Research Article

Self-regulatory strength amplification through selective information processing

Remi Trudel [a,*], Kyle B. Murray [b]

[a] *School of Management, Boston University, 595 Commonwealth Avenue, Boston, MA 02214, USA*
[b] *School of Business, University of Alberta, Edmonton, Alberta, Canada T6G 2R6*

Abstract

We propose and demonstrate that although depletion of self-regulatory strength is common, it is not inevitable. Four experiments show that under certain conditions, consumers can *amplify* their self-regulatory strength and, as a result, increase their ability to control their behavior. Experiments 1–3 examine the depleting effects of information processing by exposing dieters and nondieters to either cost or pleasure information about chocolate. The results of experiments 1–3 show that when dieters have the ability to monitor the costs of consumption, they are motivated to mobilize additional strength and increase their ability to self-regulate. In experiment 4 we show the practical implications of our work and show that dieters are better able to control their eating because they choose to focus more on the cost (versus pleasure) of consumption.
© 2012 Society for Consumer Psychology. Published by Elsevier Inc. All rights reserved.

Introduction

Self-regulation is the conscious and nonconscious processes used to exercise control over one's thoughts, emotions, attention, or impulses, to bring the self in line with preferred long-term goals (Vohs & Baumeister, 2004). In the consumption of food, the social and economic consequences of self-regulatory failure are evident in the global obesity epidemic (Abelson & Kennedy, 2004; Caballero, 2007). For example, the average American consumes approximately 3800 calories per day—about twice the daily requirement—which has significantly contributed to the fact that two-thirds of the U.S. population are now considered obese or overweight (Abelson & Kennedy, 2004). Technically, the solution to this growing problem is simple: consumers need to balance their caloric consumption with their energy expenditure (Morrill & Chinn, 2004). Unfortunately, this type of self-regulation is extremely difficult for most people (Herman & Polivy, 2004).

Successful self-regulation is challenging because it requires the right mix of four critical factors: a self-regulatory goal, the ability to monitor progress towards that goal, the strength to exercise self-control, and the motivation to do so (Baumeister & Vohs, 2007). Self-regulatory strength has proven to be particularly problematic. Research has shown that it is a limited internal resource that is depleted with use and that depletion increases the likelihood of self-regulatory failure (Baumeister & Heatherton, 1996; Baumeister, Heatherton, & Tice, 1994; Baumeister, Sparks, Stillman, & Vohs, 2008; Baumeister, Vohs, & Tice, 2007; Vohs & Heatherton, 2000). Strong empirical support for the power and prevalence of self-regulatory strength depletion has even led some to debate the extent to which people have free will in their consumption decisions (Baumeister et al., 2007; Hofmann, Strack, & Deutsch, 2008; Johnson, 2007; Wertenbroch, Vosgerau, & Bruyneel, 2007).

In this paper, we propose that although depletion of self-regulatory strength is common, it is not inevitable. The major contribution of this paper is demonstrating that consumers can *amplify* their self-regulatory strength in situations that have previously been shown to result in depletion. Specifically, we find that depletion occurs when self-regulating consumers do not have

* Corresponding author. Fax: +1 617 353 4098.
E-mail addresses: rtrudel@bu.edu (R. Trudel), kyle.murray@ualberta.ca (K.B. Murray).

access to information about the costs of consumption (e.g., fat and caloric content of food they are considering consuming); however, our results demonstrate that consumers can mobilize additional self-regulatory strength when given the opportunity to process information about the costs of consumption.

In the sections that follow we review the important role played by each of the four factors that determine self-regulatory performance and explain how the right mix of these factors can lead to self-regulatory strength amplification. We then describe the methods and results of four experiments that examine our predictions in the context of food consumption. The results provide strong support for our prediction that consumers are capable of amplifying their self-regulatory strength. We discuss the theoretical and practical implications of our findings within the context of the global obesity epidemic and the current Congressional debate over nutritional labeling.

Depletion versus amplification: monitoring the costs of consumption relative to goals

Self-regulation is the capacity to override or alter behavior to bring the self into line with a preferred standard or goal and success or failure in self-regulation is measured with respect to those goals (Vohs & Baumeister, 2004). Goals help consumers determine when they should engage in self-regulation, to what extent behavior needs to be controlled, and what responses need to be overridden. Consumers, for example, may aim to lose weight but how successful they are in self-regulating their eating behavior will depend on the clarity and specificity of their weight loss goals. Prior research has shown that when such goals are clear and consistent, the probability of successful self-regulation is greatly improved (Baumeister, 2002).

However, goals alone are insufficient. Without the ability to monitor current behavior relative to goals, self-regulation is extremely difficult (Baumeister & Heatherton, 1996; Baumeister et al., 1994). For example, if an individual plans to limit her caloric intake to 1800 cal per day, it will be extremely difficult to meet (or even work towards) that goal without keeping track of the calories being consumed. Similarly, when a person sets an annual savings goal, it will be necessary to monitor how much has been set aside at shorter-term intervals relative to that goal. In the majority of self-regulatory situations, it is particularly important for individuals to monitor the costs of consumption relative to their goals (Argo & White, 2012; Baumeister, 2002; Fishbach & Shah, 2006; Wertenbroch, 1998). Specifically, in the realm of eating behavior, recent research has demonstrated that a dieter who does not have access to information about the costs of consumption is significantly more likely to experience self-regulatory failure (Trudel & Murray, 2011). We believe that this is an important oversight of the existing regulatory strength depletion research as monitoring information, and cost information in particular, likely plays an important role in regulatory resource allocation.

At a general level, food can be characterized in terms of both cost and pleasure attributes, which people can take into account when making dietary decisions. Pleasure attributes provide information about the hedonic value of food (e.g.,

how rich and creamy it will taste), while cost attributes provide more utilitarian information and highlight the consequences of consumption (e.g., how much fat and how many calories it contains). Prior research has demonstrated that although most people are naturally drawn to the pleasure of consuming food, focusing on the costs of consumption can enhance self-regulatory success. Specifically, Trudel and Murray (2011) demonstrated that when details about the caloric and fat content of chocolate are available, dieters tend to spend more of their time focusing on those attributes—versus how rich and creamy the chocolate will taste—and, as a result, they are better able to control their eating behavior. Although prior research has indicated that focusing on the costs of consumption appears to enhance self-regulatory success, the underlying mechanism has not been explained. In this paper, we propose that when people with a clear goal focus on the costs of consumption they are able to amplify self-regulatory strength, which significantly improves their ability to control their behavior.

Self-regulatory strength refers to the internal resources available to inhibit, override, or limit goal inconsistent desires and temptations (Baumeister & Heatherton, 1996; Baumeister et al., 2007). A large body of research has concluded that people have a limited amount of self-regulatory strength and that it is depleted with each act of self-regulation. Once depleted, the capacity for subsequent acts of self-regulation is impaired (Baumeister, 2002; Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Heatherton, 1996; Baumeister et al., 2008; Hoch & Loewenstein, 1991; Muraven & Slessareva, 2003; Muraven, Tice, & Baumeister, 1998; Vohs & Baumeister, 2004; Vohs & Faber, 2007; Vohs & Heatherton, 2000; Vohs et al., 2005).

There are several examples of research investigating resource depletion in the consumer context. For instance, research has demonstrated that consumers whose self-regulatory strength has been depleted are more likely to give in to tempting product offers and make impulsive purchases (Bruyneel, Dewitte, Vohs, & Warlop, 2006; Vohs & Faber, 2007). Similarly, studies have demonstrated that when their self-regulatory strength has been depleted, dieters are less able to control their food consumption (Baumeister et al., 1998; Kahan, Polivy, & Herman, 2003; Vohs & Heatherton, 2000).

Prior research has also shown that regulatory strength depletion depends on the extent to which a consumer aims to control his or her behavior—such as, whether or not an individual has an active goal to self-regulate (Muraven & Slessareva, 2003; Vohs & Heatherton, 2000). For example, a dieter who is trying to limit or avoid the consumption of candy will need to exercise self-regulatory strength in order to resist a bowl of M&M's placed directly in front of him. In contrast, a nondieter is not trying to regulate his behavior and therefore does not need to expend resources resisting the candy. This notion is supported by empirical evidence—e.g., Vohs and Heatherton (2000) found that dieters expend more self-regulatory strength as a bowl of M&Ms was moved closer to them, but proximity of the candy had no effect on nondieters.

