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Self-Regulatory Resources Power the Reflective System: Evidence from Five Domains

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In this commentary, I focus on the deficiencies in the reflective-impulsive model (RIM) by Strack, Werth, and Deutsch (2006) in terms of understanding the mechanics of the reflective system. Strack et al. outlined the cognitive architecture of the consumer with the RIM but failed to specify how its most impressive feature, the reflective system, is powered. Drawing on the literature on self-regulation (as a reconceptualization of RIM incompatibility), I argue that self-regulatory resources drive the reflective system. Research from 5 domains—overeating among dieters, impulsive spending, logical thinking, making choices, and subjective perceptions of duration—supports this hypothesis.

Strack, Werth, and Deutsch (2006) argue that their reflective-impulsive model (RIM) can parsimoniously explain consumer irrationality, as exemplified by the existence of impulsive purchasing. The RIM builds on a wealth of research suggesting that two forces, which emanate from what Strack and colleagues term the *reflective system* and the *impulsive system*, determine behavior. Their model advances the field understanding of consumer behavior in multiple ways, not the least of which is by aiming to predict actual behavior, rather than behavioral intentions or other penultimate steps toward behavior. Although the RIM is generic and thus could be used to predict a range of human behavior, in some ways the model seems best suited for understanding the trials and tribulations of consumption. The fit between the RIM and consumer behaviors is especially strong because consumption is frequently self-regulated to better fit with personal, relational, or societal standards. In this way, the RIM moves the field further toward a comprehensive understanding of consumer impulses, self-control, and behavior.

Within this framework, the reflective system and the impulsive system operate in parallel as well as interact, and the usefulness of the RIM comes into focus in its depiction of this interaction. Operationally, schemata within each system must be activated above some threshold to influence behavior. Therefore, determining the level of activation in both systems is crucial to predict behavior. Strack et al. (2006) have provided a compelling depiction of the cognitive architecture of the consumer mind, but have failed to tell researchers what greases the wheels. Without an additional mechanistic component, it is difficult to anticipate under what conditions one or the other system will be have a greater influence on behavior.

The impulsive system contains schemata (urges, desires, impulses, etc.) that rest underneath threshold until pushed toward the threshold when stimulated by aspects of the environment (e.g., warm chocolate brownies). Inputs into the impulsive system, almost by definition, contain their own energy (the word *impulse* comes from the Latin *impulsus*, which means to impel). Conversely, the reflective system contains schemata that rest below activation level, waiting to be called into action by the plans, goals, and if-then rules of the reflective system (e.g., my diet does not allow chocolate brownies). Schemata in the reflective system, however, need a source of energy of their own to reach the threshold for activation. Due to their complex nature, these schemata are clunky, heavy, and hard to get started (but can be tremendously powerful once activated). It is at this point that self-regulatory resources come into play. Self-regulatory resources are the underlying energy system for the reflective system, as they push reflective system schemata above threshold when called up by self-guides, policies, and other rules.

Strack et al. (2006) list factors that enhance the activation of the impulsive system and reflective system; however, factors that promote impulsive system activation can be characterized as both motivational (e.g., homeostatic dysregulation spurs behavior to reach homeostasis) and ability-driven (e.g., the facilitation of schema activation on the basis of previous

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activation), whereas the factors listed by Strack et al. as determinants of reflective system performance are only motivational in nature (importance, justification). I argue that Strack et al. omitted a key ability factor—self-regulatory resources—as a primary determinant of reflective system efficacy.

In this analysis, I review research and theory in the domains of overeating, impulsive spending, decreased intelligent thought, decision fatigue, and changes in the subjective experience of time to support the idea that self-regulatory resources are the mechanism of the reflective system. If self-regulatory resources enable the reflective system to influence behavior, then low self-regulatory resource levels would disable reflective schema activation and hence the impulsive system will have a greater influence on behavior.

