Journal of Personality and Social Psychology
2000, Vol. 79, No. 4, 493–506

0022-3514/00/$5.00 DOI: 10.1037//0022-3514.79.4.493

Counteractive Self-Control in Overcoming Temptation

Yaacov Trope
New York University
and Tel Aviv University

Ayelet Fishbach
The Academic College of Tel Aviv-Yaffo

How do anticipated short-term costs affect the likelihood of engaging in an activity that has long-term benefits. Five studies investigated the factors that determine (a) how anticipated short-term costs elicit self-control efforts and (b) how self-control efforts eventually diminish the influence of short-term costs on behavior. The studies manipulated short-term costs (e.g., painful medical procedures) and assessed a variety of self-control strategies (e.g., self-imposed penalties for failure to undergo a test). The results show that short-term costs elicit self-control strategies for self rather than others, before rather than after behavior, when long-term benefits are important rather than unimportant and when the costs are moderate rather than extremely small or large. The results also show that the self-control efforts help people act according to their long-term interests.

People sometimes know what they prefer but feel uncertain that this is what they will actually do. This uncertainty often reflects feasibility constraints such as lack of opportunity, freedom of choice, or prerequisite skills. In some cases, however, people may know that what they prefer is entirely feasible but may nevertheless suspect that when faced with the actual choice they will be tempted to do something else. A considerable amount of basic and applied research on self-control has investigated how immediate temptations prevent people from acting according to their preferences and has suggested techniques that may help people resist the temptations (Baumeister, Heatherton, & Tice, 1994; Gollwitzer & Moskowitz, 1996; Kuhl, 1984; Loewenstein, 1996; Mischel, Cantor, & Feldman, 1996; Rachlin, 1995; Thaler, 1994; Wegner, 1994). On the basis of this work, the present article examines the antecedents and consequences of self-control designed to counteract the influence of anticipated temptations on behavior. In this article, we seek to extend earlier research by investigating the factors that determine (a) how anticipated temptations elicit counteractive self-control and (b) whether counteractive self-control actually diminishes the influence of temptations on behavior.

Counteractive Control

To understand self-control when future choice is anticipated, it may be useful to distinguish between perceived short-term and long-term outcomes of activities (Ainslie, 1992; Loewenstein, 1996; Metcalfe & Mischel, 1999; Mischel, 1974; Mischel, Shoda, & Peake, 1988; Rachlin, 1995, 1996, 1997; Shoda, Mischel, & Peake, 1990). Basically, short-term outcomes are immediate but not long lasting. In contrast, long-term outcomes are remote but long lasting. Situations in which short-term outcomes are in opposition to long-term outcomes pose a self-control dilemma. For example, a medical checkup could cause immediate inconvenience and discomfort but also promote one's health in the long run. People may be convinced that the informational benefits of the checkup outweigh the discomfort it entails. At the same time, however, they may suspect that, contrary to their preferences, the discomfort may deter them from actually deciding to undergo the checkup.

In general, in situations in which the short-term outcomes of an activity (e.g., temporary costs) are in conflict with its long-term outcomes (e.g., enduring benefits), people may perceive the short-term outcomes as a threat to their long-term interests. In response to such threat, people may exercise *counteractive control* involving a variety of cognitive, affective, and motivational processes in order to counteract the influence of short-term costs and, thus, secure long-term outcomes. In our example, the possibility of being deterred by temporary pain or discomfort may lead people to bolster the importance of the checkup, to relate the checkup to central self-standards, and even to impose on themselves material, psychological, or social penalties for failing to get the checkup. When the anticipated discomfort is small, the perceived threat to getting the checkup will also be small, and little or no self-control will be exercised. However, at higher levels of discomfort, the increased threat to getting the checkup may elicit more intensive self-control efforts.

Figure 1 presents in schematic form the consequences of associating with an activity increasingly more short-term outcomes that conflict with its long-term outcomes. According to this counteractive control theory (CCT), valenced short-term outcomes may elicit more intense self-control efforts that, in turn, act to increase the likelihood of choosing according to long-term outcomes. Self-control efforts may thus counteract the effect of short-term out-

Yaacov Trope, Department of Psychology, New York University, and Department of Psychology, Tel Aviv University, Tel Aviv, Israel; Ayelet Fishbach, Department of Psychology, The Academic College of Tel Aviv-Yaffo, Tel Aviv, Israel.

The research was supported in part by National Institute of Mental Health Grant MH59030-R01. We thank Nehemia Friedland, Yechiel Klar, Tory Higgins, and Nira Liberman for their invaluable help in the various stages of this project.

Correspondence concerning this article should be addressed to Yaacov Trope, Department of Psychology, 6 Washington Place, 7th Floor, New York University, New York, New York 10003. Electronic mail may be sent to trope@psych.nyu.edu.

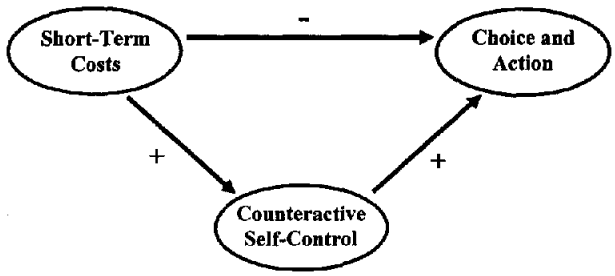

Figure 1. The influence of short-term outcomes on choice and action.

comes on the likelihood of choosing an activity, so the likelihood of engaging in the activity may become unrelated to the valence of its short-term gains or costs. For example, as a result of counteractive bolstering of the value of a checkup, an individual expecting a painful checkup may be as likely to undergo the checkup as an individual expecting a pleasant checkup. In itself, the anticipated pain makes the checkup aversive. However, the counteractive bolstering elicited by the anticipated pain may prevent the anticipated pain from affecting actual choice.