Although the extant literature provides strong evidence supporting the contention that the depletion of regulatory strength can reduce self-regulatory performance, only a few studies

have demonstrated how people might be able to reduce their vulnerability to resource depletion or be successful in self-regulation even when they are depleted. For example, Muraven and Slessareva (2003) found that when depleted individuals were given a sufficient cash incentive, they were able to perform better on a subsequent self-control task than depleted individuals who were not given a cash incentive. The results reveal that people can compensate for being depleted when sufficiently incentivized. Other studies have shown that inducing positive moods (Tice, Baumeister, Shmueli, & Muraven, 2007) after a depleting task counteracted depletion and allowed participants to perform as well as non-depleted participants on a second unrelated self-regulatory task. The research did not provide a process by which positive moods counteract resource depletion, as a result, the authors were unable to determine whether positive moods enhance self-regulatory strength or whether positive moods motivate participants to control their behavior despite being depleted. Schmeichel and Vohs (2009) found that self-affirming core values reinforced the self as competent and capable, which temporarily improved self-control under conditions of depletion. More recently, research has indicated that construing a task as fun rather than work (Laran & Janiszewski, 2011) or completing similar tasks (Dewitte, Bruyneel, & Geyskens, 2009) can also counteract depletion. In the current paper, we extend this emerging stream of research by demonstrating self-regulatory strength *amplification*. Specifically, we find that when consumers with a self-regulatory goal have the ability to monitor the costs of their consumption decisions, they are able to increase their self-regulatory strength.

Motivation, energy mobilization, and regulatory strength amplification

Baumeister and Vohs (2007) have recently argued that the fourth critical factor necessary for effective self-regulation is motivation. At one level, this is relatively straightforward: people with a clear goal, the ability to monitor, and abundant resources can still fail in self-regulation if they lack the motivation to achieve that goal. For example, on a doctor's advice an individual may set a goal to lose ten pounds. Following the doctor's advice that individual might ensure they can monitor their progress (e.g., buy a scale and sign-up for a calorie counting website) and have an abundance of self-regulatory strength. Nevertheless, if the individual does not really want to lose weight— i.e., lacks the necessary motivation to take the required action— s/he is likely to fail at the required self-regulatory behaviors.

Although untested, Baumeister and Vohs (2007) propose that motivation may be able to compensate for depletion. Specifically, they suggest that depletion is not equivalent to exhaustion and, in fact, a sufficiently motivated individual can mobilize energy resources that allow for successful regulation even in situations that would normally result in self-regulatory failure. For example, although having a bowl of chocolate nearby is depleting for most people (Vohs & Heatherton, 2000), a committed dieter may be able to mobilize resources that allow for improved self-regulatory performance.

Recent work has provided some initial evidence to support the important role of motivation in self-control and suggests that consumers progress through a two-stage process of self-regulation (Myrseth & Fishbach, 2009; Myrseth, Fishbach, & Trope, 2009). The first stage is conflict identification—that is, consumers with a self-regulation goal need to be aware of the cost of failing to control their behavior. In the second stage, they need to activate the self-regulatory strength necessary to resist temptation. The notion that people tend to mobilize the energy required to achieve their behavioral goals, is supported by the literature on motivational intensity (Brehm & Self, 1989). Research in this area has indicated that energy mobilization can fluctuate based on a variety of factors that are both internal and external to the individual. In particular, people tend to draw more heavily on energy resources when: 1) their expectation of task difficulty increases (Wright, Martin, & Bland, 2003); 2) they are more personally involved in the task (Gendolla & Richter, 2005), and 3) short-term costs of consumption are made salient (Fishbach & Trope, 2005; Fishbach, Zhang, & Trope, 2010; Trope & Fishbach, 2000).

As we have discussed above, in the context of self-regulation, the energy required to control one's own behavior in line with longer terms goals is referred to as self-regulatory strength. Based on the motivational intensity literature, we posit that people should be able to mobilize self-regulatory strength to the extent that they are personally involved in a difficult task with salient short-term costs. For a dieter, resisting a tempting hedonic food is very personal and difficult (Herman & Polivy, 2004), which leads us to predict that *dieters will increase their self-regulatory strength and improve their ability to resist temptation when presented with information about the costs of consumption* (e.g., fat and caloric content of hedonic food). This prediction makes an important contribution to our understanding of self-regulation by demonstrating that consumers with an active goal, and access to information on the short-term costs of consumption, can amplify their self-regulatory strength. In the sections that follow we report the results of four experiments that provide strong support for this prediction.

Experiment 1

In the domain of eating behavior, prior research has indicated that the extent to which self-regulatory strength is depleted can depend on moderating variables—such as how desirable the food is and how close it is to the consumer. For instance, Vohs and Heatherton (2000) found that dieters who were seated close to a bowl of ice cream ate more ice cream. The authors argued that the physical proximity of the ice cream increased temptation and thus depleted self-regulatory strength. They concluded that dieters, those with a self-regulatory goal, who are near desirable food, are likely to experience depletion that increases the risk of self-regulatory failure. Consistent with Vohs and Heatherton (2000) we expect that consumers with a dieting goal will be more depleted than consumers without a dieting goal when a bowl of tempting chocolates is placed near them.

Experiment 1 examines whether these depletion effects are contingent on the type of information that consumers process prior to consumption. We use the standard two-stage procedure to investigate how self-regulatory goals and access to information affect regulatory strength (Baumeister, 2002; Baumeister & Heatherton, 1996; Baumeister et al., 2007; Muraven et al., 1998; Vohs & Faber, 2007). In the interval between the two stages, participants were exposed to pleasure or cost information about the chocolate. Consistent with the theory of motivational intensity (Brehm & Self, 1989), we predict that information about the costs of consuming the chocolate will motivate dieters to amplify their self-regulatory strength. As a result, dieters will perform better on the second task as compared to non-dieters and dieters who do not have access to cost information. Importantly, we expect that access to cost information will ultimately lead to fewer chocolates being consumed.

In addition to examining the impact of cost versus pleasure information, experiment 1 includes a control condition that provides participants with neither cost nor pleasure information. This condition makes an important contribution to the external validity of this study, because in many consumption situations attribute information is not explicitly available (e.g., when eating at most restaurants) and consumers must generate their own thoughts about the food. From a public policy perspective, this condition is especially interesting given the ongoing congressional debate regarding a mandate to make calorie and nutrition information available on restaurant menus. Previous research suggests that the probability that cost and/or pleasure information will be recalled from memory depends on the relative ease with which each type of information can be retrieved (Kahneman & Tversky, 1973; Menon, Raghubir, & Schwarz, 1995; Schwarz, 1998). Because pleasure information is more affect laden and experiential in nature, we predict that pleasure information will be more accessible than cost information (Metcalfe & Mischel, 1999; Shiv & Fedorikhin, 1999). Therefore, we expect that consumers given no relevant information will be depleted to the same extent as those given only pleasure information.

Participants and procedure

160 undergraduate students (89 females) were randomly assigned to a 2 (dietary goal: present vs. absent) by 3 (information: pleasure vs. cost vs. no relevant information) between subjects design. Participants were told that they would participate in multiple experiments. The first experiment would examine their ability to construct sentences. Participants were seated in cubicles and completed the dietary goal priming manipulation. The priming manipulation used 10 scrambled sentences, requiring participants to form a grammatically correct four-word sentence from five scrambled words (Laran, 2009; Trudel & Murray, 2011). Examples of the goal present prime items are "*I, good, diet, want, grades*" and "*students, thin, are, green, most*". The health related word was incorporated into the sentence half the time. Dietary goal absent items contained neutral

sentences. Examples are "*is, dog, the, car, hairy*" and "*begin, I, orange, will, when*".

The efficacy of this priming procedure was examined in a pretest that included forty-four participants sampled from the same population as the main experiment. After completing the scrambled sentences, participants responded to a questionnaire, that included a 6-item affect scale (3 positive items and 3 negative items) adapted from Watson, Clark, and Tellegen (1988), three items to measure involvement (7 point scale), and seven state self-control/health consciousness items (9 point-scale) adapted from Moorman and Matulich (1993). Those scoring high in health consciousness are expected to have a self-regulatory goal (goal-present) of healthy eating, whereas those scoring low in health consciousness are not expected to have a self-regulatory goal (goal-absent). An ANOVA revealed that those in the primed *goal-present* condition scored higher (M=6.60) than those in *goal-absent* condition (M=5.67; $F(1, 42)=6.67$, $p=.013$). No differences were found across priming conditions in positive affect or negative affect (ps>.35) or in involvement (p>.70).

