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# The Use of Cognitive Interventions in Reducing the Effects of Ego-Depletion

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**Abstract:**
Acts of self-regulation, the controlling of behavior to obtain long-term goals, deplete a common mental resource that reduces the capacity for further self-regulation, this depletion is known as ego-depletion (Baumeister, 2014; Fischer, Kastenmüller, & Asal, 2012; Hagger, Wood, Stiff, & Chatzisarantis, 2010; Vohs et al., 2008). The effects of ego-depletion are linked to increases in risk-taking, subjective fatigue, and failure to resist temptation, which impede progress towards accomplishment of any long-term, self-regulatory goal. The mental processes of self-regulation and general cognitive function are intrinsically connected as they both deplete the same mental resource and induce ego-depletion. Magnetic resonance imaging (MRI) has shown that both these mental processes occur in the prefrontal cortex of the brain, implicating these as interconnected mental activities (Hare, Camerer, & Rangel, 2009; Harris, Hare, & Rangel, 2009; Hedgcock et al., 2012). This review investigates the underlying principles of cognitive interventions that successfully reduce the effects of ego-depletion by analyzing strategies that either shift attention away from self-regulation tasks or prime individuals to increase performance, despite a state of ego-depletion.

On an average day, people make decisions that range from instantaneous easy choices to elaborate, consequential, and potentially life-changing decisions. Conflict arises when a person's automatic desires do not align with goals he or she has made. In such instances, a person utilizes willpower or self-regulation, the ability to exert control over automatic, impulsive desires or behaviors and replace them with behaviors associated with achieving long-term goals or standards (Baumeister, 2014; Fischer, Kastenmüller, & Asal, 2012; Hagger, Wood, Stiff, & Chatzisarantis, 2010; Vohs et al., 2008). Self-regulation has been conceptualized by psychologists to occur in two-stages; conflict-identification and behavior implementation (Alberts et al., 2007; Alberts et al., 2008). A person first identifies the difference between immediate desire, resulting impulsive behavior and a more positive (but long-term) goal, then implements behaviors that either correspond to the immediate desire or the long-term goal (Hedgcock, Vohs, & Rao, 2012; Hoffman, Baumeister, Förster, & Vohs, 2012). Self-regulation is thus a cognitive process that involves deliberation between different enticing behaviors that have either immediate or long-term benefits.

Studies on the neurological components behind self-

regulation, where subjects engaged in activities requiring self-regulation, found that brain activity increased in the rostral middle frontal gyrus (rMFG), dorsolateral prefrontal cortex (dlPFC), and ventromedial prefrontal cortex (vmPFC) ( Hare, Camerer, & Rangel, 2009; Harris, Hare, & Rangel, 2009; Hedgcock et al., 2012). All three of these areas in the brain occupy the same general region of the prefrontal cortex, an area associated with planning complex cognitive behavior. This commonality of location amongst brain regions helps explain the relationship between goal-making, goal-keeping, and self-regulation in decision making. Self-regulation as a mental process is a necessary component of goal-keeping, especially when an individual is tempted with options counter-productive to his or her planned goals. The importance of self-regulation increases considering the potential negative effects an individual may face should he or she fail to accomplish important goals. Unfortunately while self-regulation is important it is not inexhaustible.

The act of exercising self-regulation consumes a limited mental resource impairing subsequent self-regulatory activity in a phenomenon known as ego-depletion (Baumeister, 2014; Hagger et al., 2010; Vohs et al., 2008). The term ego-

depletion references the Freudian concept of the ego, a person's ability to mediate between short-term carnal desires and long-term morally responsible goals. This phenomenon poses a problem for any individual whose long-term goals might often conflict with everyday temptations or short-term immediately gratifying behaviors (e.g., those struggling with addictions). Some external factors, such as the presence of others, personality traits, and alcohol intake, affect the success of self-regulation in inhibiting the immediate gratification of automatic desires (Hoffman et al., 2012). Ego-depletion typically occurs after repeated self-regulatory activity, regardless of social context (Hoffman et al., 2012). Additionally, physical and mental fatigue are both associated with ego-depletion, as experienced by people who continually exercise self-regulation (Hagger et al., 2010; Vohs et al., 2008).