CCT assumes that people exert self-control efforts as a means of attaining long-term outcomes. Three hypotheses follow from this instrumentality assumption. First, counteractive control efforts depend on the value of the long-term outcomes. That is, short-term outcomes should elicit counteractive control processes when long-term outcomes are valuable. When long-term outcomes are not particularly valuable, the motivation to engage in self-control efforts will be reduced. For example, for individuals who are not particularly concerned about their health, the long-term value of a checkup should be relatively small. Such individuals are unlikely to bolster the value of the checkup after learning that it is painful.

Second, the effect of short-term outcomes on counteractive control is nonmonotonic. As the valence of short-term outcomes increases, counteractive control efforts would also increase. However, the valence of short-term outcomes might reach a level beyond which people may feel unable to resist their influence, and counteractive control efforts will decrease. Thus, when the short-term costs of an activity are very low, people may feel capable of undertaking an activity without exerting self-control efforts. When short-term costs are extremely high, people may feel incapable of undertaking the activity even if they exert self-control efforts. It is only when the short-term costs of an activity are moderate that self-control efforts can determine whether the activity should be undertaken. Moderate costs should, therefore, elicit a relatively high level of self-control efforts. For example, bolstering of the value of a medical checkup should be an inverted U-shaped function of the anticipated discomfort of the checkup. Initially, increasing levels of expected discomfort should intensify counteractive bolstering. However, beyond a certain point such self-control efforts should diminish (for similar predictions regarding effort exertion in skill-related tasks, see Atkinson & Feather, 1966; J. W. Brehm & Self, 1989; Kukla, 1974).

Third, people exercise counteractive control before but not after performing an activity. Before performing an activity, counteractive control may help people choose and carry out the activity. After performing the activity, counteractive control (such as bolstering the value of the activity) ceases to have instrumental value (Beckmann & Kuhl, 1984) and can only reduce dissonance and regret (Aronson, 1997; Cooper & Fazio, 1984; Festinger, 1957; Shultz & Lepper, 1996). CCT therefore predicts that short-term outcomes of an activity should elicit counteractive control before rather than after one engages in an activity (for related findings regarding effort exertion in skill-related tasks, see J. W. Brehm & Self, 1989; J. W. Brehm, Wright, Solomon, Silka, & Greenberg, 1983). For example, finding out that a medical test entails significant costs should bolster the value of the test before it is undertaken but not afterward.

Counteractive Control Strategies

The various self-control strategies that have been proposed in the literature on delay of gratification (Metcalfe & Mischel, 1999; Mischel, 1984), implementation of intentions (Gollwitzer, 1990; Gollwitzer & Brandstatter, 1997; Kuhl, 1984), and control over impulsive behavior (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Heatherton, 1996) may be used proactively to counteract the influence of short-term outcomes. Some of these strategies change the choice situation. Specifically, people may impose on themselves penalties ("side bets") for failing to act according to their long-term outcomes (Ainslie, 1975; Becker, 1960). These self-imposed penalties may then serve as external deterrents against failure to act according to long-term outcomes. For example, one may be willing to pay a cancellation fee for missing a painful checkup. By itself, the expected pain increases the likelihood of failing to actually get the checkup and having to pay the cancellation fee. Simple economic considerations (minimizing expected monetary penalties) should lead people to impose on themselves a relatively small fee to the extent that the checkup is painful. CCT predicts, however, that the more painful a checkup is expected to be, the higher the cancellation fee people will be willing to pay. Thus, high (compared with low) short-term costs of an activity will lead people to impose on themselves higher penalties for failing to undertake the activity.

Another way in which one may change future choice situations is by making rewards contingent on acting according to one's long-term interests. Instead of receiving a reward unconditionally, people may prefer to receive it only if they act according to their long-term interests. For example, people may prefer to receive a bonus for actually completing a painful medical checkup than for merely agreeing to do it.

In making penalties and rewards contingent on performing an activity, people precommit themselves to the activity (Brickman, 1987). People may precommit themselves more directly by eliminating action alternatives and thus making a decision to act according to their long-term interests irreversible (Ainslie, 1975; Green & Rachlin, 1996; Rachlin & Green, 1972; Schelling, 1978, 1984; Strotz, 1956; Thaler, 1994; Thaler & Shefrin, 1981). Counteractive control thus entails self-imposed restrictions on freedom of choice, which people ordinarily seek to maintain (see J. W. Brehm, 1966; S. S. Brehm & Brehm, 1981). For example, people may eliminate opportunities for canceling an appointment for a painful medical checkup to ensure that they actually get the checkup. CCT predicts that people will impose greater restrictions on their future freedom of choice when they anticipate high rather than low short-term costs of acting according to their long-term interests.

Other self-control strategies change the psychological meaning of future choice situations by bolstering the value of activities that have long-term value but short-term costs (Mischel, 1984). People may link attainment of long-term outcomes to their general self-standards. Failure to choose according to long-term outcomes is then construed as a violation of one's central values and a threat to one's sense of self-worth and self-determination. As suggested by Bandura (1976, 1977, 1986, 1989), self-standards serve as a criterion for self-reinforcement, which, in turn, enables people to achieve control over their own behavior. Finally, people may bolster the value of attaining long-term outcomes by elaborating on what makes attainment of these outcomes important and emotionally gratifying (Kuhl, 1984). For example, in trying to decide whether to undergo a medical checkup, people may think of how undergoing the checkup may help them detect and prevent potential health problems. The more painful the offered checkup, the more people attempt to bolster its potential contribution to their health.