Following the scrambled sentence priming procedure, a bowl of 25 chocolates was placed directly in front of each participant and they were told that they would be evaluating the chocolate. This proximity manipulation served as our initial resource depletion task (Baumeister et al., 1998; Vohs & Heatherton, 2000). Prior to evaluating the chocolates, participants were asked to review one of the following three types of information (based on the condition to which they were randomly assigned): 1) an advertisement for the chocolate (pleasure information); 2) the chocolate's nutritional information as seen on the back of its packaging (cost information); or, 3) an advertisement for Amazon's Kindle (no relevant information). In each condition, the exposure time was controlled to 30 s.

Next, participants were asked to complete a "spot the differences" puzzle with the objective of finding 13 differences between two photos. In fact, there were only 10 differences. Prior to starting the puzzle, participants were instructed to "Work on it for as long as you want, and when you want to stop, just hit the 'I Give Up!' button." Similar puzzle tasks have been used in prior research to measure self-regulatory strength (for example; Muraven et al., 1998). Individuals with depleted self-regulatory strength demonstrate poor self-regulatory performance by quitting persistence tasks sooner than those whose resources have not been depleted. Hence the time spent persisting in the puzzle task was our measure of self-regulatory strength. After giving up on the puzzle, participants were instructed to move on to evaluating the chocolate and told that they could eat as many chocolates as they needed to make a good evaluation. They then completed a four-item evaluation questionnaire, which asked for (seven-point scale) ratings on how tasty, appealing, delicious, and desirable the chocolate was. After the participants left, a research assistant counted the number of chocolates eaten by each participant.

Results

There were no differences in the evaluations of the chocolate between goal present and absent conditions (M $_{Goal\ Present}$=5.42

vs. M $_{Goal\ Absent}$=5.22; $F(1, 154)$=1.72, p=.191). There were no differences in evaluations across information conditions (M_p=5.34 vs. M_c=5.28 vs. M $_{No\ Info}$=5.38; $F(2, 154)$=.26, p=.769). The interaction between goals and information was not significant ($F(2, 154)$=.09, p=.914). These results indicate that the differences we find in chocolate consumption are not being caused by variations in participants' general chocolate evaluations.

Self-regulatory strength

All persistence times were submitted to a natural log transformation. For clarity, the reported means are not transformed but all statistical tests were conducted on the transformed data. A 2 (dietary goal)×3 (information) ANOVA revealed a main effect of information on persistence times ($F(2, 154)$=4.75, p=.010). The data also yielded a significant goal by information interaction ($F(2, 154)$=6.72, p=.002; Fig. 1). Further analysis revealed differences in persistence for goal present participants ($F(2, 154)$=10.86, p<.001), but not for goal absent participants ($F(2, 154)$=.43, p=.651). Goal present participants persisted longer when exposed to cost information (M_c=13.80 min) than when exposed to pleasure information (M_p=7.49 min, p<.001) or no relevant information ($M_{No\ info}$=8.09 min, p=.001). As expected, the pleasure and no relevant information conditions were not significantly different (p=.301).

Consistent with regulatory strength depletion, goal present (compared to goal absent) participants demonstrated less persistence when exposed to pleasure information ($M_{Goal\ Absent}$=10.36 vs. $M_{Goal\ Present}$=7.49 min; $F(1, 154)$=5.08, p=.026) and no relevant information ($M_{Goal\ Absent}$=11.11 vs. $M_{Goal\ Present}$=8.09 min; $F(1, 154)$=4.10, p=.045). However, consistent with regulatory strength amplification, goal present participants demonstrated greater persistence when exposed to cost information ($M_{Goal\ Absent}$=10.10 vs. $M_{Goal\ Present}$=13.80 min; $F(1, 154)$=5.35, p=.022).

Consumption

A 2(dietary goal)×3(information) ANOVA on the number of chocolates consumed revealed that goal present participants consumed more chocolates than goal absent participants ($M_{Goal\ Absent}$=2.19 vs. $M_{Goal\ Present}$=2.81 chocolates; $F(1, 154)$=3.90, p=.050). The goal by information interaction was also significant ($F(2, 154)$=4.08, p=.019; Fig. 2). Further analysis revealed differences for goal present participants ($F(2, 154)$=6.17, p=.003), but not for goal absent participants ($F(2, 154)$=.20, p=.820). Pairwise comparisons revealed that goal present participants consumed significantly less when exposed to cost information (M_c=1.77 chocolates) relative to pleasure information (M_p=3.42 chocolates, p=.001) and no relevant information ($M_{No\ info}$=3.11 chocolates, p=.007). There were no differences in consumption for goal absent participants across information conditions (p=.552).

Goal present participants also consumed more than goal absent participants when exposed to pleasure information ($M_{Goal\ Absent}$=2.20 vs. $M_{Goal\ Present}$=3.42 chocolates; $F(1, 154)$=5.43, p=.021) and when given no attribute information ($M_{Goal\ Absent}$=2.04 vs. $M_{Goal\ Present}$=3.11 chocolates; $F(1, 154)$=4.67, p=.032). The difference between goal conditions was not significant when participants were exposed to cost information but is in the predicted direction ($M_{Goal\ Absent}$=2.35 vs. $M_{Goal\ Present}$=1.77 chocolates; $F(1, 154)$=1.42, p=.235). Given that participants had to consume at least one chocolate to complete the evaluation task, we suspect that this lack of significance is the result of a floor effect. In experiment 2, we use a higher quality chocolate to increase overall chocolate consumption and eliminate this floor effect.

Discussion

The results of experiment 1 demonstrate that when consumers are exposed to no relevant information or pleasure information their behavior is highly consistent with the strength model of self-regulation (Baumeister et al., 1998; Vohs & Heatherton, 2000)—that is, dieters are more depleted than non-dieters when a desirable food is placed nearby. However, we also find that dieters with access to information about the costs of consumption are able to persist longer on the puzzle task than non-dieters or dieters without access to cost information. Although the traditional strength model of self-regulation does not easily account for this finding, it is entirely consistent with our theory of self-regulatory strength amplification.
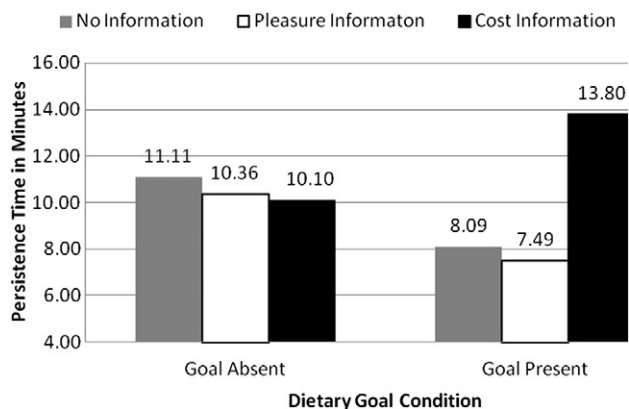

Fig. 1. Self-regulatory performance results by experimental condition for experiment 1.
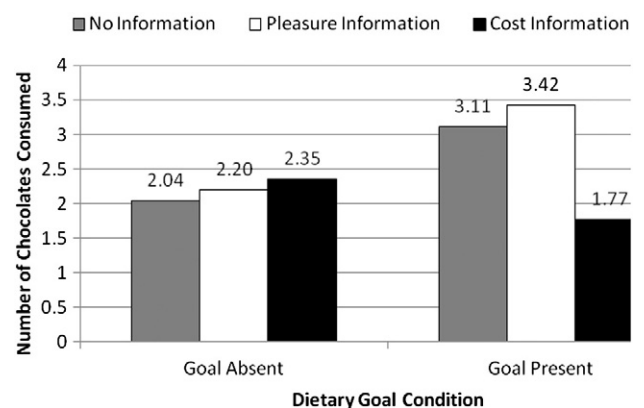

Fig. 2. Consumption results by experimental condition for experiment 1.

Moreover, these results strongly supports the consumer welfare argument for calorie and nutritional information to be made broadly available. This study clearly indicates that dieters are able to amplify self-regulatory strength in the presence of calorie and nutrient information, but they are depleted in the presence of pleasure information and in situations where they have no relevant information.

