment.

CHAPTER III

RESULTS

Analysis

Participants' reading comprehension scores indicated that the participants had read the essays presented to them. No participants were removed as a result.

Felt understanding. An independent sample t-test was conducted to test if the manipulation increased felt understanding between conditions. The results were not significant $t(55) = -.447$, $p = .64$, suggesting no difference in felt understanding between the metaphor and non-metaphorical conditions. This suggests that the metaphor did not have an effect.

Self-control performance. All analyses were conducted using hierarchical linear regression. Specifically, self-control performance was regressed onto the dummy coded metaphor framing condition (0 = metaphor, 1 = no metaphor), the suspected moderator (e.g., personal need for structure), and the multiplicative cross product of these two variables. In all cases, the independent main effects (i.e., metaphor framing condition and moderator) were entered into the first block of the hierarchical regression and the cross product was added to the second block.

To test my primary prediction, I first examined if personal need for structure

interacted with the metaphor condition to influence self-control performance. Personal need for structure did not differ between conditions $t(55) = -.208$, $p = 84$. The results indicated the main effect of metaphorical framing was not significant $\beta = .088$, $t(56) = .653$, $p = .52$ and the main effect of personal need for structure was also not significant $\beta = -.038$, $t(56) = .-.284$, $p = .78$. Results also indicated that the interaction was not significant $\beta = -.292$, $t(56) = -.209$, $p = .84$.

Next, I examined if the ancillary measures (i.e., Need for Cognitive Closure scale (NFCS), Self-control scale (SCS), and felt understanding composite) served as moderators. In regards to the NFCS, the results indicated that the main effect of metaphorical framing was not significant $\beta = .082$, $t(56) = .604$, $p = .55$ and the main effect of NFCS was also not significant $\beta = .075$, $t(56) = .555$, $p = .58$. Furthermore, the interaction was also not significant $\beta = -.812$, $t(56) = -.659$, $p = .51$.

In regards to SCS, the results indicated the main effect of metaphorical framing was not significant $\beta = .098$, $t(56) = .725$, $p = .47$ and the main effect of SCS was also not significant $\beta = .112$, $t(56) = .827$, $p = .41$. Furthermore, the interaction was also not significant $\beta = -.202$, $t(56) = -.328$, $p = .74$.

Lastly, in regards to felt understanding, the results indicated the main effect of metaphorical framing was not significant $\beta = .066$, $t(56) = .514$, $p = .61$. However, the main effect of felt understanding was significant $\beta = .337$, $t(56) = 2.636$, $p = .01$. That is, the more participants felt they understood the nature of self-control; the better they performed on the self-control task (i.e., longer persistence). The interaction though was not significant $\beta = -.270$, $t(56) = -.486$, $p = .63$.

CHAPTER IV

Discussion

The aim of this research was to examine the effect of metaphorical framing of the muscle metaphor of self-control on self-control performance. Additionally, this research hoped to show a moderating effect of personal need for structure on metaphorical framing, suggested previously by other researchers (Laundau et al., 2010; Landau et al., 2014). Overall, the results did not support the predictions. The metaphor priming had no effect on self-control performance and it did not interact with any of the suspected moderators (e.g., PNS).

However, the results did reveal one interesting effect. Although metaphorical priming had no effect on self-control performance, greater felt understanding did improve self-control performance. This suggests that although the use of metaphor may not be helpful in increasing understanding of the abstract concept of self-control, but greater understanding of the concept of self-control can be obtained through alternative methods, and this does improve self-control performance. Future research should attempt to replicate this effect and explore it further.