The Present Research

Five studies were conducted to test specific predictions of CCT regarding (a) how anticipated temptations elicit counteractive self-control efforts and (b) whether these self-control efforts actually diminish the influence of temptations on behavior. The first two studies investigated how people change, in advance, future choice situations by making penalties or rewards contingent on their choice. Study 1 examined the monetary penalties participants imposed on themselves for possible failure to take an activity that had high versus low short-term costs. Study 2 tested the CCT hypothesis that the effect of short-term costs on counteractive control depends on the long-term value of the activity. The counteractive control strategy examined in this study was participants' willingness to make a reward contingent on performing an activity. The other three studies investigated (a) how people bolster the value of activities that have long-term value but short-term costs and (b) how this self-control strategy affects choice and behavior. Study 3 investigated bolstering of the value of a medical test as a function of physical unpleasantness. This study tested the CCT hypothesis that counteractive bolstering enabled participants to undergo the test despite its physical unpleasantness. Study 4 tested the CCT hypothesis that the effect of short-term costs on counteractive control is nonmonotonic. Applied to taking a diagnostic test, this hypothesis predicts that up to some level, the degree of discomfort associated with the test will increase counteractive bolstering of the value of the test, which, in turn, will prevent discomfort from impairing test performance. But beyond this level, counteractive bolstering should decrease, and test performance will decline. Study 5 tested the CCT hypothesis that priming short-term costs elicited counteractive boosting of the value of an activity before but not after undertaking the activity. Moreover, this study tested the hypothesis that the elicited counteractive boosting offsets the influence of priming short-term costs on behavior.

Study 1: Self-Imposed Monetary Penalties

This study investigated how the discomfort associated with a medical test affects the monetary penalty people are willing to pay for possible failure to complete the test. Participants were offered the opportunity to test the influence of glucose intake on their cognitive functioning. The feedback from the test was described as very useful, but required abstinence from food containing glucose (e.g., candy, bread) for either a short period of time (6 hr) or a long period of time (3 days). Before deciding whether to take the test, participants were asked to indicate the amount of money they would be willing to pay (if any at all) as a penalty for failing to complete the test. The question was, then, how would the period of glucose abstinence affect the magnitude of this self-imposed penalty?

In addition, the present study compared the penalty people impose on themselves with the penalty they impose on others. A group of participants, serving as observers, received the same information about the testing conditions and were asked to indicate the amount of money a participant should pay in the event of failing to complete the test. For involved participants, the monetary penalty is a counteractive control method for overcoming the influence of the abstinence on their decisions. Hence, the longer the abstinence, the higher the self-imposed fine. For observers, however, the monetary penalty is a price that a participant deserves to pay for violating a commitment to complete a test. The longer the abstinence, the stronger the justification for failing to complete the test and the smaller the monetary penalty the participant deserves to pay.

In sum, we predicted that the monetary penalty participants will impose on themselves for failure to complete the test will be directly related to duration of abstinence, whereas the monetary penalty participants will impose on others for their failure to complete the test will be inversely related to duration of abstinence.

Method

Participants. Participants were 112 (82 female, 30 male) undergraduate students from the Ramat-Gan College in Israel. Participants were randomly assigned to the four conditions comprising the Abstinence Duration (6 hr vs. 3 days) × Target (self vs. other) design.

Procedure. Participants were offered the opportunity to take part in a study on the influence of blood glucose on cognitive functioning for an $18 fee. The information about this fictitious study was presented in a booklet titled "The Influence of Food on Cognitive Performance." Participants read that the study was part of a research project conducted by the School of Medicine and the Department of Psychology of Tel Aviv University. Participants were further informed that they would undergo a series of tests and that on the basis of the results they would be individually told how to maintain a level of blood glucose that would be optimal for their cognitive functioning. The tests were said to require an initial period of abstinence from foods containing glucose (e.g., candy, cakes, bread, and fruits) and drinks containing sugar. Depending on the experimental condition, participants were told that the period of abstinence would be either 6 hr or 3 days. It was explained that immediately after the period of abstinence a series of glucose tests and a battery of cognitive tests would be administered.

As a manipulation check, two groups of 21 undergraduates rated the unpleasantness of the 6-hr or 3-day abstinence on a 7-point scale ranging from 1 (*very pleasant*) to 7 (*very unpleasant*). The 3-day abstinence was rated as significantly more unpleasant ($M = 5.43$) than the 6-hr abstinence ($M = 3.85$), $t(40) = 2.81$, $p < .01$.

After receiving the information about the test, participants were informed that if they failed to comply with the abstinence requirements they would not be paid for participating in the study. It was explained that compliance with the abstinence requirements would be detected by the

glucose test. Participants were then asked to indicate the amount of money (between $0 and $18) they were willing to pay if they failed to comply with the glucose abstinence requirement. This payment was said to cover expenses caused by canceling the test session. After indicating their response, participants were debriefed and thanked for participation in the study.

Observers received the same information about the tests as did experimental participants and were asked to indicate the amount of money (between $0 and $18) participants should pay for failure to comply with the glucose abstinence requirements.

Results and Discussion

An Abstinence Duration (6 hr vs. 3 days) × Target (self vs. other) analysis of variance (ANOVA) was performed on the penalties for failure to comply with the glucose abstinence requirement (see Figure 2 for the relevant means). As predicted, the ANOVA yielded a significant interaction between abstinence duration and target, $F(1, 108) = 8.58$, $p < .01$. When penalizing themselves, participants set higher penalties for failure to complete a long period of abstinence ($M = \$3.86$) than for failure to complete a short period of abstinence ($M = \$1.49$), $t(48) = 1.76$, $p < .05$. When penalizing others, the reverse pattern was obtained: Observers set higher penalties for failure to complete a short period of abstinence ($M = \$5.82$) than for failure to complete a long period of abstinence ($M = \$2.53$), $t(60) = 2.48$, $p < .01$. No other effect was significant in this analysis.

