Decision Fatigue Exhausts Self-Regulatory Resources

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The current research tested the hypothesis that making many choices impairs subsequent self-control. Drawing from a limited-resource model of self-regulation, we hypothesized that decision making depletes an internal resource that governs self-control. In four laboratory studies, some participants made choices among consumer goods or college course options, whereas others reviewed the same options without making choices. Making choices led to reduced self-control (i.e., less physical stamina, task persistence in the face of failure, more procrastination, and less quality and quantity of arithmetic calculations). A field study also found that reduced self-control was predicted by shoppers' self-reported degree of active choice making.

"*The difficulty in life is the choice."* --George Moore, The Bending of the Bough, 1900

The rich complexity of human social life is partly attributable to choice. Each day, millions of people make decisions that will have lasting effects on their lives. Above and beyond the choices that will leave lasting imprints, consumers face a multitude of choices that must be made, despite the fact that the repercussions are quite limited. There is no denying that choices have proliferated, in terms of the number of decisions consumers can make.

Consider that the diversity of product selection has expanded exponentially, such that the average American supermarket in 1976 carried 9,000 different SKUs, whereas fifteen years later that figure had ballooned to 30,000 (Waldman 1992). It is estimated that there are currently 1 million SKUs in the U.S., and that the average supermarket carries 40,000 of them (Trout 2005). The coffee shop chain Starbucks boasted in 2003 that it offered each customer 19,000 "beverage possibilities" at every store, and this was before their new "superheated" option, which multiplied the number even further.

Has the proliferation of choice uniformly made life easier and better? The answer is a resounding no. Consumer behavior scientists long have observed that consumers feel frustrated and overwhelmed with the intense information demands that accompany large assortments (Huffman and Kahn 1998; Maholtra 1982). Iyengar and Lepper (2000) found that consumers who faced 24 options, as opposed to six options, were less willing to decide to buy anything at all, and those who did buy were less satisfied with their purchase. Such findings suggest that choice, to the extent that it requires greater decision-making among options, can become burdensome and ultimately counterproductive. Although one would not argue that having no choice is good, recent commentaries and critiques have denounced ever-increasing choice, using words like "relentless" and "inescapable" (Mick forthcoming) to describe this "tyranny of freedom" (Schwartz 2000).

The present investigation was designed to offer a possible explanation for the detrimental side effects of choosing. Our approach was based on recent evidence that the self's executive function operates on the basis of a limited resource that resembles a form of strength or energy. Past work has

mainly established that this resource is depleted in acts of self-regulation (Baumeister 2002; Muraven, Tice, and Baumeister 1998; Vohs and Heatherton 1998), but it may also be used in other executive activities of the self, most notably in making choices.

The purpose of the present research was to test the hypothesis that making choices in a conscious, effortful, deliberate manner will deplete a limited internal resource. Moreover, we hypothesized that this resource is that which is used for self-regulation. As a result, one repercussion of making choices will be a subsequent reduction in effective self-regulation. Given that classic and contemporary work in marketing has revealed the myriad processes involved in choice (Dhar 1997; Luce, Payne, and Bettman 1999; Lynch and Srull 1982; McAlister 1979; Simonson 1989; Simonson and Tversky 1992), we sought to look beyond the choice setting itself to behaviors that occur after consumers have engaged in choice making.

CHOICE AND CONTROL

By some analyses, human life is full of constant choices, insofar as almost every time one acts, one could probably have done something different (Sartre 1956). We use the term choice in a more limited sense, however, to refer to choices made by a conscious consideration among alternatives. Most of the time people proceed by routine, habit, and automatic processes (Bargh 2002). However we consider the contemplation of alternatives and selection among them to be a meaningful and effortful internal act that involves more than habitual behavior. After all, having fifty different options would not be difficult or troubling if one always picked the same favorite one. Hence we reserve the term choice for these inner, effortful processes of actually making a decision.

Indeed, in some views the capacity to make flexible choices based on new information is one of the driving forces behind the evolution of basic cognitive processes (Tomasello and Call 1997). That is, simple organisms behave according to fixed action patterns, by which their biological programming dictates a single and inflexible response. More complex organisms may act on the basis of operant

conditioning, so that current behavior is somewhat flexibly shaped by the consequences of past behavior. The most advanced form of choosing involves weighing information about currently available options to select the option that seems most promising. This response would be the most flexible, and potentially the most adaptive in terms of promoting survival and reproduction, but it requires the most elaborate information-processing apparatus and the most pliant behavior control system — so, in a sense, it is costly. The cost of such choosing is the central focus of this investigation.

SELF-REGULATORY RESOURCE DEPLETION

Recent findings have begun to suggest that many of the self's activities depend on a common resource, akin to energy or strength. The self's executive function is the agent that makes choices and decisions, initiates and controls action, and regulates the self by operating on its inner states (Baumeister 1998). All of these important activities seem to draw on this same resource, which is limited and may therefore easily become depleted.

We define self-regulation as the self exerting control over itself to change its responses in an attempt to pursue goals and standards. These responses include altering one's emotional state, regulating thought processes, persisting at a task despite a strong desire to quit, and overriding impulses. The goals and standards include ideals, morals, norms, performance targets, and the expectations of other people. A series of studies has provided evidence that some self- resource is depleted by acts of regulating the self. Baumeister, Bratslavsky, Muraven, and Tice (1998) showed that performing one act of regulating the self impaired performance on a subsequent, seemingly unrelated act of self-control. For example, resisting temptation, stifling emotional distress, or suppressing thoughts caused people to quit earlier on a frustrating task, show less physical stamina, and be unable to refrain from laughing at a humorous scene. Presumably, the first act of self-control depleted some resource that would have been needed to perform better at the second act of self-control. Depletion of the self's resources has been linked to multiple behavioral problems, including overeating by dieters

(Vohs and Heatherton 2000), prejudicial responding (Richeson and Shelton 2003), inappropriate self-presentation (Vohs, Baumeister, and Ciarocco 2005), intellectual underachievement (Schmeichel, Vohs, and Baumeister 2003) and impulsively overspending (Vohs and Faber forthcoming).

These studies of self-regulation are relevant because they involve the self's executive function, which is to say the inner agency that exerts control and also makes choices. Baumeister et al. (1998) speculated that the resource involved in self-regulation might be the same one needed for other activities of the executive function, such as decision making. The present studies were designed to test that hypothesis.

CHOICE CAN IMPAIR SELF-CONTROL

The current work tests the hypothesis that there is a hidden cost to choosing, a cost that goes beyond that of being responsible for outcomes or the costs involved in thinking about options. Specifically, the process of choosing may itself drain some of the self's precious resources, thereby leaving the executive function less capable of carrying out its other activities. Decision fatigue can therefore impair self-regulation.

There are several reasons to think that choosing would deplete the self's strength. These reasons also differentiate the act of deliberation from that of choosing. Self-regulation presumably consumes resources because the self must override one response and then substitute a different response, and energy is needed to perform these interrupt and initiate functions. Choosing may also involve an energy-consuming transition, namely when people shift from deliberation to actual choosing. The Rubicon model of action (Gollwitzer 1996) outlines two mindsets that people move through serially. The deliberative mindset allows the person to consider and weigh various options and the implemental mindset enables the person to pursue the selected course of action. To move from the first mental mode to the second involves terminating the deliberating process and then initiating actions to pursue the chosen option. In further support of the uniqueness of choosing, the Reflective-

Implemental Model (Strack, Werth, and Deutch 2006) conceptualizes choosing as a quasi-behavioral act that ties the selected option to the self via the creation of a mental representation. The initiation of a mental link between the active, intentional, reflective part of the self and the desired option also suggests an energy-consuming act that would deplete regulatory resources (see Vohs forthcoming).