The results of experiment 1 provide support for our amplification prediction when comparing non-dieters and dieters without access to cost information; however, this experiment did not measure baseline self-regulatory strength without interference from our experimental manipulations. In order to support our claim that consumers are able to amplify their self-regulatory strength—as opposed to just being less depleted—it is important to compare dieters in our cost information condition to consumers who are not affected by manipulations that have been shown to affect self-regulatory strength (that is, cost or pleasure information or the presence of chocolates). The following two experiments address this limitation with both between-subject (experiment 2) and within-subject (experiment 3) baseline measures of self-regulatory strength. The results of experiments 2 and 3 provide additional strong support for our theory of self-regulatory strength amplification.

Experiment 2

Experiment 2 aims to directly test the prediction that exposure to cost information results in amplified self-regulatory strength among dieters. We again use a two-stage procedure that begins with exposure to a typically depleting situation—that is, chocolate is placed directly in front of each participant (Vohs & Heatherton, 2000)—and then self-regulatory strength is measured based on participants' persistence at a second unrelated puzzle task (as in experiment 1). The critical comparison is between dieters with access to cost information—the condition in which we predict amplification—and a baseline control condition wherein participants were only asked to complete the puzzle task (i.e., their self-regulatory strength was not affected by the presence of chocolates or cost information or pleasure information). If amplification is taking place, then the dieters with access to cost information should demonstrate greater persistence on the second task than participants in the control condition.

Participants and procedure

105 undergraduate students (63 females) were randomly assigned to a between-subjects 2 (dietary goal: present vs. absent) by 2 (information: pleasure vs. cost) experimental design with a control condition. Participants completed the same priming manipulation used in the second experiment. Next, a bowl of 15 chocolate truffles was placed directly in front of each participant and they were told that they would be evaluating the chocolate. Prior to evaluating the chocolates, participants were asked to review one of the following two types of information (based on the condition to which they were randomly assigned): 1) an advertisement for the truffles (pleasure information); 2) the chocolate's nutritional information as seen on the back of its packaging (cost information). Exposure time was again controlled to 30 s.

Participants then went on to complete a "spot the differences" puzzle. As in experiment 2, participants were asked to find 13 differences, but only 10 differences were actually present in the puzzle. The time spent on the puzzle is our dependent measure of persistence (i.e., self-regulatory strength). After giving up on the puzzle, participants were instructed to move on to evaluating the chocolate. Participants were told that they could eat as many chocolates as they needed to make a good evaluation. They then completed the same four-item evaluation questionnaire as in experiment 1. When the participants left, a research assistant counted the number of chocolates eaten by each participant.

Participants in the control condition completed the neutral sentences (goal absent condition) and then went straight to the "spot the differences" puzzle—that is, they did not evaluate nor eat chocolate during the study. This allowed for a baseline regulatory strength condition in which control participants were never exposed to the depleting chocolates or to the cost or pleasure information about the chocolates. As a result, control participants self-regulatory strength should not have been depleted (or amplified)—that is, this condition provides a baseline measure of self-regulatory strength. If our prediction is correct then dieters exposed to cost information will demonstrate self-regulatory strength amplification—that is, they will persist longer at the puzzle task then the non-depleted participants in the control condition.

Results

There were no differences in evaluations of the chocolate between goal present and absent conditions (M $_{Goal\ Present}$=6.06 vs. M $_{Goal\ Absent}$=6.26; $F(1, 75)=2.40$, $p=.125$). There were no differences in evaluations across information conditions (M_p=6.19 vs. M_c=6.13; $F(1, 75)=.28$, $p=.597$). The interaction between goals and information was also not significant ($F(1, 75)=1.12$, $p=.293$). As in experiment 2, these results indicate that the differences we find in chocolate consumption are not being caused by variations in participants' general chocolate evaluations.

Self-regulatory strength

Data was again skewed so all persistence times were submitted to a natural log transformation. For clarity, the reported means are not transformed but all statistical tests were conducted on the transformed data. A 2 (dietary goal) × 2 (information) ANOVA revealed a main effect of information on persistence times ($F(1, 75)=10.88$, $p=.001$). The data also yielded a significant goal by information interaction ($F(1, 75)=19.15$, $p<.001$; Fig. 3). Pairwise comparisons indicated differences in persistence times for goal present participants but not for goal absent participants ($F(1, 75)=.56$, $p=.46$). Goal present participants persisted longer when exposed to cost information (M_c=8.46 min) than when exposed to pleasure information (M_p=3.75 min; $F(1, 75)=30.60$, $p<.001$).

Consistent with the previous experiment, when compared to goal absent participants, goal present participants did not persist as long when exposed to pleasure information ($M_{\text{Goal Absent}}=4.94$ vs. $M_{\text{Goal Present}}=3.75$ min; $F(1, 75)=4.42$, $p=.04$), but persisted longer when exposed to cost information ($M_{\text{Goal Absent}}=4.36$ vs. $M_{\text{Goal Present}}=8.46$ min; $F(1, 75)=16.58$, $p<.001$).

To test for self-regulatory strength amplification, we next examine persistence times relative to the control condition. We find that goal present participants who were exposed to cost information demonstrated significantly greater persistence at the puzzle task than the control group ($M_{\text{Goal Present/cost}}=8.46$ vs. $M_{\text{Control}}=5.98$ min; $t(44)=2.08$, $p=.04$). However, participants in the control group demonstrated greater persistence than did goal present participants who were given pleasure information ($M_{\text{Goal Present/pleasure}}=3.75$ vs. $M_{\text{Control}}=5.98$ min; $t(44)=4.22$, $p<.001$). Goal absent participants exposed to cost information did not persist as long as the control group when exposed to cost information ($M_{\text{Goal Absent/cost}}=4.36$ vs. $M_{\text{Control}}=5.98$ min; $t(43)=2.92$, $p=.006$). There were no differences when goal absent participants were exposed to pleasure information ($M_{\text{Goal Absent/pleasure}}=4.94$ vs. $M_{\text{Control}}=5.98$ min; $t(43)=1.76$, $p=.09$).

Consumption

A 2 (dietary goal) × 2 (information) ANOVA on the number of chocolates consumed revealed that participants consumed more chocolates when exposed to pleasure ($M=2.99$) versus cost information ($M=2.12$ chocolates; $F(1, 75)=8.22$, $p=.005$). The goal by information interaction was also significant ($F(1, 75)=8.22$, $p=.005$; Fig. 4). Further analysis revealed differences in consumption across information conditions for goal present participants ($F(1, 75)=17.09$, $p<.001$), but not for goal absent participants ($F(1, 75)=0$, $p=1$). Pairwise comparisons indicate that goal present participants consumed significantly less when exposed to cost information ($M_c=1.55$ chocolates) relative to pleasure information ($M_p=3.29$ chocolates, $p=.001$). Goal present participants also consumed less than goal absent participants when exposed to cost information ($M_{\text{Goal Absent}}=2.68$ vs. $M_{\text{Goal Present}}=1.55$ chocolates; $F(1, 75)=6.94$, $p=.01$). The difference between goal conditions was not significant when exposed to pleasure information
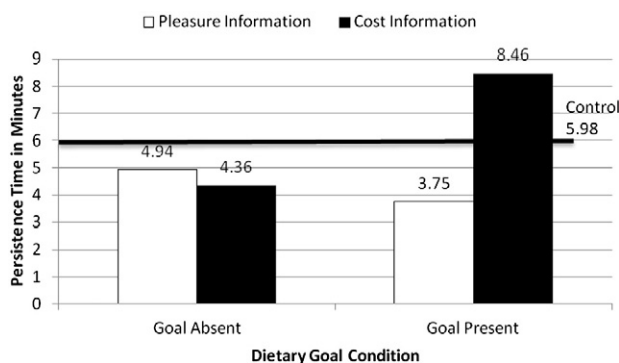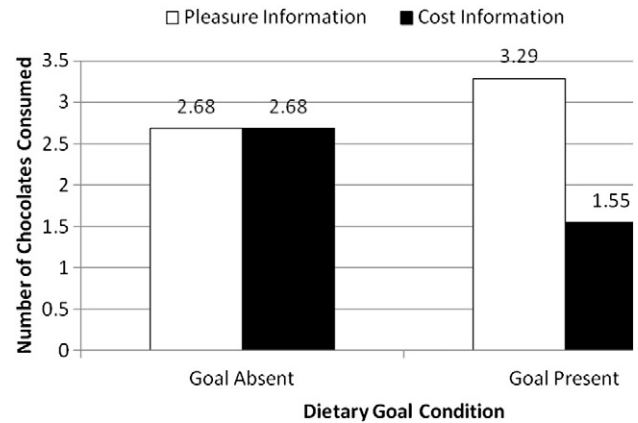
Fig. 4. Consumption results by experimental condition for experiment 2.