These results provide initial support for the CCT hypothesis relating temporary unpleasantness of a test to self-imposed penalties for possible failure to complete the test. Observers imposed a higher monetary penalty for failing to comply with a short rather than a long abstinence requirement. This finding is consistent with our assumption that observers impose penalties according to the perceived justifiability of failing to comply with the abstinence requirements. Observers apparently viewed failure to comply with the long abstinence requirement as more justifiable and therefore deserving of a relatively small penalty. The penalties participants imposed on themselves showed the opposite pattern. These participants apparently used the monetary penalty as a self-control strategy designed to help them overcome the temptation to violate the abstinence requirements and thus ensure that they obtain the useful feedback regarding their eating habits. Expecting the temptation to be strong (but still resistible) during a long abstinence period, participants imposed on themselves a larger penalty for failure to comply with the long rather than short abstinence requirement. Purely economic considerations (minimizing expected monetary penalty) should have led involved participants to impose on themselves a relatively small penalty when a long abstinence period is required, because, in itself, a long abstinence period makes failure and the attendant penalty more likely. The finding that self-imposed penalties were positively rather than negatively related to the length of the abstinence period suggests that participants used the penalties to ensure that the abstinence does not prevent them from attaining the useful feedback regarding their eating habits.

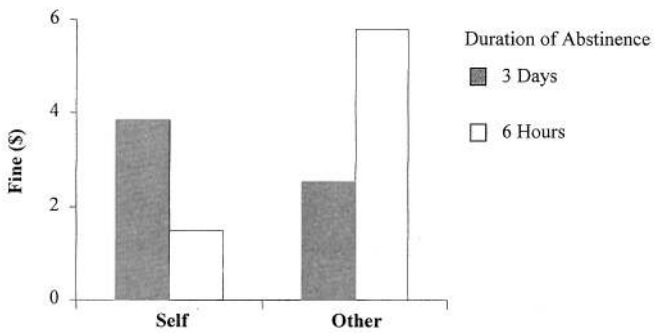

Figure 2. Monetary fine on self vs. other for short vs. long abstinence requirements (Study 1).

Study 2: Self-Imposed Contingencies for Receiving a Bonus

The present study was designed to test the CCT instrumentality assumption that temporary unpleasantness of an activity will elicit self-control efforts only when failure to perform the activity threatens the attainment of an important long-term goal. We predicted that in deciding whether to take a medical test, the physical unpleasantness of a test would elicit counteractive control only when participants place a high value on maintaining good health. Study 1 examined participants' willingness to make a penalty contingent on completing an unpleasant medical test. The present study examined participants' willingness to make a bonus contingent on completing such a test.

Participants were offered the opportunity to take part in a study on the risk of heart disease that included a cardiovascular test. The test was described as involving either a low or high degree of physical discomfort. Participants were told that they would be able to receive a bonus for taking part in the study. The question was whether participants would make the bonus contingent on completing the cardiovascular test. We assumed that imposing such a contingency reflects a self-control strategy designed to ensure that the test is actually completed. We therefore predicted that to the extent that good health is important to participants, they will prefer the bonus to be contingent on completing the test when the test involves a high (rather than low) level of discomfort.

Method

Participants. Participants were 52 (44 female, 8 male) undergraduate students at Tel Aviv University. Participation in the experiment partially fulfilled an introductory psychology course requirement. Participants were randomly assigned to experimental conditions varying in discomfort of test.

Procedure. On arrival to the lab, participants received a booklet entitled "Assessing the Risk of Heart Disease." The booklet described a joint research project by the Department of Psychology and the Tel Aviv University School of Medicine on the assessment of risk of heart disease. After being provided with general information about this project, participants were asked to indicate the importance of assessing and improving one's health on two 7-point rating scales, ranging from 1 (*not at all important*) to 7 (*very important*). Participants were then informed that the study included a series of psychological questionnaires and a new cardiovascular test for assessing the risk of heart disease. The cardiovascular test was described as reliable and capable of providing highly accurate and useful information regarding potential heart problems.

The description of the test procedures varied according to conditions. In the high discomfort condition, participants were told that the test would require an hour of arduous exercise during which several hormone samples

would be taken by a nurse. The hormone sampling was described as "rather painful" and the overall test procedure as strenuous and unpleasant. In the low discomfort condition, participants were told that the test would require an hour of relaxation (reading a paper or book while lying on a bed) during which a number of hormone samples would be taken by a nurse. The hormone sampling was said to not be painful and the overall test procedure easy and comfortable.

As a manipulation check, a group of 83 (62 female, 19 male) undergraduate psychology students rated the unpleasantness of the two test procedures on a 7-point rating scale ranging from 1 (*very pleasant*) to 7 (*very unpleasant*). The high discomfort procedure was rated as significantly more unpleasant ($M = 4.66$) than the low discomfort procedure ($M = 3.88$), $t(81) = 2.31$, $p < .05$.