SELF-REGULATION AS REFLECTIVE-IMPULSIVE SYSTEM INCOMPATIBILITY

The reflective-impulsive model (RIM) ability to better predict consumer behavior is put to the test under conditions in which the reflective system and impulsive system are antagonistic. These conditions require restraints on impulses and the substitution of one response for a less desirable response. This process has been termed self-regulation (Hoch & Loewenstein, 1991; Vohs, Baumeister, & Tice, in press) and it nicely maps onto the concept of reflective system and impulsive system incompatibility as articulated by Strack et al. (2006).

Without the ability to engage the reflective system, the impulsive system would determine behavior in an animal-like fashion. Indeed, my colleagues and I have noted that the development from animals bound by stimulus-response patterns to more rational creatures is by virtue of humans' sophisticated executive functioning capacity (Vohs & Baumeister, 2004; Vohs & Schmeichel, 2003). In other words, one of the hallmarks of human functioning is the ability to engage in reflective, controlled behavior (Higgins, 1996).

Self-regulatory resources are conceptualized as resources that govern controlled and regulated (i.e., reflective) responses (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Vohs, Baumeister, & Ciarocco, 2005; Vohs & Heatherton, 2000). They represent a general supply of resources that are put to use in all circumstances in which one attempts to modify, alter, change, or otherwise regulate oneself. Because these resources can be reduced with use, they are therefore finite and precious. Moreover, a reduction in this supply of reflective energy (to use the parlance of the RIM) renders the person less capable of successfully self-regulating (i.e., engaging the reflective system past threshold) during an ensuing period. The resource depletion pattern can be described as a hangover effect, such that one act of self-regulation leads to poorer self-control subsequently. The results of almost 60 published studies confirm this limited-resource pattern (see Baumeister, Schmeichel, & Vohs, in press; Schmeichel & Baumeister, 2004; Vohs et al., in press). To support the hypothesis that self-regulatory resources are the drivers of the reflective system, one should see parallels in behavior resulting from decreased activation of the reflective system and behavior resulting from a loss of self-regulatory resources.

THE REFLECTIVE SYSTEM IS DRIVEN BY SELF-REGULATORY RESOURCES: EVIDENCE FROM FIVE DOMAINS

The evidence cited by Strack et al. (2006) as supportive of the reflective system importance falls neatly in line with evidence from the self-regulatory resource model. What follows is a review of self-regulatory resource depletion effects across five domains. It is argued that analogous patterns of effects between self-regulatory resource availability and reflective system activation represent strong evidence that self-regulatory resources drive the reflective system.

Impulsive Spending Results from a Loss of Self-Regulatory Resources

Strack and colleagues (2006) use impulsive spending as an illustration of consumer irrationality. From the perspective of the RIM, impulsive spending occurs when the impulsive system is more highly activated than the reflective system. In support of the notion that regulatory resource depletion underlies these patterns, Faber and I have demonstrated that impulsive spending results from a loss of self-regulatory resources (Vohs & Faber, in press). Depleting consumers of their self-regulatory resources by having them engage in attentional, emotional, or mental self-control resulted in subsequent increases in four indexes of impulsive spending tendencies. In one experiment, some participants were required to exert attentional control by focusing their gaze on the center of a screen while simultaneously ignoring distracting stimuli, whereas other participants were not required to control their attention. Those who had been regulating their attention later reported that they would spend more money on an array of high-end products, relative to participants who had not been regulating their attention. Two additional studies brought participants to a mock store and measured actual buying. In one study, participants were resource depleted through instructions to read aloud in a highly emotional manner text that was devoid of emotional content, whereas in another study participants were depleted by virtue of having to suppress unwanted thoughts. These participants, compared to participants who first engaged in tasks that did not require response modification, bought more products and spent more money in our mock stores. To illustrate that the effect is not specific to product type, one store contained bookstore-type

products, whereas the other contained grocery items. Moreover, participants who had used their self-regulatory resources reported stronger urges to buy impulsively, which suggests that the impulsive system was active but the reflective system was not.

Some consumers showed regulatory resource loss effects more strongly than others. People who reported general tendencies to spend impulsively bought significantly more than did participants who reported that they do not normally feel urges to buy impulsively. It is noteworthy that the latter group still spent significantly more if they had been drained of their self-regulatory resources than if their resources were fully intact. Again, these results show convergence between the reflective system within the RIM and the role of self-regulatory resources in facilitating reflectively driven behavior.