Accordingly, choosing is not equivalent to the cognitive process of deliberating. The philosopher Searle (2002) has discussed this difference at some length and concluded that rationality presupposes some degree of purposeful control over behavior because rational analysis is functionally useless unless one can act based on the outcome of the analysis. Searle further emphasized that people can recognize multiple reasons to behave in a certain way but still not perform the behavior, again indicating that contemplating and choosing are separable steps. Converging evidence comes from Damasio (1994), a neuropsychologist who observed that certain brain-damaged patients with emotional deficits can and do engage in sophisticated (and accurate) cognitive deliberations, such as lengthy ruminations about the costs and benefits of several options — but they often cannot bring themselves to finally make a choice.

In sum, we reasoned that making a choice involves a particular intrapersonal act. This step, which in some way commits the person to a course of action, requires an effortful inner process. As such, we hypothesize that it consumes some of the self's limited supply of energy, thereby rendering the resource less available for future self-directed activities. This investigation was designed to test the hypothesis that acts of choice would produce a state of resource depletion that could be measured subsequently as impaired self-regulatory ability.

PRESENT INVESTIGATION

This investigation used an assortment of procedures, settings, and measures to test the hypothesis that making choices would reduce subsequent self-control. Experiments 1-4 took place in the laboratory, and in these studies participants in the crucial condition were instructed to make a series

of choices. The choices were made meaningful and personally relevant. Afterward, self-regulatory resource depletion was assessed by having participants perform a task that required self-control. We predicted that those who made many choices in the first task would be more depleted and would therefore perform worse on the second task, relative to those who had not made choices earlier. Experiment 5 was a naturalistic study in which participants at a shopping mall were asked about the extent to which they had engaged in decision-making throughout their shopping trip that day. Subsequently, shoppers' performance on a self-control task was measured. We predicted that making many personally involving choices would result in subsequent impairments in self-regulation.

An alternative to the resource depletion hypothesis would suggest that making choices can be aversive because people must necessarily give up some options, and so one result of choosing might be a foul mood that itself could alter later behavior. To rule this out, several of the following studies administered measures of mood and emotional state after the choosing manipulation.

PILOT STUDY

The Pilot Study was a preliminary study designed to justify the assumptions behind the choice procedure that was to be used in Experiments 1-4, and it also validated a self-report measure for use in Experiment 5. In this initial test, we assigned participants either to make a series of binary choices between products or to report their usage of the same products, and then we asked them all to report the degree of effort, consciousness, and deliberation involved in the act of making choices or reviewing one's usage. We did this initial test to confirm our basic hypothesis people do make more effortful, self-involving choices in the high choice condition than in the no-choice condition, and to establish a questionnaire that would later be used in a field setting to measure choices.

The choice condition was designed to mimic aspects of choice in consumer behavior. In Experiment 1, participants in the high choice condition were asked to make a multitude of choices between products, and at least one of these choices would determine which item they would receive as

a prize. No-choice participants were also told that their prize for participating would be contingent on their answer to the usage question. Thus, participants' responses had potentially real (though relatively minor) outcomes.

Method

Participants were 34 undergraduate students (20 male) who participated in exchange for partial course credit. Participants were randomly assigned either to make choices or rate products. They were given a list of 60 specific varieties of products, such as colored pens, scented candles, popular magazines, and colored t-shirts. Participants in the *no choice condition* were asked to read and rate the products on the extent to which they had used each product in the past (on a scale from one-five, from *never* to *very often*). Participants in the *choice condition* were asked to read the list of products, but they were also instructed to choose between two different versions of each product (e.g., between a white t-shirt and a black t-shirt; a red pen or a purple pen).

Subsequently, participants completed the state version of the Positive and Negative Affectivity Schedule (PANAS; Watson, Clark, and Tellegen 1988) and also an eight-item questionnaire that served as the manipulation check of the methods. Two items asked participants about the extent to which participants engaged in choice making during the products task, three items asked about the amount of consideration, deliberation, and thinking that participants put into the task, one item tapped the extent to which responses to the product task were of participants' own choosing, and one final item asked how tired participants felt. The first seven items were designed to tap into the different aspects of choice making that are important in the depletion of self-resources; the last item on tiredness was included to see if participants reported feeling more tired after making multiple choices. After completing the product task questionnaire, participants were debriefed and thanked.

Results

A factor analysis of the eight items showed that one factor accounted for 43% of the variance in the unrotated solution (*eigenvalue* = 3.46), whereas the second factor (*eigenvalue* = 1.27) accounted for an additional 16% of variance. Inspection of the varimax-rotated solution showed that 7 items loaded onto one factor at over .55, whereas item eight (*How tired do you feel?*) loaded onto a second factor (i.e., item 8 loaded at -.001 onto Factor 1 and at .86 on Factor 2). Accordingly, we aggregated the first 7 items into one factor that tapped *involvement of self in choosing* and left the eighth item on its own to represent the second factor of feeling tired. Coefficient alpha for the entire scale was satisfactory, $\beta = .75$.

A t-test with condition as predictor and the dependent measure of *involvement of self (*i.e., scale items one-seven) revealed the predicted effect of condition, $t(32) = 2.43$, $p = .02$. Participants in the choice condition ($M = 43.63$, $SD = 7.09$) reported that they were more involved and made more choices during their task than did participants in the frequency (no choice) condition, ($M = 36.06$, $SD = 10.52$). Reports of feeling tired did not, however, vary with condition, $t(32) < 1$, $p = ns$ ($M = 3.31$; $SD = 2.44$ versus $M = 3.22$, $SD = 2.02$).

There was a significant difference in the length of time it took each group to complete their task, $t(32) = 3.36$, $p < .01$. The choice task took about a minute longer ($M = 210.32$ seconds; $SD = 65.98$) than did the frequency rating task ($M = 146.32$ seconds; $SD = 44.02$). But analyses confirmed that time spent on the task did not predict scores on Factor 1 (items 1-7), which was the focal 'involvement of self' measure, $r(34) = .10$, ns. Furthermore, an ANCOVA with time spent on the product ratings task as a covariate showed that differences in length of time did not account for differences on Factor 1 (involvement of self), $F(1, 31) < 1$, but rather experimental condition remained a significant predictor in this model, $F(1, 31) = 6.01$, $p < .01$.

As mentioned, participants' first charge after completing the product ratings task was to complete the PANAS to determine whether mood differed as a consequence of choosing versus rating products. A t-test showed that condition did not determine positive affect (PA; *M* choices = 24.31, *SD*

= 7.09; *M* frequency = 25.05, *SD* = 6.61) or negative affect (NA; *M* choices = 13.19, *SD* = 4.45; *M* frequency = 11.89, *SD* = 2.25), *t*(32) = .32, *ns*.