($M_{\text{Goal Absent}}=2.68$ vs. $M_{\text{Goal Present}}=3.29$ chocolates; $F(1, 75)=1.42$, $p=.16$).

Discussion

Experiment 2 was designed to replicate the pattern of results in the first experiment and allow for a direct comparison between participants exposed to the experimental manipulations and a control group. To ensure that control participants' self-regulatory strength was not affected prior to the puzzle task, it was important that they not be exposed to the experimental manipulations. Consistent with the results of experiment 1 and with the strength model of self-regulation, we find that dieters exposed to pleasure information are depleted relative to the control condition. In fact, the magnitude of the depletion in the experimental conditions relative to the control condition was substantial: control group participants persisted 59% (2.23 min) longer on the puzzle task than dieters with pleasure information. Overall, the results provide strong evidence of depletion among dieters who were exposed to pleasure information.

The critical test of the self-regulatory strength amplification prediction, however, is the comparison between the control condition and the experimental condition wherein dieters had access to cost information. Importantly, dieters with cost information completed the same chocolate evaluation task that substantially depleted dieters with pleasure information and has been shown to deplete dieters in other studies (Vohs & Heatherton, 2000). Yet, we find that dieters with cost information demonstrated self-regulatory strength amplification, persisting 41% (2.48 min) longer on the puzzle task than those in the control condition.

In experiment 1, the no relevant information condition showed that having a desirable food nearby was depleting for participants primed with a dieting goal. In the second study we included a control condition in which participants were not depleted by either the chocolate or the (cost or pleasure) information—that is, they provided us with a baseline measure of self-regulatory strength. Critically, we find that dieters exposed to the depleting chocolate and cost information demonstrate amplified self-regulatory strength as compared the participants in the control condition.

Fig. 3. Self-regulatory performance results by experimental condition for experiment 2.

Experiment 3

The results of experiment 2 provide strong support for the prediction that consumers can amplify their self-regulatory strength. In experiment 3, we demonstrate the robustness of this result using a different metric for self-regulatory strength and a measure of participants' dieting goals (rather than the priming procedure used in the first two experiments). To assess self-regulatory strength, we record how long participants are able to squeeze a handgrip (Muraven et al., 1998; Rethlingshafer, 1942).

In addition, rather than using a between-subjects control condition comparison, as in experiment 2, this study uses a within subjects baseline measure of self-regulatory strength. Specifically, we measure how long participants are able to continuously squeeze a handgrip about 30 min prior to the beginning of the experiment and then compare that to their performance with the same handgrip after a tempting bowl of chocolates is placed nearby and they are exposed to either cost or pleasure information.

Participants and procedure

Ninety-eight subjects were randomly assigned to two between subjects information conditions: pleasure vs. cost attributes. Participants were told that they would be participating in a series of studies. Participants were first required to squeeze a handgrip exerciser as an initial practice trial (t_1; measured in seconds). The handgrip exerciser consisted of two handles connected by a metal spring. Squeezing the handles together compresses the spring, and subjects were timed using a stopwatch to determine how long they could keep the spring compressed. In order to increase accuracy in timing, a research assistant placed a penny between the two handles when the subject squeezed them together. The handles held the penny in place and the research assistant would start timing using a stopwatch. When the subject began to relax their grip, the penny would fall out and the research assistant would stop timing. To prevent subjects from working hard towards a specific time goal, the research assistant did not give any feedback about the subject's performance and the subjects were not told their times. Prior research has demonstrated that the handgrip test is a valid measure of self-regulatory strength (Muraven et al., 1998; Rethlingshafer, 1942).

After the initial practice trial of squeezing the handgrip, subjects participated in three other unrelated studies that were completed in 30 to 40 min. Included in the first study was a 15-item lifestyle questionnaire. Embedded within that questionnaire was one item that asked participants "Are you currently watching your diet"? Participants who answered yes were classified as dieters. Participants then went on to our main experiment and were told that they would be evaluating chocolate. A bowl of 15 chocolate truffles was placed directly in front of them. Next to the bowl, a sheet of paper containing either the truffle's nutritional information (for participants assigned to the cost information condition) or a sheet of paper with the word "delicious" typed on it (pleasure information condition).

The paper remained throughout the experiment. Next, the research assistant measured self-regulatory strength based on persistent compression of the handgrip exerciser (t_2; measured in seconds). Our self-regulatory strength measure was calculated by subtracting the initial trial time (t_1) from the trial time captured after participants were exposed to the information and chocolate (t_2). This allowed us to control for within-subjects variation in hand strength. A negative net time is evidence of depletion whereas a positive net time is evidence of amplification. Participants were then told that they could eat as many chocolates as they needed to complete their evaluation of the chocolate. Finally, they completed a short questionnaire that included the evaluation questions, a shortened PANAS scale (Watson et al., 1988), and asked for some basic demographic information.

Results

There were no differences in evaluations of the chocolate between dieters and nondieters ($M_{dieter}=5.65$ vs. $M_{nondieter}=5.35$; $F(1, 94)=1.95$, $p=.166$) or across information conditions ($M_p=5.47$ vs. $M_c=5.54$; $F(1, 94)=.10$, $p=.748$). The interaction between dieting goal and information on evaluations was also not significant ($F(1, 94)=.01$, $p=.975$). There were also no significant main effects between dieters and non-dieters in positive affect ($M_{dieter}=3.25$ vs. $M_{nondieter}=3.32$; $F(1, 94)=.28$, $p=.597$). There were no main effects of information condition on positive affect ($M_p=3.34$ vs. $M_c=3.23$; $F(1, 94)=.69$, $p=.41$). The interaction between dieting goal and information on positive affect was also not significant ($F(1, 94)=1.04$, $p=.310$). There were no main effects of dieting goal on negative affect ($M_{dieter}=2.05$ vs. $M_{nondieter}=2.11$; $F(1, 94)=.12$, $p=.735$). There we also no differences in negative affect across information conditions ($M_p=2.11$ vs. $M_c=2.06$; $F(1, 94)=.07$, $p=.794$). The interaction between dieting goal and information on negative affect was also not significant ($F(1, 94)=1.17$, $p=.282$).

Self-regulatory strength

A 2 (dietary goal)×2 (information) ANOVA revealed a main effect of information on self-regulatory strength (t_2-t_1) ($F(1, 94)=7.58$, $p=.007$). The data also yielded a significant dieting goal by information interaction on self-regulatory strength ($F(1, 94)=11.27$, $p=.001$; Fig. 5). Follow-up tests revealed differences in strength for dieters but not for nondieters ($F(1, 94)=.20$, $p=.656$). Dieters' exhibited greater self-regulatory strength when exposed to cost information as compared to pleasure information ($M_c=5.56$ s vs. $M_p=-11.70$ s; $F(1, 94)=17.14$, $p<.001$). The positive value is evidence of self-regulatory strength amplification and the negative value is evidence of depletion. When exposed to pleasure information dieters' self-regulatory strength was significantly less than nondieters ($M_{dieters}=-11.70$ vs. $M_{nondieters}=-3.45$ s; $F(1, 94)=4.44$, $p=.038$). However, when exposed to cost information, dieters demonstrated amplified self-regulatory strength relative to nondieters ($M_{dieters}=5.56$ vs. $M_{nondieters}=-5.16$ s; $F(1, 94)=6.91$, $p=.01$).
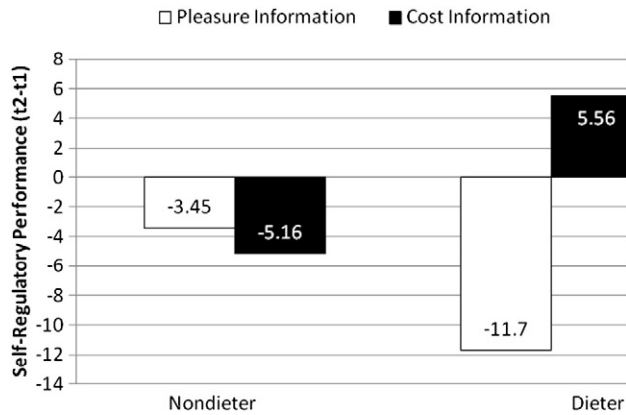
Fig. 5. Self-regulatory performance results by experimental condition for experiment 3.