Overeating Among Dieters Results from a Loss of Self-Regulatory Resources

Overeating among people who are trying to lose weight is a fascinating, paradoxical, and all too common behavior (National Institutes of Health Technology Assessment Conference Panel, 1993). Why would overeating occur when the reflective system has strong reasons to maintain control over caloric intake? It may be that the food is proximal and available and these factors activate the impulsive system, as Strack and colleagues suggest. However, why wouldn't the reflective system exert its own energy to halt the impulsive system from leading to the undesired behavior of overeating? Heatherton and I (Vohs & Heatherton, 2000) demonstrated that when food is proximal and available to be eaten, dieters must exert self-regulatory resources not to indulge their urge to eat, which consequently depletes their ability to resist other impulses. Hence, overeating occurs among dieters who have been depleted in terms of self-regulatory strength and, by extension, who could not use their reflective system self-guides to guard against overeating.

In one study, participants whose dieting status was known before the experiment first watched a boring movie on the life of bighorn sheep. The room was arranged such that delicious candies and snack foods were placed either next to or across the room from the participant. The snacks were said to be available to eat ("help yourself") or off-limits ("please don't touch"), and we expected that this factor and the proximity factor would combine to significantly reduce self-regulatory resources in dieters but not in nondieters. Why? Because dieters, but not nondieters, need the engagement of the reflective system to stop themselves from acting on the inputs from the impulsive system that signal them to eat the candies and, according to this analysis, self-regulatory resources are the mechanism that engages the reflective system. After the movie, participants were asked to taste and rate ice cream as part of a perceptual experiment, and the amount of ice cream consumed was surreptitiously recorded. As expected, only dieters' ice cream eating was predicted by the proximity and availability of the snacks during the movie task. Dieters ate the most ice cream when they had been seated next to delicious candies and snacks that they knew to be available to eat. The eating behavior of nondieters occurred merely (and sensibly) as a function of their level of hunger.

Results from two additional experiments support the notion that overeating among dieters was the result of the reflective system being drained of its self-regulatory resources and did not result because inputs from the impulsive system to eat the food were overpowering. In these studies, we tested for cross-domain effects of resisting eating on other forms of self-regulation. In one study, dieters were either strongly tempted with snack foods that were placed within arm's reach or were weakly tempted by having the snack foods across the room. Later, dieters attempted to solve an impossible geometric-figures task as a measure of regulated (i.e., reflective) behavior. As expected, dieters who depleted their self-regulatory resources with an earlier engagement of the reflective system in the proximal food condition persisted less on the task than dieters who had not depleted self-regulatory resources because the food was located further away. A third study showed that an emotion-regulation task that involved suppressing sadness subsequently led to increased ice cream eating among dieters, relative to conditions in which dieters were similarly sad but had not been working to suppress those sad feelings. These two additional experiments demonstrate that activation of the reflective system was impaired by its earlier engagement in either fighting temptation or resisting sad feelings, which suggests that the reflective system had been robbed of some energy that otherwise would have been used to push behavior to be more reflective. Nondieters, conversely, do not exert self-regulatory resources (because they need not activate the reflective system to summon rules about eating) in the presence of food and therefore differences in food proximity do not have the same depleting effect on these individuals.

Impairments in Intelligent, Rational Thinking Result from a Loss of Self-Regulatory Resources

A core tenet of the RIM is that behavior driven by the reflective system is the result of reasoning. Translated into limited-resource terms, this tenet would mean that a reduction in self-regulatory resources, which power the reflective system, should severely impair reasoning, rational thought, and intelligent decision making. Work by Schmeichel, Baumeister, and Vohs (2003) shows this pattern. In three experiments, we found that an initial task that required self-regulation—and therefore that entailed draining the supply of self-regulatory resources—renders people less able to perform tasks that require rational thought and logical reasoning.