Discussion

In this study, we sought to provide initial evidence that the choice procedure led to higher ratings of psychological involvement than the frequency of use task. We confirmed this hypothesis by showing that participants who made choices among products reported being more active, conscious, and deliberative during the task, relative to participants who rated the frequency with which they had used the products.

EXPERIMENTS 1A AND 1B

Experiments 1a and 1b were the first tests of our hypothesis that making choices depletes the self's resources. The Pilot Study confirmed that our procedure of having people make a series of binary choices was perceived by participants as making demands on the self more than the no-choice procedure of merely rating usage of the same products. Our theory holds that such effortful, involving choices will deplete the self's resources, and that this depletion would impair performance on a self-regulation task. Hence in Experiments 1a and 1b, the choice (versus rating) procedure was followed by a self-regulation task that had no obvious connection with the product-rating task.

Self-regulatory resource depletion was measured by how much of a bad-tasting beverage people could make themselves drink. Making oneself drink an aversive beverage requires self-control insofar as people are disinclined to consume it and must therefore force themselves do something they do not want to do. We understand self-control as overriding one's habitual, normal, or natural response (Baumeister and Heatherton 1996), and so in this case people had to override their normal tendency to avoid a bad-tasting drink. This drink is a healthy drink made of a combination of vinegar and water, and thus the task of drinking a less-than-tasty liquid that is good for one's health nicely approximates a 'taking one's medicine' scenario. We predicted that people who had made choices among products

would not consume as much of the drink as no choice (frequency rating) participants.

The two studies were nearly identical, but the experimenter in 1a got the impression that the choices task took longer than the no-choice (control condition) task, which could potentially confound the results. Hence Experiment 1b instituted two changes, one to keep track of the time spent on the initial task, and the other to lengthen the no-choice task to equalize the time spent in the two conditions.

Method

Thirty undergraduate students (20 women) participated in Experiment 1a and 30 participants (18 women) participated in Experiment 1b in exchange for partial course credit. Participants were randomly assigned to a choice task or a no choice task. Before completing questionnaires, participants in the choice condition were told that they would receive a gift at the end of the experimental session that was based on the choices they reported in the questionnaire; those in the no choice condition were told they would also receive a gift but that it would be chosen for them.

In the choice condition, participants made a long series of choices between products, both within and across categories, much the same as in the Pilot Experiment. For example, 11 colors of t-shirts were displayed on the table in front of the participants, each labeled with a letter code. Participants made similar choices between items in the following categories: scented candles, t-shirt sizes, shampoo brands, color posters, candy, and types of socks. After choosing items within each product category, participants then chose between different categories of products. In a final task, participants made binary choices between occupations.

Participants in the no choice condition in Experiment 1a completed a questionnaire that required them to rate products and occupations but were not asked to choose between items. Participants in the no choice condition completed a questionnaire asking them to indicate which products they had used in the past year. These were the same products mentioned in the choice condition; here, however, they were presented in a list rather than as binary choices. The second part of the questionnaire asked participants to indicate which occupations they had seriously considered entering. These occupations were the same used in the choice task condition. Thus participants in each condition were exposed to the same stimuli and both completed questionnaires dealing with the same

products and occupations, but those in the choice condition made choices between the options whereas those in the no choice condition reported which products they had used or which occupations they had considered. For Experiment 1b, the no-choice condition had participants record their thoughts, feelings, and opinions about 8 advertisements. Time spent at this task was recorded for Experiment 1b (but not in Experiment 1a).

After completing the product-rating task, participants entered another room and were seated at a table on which were placed twenty small paper cups. Each cup held one ounce of a mixture made with orange drink mix, sugar, water, and vinegar. (The drink was made with two cups of vinegar and six cups of water instead of the eight cups of water that are called for in the regular directions). The experimenter then told the participant that this part of the experiment concerned motivation. "This is a drink that does not taste good to most people. It is not harmful. I will give you a nickel for every ounce you drink; each little cup is one ounce, and each one is identical. How much you drink is up to you." The number of ounces each participant drank was recorded as a measure of self-regulatory resource depletion; the fewer ounces consumed, the more depletion displayed. After the vinegar-drinking task, participants were paid for their drink consumption and given a free gift.

Results and Discussion

Experiment 1a provided evidence that making choices depletes an important resource in the self and results in impaired capacity for self-regulation. Participants who made a series of choices between and within product categories and occupations later drank fewer ounces of an ill-tasting drink than participants who merely rated their prior frequency of exposure regarding those same products and occupations, $F(1, 29) = 13.57$, $p < .001$. The means are presented in table 1.

In Experiment 1b also, participants in the choice condition drank significantly less than participants in the no choice condition, $F(1, 28) = 7.68$, $p < .01$ (see table 1). Time did not confound the results. If anything, participants in the no choice condition spent slightly longer on their initial task than did those in the choice condition (31 vs. 30 min) but the two conditions did not differ statistically $F(1, 28) < 1$, *ns*. Thus, as suggested by the Pilot Study and Experiment 1a, decreased self-control after decision making does not appear to depend on the amount of time that the initial task required.

EXPERIMENT 2

Experiments 1a and 1b provided the first real tests of the hypothesis that making choices depletes the self's resources. Experiment 2 was designed as a replication and extension, with several refinements. First, the choice manipulation and the dependent measure were administered by separate experimenters and presented as separate experiments. We used two different experimenters to avoid the possibility that participants would try to perform well on the second, self-control task in order to ingratiate themselves with the experimenter, so as to get a better gift (which was promised as the reward for the first task). Second, the experimenter for the dependent measure was kept blind to condition, which eliminates the possibility of unknowingly biasing the results via demand characteristics. Third, the cold pressor task requires participants to hold their non-dominant hand and most of their lower arm (to the elbow) in frigid water for as long as possible. We understand self-control as overriding one's habitual, normal, or natural response (Baumeister and Heatherton 1996), and so in this case people had to override their normal tendency to recoil and pull one's arm out of the near-freezing water. The main prediction was that making choices would deplete the resource needed for self-control, leaving people less able to keep their hand in icy water for a long period of time.

Method

Twenty-five (16 female) undergraduates participated in exchange for partial course credit. Participants were randomly assigned to either a choice task or a no choice task. In the choice condition, participants made a long series of choices between products, both within and across categories, as in previous studies. For example, we again used 11 colors of t-shirts that were displayed on the table in front of the participants, each labeled with a letter code. Participants made similar choices between items in the following categories: scented candles, t-shirt sizes, shampoo brands, candy, and types of

socks. After choosing preferred items within each product category, participants then chose between different categories of products. Participants were encouraged to "think carefully about each choice, because you will be given a free gift at the end of the experiment based in part on the preferences you indicate here." In the no choice condition, participants recorded their thoughts, feelings, and/or opinions about each of eight advertisements taken from popular magazines. Participants in the no choice condition were also informed that they would be given the opportunity to select a free gift for themselves at the end of the experiment. They were also told that the same options were presented to all participants.