After receiving the information about the cardiovascular test, participants were told that if they decided to take part in the study, they would be able to earn a bonus of two extra credit hours stickers. Introductory psychology students at Tel Aviv University receive a sticker for each of the eight research hours they are required to fulfill. The experimenter explained that she could deliver the extra credit hours stickers either before or after the cardiovascular test and asked the participant what he or she would prefer. The option of receiving the extra credit stickers before the cardiovascular test assured participants that they would receive the bonus regardless of whether they completed the test. The experimenter explained that she would give the stickers to the participant before the test started and then leave. The other option of receiving the extra credit stickers after completing the test meant that participants could lose the bonus if they failed to complete the cardiovascular test. Participants were asked, "If you decide to take part in the study, would you prefer to receive the credit hours sticker before or after the cardiovascular test?" Participants indicated their preference on a 6-point rating scale ranging from 1 (*very interested in receiving the credit stickers before the test*) to 6 (*very interested in receiving the credit stickers after the test*). A decision to postpone the bonus made the bonus contingent on taking the test. Participants' preference to impose on themselves this contingency served as a measure of self-control. After indicating their preference, participants were thanked and debriefed.

Results and Discussion

Participants' ratings of the importance of assessing and improving their health were highly correlated ($r = .78$, $p < .001$). A median split on the mean of the two ratings was therefore used to classify participants as low ($M = 4.12$) or high ($M = 6.19$) in importance of health. A Discomfort Level (low vs. high) × Importance of Health (low vs. high) ANOVA was performed on participants' preferred timing of the bonus. The analysis yielded an effect of importance of health, $F(1, 48) = 3.32$, $p = .08$, indicating that participants to whom health was important rather than unimportant tended to be more interested in postponing the bonus. More important, the analysis yielded the predicted Discomfort Level × Importance of Health interaction, $F(1, 48) = 6.48$, $p < .01$. As can be seen in Figure 3, participants to whom health was important were more interested in postponing the bonus when the cardiovascular test was expected to be associated with a high level of discomfort ($M = 3.94$) than when it was expected to be associated with a low level of discomfort ($M = 2.54$), $t(24) = 3.63$, $p < .001$. If anything, level of discomfort had the opposite effect on participants to whom health was unimportant ($p = .24$). These participants tended to have a stronger preference for receiving the bonus before the test when the test was expected to cause a high level of discomfort ($M = 2.00$) than when the test was expected cause a low level of discomfort ($M = 2.71$).

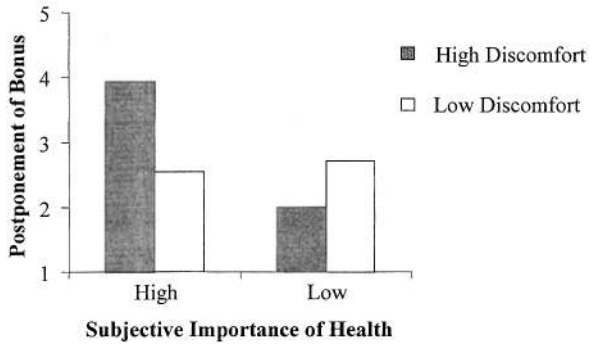

Figure 3. Self-imposed postponement of bonus as a function of discomfort of medical test procedure and subjective importance of health (Study 2).

These findings support the CCT instrumentality assumption that people engage in counteractive control when deciding whether to undertake a physically unpleasant activity only when performing the activity serves their long-term goals. The present study demonstrates that under specifiable conditions people are willing to make a bonus contingent on completing a physically unpleasant test. Our participants could earn the bonus without taking the cardiovascular test. Nevertheless, when getting the results of the test was subjectively important, they asked us to make the bonus contingent on performing the test, particularly when the test was expected to be highly unpleasant. In imposing on themselves this contingency, participants risked losing the bonus, but at the same time they also motivated themselves to complete the arduous cardiovascular test.

This was true, however, only for participants to whom health was important. Participants to whom health was not very important tended to choose according to what simple economic considerations would prescribe, namely, accepting the bonus before rather than after the test, particularly when the test was expected to be difficult. In itself, the preference to postpone the bonus for the physically unpleasant test might be interpreted as reflecting some fairness considerations, namely, participants' reluctance to receive credit for a test they may not be able to complete. However, the fact that only participants to whom health was important expressed this preference argues against such interpretation and supports the assumption that the self-imposed contingency was used as a means for overcoming a temptation to give up a valuable long-term goal.

Finally, although the moderating effect of the subjective importance of health is consistent with CCT, this effect should be interpreted with caution, because importance was measured rather than manipulated in this study. It is possible, then, that some other variable that is correlated with importance moderated the effect of discomfort on self-control. To rule out such a possibility, our subsequent tests of the instrumentality assumption (Studies 4 and 5) experimentally manipulated the relevant moderators.

Study 3: The Elicitation and Behavioral Consequences of Boosting the Subjective Value of an Activity

The preceding two studies investigated the self-control tactics people use in deciding whether to undertake an activity (medical test) that has long-term benefits but is temporarily unpleasant. The

question we address in the present study was how self-control influences people's willingness to actually undertake a temporarily unpleasant activity. By itself, high physical unpleasantness should decrease willingness to undergo the activity. However, according to CCT, the self-control processes elicited in deciding whether to undertake a temporarily unpleasant activity will act to maintain people's willingness to undertake an activity despite its unpleasantness. In path analytic terms, the temporary unpleasantness of an activity affects the willingness to undertake the activity in two ways (see Figure 1). On the one hand, unpleasantness (high vs. low) directly decreases the willingness to undertake the activity. On the other hand, unpleasantness increases counteractive control, which, in turn, increases the willingness to undertake the activity. This indirect effect may thus prevent temporary unpleasantness from diminishing people's willingness to undertake an activity.