Limitations and Future Research

The lack of predicted results may have occurred for several reasons. First and foremost is the non-metaphorical condition essay might have illicited the muscle

metaphor. It is reasonable to assume that describing self-control as a limited resource might illicit comparisons to other limited resources in the human body such as the capacity for physical action. Specifically, the last paragraph of the non-metaphorical condition describes how performing self-control tasks over time improves self-control performance in the future. Although this was described in a way that does not directly suggest self-control is like a muscle, it is reasonable to assume that participants might have applied a muscle-like metaphor to self-control independently, in order to understand the concept they were reading about. Future research should find a way to prevent participants from developing a metaphor to understand the passage independent of the intent of the passage. Future research might also benefit from neutral control conditions that do not discuss self-control. Research with a netural condition might not be able to support the idea that metaphor specifically caused the effects, but could support the idea that greater understanding of the abstract concept of self-control might lead to greater self-control performance. This would be consistant with results found in this study that support a link between felt understanding and self-control performance.

A second reason why the predicted results were not found may have to do with the poor relability of the Personal Need for Structure Scale ($\alpha = .23$). This low internal relibility may have occurred because of participant error or an error on the part of the experimenter. However, since there was still no effect when personal need for structure was subsituted in the analysis for Need for Cognitive Closure, which is another measure of epistemic motiviation, this may not be the case.

Future research on the relationship between metaphorical framing and self-control performance could also explore the relationship between muscle activation and self-

control performance. Examining if this relationship between muscle activation was actually due to embodied cognition or some other process such as sympathetic response or influences through other cognitive mechanisms could also be explored. For example, future research could insure that the effects of muscle activation does not increase motivation, increase concentration, or encourage the use of a more effective self-control strategy.

Implications and Conclusions

The research presented here suggests that although metaphorical priming may affect some cognitive functions such thoughts, behaviors, and attitudes (Laundau et al., 2010), self-control might not be influenced in this manner. Since metaphorical framing seemed not to influence self-control performance, this study does not rule out the potential moderating effect of personal need for structure on metaphorical priming effects. This suggests that personal need for structure or other epistemic motives may still be a moderating variable in other metaphorical research. Although the current research did not yield the expected results, it does provide some insight into metaphorical research and should steer future research in a productive direction.

REFERENCES

Bargh, J. A., & Kirsch, I. (1999). The unbearable automaticity of being. *American Psychologist, 54*, 462-479.

Briñol, P., Petty, R. E., Valle, C., Rucker, D. D., & Becerra, A. (2007). The effects of message recipients' power before and after persuasion: A self-validation analysis. *Journal of Personality and Social Psychology, 93*, 1040-1053. doi: 10.1037/0022-3514.93.6.1040.

Fast, N. J., Gruenfeld, N. S., Sivanathan, N., & Galinsky, A. D. (2009). Illusory control A generative force behind power's far reaching effects. *Psychological Science, 20*, 502-508. doi: 10.1111/j.1467-9280.2009.02311.x.

Fishback, A., & Labroo, A. (2007). Be better of be merry: How mood affects self-control. *Journal of personality and social psychology*, 158-173.

Gailliot, M. T., & Baumeister, R. F. (2007). The physiology of willpower: Linking blood glucose to self-control. *Personality and Social Psychology Review, 11*, 303-327. doi: 10.1177/1088868307303030.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. (2010). Ego depletion and the strength model of self-control: a meta-analysis. *Psychological Bulletin, 136*, 495-525. doi: 10.1037/a0019486.

Bargh, J. A., & Kirsch, I. (1999). The unbearable automaticity of being. *American Psychologist, 54*, 462-479.

Briñol, P., Petty, R. E., Valle, C., Rucker, D. D., & Becerra, A. (2007). The effects of message recipients' power before and after persuasion: A self-validation analysis. *Journal of Personality and Social Psychology, 93*, 1040-1053. doi: 10.1037/0022-3514.93.6.1040.

Fast, N. J., Gruenfeld, N. S., Sivanathan, N., & Galinsky, A. D. (2009). Illusory control A generative force behind power's far reaching effects. *Psychological Science, 20*, 502-508. doi: 10.1111/j.1467-9280.2009.02311.x.

Fishback, A., & Labroo, A. (2007). Be better of be merry: How mood affects self-control. *Journal of personality and social psychology*, 158-173.

Gailliot, M. T., & Baumeister, R. F. (2007). The physiology of willpower: Linking blood glucose to self-control. *Personality and Social Psychology Review, 11*, 303-327. doi: 10.1177/1088868307303030.