Consumption

A 2(dietary goal) × 2(information) ANOVA on the number of chocolates consumed revealed that participants consumed more chocolates when exposed to pleasure (M = 2.96) versus cost information (M = 1.97 chocolates; $F(1, 94) = 7.40, p = .008$). The main effect of dietary goal was not significant ($F(1, 94) = .03, p = .861$). The dietary goal by information interaction was significant ($F(1, 94) = 9.10, p = .003$; Fig. 6). Follow-up pairwise comparisons revealed that dieters consumed significantly less when exposed to cost information ($M_c = 1.45$ chocolates) relative to pleasure information ($M_p = 3.54$ chocolates, $F(1, 94) = 15.10, p < .001$). Dieters also consumed less than nondieters when exposed to cost information ($M_{dieters} = 1.45$ vs. $M_{nondieters} = 2.48$ chocolates; $F(1, 94) = 3.87, p = .052$), but consumed more when given pleasure information ($M_{dieters} = 3.54$ vs. $M_{nondieters} = 2.38$ chocolates; $F(1, 94) = 5.32, p = .023$). Differences in consumption across information conditions were not significant for goal absent participants ($F(1, 94) = .05, p = .83$).

Discussion

Experiment 3 provides additional strong support our self-regulatory strength amplification hypothesis. Moreover, experiment 3 replicated the pattern of results evident in the
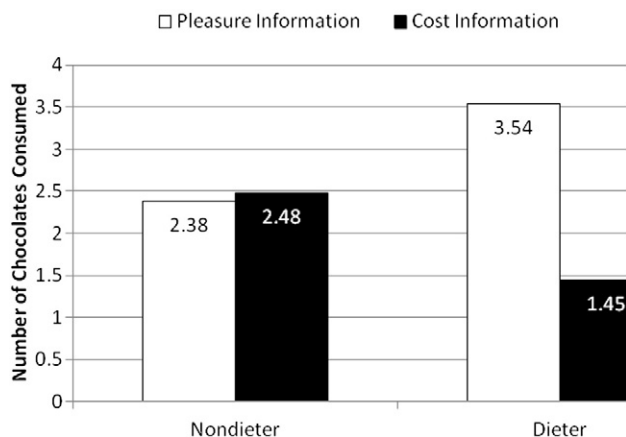

Fig. 6. Consumption results by experimental condition for experiment 3.

earlier experiments using a different measure of self-regulatory strength (handgrip) that compares performance to a within-subjects baseline (as compared to the between-subjects baseline control condition used in experiment 2). We demonstrate that the effects remain robust whether we measure participants' dieting goals (experiment 3) or use a priming procedure to manipulate dieting goals (experiments 1 and 2).

Consistent with our theory we observed self-regulatory strength amplification when dieters were exposed to cost information. Specifically, when processing cost information, dieters were able to increase their physical persistence by an average of 17.5% (5.56 s) over their initial trial time. In contrast, the physical persistence of dieters was decreased by an average of 26.3% (−11.70) seconds when processing pleasure information.

Experiment 4

In this final experiment, we allow consumers to select the type of information (cost vs. pleasure) that they can process about chocolate prior to sampling. This approach reflects the fact that in many consumption contexts people are required to actively select what information they will process and which they will ignore. The first three experiments have carefully controlled consumers' exposure to cost, pleasure or other information in an attempt to isolate the impact that information processing has on self-regulatory strength and consumption behavior. It is not clear, however, where consumers will focus their attention if they have free access to both types of information. Experiment 4 examines this question directly by observing the type of information that consumers choose to process and the impact that selective information processing has on their ability to self-regulate their eating behavior. This study is especially important given the on-going global debate over the need for nutritional labeling.

Participants and procedure

Fifty-eight undergraduate participants were seated in front of computer terminals upon entering the research lab and randomly assigned to one of two dietary goal conditions (present vs. absent; Trudel & Murray, 2011). In the *dietary goal-present* condition, participants were primed as follows: they were asked to "list at least 5 things that you have done in the last week that you expect will have a negative impact on your health." In the *goal-absent* condition participants were primed as follows: they were asked to "list at least 5 things that you have done in the last week that you expect will have a positive impact on your health."

A pretest (n = 58), conducted prior to experiment 4, indicated that the priming procedure worked as intended. Specifically, after completing the pretest priming manipulation, participants responded to a questionnaire, that included a 6-item affect scale (3 positive items and 3 negative items) adapted from Watson et al. (1988) and seven state self-control/health consciousness items (5 point scale) adapted from Moorman and Matulich (1993). Those scoring high in health consciousness

are labeled (healthy eating) goal-present, whereas those scoring low in health consciousness are labeled (healthy eating) goal-absent. An ANOVA revealed that those in the primed *goal-present* condition scored higher (M=4.58) than those in *goal-absent* condition (M=3.68; $F(1, 57)=6.35$, $p<.05$). No differences were found in positive affect ($p>.30$) or negative affect ($p>.90$) between goal conditions.

After completing the priming manipulation, the participants were thanked and they were informed that the second study required them to evaluate chocolate. A bowl of 25 chocolates was then placed directly in front of the participants. They were told that they could consume as many pieces of chocolate as they wanted once they had finished the information search task. Participants were given the opportunity to use a MouselabWEB (Willemsen & Johnson, 2009) computer-based interface to search for information about the chocolate. MouselabWEB is a process-tracing tool that allows researchers to monitor the information acquisition process of decision makers. Participants were able to access information about two pleasure attributes (richness and creaminess) and two cost attributes (fat content and caloric content) by passing their mouse pointer over the appropriate square on the computer screen. As long as the mouse pointer remained over a square, the attribute information was visible. As soon as the pointer was moved outside of the square, the attribute became hidden again. The order of presentation of the attributes was counterbalanced between subjects and MouselabWEB recorded the total time spent processing each attribute. Once participants had finished this task, they were permitted to consume as much chocolate as they wanted while they completed a follow-up questionnaire.

There are two key dependent measures for experiment 4. First, the number of chocolates consumed by each participant will provide a measure of consumers' ability to regulate their eating behavior—i.e., our self-regulatory strength measure. The second key measure is the ratio of the time spent processing cost information to the time spent processing pleasure information (Fazio, 1990). The processing ratio was calculated as: (time processing cost information − time processing pleasure information)/(time processing cost information + time processing pleasure information). The resulting ratio is such that a positive number indicates that a greater proportion of cost information was processed; whereas a negative number indicates a greater proportion of pleasure information was processed. The questionnaire measured health consciousness using a seven-point scale developed by Moorman and Matulich (1993) and involvement was also measured by asking participants to rate the study (on a seven-point scale) in terms of importance, relevancy, and interest. The 3 items were averaged to form a single involvement measure ($\alpha=.81$).

Results

Manipulation checks

Participants in the primed *goal-present* condition scored higher on a health consciousness/awareness scale ($M_{Goal\ Present}=5.81$) than participants in the *goal-absent* condition ($M_{Goal\ Absent}=5.11$; $F(1, 56)=5.01$, $p=.029$). There were no differences in

involvement between participants primed across goal conditions ($p>.40$).

Information processing and self-regulatory strength

Analysis of Variance (ANOVA) revealed a significant difference in the ratio of time spent processing cost/pleasure attribute information across goal conditions ($M_{Goal\ Present}=.15$ versus $M_{Goal\ Absent}=-.05$; $F(1, 56)=7.24$, $p=.009$). A positive ratio value for goal present participants indicates that they spent proportionately more time processing cost information, whereas the negative ratio value for goal absent participants indicates that they spent proportionately more time processing hedonic attribute information. As evidence of increased self-regulatory strength amplification, goal present participants, in comparison to goal absent participants, ate less chocolate ($M_{Goal\ Present}=1.48$ versus $M_{SR\ Goal-Absent}=3.10$; $F(1, 56)=9.44$, $p=.003$).

To test whether the ratio of cost/pleasure attribute information processed mediated the effect of self-regulatory goal on the consumption of chocolate, we tested whether the indirect effect was significant using the bootstrapping method with bias corrected confidence estimates (Preacher & Hayes, 2004, 2008). We found the mean indirect effect from the bootstrap analysis (based on 5000 bootstrap samples) is positive and significant ($a\times b=-.82$), with a 95% confidence interval excluding zero (−.1.72 to −.24). There is no direct effect ($\beta=-.80$, $t=-1.73$, $p=.09$) when controlling for the mediator indirect-only mediation (Zhao, Lynch, & Chen, 2010). Thus, all criteria for full mediation were met and the results support our notion that pleasure information leads to depletion for dieters whereas cost information leads to self-regulatory strength amplification.