The form of counteractive control examined in this study was bolstering of the value of a temporarily unpleasant activity. People may bolster the value of an activity by thinking about it as important, interesting, and likely to yield useful outcomes. CCT predicts that the greater the temporary unpleasantness of an activity, the more likely people are to bolster its value. Moreover, unlike dissonance theory, CCT predicts that people will bolster the value of an activity before engaging in the activity or even deciding to undertake it.

Method

Participants. Participants were 41 (32 female, 9 male) undergraduate students from the Academic College of Tel Aviv-Yaffo who volunteered to participate in the study. Participants were randomly assigned to experimental conditions.

Procedure. The procedure of this study was identical to that of Study 1, except for the self-control and behavioral intention measures. Participants were offered the opportunity to take part in a study to test the influence of glucose intake on their cognitive functioning. As before, the test was described as requiring abstinence from glucose containing food for either a short period (6 hr) or a long period (3 days). After receiving a description of the test, but before indicating their decision, participants rated on 7-point scales (ranging from 1 [*not at all*] to 7 [*very much*]) the usefulness of the test results, the importance of taking the test, the importance of the study, the importance of participating in scientific research, and the extent to which the study was interesting. These ratings were designed to assess bolstering of the subjective value of the test. The last question asked, "Do you intend to take the test?" The responses were indicated on a 6-point rating scale ranging from 1 (*definitely intend not to take the test*) to 6 (*definitely intend to take the test*). This question was designed to assess participants' behavioral intentions. Participants were then debriefed and dismissed.

Results and Discussion

The five ratings of the value of the test were highly correlated ($\alpha = .86$) and therefore combined into an index of the subjective value of the test. Analysis of this index revealed a significant effect of abstinence duration, $t(39) = 2.07$, $p < .05$. As predicted, participants evaluated the test more positively when the test required 3 days of glucose abstinence ($M = 5.53$) than when it required only 6 hr of glucose abstinence ($M = 4.85$). Consistent with CCT, then, participants bolstered the value of the offered test when it was expected to cause high rather than low level of physical discomfort.

A path analysis (Baron & Kenny, 1986; Kenny, Kashy, & Bolger, 1998) was conducted to test the hypothesis that counteractive control prevents the physical discomfort of the test from diminishing participants' willingness to actually undergo the test. Consistent with this hypothesis, regression analyses revealed opposite direct and indirect effects of abstinence duration on participants' intention to take the test (see Figure 4).[1] Specifically, in itself, a long versus short period of abstinence acted to decrease participants' willingness to take the test, as indicated by the regression of intention on abstinence duration, controlling for bolstering ($\beta = -.27$, $p < .05$). This negative direct effect of abstinence duration on intention was offset by its positive indirect effect by means of bolstering of the value of the test. Specifically, a long versus short period of abstinence elicited bolstering of the value of the test, as indicated by the regression of bolstering on abstinence duration ($\beta = .31$, $p < .05$). Bolstering the value of the test, in turn, increased participants' willingness to actually undergo the test, as indicated by the regression of intention on bolstering, controlling for abstinence duration ($\beta = .74$, $p < .001$). Thus, by means of counteractive bolstering, a long versus short period of abstinence acted to increase willingness to undergo the test. As a result, the overall (unmediated) effect of abstinence duration on intention to take the test was negligible, as indicated by the regression of intention on abstinence duration ($\beta = -.05$, $p = .73$).

These findings are consistent with CCT. Other things being equal, the temporary discomfort of an activity acts to decrease the likelihood of undertaking the activity. However, self-control efforts elicited in anticipation of the physical discomfort act to maintain people's willingness to undertake the activity despite its physical discomfort.

Study 4: Nonmonotonic Counteractive Control

The present study (a) tested the CCT instrumentality assumption that self-control efforts are a nonmonotonic function of the short-term costs of an activity and (b) examined how the elicited self-control efforts diminish the influence of short-term costs on behavior. Studies 1–3 demonstrated that as the anticipated discomfort of a diagnostic test increased, participants intensified their self-control attempts. However, the anticipated discomfort may reach a level beyond which people may feel unable to perform the offered test despite its long-term value. At this extreme high level of discomfort self-control efforts may cease because they can no longer ensure that the test will be performed. Self-control attempts

[1] This path analysis included three steps. First, intention to take the test was regressed on abstinence duration. This path ($\beta = -.05$, $p = .73$) indicated the unmediated effect of period of abstinence on intention to take the test. Second, bolstering of the value of the test was regressed on abstinence duration ($\beta = .31$, $p < .05$), and intention to take the test was regressed on bolstering of the value of the test ($\beta = .67$, $p < .001$). Those regressions indicated the positive effect of abstinence duration on intention to take the test. Finally, to assess the direct influence of long versus short period of abstinence, intention was regressed on two predictors: abstinence duration and bolstering test value. This time, the path coefficient from abstinence duration to intent to participate was negatively significant ($\beta = -.27$, $p < .05$), whereas the path coefficient from bolstering to intent remained positive ($\beta = .74$, $p < .001$).

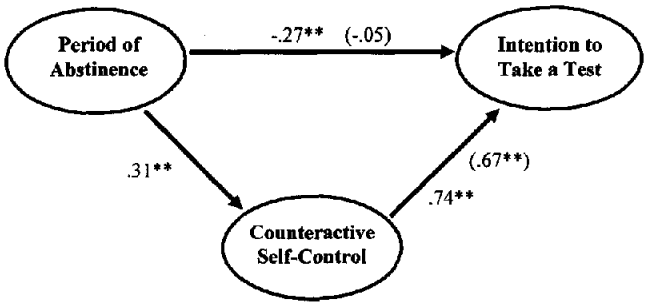

Figure 4. Path model of the influence of period of abstinence on intention to take a test (Study 3). Numbers in parentheses are zero-order standardized betas. $^{**}p < .05$.

may thus be a curvilinear, inverted U-shaped function of the anticipated level of discomfort of the offered test. Increasing levels of discomfort of the test should initially increase attempts to boost the value of the test, but beyond a certain point, further increases of discomfort should reduce such attempts and the value of the test should start to decline.