Galliot, M. T., Baumeister, R. T., Dewall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., . . . Schmeichel, B. J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology, 92*, 325-336. doi: 10.1037/0022-3514.92.2.325.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. (2010). Ego depletion and the strength model of self-control: a meta-analysis. *Psychological Bulletin, 136*, 495-525. doi: 10.1037/a0019486.

Hargreaves, M., Costill, D. L., Coggan, A., Fink, W. J., & Nishibata, I. (1984). Effect of carboydrate feeding on muscle glycogen utilization and exercise performance. *Medicine and science in sports and exercise*, 219-222.

Hung, I. W., & Labroo, A. A. (2011). From firm muscles to firm willpower: Understanding the role of embodied cognition in slef-regulation. *Journal of Consumer Research, 37,* doi: 10.1086/657240.

James, W. (1890). *The principles of psychology (vol. 1).* New York, NY: Holt.

Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego depletion—Is it all in your head? Implicit theories about willpower affect self-regulation. *Psychological Science,* 1-8 doi: 10.1177/0956797610384745.

Kruglanski, A. W., Webster, D. M., & Klem, A. (1993). Motivated resistance and openness to persuasion in the presence or absence of prior information. *Journal of Personality and Social Psychology, 65*, 861-876. doi: 10.1037/0022-3514.65.5.861.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by.* Chicago: University of Chicago Press.

Landau, M. J., Keefer, L. A., & Rothschild, Z. A. (2014). Epistemic motives moderate the effect of metaphoric framing on attitudes. *Journal of Experimental Social Psychology, 53*, 125-138.

Landau, M. J., Sullivan, D., & Greenberg, J. (2009). Evidence that self-relevant motives and metaphoric framing interact to influence political and social attitudes. *Psychological Science 20*, 1421-1427 doi: 10.1111/j.1467-9280.2009.02462.x.

Laundau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin, 136,* 1045-1067. doi: 10.1037/a0020970.

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126,* 247-259. doi: 10.1037/0033-2909.126.2.247.

Muraven, M., Baumeister, R. F., & Tice, D. M. (1999). Longitudinal improvement of self-regulation through tractice: Building self-control strength through repeated exercise. *The Journal of Social Psychology, 139,* 446-457 doi: 10.1080/00224549909598404.

Muraven, M., Shmueli, D., & Burkley, E. (2006). Conserving self-control strength. *Journal of Personality and Social Psychology 91,* 524-537. doi: 10.1037/0022-3514.91.3.524.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion paters. *Journal of Personality and Social Psychology 74,* 774-789 doi 10.1037/0022-3514.74.3.774.

Neuberg, S. L., & Newsom, J. T. (1993). Personal need for structure: Individual differences in the the desire for simpler structure. *Journal of Personality and Social Psychology, 65,* 113-131. doi: 10.1037/0022-3514.65.1.113.

Neuberg, S. L., Judice, T. N., & West, S. G. (1997). What the Need for Closure Scale measures and what it does not: Toward differentiating among related epistemic motives. *Journal of Personality and Social Psychology, 72,* 1396-1412.

Oaten, M., & Cheng, K. (2006). Longitudinal gains in self-regulation from regular physical exercise. *British Journal of Health Psychology, 11*, 717-733. doi: 10.1348/135910706X96481.

Ottati, V., Rhodes, S., & Graesser, A. C. (1999). The effect of metaphor on processing style in a persuasion task: A motivational resonance model. *Journal of Personality and Social Psychology,* 688-697.

Rothschild, Z. K., Landau, M. J., & Sullivan, D. (2011). By the numbers: Structure seeking individuals prefer quantitative over qualititaive representations of personal value to compensate for the threat of unclear performances contingencies. *Personality and social Psychology Bulletin, 37*(11), 1508-21. doi: 10.1177/0146167211415421.

Schmeichel, B. J., & Vohs, K. (2009). Self-affirmation and self control: Affirming core values counteracts ego depletion. *Journal of Personality and Social Psychology, 96*, 770-782. doi: 10.1037/a0014635.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271-324. doi: 10.1111/j.0022-3506.2004.00263.x.