Following the manipulation (choosing versus rating), participants were escorted to another room, where a second experimenter who was blind to participants' condition, administered the cold pressor task. For the cold pressor task, water temperature was maintained at 1 degree Celsius (about 34 degrees Fahrenheit) using a mixture of ice and water. An aquarium pump was used to circulate the water continually to prevent a warm pocket of water from forming around the participant's hand. The room air temperature was also maintained at a constant 72 degrees Fahrenheit (22 degrees Celsius). Participants first held their hand and lower arm in room temperature water for one minute to ensure an equal starting point before putting their arm in the ice water. Using the standard directions that qualify the cold pressor task as a measure of self-control, the experimenter asked the participant to put his or her arm into the water up to the elbow and hold it there for as long as possible. The experimenter used a stopwatch to measure the length of time the participant held his or her arm in the water. This number (in seconds) served as the measure of self-control. After completing the cold pressor task, participants were fully debriefed, given an opportunity to choose a free gift, and thanked.

Results

Experiment 2 supported the hypothesis that making a series of choices depletes a valuable resource, leaving the self subsequently less effective at self-regulation. The self-regulation measure in

this study involved holding one's hand in unpleasantly cold water. Participants who had made a series of choices quit earlier on the task relative to participants in the no choice condition, $F(1, 23) = 5.97$, $p < .025$ (see table 1). Persistence on the cold pressor task was not confounded with time spent on the first task because the product rating task took no longer than the choice task, $F(1, 23) = 1.76$, *ns*.

Discussion

The design of Experiment 2 bolstered the findings of Experiments 1a and 1b by ruling out several alternative explanations. We used two experimenters in the current study, one to administer the dependent measure and one to administer the product task. Moreover, the experimenter overseeing the dependent measure was blind to condition, thereby eliminating concern that experimenter demand could have contributed to the results. Also, participants in the no choice condition were told they would be able to choose their own gift from a standard set of options, thereby eliminating concern that their performance on the self-control measure was aimed at persuading the experimenter to offer them a better gift or a more appealing set of options.

EXPERIMENT 3

To provide further evidence of the detrimental impact of making choices on subsequent self-regulation, Experiment 3 was designed as a conceptual replication of Experiment 2 but with new procedures for both the choice task manipulation and the dependent measure of self-regulation. Instead of making choices among small household products, participants in this study either made choices, or not, regarding the courses they would take to satisfy their degree requirements. They were encouraged to take these choices seriously as if they were actually selecting the classes they were to take in future years, so it seems reasonable to assume that they regarded these choices as important and relevant.

Self-regulation was measured in terms of resisting procrastination. Participants were given 15

minutes to study for an upcoming nonverbal (math) intelligence test that was framed as a predictor of many desirable life outcomes. To practice, participants were given a packet of sample problems. However, as a competing temptation, they were also allowed to read magazines and play a video game. We knew that self-regulation would be required for most participants to override the seductive pull of games and magazines and make oneself practice arithmetic problems. Most likely, this is a self-regulation dilemma that would be familiar to many college students, namely whether to push oneself to study for a test or indulge in more pleasant pastimes. We hypothesized that choosing one's courses would deplete the self's resources, as compared to merely reading about courses and requirements without choosing. Hence we predicted that participants who made choices would spend more of their time on the time-wasting temptations of magazines and video game and, correspondingly, would spend less time studying for the upcoming test.

Method

Twenty-six introductory psychology students (17 males) participated in exchange for partial course credit. Data from two participants were not included in analyses (leaving 24). One participant correctly surmised that the intelligence test was not going to be administered, and the other was an acquaintance of the experimenter. Participants arrived at the laboratory individually, where they were informed that the experiment examined whether a person's choice of college major was related to nonverbal intelligence. All participants were shown a list of general education course requirements and a list of all the classes that satisfy each of these requirements. This information was taken directly from the official undergraduate bulletin, which stated that a total of 36 credit hours (12 courses) in pre-determined content areas were required of all undergraduates regardless of major area of study. These 12 courses must be selected from a total of over 60 distinct courses offered at the university.

In the *choices condition*, participants were directed to spend eight minutes indicating which courses they would choose to take to satisfy each of the general education requirements and to write

down their selections on the response sheet they were given. If they finished this task, participants were to consult the undergraduate course bulletin to select and then write down the courses they would take to satisfy their major degree requirements. In the *no choices condition*, participants were instructed to peruse course requirements and then read over the different courses that satisfy these requirements. These participants were also encouraged to review course descriptions of classes in their major and to consider courses in which they might enroll to satisfy their major degree requirements. These participants, unlike choice condition participants, were not asked to make formal choices by writing them down on a response sheet. Rather, they were simply instructed to think about courses in which they would prefer to enroll.

After eight minutes had elapsed, the experimenter asked participants to complete the PANAS (Watson et al. 1988) as a mood questionnaire. Participants then began the nonverbal intelligence (math) test portion of the experiment. The experimenter explained the format of the test and told participants that the test is highly predictive of skills important for real-word success. Additionally, participants were told of past research showing that performing practice math problems for 15 minutes significantly improved performance on the test but practicing for more than 15 minutes did not lead to additional increases on performance. The experimenter announced he was going to leave the room for 15 minutes and gave participants a packet of practice math problems. Participants were told they could practice for the upcoming test for as long as they wanted during the next 15 minutes. The experimenter also noted that participants could look at magazines or play a hand-held video game (both of which were located on a stand next to the participants' work area) if they did not want to work on the practice problems for the entire 15 minutes.

As the experimenter left the room, a research assistant who was blind to participants' experimental condition entered an adjacent room and observed participants through a two-way mirror. The mirror was covered by closed vertical blinds, except for two slats that were slightly bent at an angle that allowed the observer to clearly view participants' behavior without their knowledge. The observer recorded participants' behavior every 30 sec according to whether the participant was

practicing math problems, looking at a magazine, playing the video game, or engaging in some other (unscripted) activity such as sitting quietly.

When 12 min 30 sec had elapsed, the experimenter returned and asked participants if they wanted more time to practice for the intelligence test. All participants declined this offer. Participants then completed a brief questionnaire that asked about difficulty of the degree requirement activity (i.e., choices versus no choices task), degree of frustration, degree of practice for the upcoming nonverbal intelligence test, and how personally important it was to do well on the upcoming nonverbal test. Finally, participants were informed that they would not be taking the nonverbal test.

Results

Our main prediction was that making a series of choices would result in a state of self-regulatory resource depletion, thereby truncating persistence (or practice) at the math problems and leading to more procrastination. As expected, the choices versus no choices manipulation affected how long participants practiced for the upcoming test, $t(22) = 2.43$, $p < .05$ (see table 1). After making a series of choices, participants spent less time practicing for the upcoming IQ test than did participants who did not make choices. This finding also indicates that depleted participants spent more time playing the video game, reading the magazines, and doing nothing than did non-depleted participants. Thus, after making choices, people spent more time on self-indulgent consumption activities and less on effortful studying.

Although our main focus in the current study was on the amount of time spent on the math problems, we also checked to see whether performance on the math problems differed as a function of choice condition. It did not. We counted every problem participants attempted (because sometimes participants did a bit of work on a problem but failed to finish it) and subjected this measure to a t-test with choice condition as a predictor. This measure showed no difference as a function of condition, $t(22) < 1$, *ns*. The number of problems completed also showed no difference as a function of choice

condition, $t(22) < 1$, $p > .60$. Number of problems correctly answered also showed no differentiation by condition, $t(22) < 1$, $p > .80$. Last, we conducted an ANCOVA, comparing the choice and no choice conditions on number of problems correct, with time spent practicing as the covariate. The effect of the covariate, time spent, was marginal, $F(1, 21) = 4.14$, $p = .06$, but the effect of condition on performance was not significant, $F(1, 21) < 1$.