It is unknown if fatigue is the result of ego-depletion or a mediator of its effects, but the effect of ego-depletion on subsequent self-regulatory activity is always negative. This negative effect poses a problem for individuals in physically or mentally demanding professions, such as health care, that expend self-regulation resources (Hagger et al., 2010). Mental fatigue implicates a connection between the phenomenon of

ego-depletion and cognitive function (Hagger et al., 2010). There are many factors that influence the rate at which an individual experiences the lowered capacity to exercise self-regulation, or ego-depletion, but all of them share a reliance upon cognitive activity. An investigation of the underlying neurophysiological components at work during the processes of self-regulation and other cognitive activities is necessary to understand the relationship between these processes.

Given that magnetic resonance imaging (MRI) literature on the subject of self-regulation has found a positive correlation between self-regulation and activity in the prefrontal cortex, a connection between self-regulation and cognitive function in relation to decision making is logical to assume (Hare et al., 2009; Harris et al., 2009; Hedgcock et al., 2012). Cognitive function is evident in the mediating influence that the presence of others has on the effect of self-regulation, on the inhibition of behavior, and in ego-depletion experienced by individuals after making many choices (Hoffman et al., 2012; Vohs et al., 2008). Activities that restore or aid an individual's ability to effectively make use of cognitive function are likely useful in restoring self-regulatory power as well (Alberts et al., 2007; Barber & Munz, 2011). Ego-depleted individuals often do

not have a problem recognizing the conflict between short-term gratification and long-term goals, but suffer from a reduced capacity to implement self-regulatory behavior and have been found to benefit from sufficient consistent sleep, which restores this cognitive capacity (Barber & Munz, 2011; Hedgcock et al., 2012). Additionally, cognitive activity can lead to ego-depletion, such as in individuals tasked with mentally reenacting the accounts of others who engaged in self-regulatory behavior (Ackerman, Goldstein, Shapiro, & Bargh, 2009). Even when individuals were only tasked with reading accounts of others engaged in self-regulatory behavior, they experienced a boost in self-regulatory performance (Ackerman et al., 2009). Just as cognitive function draws from the same common resource as self-regulation, strategies that rely on cognitive function also decrease the effects of ego-depletion.

Although psychologically restoring activities such as sleep, good diet, and the support of others restore self-regulatory power, they cannot immediately decrease the effects of ego-depletion (Barber & Munz, 2011). The use of cognitive interventions such as attentional shifting, priming oneself with inspirational accounts of self–control, and the activation of persistence reduce ego–depletion and improve

self–regulation. This literature review discusses the negative effects of ego-depletion, the connection between self-regulation, ego-depletion, and cognitive function, and the cognitive interventions that reduce ego-depletion and its effects. The use of cognitive intervention to reduce ego-depletion may aid individuals in accomplishing long-term goals more effectively and better help them resist daily, tempting, but negative short-term alternatives.

## The Negative Effects of Ego-depletion

It is useful to review the phenomenon of ego-depletion within the context of the strength model of self-regulation and the specific mechanisms behind its occurrence before examining its negative effects. Ego-depletion is an impaired state that an individual may enter when the ability to inhibit or regulate behavior is compromised due to prior inhibition or exercise of self-regulation (Baumeister, 2014; Hagger et al., 2010). The key theoretical tenet that has been reviewed in the literature to explain the occurrence of this phenomenon is that ego-depletion reflects the expenditure of a common resource that the mind draws upon to fuel self-regulation (Baumeister, 2014; Hagger et al., 2010). An analogy comparing this process to drawing water from a well to irrigate crops proves useful:

the more water drawn from the well (prior self-regulation), the less water that will remain for future crop use (ego-depletion), ultimately leading to withered produce (negative outcomes).