Thompson, M. M., Naccarato, M. E., Parker, K. C., & Moskowitz, G. (2001). The Personal Need for Structure (PNS) and Personal Fear of Invalidity (PFI) scales: Historical perspectives, present applications and future directions. In G. Moskowitz, *Cognitive social psychology: The Princeton symposium on the legacy and future of social cognition* (pp. 19-39). Mahwah, NJ: Erlbaum.

Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology*, 379-384.

Vohs, K. D., Baumeister, R. F., & Schmeichel, B. J. (2013). Erratum to "Motivation, personal beliefs, and limited resources all contribute to. *Journal of Experimental Social Psychology, 48*, 943-947.

Williams, L. E., & Bargh, J. A. (2008). Experiencing phsycial warmth promotes interpersonal warmth. *Science, 322*, 606-607. doi: 10.1126/science.1162548.

APPENDICES

Appendix A

Consent form:
Project Title: Standardized Test Question Selection
Investigator: Thomas Hatvany & Dr. Ed Burkley
Purpose: The purpose of this study is to examine potential standardized test questions and determine if these questions are effective for future standardized tests.
Procedure: You will be asked to read and answer a few questions and then answer a series of questions regarding those questions.
Risks of participation: There are no known risks associated with this project that are greater than risks ordinarily encountered in daily life.
Benefits: There are no direct benefits to participants.
Confidentiality: You responses are completely confidential. The records of this research study are kept private. Any written results will discuss group findings and will not include information that will identify you. Research records will be stored securely in north Murray 018 for 5 years and only researchers and individuals responsible for research oversight will have access to the records.
Compensation: You will receive a total of 0.5 or half a unit of research credit for participation. Your credit will be awarded through the online Sona system and your instructor will receive a report by the end of the semester. Courses that participate in the online Sona system allow comparable credit to be obtained through participation in non-research related activities. Contact your instructor for a list of those activities.
Contacts: If you have any questions about this study you may contact Thomas Hatvany (Thomas.Hatvany@okstate.edu) or Dr. Ed Burkley at 744-6951 (ed.burkley@okstate.edu)
Participant rights: By signing below you are indicating that your participation today is voluntary; you are free to withdraw at any time. You are also free to skip any question or task that you do not feel comfortable completing. If you have questions about your rights as a research volunteer, you may contact the Oklahoma State University Institutional Review Board (IRB) Chair, Dr. Shelia Kennison at 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

I HAVE HAD THE OPPORTUNITY TO READ THIS CONSENT FORM AND I AM PREPARED TO PARTICIPATE IN THIS PROJECT. BY CHECKING THE BOX BELOW, YOU ARE GIVING CONSENT TO PARTICIPATE.

I consent: ☐ I do not consent: ☐
Participant signature: _____

Appendix B

MUSCLE CONDITION

What You Need to Know about Willpower

By Judith Carey

Many people believe they could improve their lives if only they had more of that mysterious thing called willpower. At its essence, willpower is the ability to exert self-control to resist short-term temptations in order to meet long-term goals. Therefore, when we pass on that dessert in order to stay healthy for the future, or skip buying that new television so we can save for a vacation, we are exercising our self-control muscle. However, willpower does not come easy. It requires strenuous exercise to force ourselves to stick with our diet or save for a rainy day.

However, what is this mysterious thing called self-control? Moreover, how does it work? In 1998, a researcher named Baumeister and his colleagues designed a clever experiment to answer these questions. In this study, hungry students arrived to the study and performed a task that either did or did not require them to flex their self-control muscles. Specifically, the hungry students were divided into one of two groups and then placed in a room that smelled of freshly baked chocolate chip cookies. In the room, they were seated at a table with two plates. On one plate were the gooey, just-baked cookies. On the other plate were some unappealing radishes. The first group received good news when they were told they would be randomly assigned to eat the cookies. However, the second group, the one that had to exercise their willpower, was told they would have to resist eating the cookies and instead forced to eat the radishes. Once the food was consumed, everyone then completed a second self-control exercise. The results were

immediate and undeniable. Those who worked out their willpower by eating radishes preformed far worse on the second self-control exercise than those who ate the cookies. In other words, those who had to resist the sweets and forced themselves to eat pungent vegetables could no longer find the strength to fully engage in another self-control exercise. Their self-control muscle was already worn out.