We assessed whether the choices manipulation influenced mood states. Consistent with expectations, the choice manipulation did not differentially affect mood. Reports of PA, $t(22) = 1.01$, $p = .33$, and NA, $t(22) <1$. *ns*, were similar in the two groups. Further analyses confirmed that choice and no choice conditions did not differ with regard to self-rated difficulty of their respective degree programs, $t(22) = 1.10$, *ns*, frustration with the tasks, $t<1$, *ns*, nor rated importance of performing well on the upcoming intelligence test, $t(22) = 1.44$, *ns*. Thus, the effects of choice were not due to mood, difficulty, frustration, or perceived importance.

Discussion

Experiment 3 conceptually replicated the finding that making a series of decisions leads to subsequent impairment of self-regulation. Participants in this study were given instructions either to select courses to fill the remainder of their undergraduate careers or to read and think about course options without having to choose. Subsequently, participants were given the opportunity to practice for an upcoming math test said to be predictive of successful life outcomes, but their studying was compromised by the availability of tempting, fun alternative activities such as video games and magazines. Participants who had made choices about their future coursework, as opposed to those who simply read and considered their options, spent less time studying and practicing for the math test (and spent correspondingly more time indulging in the tempting distractor tasks). Poor or failed self-regulation is an important contributor to procrastination (Tice and Baumeister 1997), and thus Experiment 3 demonstrates another way in which making a multitude of choices can lead to a

breakdown of self-control.

The fact that choosing courses to take led to less studying is somewhat counterintuitive. Had the opposite effect obtained, one might readily have interpreted it as indicating that priming the idea of course work prompted people to study. The fact that choosing courses led to less studying is thus most consistent with a limited resource model.

EXPERIMENTS 4A AND 4B

One ambiguity about the findings of Experiment 3 was that participants solved the same number of problems in both conditions, despite the difference in duration of persistence. Although null findings are generally not entitled to substantive interpretation, one could read those results as indicating that people who made choices were better at self-regulation (not worse, as we found in Experiment 2), insofar as they solved approximately the same number of problems in less time. Hence we felt the importance of conducting a conceptual replication. Experiment 4 tested persistence on unsolvable problems (4a) and solvable problems (4b) after choice or no choice procedures.

To increase the robustness of our conclusions, the choice manipulation was again changed, in this case to decisions about the psychology course in which participants were currently enrolled. Participants in the choices condition made a series of decisions about the course, choices they were told (veridically) would determine the way the instructor taught the course both during the current term and in subsequent terms. It is possible that participants in Experiment 3 did not see their choices as binding because students can and do change their minds about what courses to take. In contrast, the choices made in Experiment 4 were irrevocable in the sense that once students' choices were communicated to the instructor via this experiment, there was no opportunity to change the selections, and the instructor was intending to modify the course on the basis of students' selections.

Another change made for Experiment 4 was to separate the procedures for the independent and dependent variables. When the same experimenter administers both the choice manipulation and the self-

regulation measure, it is conceivable that extraneous attitudes toward the experimenter may develop during the choices manipulation that could confound responses to the dependent measure, as we noted in connection with Experiment 2. Hence we used the more elaborate procedure of presenting the tasks as unrelated, including having different experimenters administer the tasks in different rooms.

The main measure of self-regulation in this study was persistence. Persistence requires self-regulation insofar as the repeated failures are discouraging and frustrating, and the participant would soon wish to be doing something else — so one has to override the impulse to quit. Because of the possibility that quitting fast on unsolvable problems could be regarded as showing exceptionally good self-regulation, however, we ran two versions of this study, one with unsolvable (4a) and the other with solvable (4b) problems. With the solvable problems, we were also able to calculate performance quality by counting correct solutions.

Method

Procedure 4a. Forty-one undergraduates (26 females) participated in exchange for partial course credit. One participant was unable to complete the study. After arriving and completing consent forms, participants were told that the first part of the study involved reviewing instructors' materials from their psychology class, and the second, unrelated part of the study involved completing a spatial design task. The first experimenter handed out the materials that contained the choices manipulation. All participants were given the same materials, but the instructions that accompanied them were different.

Instructions for participants in the *choices condition* asked them to read the material and, for each section, to choose which option they preferred. Options were always presented as a two-option forced choice. In one example, participants read descriptions of two possible video clips and chose which film clip they would prefer to see. Another item involved choosing between two different styles of a test question, and another item asked them to choose between two paragraphs of text. Participants in the choices conditions were also told (truthfully) that the choices they made would be reviewed by their

instructor and would affect her decisions for future lectures and tests both during this semester while the participants were taking her course as well as for future classes. Thus, the choices were presented as important and consequential. Participants were asked to complete all the choices and return the packet to the experimenter before moving on to the next part of the experiment.

Participants in the *no choices condition* were simply instructed to read the same material that was presented to the participants in the choices condition. They were not asked to make any choices between the options or to rate the material in any way. They were asked to read the material very carefully and return the packet to the experimenter before moving on to the next part of the experiment.

Next, participants moved across the hall to complete the persistence part of the experiment with the second experimenter. The persistence measure involved unsolvable tracing puzzles. This procedure was made popular by Glass, Singer, and Friedman (1969), and it has been used in several previous studies as a measure of self-regulation. Participants were given a packet containing several complex figures. Participants were told that performance on these geometric figures was predictive of future life success, due to its links with higher-order cognitive abilities. They were instructed to trace each figure in its entirety without once lifting the pencil from the paper or re-tracing any lines. They were asked to bring their packets back to the experimenter either when they had finished or when they had worked as long as they could on them and wanted to stop. The experimenter recorded how long each participant persisted (to the nearest quarter minute). After finishing, participants were given a manipulation check, debriefed, and thanked.

Procedure 4b. Forty-two undergraduates (28 females) took part in the study. Two participants failed to complete the study. The procedure for Experiment 4b was the same as for 4a, with two changes.

First, the length of time it took participants to finish the choices or ratings was held constant at 12 min. The choices versus no choices task required going through a lengthy packet. No participant could complete the choices or ratings task in under than 12 min. After the 12 min had elapsed, participants were stopped and informed that they would now complete a separate experiment.

The second change was that the dependent measure was persistence on solvable problems. The second experimenter explained that the next study involved a test of simple mathematical calculations, which long have been known to predict success in later life. She explained that although most people used calculators and computers to perform basic arithmetic, this math test was sensitive to brief amounts of practice and therefore everyone was allowed practice time before taking this test. Participants were moved into new rooms or carrels and given practice sheets of three-digit multiplication problems, which they were told to practice for as long as they could, for a maximum of 30 minutes. When participants felt they could not practice any longer, they were to return to the first experimental room. At that time, the experimenter recorded the length of time participants had practiced the math problems (to the nearest quarter minute). Last, participants were given a questionnaire of manipulation checks.