In examining the factors that contribute to the occurrence of ego-depletion, it was found that the duration of prior self-regulation does not influence the magnitude of resulting ego-depletion (Baumeister, 2014; Hagger et al., 2010; Hofmann et al., 2012). The strength of the desire behind impulsive immediately gratifying behaviors determined whether ego-depleted individuals would exercise subsequent self-regulation or not (Baumeister, 2014; Hagger et al., 2010; Hofmann et al., 2012). Additionally, the occurrence of ego-depletion depends on the fulfillment of general rather than specific criteria as evidenced by individuals experiencing similar ego-depletion effects after performing different tasks such as mentally reenacting an example of self-regulation or holding up a weight for as long as possible (Ackerman et al., 2009; Alberts et al., 2008). The type of self-regulatory task does not matter in eliciting ego-depletion, and other types of tasks, such as making choices, have also been shown to produce the state of ego-depletion in individuals (Baumeister, 2014; Hagger et al., 2010; Vohs et al. 2008). Just as ego-depletion

is a generalizable phenomenon, the negative outcomes of ego-depletion can manifest themselves in diverse areas of an individual's life.

When an individual enters a state of ego-depletion, he or she becomes subjectively fatigued as a result of the depletion of a common energy resource, which then impairs future decision-making as well as self-regulation (Baumeister, 2014; Hagger et al., 2010; Vohs et al. 2008). This impairment of decision making ability, combined with a lowered capacity for self-control, explains the high positive correlation between ego-depletion and engagement in risky behaviors (Fischer et al., 2012; Vohs et al. 2008). Risky behavior is best defined as "unnecessary" risks or behaviors that provide pleasure in the immediate future but ultimately has long-term consequences, examples of which include taking harming recreational drugs, responding violently when provoked, and engaging in inappropriate sexual activity (Baumeister, 2014; Fischer et al., 2012; Hagger et al., 2010). In a study by Hoffman et al. (2012), several traits and situational factors were identified that negatively impacted an individual's ability to self-regulate, alcohol consumption being one of them (see Appendix A). Consumption of alcohol might not only be a situational factor

that reduces an individual's ability to self-regulate, but might also occur as a risky behavior engaged in as a result of prior ego-depletion (Fischer et al., 2012; Hoffman et al., 2012). A repetitive cycle is thus formed, where an ego-depleted individual is more likely to engage in risky behavior, such as irresponsible alcohol consumption, which then further impairs the ability to exercise self-regulation, leading to more risky behaviors and self-endangerment.

The dangers of ego-depletion are apparent and present a serious obstacle to any individual who relies on the ability to exercise self-regulation to accomplish long-term goals. The absence of self-regulation in an individual would lead to a life whose goal would be to satisfy any and all immediate desires that would arise, much like the way Freud conceptualized an individual motivated entirely by the id component of their ego (Hagger et al., 2010). Although ego-depletion does not represent a complete absence of self-regulatory power, it is closer to that extreme of the spectrum than to complete self-control (Baumeister, 2014; Hagger et al., 2010; Fischer et al., 2012). To better understand how the negative outcomes of ego-depletion may be reduced, a review of the mental and neurological components of the self-regulation process is

needed.

## Self-regulation, Ego-depletion, and Cognitive Function: An Interplay

Self-regulation and accompanying ego-depletion do not occur in isolation from other mental processes in the brain of an individual. Just as many parts of the brain are interconnected and work in unison as an individual carries out mental tasks, self-regulation is also an integrated process. A growing body of MRI literature relating to self-regulation has found that during self-control activities, areas of the prefrontal cortex activate, indicating a strong connection between self-regulatory behaviors and cognitive function (Hare et al., 2009; Harris et al., 2009; Hedgcock et al., 2012). Specifically, self-regulation seems to involve two distinct but connected processes. The first process involves the vmPFC where different factors, such as health and taste in food options, are given relative importance (Hare et al., 2009). The second process involves the dlPFC where the encoded weight of importance of the different factors underlying a self-regulatory choice, such as whether health is more important than taste in food options, are modified (Harris et al., 2009). Thus, when confronted with a choice between a tasty but fattening snack, and a healthy but