In the psychology world, the key finding of this seemingly silly study was a breakthrough. Willpower is not just a matter of wanting something bad enough. Instead, willpower is a resource that can be worked out to the point of exhaustion. Whenever we flex our self-control muscle, we use up a precious and limited resource. This means that once you exercise it or work it out, your self-control loses its strength, gets fatigued, and becomes ineffectual, at least in the short-term. However, there is good news too. Later studies showed that engaging in small self-control exercises each day, like sitting up straight, trying not to swear, or sticking to a financial budget, causes our self-control muscle to slowly grow and bulk up overtime, making our willpower even stronger.

CONTROL CONDITION

What You Need to Know about Willpower

By Judith Carey

Many people believe they could improve their lives if only they had more of that mysterious thing called willpower. At its essence, willpower is the ability to use self-control to resist short-term temptations in order to meet long-term goals. Therefore, when we pass on that dessert in order to stay healthy for the future, or skip buying that new television so we can save for a vacation, we are using our self-control. However, willpower does not come easy. It requires a great deal of energy to force ourselves to stick with our diet or save for a rainy day.

However, what is this mysterious thing called self-control? Moreover, how does it work? In 1998, researcher named Baumeister and his colleagues designed a clever experiment to answer these questions. In this study, hungry students arrived to the study and performed a task that either did or did not require them to use their self-control. Specifically, the hungry students were divided into one of two groups and then placed in a room that smelled of freshly baked chocolate chip cookies. In the room, they were seated at a table with two plates. On one plate were the gooey, just-baked cookies. On the other plate were some unappealing radishes. The first group received good news when they were told they would be randomly assigned to eat the cookies. However, the second group, the one that had to use their willpower, was told they would have to resist eating the cookies and instead had to eat the radishes. Once the food was consumed, everyone then completed a second self-control task. The results were immediate and undeniable. Those who used their willpower by eating radishes preformed far worse on the second self-control task than those who ate the cookies. In other words, those who had to resist the sweets and made themselves to eat pungent vegetables could no longer find the energy to fully engage in another self-control task. Their self-control was already used up.

In the psychology world, the key finding of this seemingly silly study was a breakthrough. Willpower is not just a matter of wanting something bad enough. Instead, willpower is a resource that can be used to the breaking point. Whenever we use our self-control, we use up a precious and limited resource. This means that once you use it, your self-control loses its energy, gets used up, and becomes ineffectual, at least in the short-term. However, there is good news too. Later studies showed that engaging in small self-control tasks each day, like sitting up straight, trying not to swear, or sticking to a financial budget, causes our self-control to slowly increase overtime, making our willpower even better.

Landau's modified "felt understanding" questions: (1 very little to 7 A great deal)

How much did this article help you learn about willpower?

How much did this article help you understand the nature of willpower?

How much did this article help you understand why willpower fails?

Reading comprehension check items:

1. How many groups were in this study?
   a) One
   b) Two
   c) Three

d) Four

2. In the study described in the article, participants in the self-control group had to eat what and resist what?
   e) Eat celery, resist radishes
   f) Eat chocolate, resist radishes
   g) Eat radishes, resist cookies
   h) Eat celery, resist chocolate

3. The researcher who conducted these studies was named
   a) Wegner, b) Gilbert, c) Clark, d) Baumeister

4. Resisting eating the cookies did what to the participants?
   a) Did nothing to the participants
   b) Reduced their self-control performance
   c) Made them hyper
   d) Trained them to eat radishes

Appendix C

Unscramble each set of letters to form a common English word. When you have finished, are tired, or decided that you have worked on them long enough, please notify the experimenter.