In one study, participants were first asked to perform a task that required either strict attention control or very little

attention control. Specifically, participants watched a video (without sound) of a woman being interviewed. While the video was playing, irrelevant words appeared at the bottom of the screen for a period of 30 sec each. Half of the participants were asked simply to watch the video (no attention control condition), whereas the other half were told to ignore the words at the bottom of the screen (attention-control condition). Then, all participants answered questions from the analytical section of the Graduate Record Examination. The results showed that even though the two groups of participants were exposed to the same stimuli, the task of regulating attention crippled participants' capacity for analytical reasoning. Indeed, being depleted of self-regulatory resources rendered participants both unmotivated and unintelligent, as we saw evidence both that fewer problems were attempted and that fewer problems were answered correctly given the number attempted, relative to participants who had full command of their regulatory resources.

A second experiment used as the manipulation of self-regulatory resources an emotional suppression task in the context of a sad and disgusting movie clip. Then, participants completed two tasks as measures of reasoning ability. In line with RIM assumptions about the distinction between the impulsive system and the reflective system, we envisioned that only during tasks that involved higher order intellectual processing would self-regulatory resources be required; basic, associative memory retrieval (which would stem from the impulsive system; see Strack et al., 2006) was not expected to drain self-regulatory resources. Therefore, we used a task that required only that participants draw on crystallized knowledge to answer a question such as "What city is known as the Windy City?" The other task required fluid reasoning because the answers could be discovered but are not known, such as "How many giraffes are there in North America?" and "How many seeds in a watermelon?" Although we used a reasoning test in the first study that allowed only a fixed amount of time for completion so that we could assess motivation and ability, in the second study we used an untimed reasoning test so that all participants were able to complete all items. Although participants had ample time to work through the problems, we found the expected effect that, after suppressing their disgust and sadness reactions to the film, participants were less able to reason (i.e., they got fewer answers correct) but were as able to conjure up associations from memory on the concrete knowledge test. A third study replicated the finding of impaired reasoning and intelligence—both in terms of fewer problems answered and fewer correct answers, proportionally—and also showed that rote memorization was unaffected by prior expenditure of self-regulatory resources.

In the studies by Schmeichel et al., the reflective system was in essence deactivated through prior exertion of self-regulatory resources, which led to a restricted capacity for logical reasoning and intelligent thought. Fluid reasoning requires the application of multiple rules and complex if-then statements to successfully solve a problem, much in the same way that rules and guides are necessary for the reflective system to be effective. Hence, when the reflective system has lost its self-regulatory resources, it does not have the capacity to retrieve and then apply appropriate rules in response to complex problems. Conspicuously, however, recall of simple associations (which presumably emanated from the impulsive system) was unimpaired. Why? Because recalling facts is a matter of merely conjuring up concrete knowledge that links the concept *Chicago* to its nickname "the Windy City," and associations do not require self-regulatory resources because they are driven by the energy contained in the impulsive system. Hence, differences in consumers' reasoning abilities may be understood as a function of the availability of their self-regulatory resources and concomitant activation of the reflective system.

Making Decisions Drains Self-Regulatory Resources

If depletion of self-regulatory resources impairs decision making, then making decisions is also likely to affect the reflective system due to the reduced supply of self-regulatory resources available to power it. Drawing on Gollwitzer Rubicon model of action (Gollwitzer, 1996), we tested the relationship between making decisions and subsequent self-control ability (Vohs, Baumeister, Twenge, Schmeichel, & Tice, 2005). If choosing engages the reflective system (Strack et al., 2006) and if it is true that the reflective system is powered by self-regulatory resources, then it should follow that repeated acts of decision making would drain self-regulatory resources within the reflective system and render the reflective system unable to engage in regulated (i.e., reflective) behavior subsequently. In a series of eight studies, we found support for the deleterious effect of decision making on later self-control (Vohs et al., 2005).

Conceptually, we think of the distinction between choosing and nonchoosing as a qualitative difference that cannot be reduced to amount of deliberation. Choosing ties the chosen option to the self, in a quasi-behavior that intimates action (cf. Strack et al., 2006). It is the creation of this mental tie between the active, intentional, reflective part of the self and the desired option that renders choosing an act that depletes regulatory resources. Furthermore, the Rubicon model of action (Gollwitzer, 1996) also posits a qualitative shift between nonchoosing and choosing in positing that the deliberative mind-set involves a rational contemplation of the possible outcomes of each option, whereas the implemental mind-set involves energetically pursuing one specific option. We called on this line of reasoning as well when positing that choosing is a special act that demands self-regulatory resources.