less-satisfying food option, the value of each factor would be computed in the vmPFC of an individual. If the goal of this individual is to lose weight, then the earlier values of the two food options are modified by the dlPFC to reflect the long-term dieting goal of the individual, enabling self-regulatory function (Hare et al., 2009). Without value modulation by the dlPFC, self-regulation would be impossible and ego-depletion may be a reflection of reduced cognitive capacity as well as self-regulatory capacity (Hare et al., 2009; Harris et al., 2009). Self-regulation is heavily connected to these cognitive factors of planning, making value judgments, and executive function.

Another connection between self-regulation, ego-depletion, and cognition is seen in processes that both restore and strain cognitive function. Barber and Munz (2011) found that psychological strain decreased and self-regulatory performance increased when individuals had sufficient, consistent sleep during a week. Psychological strain, as measured in this study, was operationalized as a reflection of an individual's own "psychological appraisal of self-regulatory depletion" (Barber & Munz, 2011, p.318). Given the self-report nature of this measure of strain, individuals are cognitively aware of when their self-regulatory capacity is depleted and

when it is restored after sufficent, consistent sleep. Additionally, increases in self-regulatory strength predicted decreases in psychological strain, which is not only a direct result of the restorative effects of sleep, but may also reflect the relief an individual may feel upon recognition of an increase in cognitive function as a means to cope with strain (Barber & Munz, 2011). While recognition of the role cognitive function plays in self-regulation may affect self-regulatory performance, other cognitive processes, such as mental simulation and contemplation of future events, certainly do have an effect.

Ego-depletion, according to the strength model of self-regulation, is usually a product of prior self-regulation, but similar reductions in self-regulatory behavior were observed in individuals tasked with prior decision-making (Baumeister, 2014; Hagger et al., 2010; Vohs et al., 2008). In three separate studies, cognitive processes, such as taking the perspective of another, making choices, and considering future choices decreased subsequent self-regulatory performance (Ackermen et al., 2009; Khan & Dhar, 2007; Vohs et al., 2008). Such findings illustrate that cognitive function must draw from the same resource as self-regulation, which is not a surprise given both mental processes occur in approximately the same region

of the brain. Additionally, the level of separation between an individual and the cognitive task involved–such as whether an individual was required to take the perspective of another individual exercising self-regulation or contemplated self-regulatory choices to be made in the future–was not a factor of whether ego-depletion occurred or not (Ackerman et al., 2009; Khan & Dhar, 2007).

**Cognitive Interventions that Reduce Ego-depletion**

Because self-regulation and cognitive function are intrinsically connected mental processes, they draw from the same mental resource to produce ego-depletion. Strategies reliant on cognitive intervention reduce the effects of ego-depletion. Generally, these strategies of cognitive intervention can be categorized into two distinct groups. The first group of strategies rely on shifting attention away from the task of self-regulation in ego-depleted individuals (Alberts et al., 2008; Hedgcock et al., 2012). The second group involves strategies that, instead of shifting attention away from a self-regulatory task, prime or inspire individuals to increase performance despite a state of ego-depletion (Ackerman et al., 2009; Alberts et al., 2007; Martijn et al., 2007; Schmeichel & Vohs, 2009). Although categorized into two groups, both share the same

principle that in order to stabilize self-regulatory performance in an ego-depleted state, individuals need to utilize cognitive function to change or refocus their perception of the self-regulatory task to be completed (Alberts et al., 2007; Alberts et al., 2008; Hedgcock et al., 2012; Martijn et al., 2007; Schmeichel & Vohs, 2009). The underlying principle behind these cognitive interventions is that an individual uses cognitive function proactively to either avoid or decrease the effects of ego-depletion.