Discussion

In the first three experiments we found that dieters exposed to cost information had amplified self-regulatory strength and were better able to control their eating behavior. Prior research has found that dieters who are seated close to a tempting food eat more than non-dieters because the physical proximity of the food is depleting and leaves dieters with less self-regulatory strength (Baumeister et al., 1998; Vohs & Heatherton, 2000). While self-regulatory failure has been consistently shown under these conditions in prior research (Baumeister et al., 1998; Kahan et al., 2003; Vohs & Heatherton, 2000), our experiments demonstrate that this effect depends on the type of information being processed. Consistent with our theory, the results from experiment 4 indicate that dieters process more cost (versus pleasure) information and, as a result, they are better able to control their eating behavior. The results of this study provide an important conceptual link between the first three studies and the vast majority of real world consumption situations in which consumers have access to both pleasure and cost information. Specifically, experiment 4 demonstrates that dieters will actively seek out more cost than pleasure information if it is available, which allows them to better regulate their eating behavior.

General discussion

In this research we demonstrate that the type of information that consumers process affects self-regulatory strength and, ultimately, their ability to self-regulate. This research is the first to demonstrate that consumers can amplify their self-regulatory strength through processing cost information. Specifically, consumers with a dietary goal persisted up to twice as long on the puzzle tasks (cognitive persistence), showed increased physical stamina (physical persistence), and they consumed approximately one-half as many chocolates when exposed to cost (versus pleasure) information. In addition, we found that dieters exposed to pleasure information did not persist as long cognitively or physically, and they consumed more chocolate (as compared to non-dieters). In other words, when exposed to pleasure attribute information, people actively trying to regulate their consumption show effects consistent with resource depletion—they performed worse on a second self-regulatory task, and ended up eating more than those who did not have such a goal. More importantly, we found that dieters exposed to cost information demonstrated self-regulatory strength amplification, increased regulatory performance on subsequent self-regulatory tasks, and ended up eating much less than the other experimental groups. All four experiments consistently show the amplification effect and increased self-regulatory performance through selective information processing.

Theoretical implications

Prior research has indicated that self-regulation consumes a limited energy resource and leaves people depleted and susceptible to desire and temptation (Baumeister & Heatherton, 1996; Baumeister et al., 2007; Vohs & Heatherton, 2000). We show that the type of information that consumers process moderates self-regulatory strength depletion. Without explicit cost information, or when only processing pleasure information, consumers have less self-regulatory strength and, ultimately, are more likely to fail to control their eating behavior. In contrast, when dieters process cost information they are able to amplify their self-regulatory strength and they are more likely to succeed at regulating their eating behavior.

We have measured self-regulatory strength in two distinctly different ways: 1) the amount of chocolate that participants consume, and 2) persistence on cognitive and physical tasks. With respect to chocolate consumption, our results replicate the findings of a number of previous studies, which have shown that when consumers are depleted they are less able to control their eating behavior (Baumeister et al., 1998; Kahan et al., 2003; Vohs & Heatherton, 2000). In addition, replicating the work of Trudel and Murray (2011), we find that dieters with access to cost information are better able to resist the temptation of chocolates placed directly in front of them.

However, our results are also different from prior work because, in our first three studies, before we record chocolate consumption, we take a different measure of self-regulatory strength. Specifically, building on prior research (Muraven et al., 1998; Rethlingshafer, 1942), we measure self-regulatory strength using cognitive (puzzle) and physical (handgrip) persistence tasks after participants have been exposed to a situation that has been shown to be depleting (Vohs & Heatherton, 2000). Persistence is the critical measure in these experiments because it allows us to compare changes in the self-regulatory strength of dieters to nondieters and, importantly, to the baseline levels of consumers who are not exposed to our manipulations. Not only do we find that dieters exposed to cost information have greater self-regulatory strength than nondieters, but dieters in the cost-conditions also demonstrate an amplification in self-regulatory strength relative to our between-subject (experiment 2) and within-subject (experiment 3) baseline conditions. In addition, this effect is strong enough that even though dieters in the cost-condition demonstrate greater self-regulatory strength in the persistence tasks, they are still able to better resist the tempting chocolates. In other words, our primary measure (persistence) contributes to the literature by demonstrating the potential for self-regulatory strength amplification; while in the same experiments our secondary measure (number of chocolates eaten) replicates the consumption results of previous studies (Baumeister et al., 1998; Kahan et al., 2003; Trudel & Murray, 2011; Vohs & Heatherton, 2000).

Traditional models of self-regulatory resource depletion (e.g., Baumeister & Heatherton, 1996; Baumeister et al., 2007) cannot easily account for these results. However our findings are consistent with the theory of motivational intensity, which contends that people tend to mobilize the energy required to achieve their behavioral goals (Brehm & Self, 1989). In addition, we add to the emerging body of literature that suggests motivation plays a central role in the ability of consumers to successfully self-regulate their behavior (Baumeister & Vohs, 2007; Myrseth & Fishbach, 2009; Myrseth et al., 2009). The results presented in this paper also contribute to a growing stream of research, which demonstrates that the depletion of self-regulatory strength is not always inevitable (Dewitte et al., 2009; Laran & Janiszewski, 2011; Muraven & Slessareva, 2003; Schmeichel & Vohs, 2009; Tice et al., 2007).

Practical and public policy implications

From a public policy perspective, the results from this research underline the importance of the current debate in the US Congress over the disclosure of nutritional information. Making calorie and nutrient information about food available at the point of purchase and consumption allows consumers to better self-regulate. In our work we find that the absence of nutritional information can make consumers' more vulnerable to resource depletion, decreases self-regulatory strength, and make dieters more likely to fail at controlling what they eat. The results from experiment 1 specifically tackled this issue and demonstrated that the absence of nutritional information led participants with a dietary goal to have similar depletion and consumption patterns as those who were exposed to only information about how pleasurable it would be to eat the chocolate—that is, consumers exposed to pleasure information

experienced a decrease in self-regulatory strength and they ate twice as many chocolates as participants exposed to nutritional information. However, our results also reveal a remedy for re-source depletion—that is, making information about the costs of consumption available to dieters can actually increase self-regulatory strength above baseline levels. Providing informa-tion about the fat and calorie content of hedonic foods at point of purchase and consumption may be an important step in helping to solve the global problem of obesity.

Limitations and future research

Building on previous research (Baumeister & Vohs, 2007; Brehm & Self, 1989; Myrseth & Fishbach, 2009), we argue that motivational intensity is the process by which regulatory strength amplification occurs. Specifically, we theorize that cost information provides consumers with the motivation to the mobilize energy necessary to increase their self-regulatory strength. We find evidence consistent with this account as dieters exposed to cost information are able to amplify their self-regulatory strength, in cognitive as well as physical tasks, and better control their chocolate consumption. Our approach to inferring motivational intensity from behavior is consistent with the extant literature on motivation in self-regulation (Fishbach et al., 2010; Myrseth et al., 2009) and reflects the difficulty of directly measuring the amplification of an internal resource that is driven by both conscious and nonconscious processes (Myrseth & Fishbach, 2009).

However, prior research has demonstrated that increases in motivational intensity can be measured physiologically in terms of heart rate, systolic and diastolic blood pressure (Brehm & Self, 1989; Gendolla & Richter, 2005). This suggests a poten-tially fruitful avenue for future research that examines the connection between self-regulatory strength, motivational in-tensity and cardiovascular reactivity. It may be that the in-crease in self-regulatory strength demonstrated in the studies described above is associated with changes in heart rate and/or blood pressure. Evidence to this effect would also provide additional support for emerging work that indicates regulatory strength is based in physical energy stores (Gailliot et al., 2007; Gailliot & Baumesiter, 2007).

A second potentially interesting avenue for future research would be to expand on the idea that consumers can actively mobilize self-regulatory resources when sufficiently motivated. This implies that consumers might actively conserve resources and perhaps even choose to fail when less motivated, in order to ensure that resources are available for other self-regulatory tasks. Does indulging in a decadent desert at dinner mean that we will have the strength to resist cheating on a spouse later? Future research investigating the allocation of self-regulatory strength to more or less important goals would benefit our cur-rent understanding of self-control. It could well be that con-sumers actively decide how to allocate their limited self-regulatory strength to ensure that they are best able to achieve their most important goals. Or, maybe the inability to achieve particular self-control goals can be attributed to the squandering of self-regulatory strength on less important tasks.