Results

Unsolvable Puzzles (4a). Participants who did not have to make choices about the material but merely read through it carefully were able to make themselves persist longer on the tracing task (see table 1) than were participants who were asked to make many choices about the same material, $F(1, 38) = 7.12$, $p < .05$. Thus, making choices seems to have depleted some resource, thereby reducing persistence on the second task. Other analyses confirmed that the manipulation was effective. Participants in the choices condition were much more likely to report that they were making choices that would affect their own course than were participants in the no choices condition, $F(1, 38) = 585.95$, $p < .001$. There were no differences on self-reports of being happy, sad, depressed, or confident (Fs < 1).

Solvable Puzzles (4b). Participants who did not make choices about the course material but merely read it and made ratings persisted longer on the practice items than did participants who made many choices about the same material, $F(1, 38) = 5.00$, $p < .05$ (see table 1). Participants who did not have to make choices also completed more practice problems than participants who were asked to make many

choices, $F(1, 38) = 6.23$, $p < .05$.

Making choices also appears to have led to poorer performance on the math problems. Participants who did not have to make choices got significantly more practice problems correct and marginally fewer wrong than participants who were asked to make many choices, $F(1, 38) = 16.56$, $p < .001$ and $F(1, 38) = 3.81$, $p = .06$, respectively. The difference in number of errors was probably weakened by the fact that participants in the choice condition spent less time and attempted fewer problems, which should cause them to make fewer errors than they would otherwise. To correct for this, we computed the error rate by dividing number of errors by number attempted for each participant. ANOVA on error rates confirmed that participants in the choices condition made more errors per attempt than participants in the no choices condition, and this was a significant difference, $F(1, 38) = 5.10$, $p < .05$.

On the manipulation check, participants in the choices condition were much more likely to believe that they were making choices that would affect the rest of their semester in the classroom than were participants in the no-choices condition, $F(1, 38) = 224.48$, $p < .001$. Thus, again, the manipulation was successful.

Discussion

Experiment 4 showed that making choices about one's psychology course had a significant and detrimental effect on subsequent task performance. Those who made choices subsequently gave up faster on unsolvable (Experiment 4a) and solvable (Experiment 4b) items, as compared to participants who did not make choices. These findings provide further evidence that making decisions can deplete an important self-regulatory resource, thereby making it more difficult for the person to resist the temptation to quit while performing a wearisome task.

Furthermore, Experiment 4b confirmed that making choices had a negative effect not only on persistence but also on quality of performance. Participants who made choices got fewer math problems right and had a significantly higher error rate than participants who had merely thought about the course

options without making choices.

Several design features facilitate interpretation of findings. The choices in Experiment 4 were real and consequential, in the sense that they did influence how the instructor set up the remainder of the course (as opposed, possibly, to what participants thought in Experiment 3). Using two experimenters (one blind) ruled out any likelihood that demand characteristics or desire to impress the (first) experimenter influenced the results. The amount of time spent on the first task was the same for all participants in Experiment 4b, ensuring that persistence on the second task was not affected by how much time had been spent on the first. It was also apparent that less persistence meant poorer performance: Participants who made choices got fewer correct (unlike in Experiment 3) and made more errors than those who did not make choices.

In sum, it appears that making choices depleted some resource that was then unavailable to facilitate performance on both unsolvable and solvable tasks. Self-regulation is useful for making oneself persist on a difficult task, for overseeing the calculation process, and for checking and correcting errors, all of which are weakened by previous efforts involved in making choices.

EXPERIMENT 5

To provide a final test of our hypothesis of decision fatigue, Experiment 5 moved outside the laboratory. We approached customers at a shopping mall and assessed the number of decisions they had made during their shopping trip thus far. To measure self-regulation, we then asked them to perform easy but tedious arithmetic problems (adding 3-digit numbers). This task requires self-regulation because most shoppers would probably rather do something else than perform arithmetic, and so the impulse to quit must be overridden if they are to continue. We predicted that shoppers whose resources were depleted by having made a greater number of prior choices would quit faster on the arithmetic problems.

A conceptual replication of the laboratory findings from Experiments 2-4 was desirable for

several reasons. First, this study drew its participants from a non-university sample, which increases confidence in the generalizability of the results. Second, this study avoided a potential confound of differential time spent on different experimental tasks (and shoppers would also furnish estimates of how long they had been shopping, which later could be controlled for when analyzing the impact of prior choices). Third, participation in this study was not affected by a desire to earn a reward, because no reward or gift was offered.

Having shoppers perform math problems also enabled us to check the accuracy of their work. Competing predictions could be made, based on previous findings indicating that regulatory resource depletion impairs intellectual performance on complex tasks that require executive control, but it does not affect simple tasks such as rote memory (Schmeichel et al. 2003). On the one hand, addition problems involve applying rote memory (for sums) and following pre-established rules. Insofar as such simple tasks do not require active regulation by the executive self, they should not be impaired by resource depletion. On the other hand, self-regulation could be useful in overseeing the process, such as checking for possible errors and ensuring that rules are followed properly, and resource depletion might therefore lead to poorer performance.

Method

Ninety-six shoppers at an open-air shopping mall in Salt Lake City, Utah were approached, and 19 women and 39 men agreed to participate (60% response rate). The age of participants ranged from 18 to 59, with 91% of participants listing their ethnicity as White (non-Latino), 4% listing Asian, and 5% listing Latino. Shoppers were approached by members of the research team and asked for their time in a volunteer (i.e., no remuneration) experiment. Research assistants were instructed not to reveal much about the experiment before participants agreed or declined to participate, so that the details of the task (described next) did not influence who chose to participate. Participants were told the experiment involved answering some questions about their shopping trip and then engaging in a

cognitive task.

After a brief demographic questionnaire, participants completed a written version of the *involvement in choices* scale that was used in the Pilot Experiment (except two redundant items asking about the degree of which choices were required during the task were combined). Participants were asked to respond to questions by thinking about their behaviors during the course of the day, and to give a numeric rating of one (*not at all*) to 10 (*very much so*) for the following items: How many choices did you feel you have made on your shopping trip today? How personally important were the choices you made shopping today? How much careful consideration did you put into choices you have made today? How much did you deliberate before making each choice today? How much did you think about your options prior to making each choice today? How active did you feel in making your choices today? How tired do you feel right now? Participants were also asked to list their time spent shopping in hours and minutes. Shopping times ranged from one minute (for participants who had just begun shopping) to four-and-a-half hours.

Subsequently participants were presented with 64 three-digit plus three-digit addition problems printed across two sheets of paper. They were asked to do as many as they could, with the understanding that they could stop anytime they "quit, finished, or decided to give up." These instructions come from past depletion research (Vohs and Heatherton 2000) in which self-control was measured as persistence on a cognitive task. Unbeknownst to participants, there was a second research assistant standing approximately five feet away who surreptitiously recorded the amount of time that participants spent on the addition problems. She started recording when the participant turned the page to begin the math problems and stopped recording when the participant stopped completing the problems. Afterwards, participants were debriefed and thanked for their cooperation.