The first strategy group involves distracting one's attention from a self-regulatory task to focusing it on something else. The distractor can be unrelated to the self-regulatory task or associated with, but still distinct and separate from, the task, such as remembering that failure to perform a self-regulatory task will result in monetary loss (Alberts et al., 2008; Hedgcock et al., 2012). If the distractor is associated with the self-regulatory task—but not separate or distinct, then self-regulatory performance will not be stabilized in a state of ego-depletion (Alberts et al., 2008). For example, this could be seen in a dieter choosing to focus on how tasty a fattening snack is instead of their goal to eat healthier foods. The properties of the fatty snack are associated with the goal of eating healthier

foods, but it is not distinct enough from this mental concept to improve self-regulatory performance and may actually be a decrement to performance. A better distractor would be to focus on something unrelated to the goals of the diet such as a calculation task (Alberts et al., 2008).

The second strategy group uses external examples of self-regulatory performances to enhance an individual's own performance in an ego-depleted state. Although external examples are used and may shift attention, the goal of this strategy is not to distract an individual's attention from a self-regulatory task. The principle in action is goal contagion, the assimilation of the goal of self-regulation from an external example by an individual (Ackerman et al., 2009; Martijn et al., 2007). Inspirational accounts of self-regulation improve self-regulatory performance regardless of whether an individual was induced to enter a state of ego-depletion or not (Ackerman et al., 2009; Martijn et al., 2007). However, the opposite effect was observed when non-depleted individuals were either tasked with taking the perspective of an individual who exercised self-regulation or to read examples of self-regulation considered to be extreme examples (Ackerman et al., 2009; Martijn et al., 2007). Such evidence suggests that this strategy is most effective

when an individual is already in a state of ego-depletion and can easily relate to the external example of self-regulation without having to mentally simulate the perspective of the individual in the external example.

While the prior focus in the second strategy group revolved around using external examples of inspirational self-regulation to improve self-regulatory behavior, a similar boost in performance is seen when individuals are primed to activate internal, automatic sources of self-regulation enhancing traits. When individuals were primed with the personality trait persistence, self-regulatory performance was enhanced and expected ego-depletion effects from prior self-regulation were not observed (Alberts et al., 2007). Similar increases in performance were reported in individuals that were induced to reaffirm the personality traits that they believed themselves to possess (Schmeichel & Vohs, 2009). The common principle in effect is a reaffirmation of positive qualities individuals either desire to have or believe to already possess, which enhance self-regulation in a state of ego-depletion (Alberts et al., 2007; Schmeichel & Vohs, 2009). However, like previous strategies, the opposite effect was observed in non-depleted individuals that were primed with self-affirmation, indicating the presence

of ego-depletion is a criterion for the success of this strategy (Ackerman et al., 2009; Martijn et al., 2007; Schmeichel & Vohs, 2009). The relative ease of inducing positive self-appraisal raises implications for the application of this strategy in an individual's daily life.

## Implications

Effective strategies based on the principles behind these cognitive interventions are not dependent on an individual's capacity for self-regulation, but rather his or her willingness to use cognitive function to circumvent the effects of ego-depletion. Many common self-regulation goals, such as dieting, quitting smoking, or improving academic performance, would benefit from the use of easy to implement cognitive interventions. For example, when confronted with the temptation to leave the gym early due to the difficulty of exercises being performed, an individual can shift their attention from the exercises by mentally simulating or physically singing a favorite song. A skier intent on mastering a new technique at the end of a long day of skiing may reflect on how someone else in his or her situation accomplished the same goal. Alcoholics reminded throughout the day of the desire to drink could take a moment to read encouraging

remarks made about traits others have observed in them, such as persistence, taken from meetings in support groups such as Alcoholics Anonymous as a means of inspiration to not give in to the desire to drink. The applications are numerous and may require adherence to the guiding principles of these cognitive interventions and creativity on the part of the individual. However, despite the benefits of using these cognitive interventions, traditional means of mental intervention, such as therapy and the support of loved ones, are still recommended for individuals who seek enduring changes in behavior.