LTEUBLA _____

GROADI _____

LENPTAE _____

UOLDIBE _____

FSNAITE _____

OECARDE _____

TRAOTCR _____

MRBTHUE _____

Appendix D

PNS scale: (6-point rating, 1 = Strongly Disagree, 6 = Strongly Agree. Items 2, 5, 6, 11 are reverse scored)

Please read each statement in this instrument and select the response that best indicates the degree to which you personally agree or disagree with that statement.

1. It upsets me to go into a situation without knowing what I can expect from it.
2. I'm not bothered by things that interrupt my daily routine.
3. I enjoy being spontaneous.
4. I find that a well-ordered life with regular hours makes my life a tedious.
5. I find that a consistent routine enables me to enjoy life more.
6. I enjoy having a clear and structured mode of life.
7. I like to have a place for everything and everything in its place.
8. I don't like situations that are uncertain.
9. I hate to change my plans at the last minute.
10. I hate to be with people who are unpredictable.
11. I enjoy the exhilaration of being in unpredictable situations.
12. I become uncomfortable when the rules in a situation are not clear.

(Thompson, Naccarato, Parker, & Moskowitz, 2001)

The Self Control Scale (measure of trait self-control):
(Items with an (R) are reverse coded.)

1. I am good at resisting temptation
2. I have a hard time breaking bad habits (R)
3. I am lazy (R)
4. I say inappropriate things (R)
5. I do certain things that are bad for me, if they are fun (R)
6. I wish I had more self-discipline (R)
7. People would say that I have iron self- discipline
8. Pleasure and fun sometimes keep me from getting work done (R)
9. I have trouble concentrating (R)
10. I am able to work effectively toward long-term goals
11. Sometimes I can't stop myself from doing something, even if I know it is wrong (R)
12. I often act without thinking through all the alternatives (R)

(Tangney et al. 2004)

Need For (cognitive) closure scale:

Read each of the following statements and decide how much you agree with each according to your beliefs and experiences. Please respond according to the following scale.

1. I think that having clear rules and order at work is essential for success.
2. Even after I've made up my mind about something, I am always eager to consider a different opinion.
3. I don't like situations that are uncertain.
4. I dislike questions, which could be answered in many different ways.
5. I like to have friends who are unpredictable.
6. I find that a well ordered life with regular hours suits my temperament.
7. I enjoy the uncertainty of going into a new situation without knowing what might happen.
8. When dining out, I like to go to places where I have been before so that I know what to expect.
9. I feel uncomfortable when I don't understand the reason why an event occurred in my life.
10. I feel irritated when one person disagrees with what everyone else in a group believes.
11. I hate to change my plans at the last minute.
12. I would describe myself as indecisive.
13. When I go shopping, I have difficulty deciding exactly what it is I want.
14. When faced with a problem I usually see the one best solution very quickly
15. When I am confused about an important issue, I feel very upset.
16. I tend to put off making important decisions until the last possible moment.
17. I usually make important decisions quickly and confidently.
18. I have never been late for an appointment or work.
19. I think it is fun to change my plans at the last moment.
20. My personal space is usually messy and disorganized.
21. In most social conflicts, I can easily see which side is right and which is wrong.
22. I have never known someone I did not like.
23. I tend to struggle with most decisions.
24. I believe orderliness and organization are among the most important characteristics of a good student.
25. When considering most conflict situations, I can usually see how both sides could be right.
26. I don't like to be with people who are capable of unexpected actions.
27. I prefer to socialize with familiar friends because I know what to expect from them.
28. I think that I would learn best in a class that lacks clearly stated objectives and requirements.
29. When thinking about a problem, I consider as many different opinions on the issue as possible.
30. I don't like to go into a situation without knowing what I can expect from it.
31. I like to know what people are thinking all the time.