Conclusions

We set out to better understand successful self-regulation. Our results demonstrate that cost attribute information can be used by consumers to amplify self-regulatory strength. As global con-cerns over nutrition and weight management rise, this research adds to our understanding of how the information provided to consumers affects their ability to regulate their behavior and sug-gests that a first step in combating the obesity epidemic might be to make nutritional information more generally available. The results from our experiments suggest that a consumers' ability to resist hedonic foods depends largely on whether or not they process information about the costs of consumption. Unfortunately, marketers may be putting consumers at a dis-tinct disadvantage. The amount of pleasure information pro-vided to consumers is almost always greater than the amount of cost information provided and often, as is the case in restau-rants, no cost information is available. The failure to provide cost information may be rendering consumers much more vulner-able to desire and to the depletion of self-regulatory strength.

References

Abelson, P., & Kennedy, D. (2004). The obesity epidemic. *Science*, *304*(5676), 1413.

Argo, J. J., & White, K. (2012). When do consumers eat more? The role of ap-pearance self-esteem and food packaging cues. *Journal of Marketing*, *76*(2), 67–80.

Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research*, *28*(4), 670–676.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, *74*, 1252–1265.

Baumeister, R. F., & Heatherton, T. F. (1996). Self-regulation failure: An overview. *Psychological Inquiry*, *7*(1), 1–15.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego, CA: Academic Press.

Baumeister, R. F., Sparks, E. A., Stillman, T. F., & Vohs, K. D. (2008). Free will in consumer behavior: Self-control, ego depletion, and choice. *Journal of Consumer Psychology*, *18*(1), 4–13.

Baumeister, R. F., & Vohs, K. D. (2007). Self-regulation, ego-depletion, and motivation. *Social and Personality Psychology Compass*, *1*(1), 115–128.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science*, *16*(6), 351–355.

Brehm, J. W., & Self, E. A. (1989). The intensity of motivation. *Annual Review of Psychology*, *40*, 109–131.

Bruyneel, S., Dewitte, S., Vohs, K. D., & Warlop, L. (2006). Repeated choosing increases susceptibility to affective product features. *International Journal of Research in Marketing*, *23*, 215–225.

Caballero, B. (2007). The global epidemic of obesity: An overview. *Epidemiologic Reviews*, *29*(1), 1–5.

Dewitte, S., Bruyneel, S., & Geyskens, K. (2009). Self-regulating enhances self-regulation in subsequent consumer decisions involving similar response conflicts. *Journal of Consumer Research*, *36*(3), 394–405.

Fazio, R. H. (1990). A practical guide to the use of response latency in social psychological research. In C. Hendrick, & M. S. Clark (Eds.), *Review of personality and social psychology: Vol. 11. Research methods in personality and social psychology* (pp. 74–97). Newbury Park, CA: Sage.

Fishbach, A., & Shah, James Y. (2006). Self-control in action: Implicit disposi-tions towards goals and away from temptations. *Journal of Personality and Social Psychology*, *90*(5), 820–832.

Fishbach, A., & Trope, Y. (2005). The substitutability of external control and self-control in overcoming temptation. *Journal of Experimental Social Psychology*, *41*, 256–270.

Fishbach, A., Zhang, Y., & Trope, Y. (2010). Counteractive evaluation: Asymmetric shifts in implicit value of conflicting motivations. *Journal of Experimental Social Psychology*, *46*, 29–38.

Gailliot, M. T., Baumeister, R. F., Schmeichel, B. J., DeWall, C. N., Maner, J. K., Plant, A., et al. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology*, *92*(2), 325–336.

Gailliot, M. T., & Baumesiter, R. F. (2007). The physiology of willpower: Linking blood glucose to self-control. *Personality and Social Psychology Review*, *11*(4), 303–327.

Gendolla, G. H. E., & Richter, M. (2005). Ego-involvement and effort: Cardiovascular, electrodermal, and performance effects. *Psychophysiology*, *42*(5), 595–603.

Herman, C. P., & Polivy, J. (2004). The self-regulation of eating: Theoretical and practical problems. *Handbook of self-regulation: Research, theory, and applications* (pp. 492–508).

Hoch, S. J., & Loewenstein, G. F. (1991). Time-inconsistent preferences and consumer self-control. *The Journal of Consumer Research*, *17*(4), 492–507.

Hofmann, W., Strack, F., & Deutsch, R. (2008). Free to Buy? Explaining self-control and impulse in consumer behavior. *Journal of Consumer Psychology*, *18*(1), 22–26.

Johnson, E. J. (2007). Man, my brain is tired: Linking depletion and cognitive effort in choice. *Journal of Consumer Psychology*, *18*(1), 14–16.

Kahan, D., Polivy, J., & Herman, C. P. (2003). Conformity and dietary disinhibition: A test of the ego-strength model of self-regulation. *International Journal of Eating Disorders*, *33*(2), 165–171.

Kahneman, D., & Tversky, A. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, *5*, 207–232.

Laran, J. (2009). Choosing your future: Temporal distance and the balance between self-control and indulgence. *Journal of Consumer Research*, *36*(6), 1002–1101.

Laran, J., & Janiszewski, C. (2011). Work or fun? How task construal and completion influence regulatory behavior. *Journal of Consumer Research*, *37*(6), 967–983.

Menon, G., Raghubir, P., & Schwarz, N. (1995). Behavioral frequency judgments: An accessibility–diagnosticity framework. *Journal of Consumer Research*, 212–228.

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review*, *106*(1), 3–19.

Moorman, C., & Matulich, E. (1993). A model of consumers' preventative health behaviors: The role of health motivation and health ability. *Journal of Consumer Research*, *40*, 208–228.

Morrill, A. C., & Chinn, C. D. (2004). The obesity epidemic in the United States. *Journal of Public Health Policy*, *25*(3), 353–366.

Muraven, M., & Slessareva, E. (2003). Mechanisms of self-control failure: Motivation and limited resources. *Personality and Social Psychology Bulletin*, *29*(7), 894–906.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, *74*(3), 774–789.

Myrseth, K. O. R., & Fishbach, A. (2009). A function of knowing when and how to exercise restraint. *Current Directions in Psychological Science*, *18*(4), 247–252.

Myrseth, K. O. R., Fishbach, A., & Trope, Y. (2009). Counteractive self-control: When making temptation available makes temptation less tempting. *Psychological Science*, *20*(2), 159–163.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*, 717–731.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879–891.

Rethlingshafer, D. (1942). Relationship of tests of persistence to other measures of continuance of activities. *Journal of Abnormal and Social Psychology*, *37*, 71–82.

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.

Schwarz, N. (1998). Accessible content and accessibility experiences: The interplay of declarative and experiential information in judgment. *Personality and Social Psychology Review*, *2*(2), 87.

Shiv, B., & Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of Consumer Research*, *26*(3), 278–292.

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*, *43*(3), 379–384.

Trope, Y., & Fishbach, A. (2000). Counteractive self-control in overcoming temptation. *Journal of Personality and Social Psychology*, *79*, 493–506.

Trudel, R., & Murray, K. B. (2011). Why didn't I think of that? Self-regulation through selective information processing. *Journal of Marketing Research*, *48*(4), 701–712.

Vohs, K. D., & Baumeister, R. F. (2004). Understanding self-regulation: An introduction. *Handbook of self-regulation: Research, theory, and applications* (pp. 1–9).

Vohs, K. D., Baumeister, R. F., Twenge, J. M., Schmeichel, B. J., Tice, D. M., & Crocker, J. (2005). *Decision fatigue exhausts self-regulatory resources— But so does accommodating to unchosen alternatives. .*

Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research*, *33*, 537–547.

Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science*, *11*(3), 249–254.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070.

Wertenbroch, K. (1998). Consumption self-control by rationing purchase quantities of virtue and vice. *Marketing Science*, *17*(4), 317–337.

Wertenbroch, K., Vosgerau, J., & Bruyneel, S. D. (2007). Free will, temptation, and self-control: We must believe in free will, we have no choice. *Journal of Consumer Psychology*, *18*(1), 27–33.

Willemsen, M. C., & Johnson, E. J. (2009). Mouselabeweb: Monitoring information acquisition processes on the web. http://www.mouselabweb.org

Wright, R. A., Martin, R. E., & Bland, J. L. (2003). Energy resource depletion, task difficulty, and cardiovascular response to a mental arithmetic challenge. *Psychophysiology*, *40*, 98–105.

Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, *37*, 197–206.