## Conclusion

Ego-depletion, as a result of prior self-regulation or cognitive function, is a severe impediment to the long-term goals of any individual who desires to change behavior or improve quality of life (Baumeister, 2014; Fischer et al., 2012; Hagger et al., 2010; Vohs et al. 2008). The reduced capacity to resist temptation and immediate gratification is a result of diminished resources needed for any subsequent self-regulation (Baumeister, 2014; Hagger et al., 2010). However, just as self-regulation and cognitive function are connected and rely on the same mental resource, interventions based in cognitive function reduce the effects of ego-depletion and improve self-

regulatory performance (Ackerman et al., 2009; Alberts et al., 2007; Alberts et al., 2008; Hedgcock et al., 2012; Martijn et al., 2007; Schmeichel & Vohs, 2009). Cognitive interventions are most effective in ego-depleted individuals when they either shift attention away from a self-regulatory task or prime or inspire an individual to persist in self-regulatory behavior (Ackerman et al., 2009; Alberts et al., 2007; Alberts et al., 2008; Hedgcock et al., 2012; Martijn et al., 2007; Schmeichel & Vohs, 2009). Priming an individual involves the use of external accounts of successful self-regulation or inducing an individual to reaffirm the positive traits he or she believes to already possess (Ackerman et al., 2009; Martijn et al., 2007; Schmeichel & Vohs, 2009). Thus, the effects of ego-depletion can be overcome through effective use of cognitive interventions which require persistent adherence to these guiding principles and creativity in tailoring an approach by any individual to reach important life goals and resist temptation.

## References

Ackerman, J. M., Goldstein, N. J., Shapiro, J. R., & Bargh, J. A. (2009). You wear me out: The vicarious depletion of self–control. Psychological Science, 20(3), 326–332.

Alberts, H. J. E. M., Martijn, C., Greb, J., Merckelbach, H., & de Vries, N. K. (2007). Carrying on or giving in: The role of automatic processes in overcoming ego depletion. British Journal of Social Psychology, 46(2), 383–399.

Alberts, H. J. E. M., Martijn, C., Nievelstein, F., Jansen, A., & de Vries, N. K. (2008). Distracting the self: Shifting attention prevents ego depletion. Self and Identity, 7(3), 322–334.

Barber, L. K., & Munz, D. C. (2011). Consistent–sufficient sleep predicts improvements in self–regulatory performance and psychological strain. Stress and Health: Journal of the International Society for the Investigation of Stress, 27(4), 314–324.

Baumeister, R. F. (2014). Self-regulation, ego depletion, and inhibition. Neuropsychologia, 65313-319. doi:10.1016/j.neuropsychologia.2014.08.012

Fischer, P., Kastenmüller, A., & Asal, K. (2012). Ego depletion

increases risk–taking. The Journal of Social Psychology, 152(5), 623–638.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. D. (2010). Ego depletion and the strength model of self-control: A meta-analysis. Psychological Bulletin, 136(4), 495-525. doi:10.1037/a0019486

Hare, T. A., Camerer, C. F., & Rangel, A. (2009). Self–control in decision–making involves modulation of the vmPFC valuation system. Science, 324(5927), 646–648.

Harris, A., Hare, T., & Rangel, A. (2013). Temporally dissociable mechanisms of self–control: Early attentional filtering versus late value modulation. The Journal of Neuroscience, 33(48), 18917–18931.

Hedgcock, W. M., Vohs, K. D., & Rao, A. R. (2012). Reducing self–control depletion effects through enhanced sensitivity to implementation: Evidence from fMRI and behavioral studies. Journal of Consumer Psychology, 22(4), 486–495.

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: An experience sampling study of desire, conflict, and self-control. Journal of Personality and Social Psychology, 102(6), 1318-1335.

doi:10.1037/a0026545

Khan, U., & Dhar, R. (2007). Where there is a way, is there a will? the effect of future choices on self–control. Journal of Experimental Psychology: General, 136(2), 277–288.