In one experiment (Study 2, Vohs et al., 2005), participants in the choice condition made dozens of binary decisions between household products, such as whether they

would prefer blue socks or black socks, then black socks versus white socks, white socks versus green socks, and so forth. In the no-choice condition, participants reviewed and thought about the same products but did not make any choices; instead, they reported on their frequency of using each product in the past year. Then, all participants saw before them a row of 1 oz cups containing a mixture of vinegar, artificial flavoring (Kool-Aid), and water that they were told veridically did not taste very good but in fact was healthy (due to the vinegar). Participants were asked to drink as many cups as they could and were offered a small incentive of earning 5¢ a cup. As predicted, participants who had depleted their regulatory resources in making decisions drank fewer cups (M = ~2 oz) than did participants who simply reported their usage patterns (M = ~7.7 oz). Another study confirmed this pattern with an experiment in which the no-choice condition participants gave their opinions about advertisements, so as to prompt them to think of their preferences (to better equate this condition with the choice condition) without necessitating choice. Again, the results showed large differences in the amount of healthy-but-bad-tasting drink they consumed (M = ~6.9 oz for the no-choice participants compared with M = ~1.9 oz for the choice participants).

In another experiment, we tested our choice hypothesis at a shopping mall. We reasoned that people would not want to work on mathematical problems during an outing to a shopping mall, but that many of them would recognize that doing a few (or more) math problems is good exercise for the brain. One way to define self-regulation is to think of it as the capacity to make oneself do something that one does not want to do, such as mathematical problems or consuming a part-vinegar drink. This idea is consistent with the RIM terminology of incompatibility between the impulsive system (which contains the impulse not do the action) and the reflective system (which invokes a rule, guide, or other instructions that promote performing the action). Hence, we assumed that most shoppers would probably rather do something else than perform arithmetic—but at the same time would recognize that it is good exercise for the brain to do a little math—and so performing math problems must be instigated by the reflective system and the impulse to quit must be overridden to continue.

In this naturalistic study, experimenters stopped shoppers and asked them to complete a questionnaire that asked them the extent to which their shopping trip involved making active, deliberate, and thoughtful choices. Then they asked them to complete as many 3-digit + 3-digit addition problems as they could. Those shoppers who reported making many active choices during their shopping trip were less likely to spend time on the math problems, thereby suggesting that these shoppers lacked the energy for this exercise. Extent of choice-making predicted reduced time spent on the math problems even when we statistically controlled for time spent shopping and other relevant covariates, such as age and gender.

Work from the self-regulatory resources model has demonstrated that it takes self-regulatory resources to make oneself do something that one does not want to do. The work reported here on choice demonstrates that it takes self-regulatory resources to make a series of choices. Therefore, making choices impairs self-control through a loss of self-regulatory resources. Why does this occur? We call on the Rubicon model of action (Gollwitzer, 1996) and the RIM as answers: Moving from the deliberative to the implemental stage requires an exertion of self-regulatory resources and, moreover, the connection of each choice to the self further robs the self of its precious resources. Taxing consumers' self-regulatory strength through the decision process limits their ability to push reflective system inputs past threshold to produce regulated behavior.

Being "Stuck in Time" Results from a Loss of Self-Regulatory Resources

The work covered thus far focused on the tenets, parameters, and extensions of our limited-resource model. Other research has focused on an explanatory account of the changes that occur within people as their reservoir of regulatory resources becomes depleted. In this line of research, our focus was on the link between goal attainment and future-orientation (Vohs & Schmeichel, 2003).