To test these predictions, participants were offered the opportunity to take a diagnostic test of their cognitive functioning at night. Participants were informed that the test consisted of several parts all of which would be administered over the telephone on one of the following two nights. To vary the level of discomfort of performing the test, participants were told that the test would take place at a convenient time (9:30 p.m.), a moderately inconvenient time (12:30 a.m.), or an extremely inconvenient time (3:30 a.m.). Two forms of self-control were assessed. One was bolstering the value of the test, as in Study 3. The other was a related form of self-control, namely, attaching emotional significance to performing the test. In this form of self-control, people make emotional gratification conditional on performing the test.

Because taking the test was mandatory (i. e., part of the experimental requirements), we used level of performance on the test as the behavioral measure. In itself, lateness of testing should act to diminish test performance. However, the intensified evaluative bolstering in anticipation of a moderately late testing hour (12:30 a.m.) should offset the effect of the lateness of this testing hour. As a result, performance may be no worse and possibly even better at 12:30 a.m. than at 9:30 p.m. However, at the extremely late hour (3:30 a.m.), bolstering should cease and no longer offset the effect of lateness of testing. Performance at 3:30 a.m. should therefore drastically drop relative to performance at 12:30 a.m. and 9:30 p.m. Thus, lateness of testing should produce a nonmonotonic effect on performance: As testing hour becomes increasingly late, performance should initially stay the same or even improve and only then decline. Path analysis was used to test the hypothesis that this nonmonotonic effect of lateness on performance is mediated by counteractive control.

Method

Participants. Participants were 126 (106 female, 20 male) undergraduate students at Tel-Aviv University. Participation in the study fulfilled an introductory psychology course requirement. Participants were randomly assigned to experimental conditions varying in time of testing: 9:30 p.m., 12:30 a.m., or 3:30 a.m.

Procedure. The experiment was conducted in small groups of 4–5 participants. Participants received a booklet entitled "Cognitive Functioning at Night." The booklet started with general information about the purpose of the study. Participants read that the study was concerned with people's ability to perform various mental tasks during the night. They were further informed that an accurate test was developed for assessing individuals' level of cognitive functioning. The test was described as consisting of a series of mental tasks administered over the telephone. The entire testing session was said to take about 20 min. Participants were told that the test would take place on one of the following two nights and that they would receive detailed feedback regarding their cognitive functioning at night.

At this point, participants were given the exact time of the test. Depending on experimental condition, the test was said to take place at either 9:30 p.m., 12:30 a.m., or 3:30 a.m. Participants then filled out a brief questionnaire designed to assess counteractive control efforts. To assess bolstering of the value of the test, participants were asked to rate the importance of taking the test and the extent to which it was interesting on two 7-point scales ranging from 1 (*not at all*) to 7 (*very much*). To assess attaching of emotional significance to performing the test, participants were asked to rate on similar rating scales the extent to which they would feel pleased, content, proud, and satisfied if they actually completed the test.

The experimenter then informed participants that the test would be administered over the telephone. The experimenter gave participants a telephone number to call at the designated time (9:30 p.m., 12:30 a.m., or 3:30 a.m.) and a closed envelope containing test materials to be opened when making the telephone call. The experimenter explained that a recorded message would provide participants with instructions on how to perform the test and would record their name before and after completing the test. These procedures were designed to ensure that participants performed the test at the designated hour. When participants actually called, their name and the time they called (day and exact hour) were automatically recorded, and a recorded message instructed participants to open the envelope, perform two tasks on the enclosed forms, and call again when they completed the tasks. The first task asked for a detailed drawing of a tree. The second task was to write 1–5 associations to each of 15 words (e.g. pink, ruler, smile). The degree of elaboration of the tree drawing and the number of associations participants generated served as measures of performance. The degree of elaboration was rated by two judges ($r = .89$) on a 10-point scale ranging from 1 (*not at all*) to 10 (*very much*). The average of the two judges' ratings served as a measure of degree of elaboration. When participants returned the completed tasks, they were thoroughly debriefed and dismissed.

As a manipulation check, a separate group of 20 Tel Aviv University undergraduates rated the unpleasantness of taking the test at each of the three times on a 7-point scale ranging from 1 (*very pleasant*) to 7 (*very unpleasant*). The 9:30 p.m., 12:30 a.m., and 3:30 a.m. sessions were rated as increasingly more unpleasant (Ms = 2.70, 3.95, and 5.05, respectively), $F(2, 38) = 15.91$ $p < .001$, with both the differences between the 9:30 p.m. versus 12:30 a.m. sessions and the 12:30 a.m. versus 3:30 a.m. sessions being significant ($ps < .01$).