Martijn, C., Alberts, H. J. E. M., Merckelbach, H., Havermans, R., Huijts, A., & De Vries, N. K. (2007). Overcoming ego–depletion: The influence of exemplar priming on self–control performance. European Journal of Social Psychology, 37(2), 231–238.

Schmeichel, B. J., & Vohs, K. (2009). Self–affirmation and self–control: Affirming core values counteracts ego depletion. Journal of Personality and Social Psychology, 96(4), 770–782.

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self–control: A limited–resource account of decision making, self–regulation, and active initiative. Journal of Personality and Social Psychology, 94(5), 883–898. doi:10.1037/0022–3514.94.5.883

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## Appendix A

### Summary of conceptual framework and entry points for the main personality traits, situational factors, and further variables

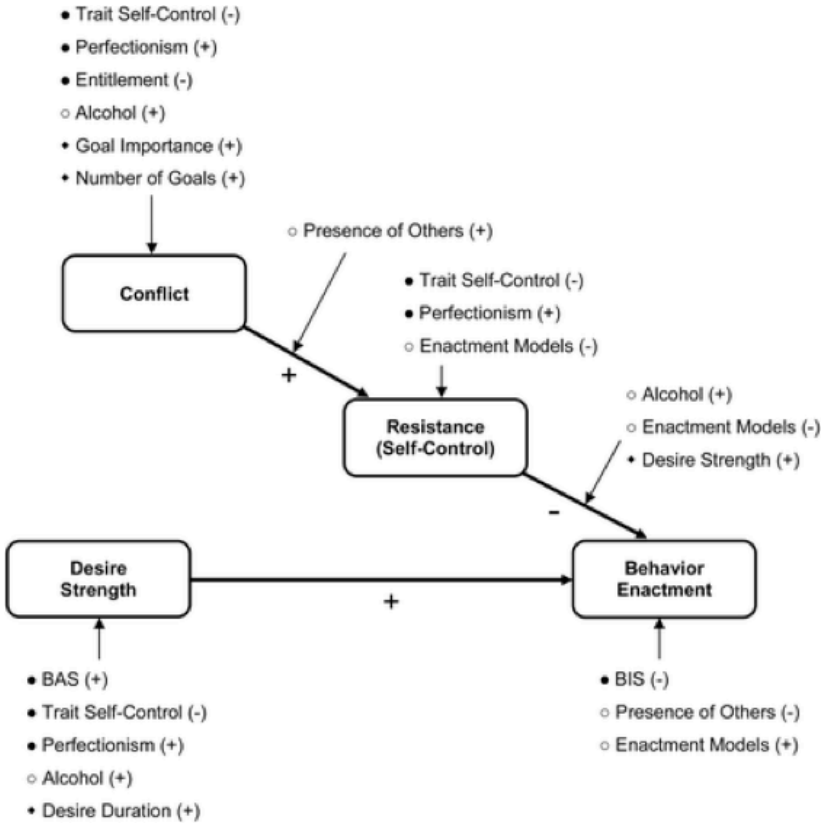


*Figure 1*. Summary of conceptual framework and entry points for the main personality traits (filled circles), situational factors (empty circles), and further variables (diamonds). Plus and minus signs indicate positive and negative relationships, respectively. Positive (+) moderator effects on the resistance-enactment pathway indicate that the strong negative relationship

between resistance and enactment becomes weaker (i.e., more positive) for high rather than low values on the moderator variable, whereas negative (–) moderator effects indicate that the negative relationship becomes stronger (i.e., more negative). BAS = behavioral activation system; BIS = behavioral inhibition system. Adapted from "Everyday temptations: An experience sampling study of desire, conflict, and self-control," by W. Hoffman, R. F. Baumeister, G. Förster, and K. D. Vohs, 2012, Journal of Personality and Social Psychology, 102(6), p. 1331. Copyright 2011 by the American Psychological Association.