On any occasion in which people override one response for another (which indicates that they are orienting toward a goal), they are necessarily orienting toward the future. We surmised that depletion of self-regulatory resources, which had been established as an impediment to goal-attainment, may also manifest itself in differences in time perception. Specifically, Schmeichel and I reasoned that if people were to become mentally stuck in the present, they would be unable to engage in activities that required consideration of future states, namely self-regulatory activities. That is, being in a state of "extended-now," as we termed it, would hamper the ability to effectively control oneself. We further hypothesized that a loss of self-regulatory resources may lead people to slip into an extended-now state. The ability to track time internally in a manner that is in sync with objective time is a highly complex task that requires much coordination and is surely housed in the reflective system. If self-regulatory resources power the reflective system and if this system controls time perception, then depletion of self-regulatory resources should lead to a warped sense of time perception.

In five studies, we found that people who had earlier engaged in a self-control task that presumably depleted their regulatory strength made significant errors in time perception that suggested their being stuck in the present. A variety of initial acts of self-regulation, such as having to read an emotionless text with expressiveness and vigor (as opposed to reading the same text in a natural fashion) as well as exaggerating an emotional expression while watching an emotional movie (versus responding naturally to the same emo-

tional movie) led to an overestimation of the length of time that had passed during the activity. We compared resource-depleted participants estimates of duration to actual duration spent during the task and to their non-depleted peers' estimates and found that self-regulatory resource depletion led to significant overestimations relative to both measures.

Furthermore, longer duration estimates predicted decreased self-regulation subsequently. That is, participants who initially engaged in self-control and whose self-regulatory resources were diminished overestimated the length of time during which they were regulating; this overestimation then produced poorer self-regulation among these participants during a second task. Importantly, as in all the experiments we conduct, we assessed mood states after the manipulations of self-regulatory resource depletion and found no differences in mood as a result of being resource depleted.

Conceptually, being in a state in which the present time is elongated means that long-term goals are not accessible but instead momentary temptations, urges, and impulses loom large. From a limited-resource model of self-regulation, the extended-now state emerges when people have lost some of their self-regulatory resources. Applied to the RIM, a loss of self-regulatory resources renders the reflective system unable to operate. The complexities involved in monitoring and aligning one's internal perceptions of duration with the objective marching of time are most certainly housed in the reflective system (cf. Frederickson & Kahneman, 1993). Conversely, the impulsive system's experiential mode of awareness is easily swayed and responds to sensations and lower-level perceptions. Hence, when the reflective system's power has been sapped through earlier efforts at self-control (that is, through the resulting loss of self-regulatory resources) the simplistic impulsive system narrows the horizon of the consumer, thereby translating the moment-to-moment passing of time into the experience that the present time extends, with the future receding into the backdrop.

CONCLUSION

The RIM by Strack et al. (2006) provides a new basis for understanding consumer behavior. With its emphasis on the interaction between the impulsive system and the reflective system, it is crucial for the RIM to be able to predict the varying contributions of each system. Without a consideration of the mechanism behind the systems, moving from understanding to prediction of behavior will not be possible. In this article, I argue that self-regulatory resources are a necessary component of the RIM to explain the mechanics of the reflective system. A review of five diverse domains of regulated behavior and rational decision making supported the hypothesis that depletion of regulatory resources impairs the operation of the reflective system. When people self-regulatory resources are sapped, they behave in a nonreflective manner: They overeat when on a diet, spend money impulsively (even when they otherwise try to control spending), fail to reason or think intelligently, and feel stuck in a present time in which impulses impinge on the self and earnest plans are abandoned. Moreover, making a series of choices disables subsequent self-control, a pattern that again reveals the connection between the reflective system and self-regulatory resources, which are reduced each time the reflective system associates a chosen option to the self. These results therefore implicate self-regulatory resources as the drivers of the reflective system.

When consumers' behavior is less a result of reflective inputs and more a result of impulse, the quality of their lives suffers. They may cheat (on exams, taxes, or partners), engage in unprotected sex, watch even more television, neglect to take their medicine, overeat, overspend, fail to manage their public images, or make bad choices. An appreciation of when the reflective system will have the capacity to control behavior, especially under conditions of strong impulsive system activation, is imperative if the field is to understand problems of consumption and improve consumer welfare (cf. Mick, 2006). Strack and colleagues' conceptualization of the RIM is incomplete because they fail to specify the driver of the reflective system. Incorporating the concept of self-regulatory resources into the RIM is crucial to understanding the best and worst consumer outcomes.

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