Results

Choices Scale. First, we conducted a factor analysis on the seven items from the choice scale to

test whether they revealed patterns similar to that seen in the Pilot Experiment. The data were subjected to a varimax rotation, and a two-factor structure emerged. Factor 1 accounted for 39% of the variance observed and Factor 2 accounted for an additional 27%. The items loaded onto factors similarly as in Experiment 1. That is, scale items asking about number of choices, importance of the choices, degree of consideration, deliberation, and thought put into the choices, and degree of activity involved in making those choices all loaded onto the first factor at > .36. In contrast, the item asking about tiredness loaded weakly and negatively onto Factor 1 (-.17), but strongly and positively on Factor 2 (.71). Therefore, we aggregated the first six items into one factor and referred to them (similar to the Pilot Experiment) as involvement of the self and left the item tapping respondents' tiredness on its own. We used these factors as predictors in the subsequent analyses.

Persistence on the Math Problems. Participants' persistence on the math problems was the primary indication of good self-control. Persistence was operationalized both in terms of number of problems completed and amount of time spent on the math problems. Using the *involvement* factor (items 1-6 from the choices scale), the tiredness item, and shopping duration as predictors, we ran two regression models to predict time spent on the math problems and number of problems completed (which were highly correlated, $r(58) = .71$). The overall models were significant, $F(3, 52) = 3.71$, $p < .05$ for math time, and $F(3, 52) = 4.77$, $p < .01$, for number of problems completed. Moreover, we found the expected (negative) effect of psychological involvement in predicting number of problems completed, $\beta = -.44$, $t(52) = 3.43$, $p < .01$, and math time, $\beta = -.31$, $t(52) = 2.38$, $p < .05$. In other words, the more that people had made frequent and deliberate choices, the less they persisted on the math task (see table 1). In these models, participants' tiredness was not a significant factor in number of problems completed, $\beta = .07$, $t(52) = .51$, *ns*, or for time spent on the math problems, $\beta = .20$, $t(52) = 1.53$, *ns*. Shopping duration was also not a significant predictor for either measure, ts $(52) < 1$, *ns*. Thus, we found support from outside the laboratory for the hypothesis that extensive decision-making impairs subsequent self-regulation.

In a second set of models we sought to test the robustness of the choices effect in models where other possible predictors would vie for variance. In these subsidiary models, we included the three predictors as before (time spent shopping, tiredness, and involvement in choices), as well as ethnicity, age, and gender in order to predict time spent on the math problems and number of problems completed. The overall models were significant, $F(6, 49) = 3.99$, $p < .01$, for number completed and $F(6, 49) = 2.64$, $p < .05$, for math time. More notably, the predicted effect of involvement in making choices remained significant despite the additional controls, showing no decrease (and in fact a slight increase in strength) from the previous three-predictor models, $\beta = -.48$, $t(49) = 3.72$, $p = .001$, for number of problems completed, and $\beta = -.35$, $t(49) = 2.65$, $p < .05$, for time spent on the math problems.

Self-reported tiredness was not a significant predictor of persistence at math problems, $t(49) < 1$, *ns*, for number of problems completed, and $t(49) = 1.09$, $p > .28$, for time spent on the problems. Time spent shopping and age likewise failed to yield a significant effect on either measure of persistence, all *t*s (49) < 1.01, *ns*. Gender showed a trend toward predicting number of math problems completed, $t(49) = 1.61$, $p = .11$, with men completing more problems than women, but gender did not predict time spent on the math problems, $t(49) = 1.15$, $p = ns$. Last, ethnicity predicted both measures, $t(49) = 2.42$, $p < .05$, and $t(49) = 1.90$, $p = .06$.

Number of problems correct. As an ancillary test of our hypothesis that making choices leaves people in a state of potential regulatory failure, we computed the number of problems correctly completed as a measure of self-control ability. As mentioned, past research has shown that one consequence of self-regulatory resource depletion is a reduction in cognitive abilities and consequently poorer intellectual performance (Schmeichel et al. 2003). Accordingly, we examined whether participants who had made more choices would perform more poorly on the computation involved in the three-digit plus three-digit math task.

Using the more sophisticated model that included the involvement factor, tiredness, time spent

shopping, age, gender, and ethnicity as predictors, we found that, similar to the other measures of self-regulation in this study, number of problems completed correctly was also predicted by the involvement factor, $\beta = -.51$, $t(49) = 4.12$, $p < .01$. The direction indicated that more choosing led to poorer performance. In this model, again, the predictive contributions of tiredness, time spent shopping, gender and age were all nonsignificant, ts < 1.4, ps = *ns*, whereas ethnicity was a significant predictor, $t(49) = 2.67$, $p = .01$.

Discussion

Experiment 5 provided converging support for the hypothesis that decision-making interferes with subsequent self-regulation. Shoppers at a local mall reported how much psychological involvement they had put into making shopping decisions that day and then were asked to solve arithmetic problems. Self-regulation was measured by persistence on math problems. We found that the more choices the shoppers had made, the more quickly they gave up on the math problems, as measured by both time spent and number of problems attempted. Moreover, the negative impact of prior decisions on math persistence remained significant even after controlling for how long they had been shopping, how tired they were, and for several demographic categories including gender, age, race, and ethnicity.

Making more shopping choices was also associated with poorer performance on the math test, measured in terms of number of problems solved correctly. This is consistent with the general hypothesis that making choices depletes a resource and thereby impairs subsequent performance. We acknowledge, however, that the correlational design of this experiment reduces its capacity for drawing causal conclusions. To be sure, the temporal sequence rules out the possibility that math persistence caused the (prior) shopping decision-making, but third variable explanations are still plausible, such as that people who enjoy making effortful decisions while shopping simultaneously dislike expending effort on math problems. (That said, on an *a priori* basis one would likely predict the

opposite, such that people with high need for cognition would put more thought into both shopping decisions and math problems.) In that respect, these findings are less conclusive than those of the prior studies, but they also add valuable convergence. The decisions in this study were not mandated by the experimenter but instead were naturally occurring decisions made by people in the course of their daily lives. The sample was also much more diverse (e.g., in age, education, and income) than the university populations sampled in the preceding studies. Also, as noted in the Introduction to this study, some of the potential confounds of the laboratory studies were ruled out by the design of this investigation. And, of course, the previous studies contained experimental manipulations of decision-making, so the most parsimonious interpretation of the findings of Experiment 5 would invoke the same conclusion, namely that making choices depletes a psychological resource and thereby has a negative impact on subsequent cognitive performance.

GENERAL DISCUSSION

Ambivalence about choice presents one of the great seeming paradoxes of modern life. On the one hand, the desire for choice seems ubiquitous. People clamor for freedom in their private and political lives. In the economic marketplace, consumers reward companies that provide them with ever more fine-grained choices. In empirical data, people exhibit patterns such as reactance (Fitzsimons and Lehmann 2004) and illusions of control (Ariely 2000; Langer 1975) that indicate deeply rooted motives to maintain a feeling of having choices. On the other hand, people tire of the endless demands for choice and the stress of decision-making. In related research, there are signs that too much choice can be detrimental to satisfaction and that people resist having to face up to the tradeoffs that many choices involve (Iyengar and Lepper 2000; Luce et al. 1999). The present investigation sought to shed light on the costs of choice. These costs can be seen in terms of the impact on subsequent self-regulation. Making choices can be difficult and effortful, and there is an intrapsychic cost to choosing that is seen in decrements in subsequent self-regulation.