32. I dislike it when a person's statement could mean many different things.
33. It's annoying to listen to someone who cannot seem to make up his or her mind.
34. I find that establishing a consistent routine enables me to enjoy life more.
35. I enjoy having a clear and structured mode of life.
36. I prefer interacting with people whose opinions are very different from my own.
37. I like to have a plan for everything and a place for everything.
38. I feel uncomfortable when someone's meaning or intention is unclear to me.
39. I believe that one should never engage in leisure activities.
40. When trying to solve a problem I often see so many possible options that it's confusing.
41. I always see many possible solutions to problems I face.
42. I'd rather know bad news than stay in a state of uncertainty.
43. I feel that there is no such thing as an honest mistake.
44. I do not usually consult many different options before forming my own view.
45. I dislike unpredictable situations.
46. I have never hurt another person's feelings.
47. I dislike the routine aspects of my work (studies).

Scoring:
1. Reverse-score items 2, 5, 7, 12, 13, 16, 19, 20, 23, 25, 28, 29, 36, 40, 41, and 47.
2. Sum items 18, 22, 39, 43, and 46 to form a lie score.
3. Remove the subject if the lie score is greater than 15.
4. Sum all items except for the above listed lie items to calculate the need for closure score.
5. Use the top and bottom quartiles to determine high and low need for closure subjects.
6. If factors are required, use the following scoring system:
    Order: 1, 6, 11, 20, 24, 28, 34, 35, 37, 47
    Predictability: 5, 7, 8, 19, 26, 27, 30, 45
    Decisiveness: 12, 13, 14, 16, 17, 23, 40
    Ambiguity: 3, 9, 15, 21, 31, 32, 33, 38, 42
    Closed Mindedness: 2, 4, 10, 25, 29, 36, 41, 44

(Kruglanski, Webster, & Klem, 1993)

Appendix E

Follow-up questions:

Have you read any articles or essays similar to the ones you have read before (yes or no?) If yes, how were the previous writings similar?

Have you seen the anagrams presented to you before? (yes or no?)

At any point, did you suspect that the anagrams were unsolvable? (yes or no?)

Do you feel that you answered all of the questions in this study truthfully and to the best of your ability? (yes or no?)

Demographics:

What is your current age in years: ____?

Which Gender do you identify with?
Male
Female

What race(s) do you identify with? (check all that apply)
Caucasian
African-American
Native-American
Asian-American
Latino
Other: _____

Appendix F

Debriefing form:

Thank you for participating in this study. The purpose of this study was to assess the effect of priming a metaphor on subsequent self-control tasks.

In this study, you were asked read and answer questions about one of two essays. You then were asked to solve a series of anagrams. These anagrams were actually unsolvable and the length of time you persisted on these anagrams was used to determine self-control strength. The researchers predicted that reading an essay that primes certain metaphors would change how participants perform on the self-control task. Your response will help to determine if this prediction is correct.

If you are interested in this research and wish to learn more about it and other related research please contact Thomas Hatvany (thomas.hatvany@okstate.edu) or Dr. Ed Burkley (ed.burkley@okstate.edu). They will be happy to discuss this and any related projects with you.

If you have questions about your rights as a research volunteer, you may contact the Oklahoma State University Institutional Review Board (IRB) Chair, Dr. Shelia Kennison at 219 Cordell North, Stillwater, OK 74078, 405-744-3377, or irb@okstate.edu

Thank you again for your participation in this study!

VITA

Thomas C. Hatvany

Candidate for the Degree of

Master of Science

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Major Field: EXPERIMENTAL PSYCHOLOGY

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Completed the requirements for the Master of Science in Experimental Psychology at Oklahoma State University, Stillwater, Oklahoma in July, 2015

Completed the requirements for the Bachelor of Arts in Psychology at Green Mountain College, Poutlney, Vermont in 2013.

Completed the requirements for the Bachelor of Science in Youth Development and Camp Management at Green Mountain College, Poutlney, Vermont in 2013.

Experience:

Peer-Reviewed Journal Articles:

Burkley, E., Curtis, J., Burkley, M., & **Hatvany, T.** (2015). Goal Fusion: The Integration of Goals Within the Self-Concept. *Self and Identity 14*(3), 348-368. doi:10.1080/15298868.2014.1000959.

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