The main hypothesis for this investigation was that that deliberate, effortful choice consumes a limited resource needed for a broad range of executive functions, including self-regulation. Participants made a series of choices about consumer products, college courses, or course materials — or, in the no-choice conditions they studied and rated those materials without choosing among them. Making choices apparently depleted a precious self-resource, because subsequent self-regulation was poorer among those who had made choices than among those who had not. We consistently found that effortful decision-making led to subsequent decrements in self-regulation. This pattern was found in laboratory, classroom, and shopping mall. This pattern was found with assigned choices and spontaneously made choices. This pattern was found with inconsequential and more consequential choices. And this pattern was found using a variety of self-regulation measures

Having five experiments permitted us to employ a diversity of measures and manipulations, so that possible ambiguities regarding one procedure could be remedied in another. We had participants make binding and irrevocable choices. In some studies we assigned them to make choices or not, and in others we measured how many choices they had spontaneously made. We allowed them unlimited time to choose, or we cut them off prematurely. We measured self-regulation in terms of how long they could hold a hand in ice water, how much of bad-tasting beverage they forced themselves to drink, how much they procrastinated while studying, how long they persisted on unsolvable puzzles, and how long they tried and how well they performed on solvable problems. We also employed a range of supplementary measures, including measures of emotion and mood, self-ratings of fatigue, and perceived difficulty of the tasks. The most parsimonious explanation for all these findings is that making choices depletes some important psychological resource, indeed the same resource that is needed for self-regulation.

Alternative Explanations

The present investigation needed multiple experiments, partly because there is no single,

unambiguous measure of the constructs. There was no direct self-report measure of decision fatigue. Likewise, there is no single gold standard measure of self-regulatory resource depletion, and so we measured self-regulation in many different behavioral spheres. The diversity of measures was especially important and helpful because of the theoretical assumption that the same resource is used for many diverse self-regulation activities as well as for effortful decision-making. In any case, the use of many different procedures and measures should help to counteract possible alternative explanations and increase confidence in the general conclusions about decision fatigue and the costs and benefits of choice. Replication is generally regarded as boosting confidence in research findings, and replication with different measures is important for providing converging evidence.

In Experiments 1a and 4a, the experimenter had the informal impression that the choice procedure seemed to take longer than the no-choice procedure, raising the possibility that the effects on self-regulation were caused by the longer duration of the initial task (and hence a greater sense of having discharged one's obligation as research participant, or perhaps more urgent desire to finish and be on one's way). In the remaining studies, however, the time for the two tasks was kept rigidly equal, and the results were the same. Experiments 2 and 4 used two different experimenters and blind testing procedures. The results remained strong, and so the effects cannot be explained away in terms of seeking to gain favor for the sake of getting a better gift. The two-experimenter system also permitted blind testing, which can largely rule out explanations based on experimenter bias or demand characteristics. Some of the procedures, such as evaluating psychology course materials or studying for a standardized graduate school admissions test, pertain mainly to student life. However, we did include field studies with non-university samples, and the results are the same. Thus it seems fair to generalize these results beyond psychology students.

Some studies used persistence on unsolvable problems as the measure of self-regulation, on the assumption that making oneself persist in the face of failure is aversive and difficult. A contrary view might argue that persisting on unsolvable puzzles is a waste of time and therefore quitting is an indication of good self-regulation. Against that view, however, we found that regulatory resource

depletion caused by decision making made people also quit faster and/or perform worse on solvable problems. In one study (Experiment 3) there was no difference between the choice and no-choice conditions on one measure of performance quality, but the studies that systematically measured performance (especially Experiments 4b and 5) confirmed poorer performance following choice.

It is conceivable that differences in mood and emotion could perhaps account for some of the patterns we observed, especially insofar as the decision-making tasks might be regarded as inherently more likely to generate aversive emotional states than the no-choice tasks. But many of our studies contained (various) mood and emotion measures and the null results on these measures counteract the view that mood or emotion mediated our results.

Last, it was important for us to empirically confirm that the experimental manipulations about choice were effective. The Pilot Experiment showed that high-choice procedures made people feel more that they were indeed engaging in decision-making, as well as putting more deliberate thought into the task, than the low-choice procedures. The self was more involved in the high-choice than the no-choice procedure, which is why we think that it expended more of its self-resources.

In short, although some findings may seem open to alternative explanations, we attempted to provide evidence against these alternatives with other studies in the current investigation. The most parsimonious explanation for these findings is that making choices depletes some valuable resource that is needed for self-regulation, and thus self-regulation is impaired in the aftermath of decision-making.

Concluding Remarks

The present findings suggest that self-regulation and effortful choosing draw on the same psychological resource. Making decisions depletes that resource, thereby weakening the subsequent capacity for self-control. The impaired self-control was found on a variety of tasks, including physical stamina and pain tolerance, persistence in the face of failure, and quality and quantity of numerical

calculation.

Decision making and self-control are both prominent aspects of consumer behavior. It is therefore useful to recognize that they draw on a common psychological resource and that one may affect the other. In particular, making many decisions leaves the person in a depleted state and hence less likely to exert self-control effectively.

Mick (forthcoming) has recently called for the field of consumer behavior to try harder to protect and benefit consumers, as opposed to studying how institutions can exploit and manipulate them. The present results could well be exploited by marketers and salespersons to take advantage of consumers, such as by asking customers to make a series of (even hypothetical) decisions to deplete their willpower and make them less resistant to sales pitches. Recent evidence suggests that depleted willpower makes people more susceptible to impulsive purchasing and to paying higher prices for the same goods (Vohs and Faber forthcoming) We think that educating and informing consumers may help them guard against those dangers. If consumers can learn not to do their shopping after a day of making hard decisions, or at least to know that when they do shop after making decisions they are vulnerable to buying more products and paying more for them, they can perhaps avoid the worst outcomes. Conserving their self-resources may therefore contribute to conserving their financial resources also, thus ultimately increasing their quality of life.

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TABLE 1
SELF-REGULATORY ABILITY AS A FUNCTION OF CHOICE CONDITION; EXPERIMENTS 1-5

	Choice Condition	**No Choice Condition**	**Dependent Variable**
Experiment 1A	2.06 (2.46)	7.67 (5.35)	Amount of Vinegar Drink Consumed (oz.)
Experiment 1B	1.89 (2.57)	6.87 (6.46)	Amount of Vinegar Drink Consumed (oz.)
Experiment 2	27.70 (15.81)	67.42 (56.35)	Time Held Arm in Freezing Water (secs)
Experiment 3	8.39 (3.64)	11.40 (1.66)	Time Spent Practicing (minutes)
Experiment 4A	9.11 (3.00)	12.25 (4.31)	Persistence (minutes): Unsolvable Puzzles
Experiment 4B	14.70 (4.05)	17.80 (4.66)	Persistence (minutes): Solvable Puzzles
Experiment 5	3.04 (2.28)	4.54 (3.29)	Persistence (minutes): Math Problems

Note — The data in this table are means and standard deviations (inside parentheses) relating to the effect of choice condition on self-regulation ability. Higher numbers indicate better self-control. Rows denote the experiment number from which the means were drawn. The first two columns are the conditions representing Choice and No Choice, and the Dependent Variable column specifies the operationalizations of self-regulation in each experiment. For Experiment 5, a median split on scores from the *involvement in choices* factor (see the Pilot Experiment) was used to create the groups of Choice and No Choice.