Results and Discussion

The two ratings of the subjective value of the test ($\alpha = .70$) and the four ratings of emotional significance attached to taking it ($\alpha = .81$) were combined into two indices. ANOVAs of these indices revealed significant effects of time of testing, $F(2, 122) = 2.90$, $p = .05$, and $F(2, 122) = 2.65$, $p = .07$, respectively. As can be seen in Figure 5, both the subjective value of the test and its emotional significance initially increased and then decreased as a function of time of testing (9:30 p.m. vs. 12:30 a.m. vs. 3:30 a.m.). Indeed, trend analysis revealed a significant quadratic effect of time of testing on both the subjective value and emotional signif-

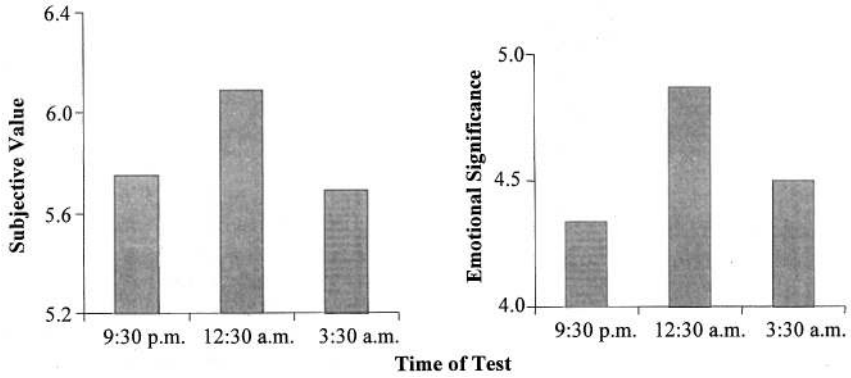

Figure 5. Subjective value and emotional significance of test by time of test (Study 4).

icance indices, $F(1, 122) = 5.13$, $p < .05$, and $F(1, 122) = 5.39$, $p < .05$, respectively. On both indices, the 12:30 a.m. test received higher scores than either the 9:30 or the 3:30 test ($ps < .05$), which were not significantly different from each other.

Let us now turn to the performance data. Only 10 of our 126 participants (8%) failed to perform the test. These 10 participants were evenly distributed across conditions (3 in the 9:30 p.m. condition, 3 in the 12:30 a.m. condition, and 4 in the 3:30 a.m. condition). All other participants performed the test at the designated hour. This uniformly high rate of compliance is not surprising given that taking the test was part of the experimental requirements. Because number of associations generated and degree of elaboration of the drawings were positively correlated ($\alpha = .60$) and yielded similar results, we combined the two measures by transforming each into a z score and averaging these scores. A one-way ANOVA of these performance scores showed an effect of time of testing, $F(2, 113) = 4.19$, $p < .05$. As expected, the quadratic effect of time of testing on performance was significant, $t(113) = 1.81$, $p < .05$. Performance was the same and even slightly increased from 9:30 p.m. ($M = .16$) to 12:30 a.m. ($M = .25$), but then significantly decreased at 3:30 a.m. ($M = -.26$), $t(113) = 2.85$, $p < .001$. The linear effect of time of testing on performance was also significant, $t(113) = 2.21$, $p < .05$.

Path analysis was conducted to test the hypothesis that counteractive control mediated the quadratic effect of lateness on performance, but not the linear effect of lateness on performance. For this analysis, the two self-control measures (bolstering of the value and emotional significance of the test) were combined ($\alpha = .65$) and the quadratic and linear contrasts on lateness were used as predictor variables. The results are presented in Figure 6. It can be seen that lateness produced a quadratic effect on self-control, as indicated by the regression of self-control on the quadratic lateness contrast ($\beta = .22$, $p < .05$). Self-control, in turn, produced a linear effect on performance ($\beta = .31$, $p < .001$), as indicated by the regression of performance on self-control, controlling for lateness effects. Lateness thus produced an indirect quadratic effect on performance by means of self-control. Controlling for this effect eliminated the quadratic effect of lateness on performance ($\beta = .10$, $p = .26$). These results suggest that counteractive control partially mediated the curvilinear effect of lateness on performance. Note that controlling for self-control did not diminish the negative linear effect of lateness on performance (see Figure 6), suggesting that self-control did not mediate the linear effect of lateness. Specifically, both the 9:30 p.m. and the 3:30 a.m. testing sessions elicited few self-control efforts, as indicated by the null regression coefficient relating counteractive control to the linear lateness contrast ($\beta = .04$, $p = .65$). Performance therefore reflected the greater difficulty of the 3:30 a.m. testing session compared with the 9:30 p.m. session, as indicated by the significant regression coefficient relating performance to linear lateness regardless of whether self-control was statistically controlled ($\beta s = -.22$ and $-.20$, $ps < .05$).

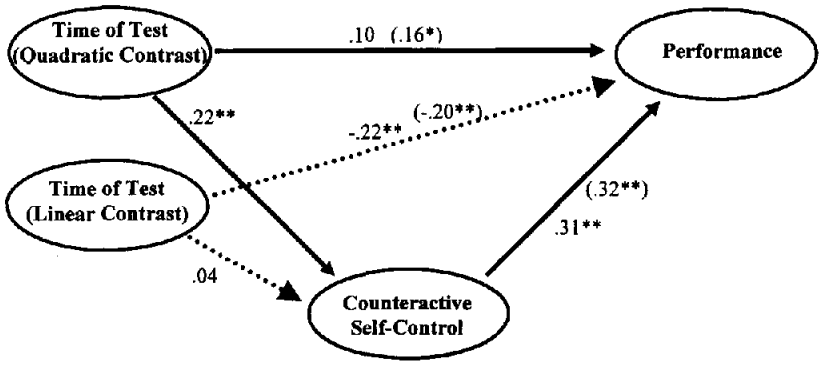

Figure 6. Path model of the influence of time of test on performance (Study 4). Numbers in parentheses are zero-order standardized betas. *$p < .07$. **$p < .05$.

To further illustrate these findings, Figure 7 presents both the observed performance scores and performance scores adjusted for self-control. It can be seen that observed performance was superior to adjusted performance at the moderately late testing session (12:30 a.m.)—the session that elicited the highest self-control efforts—but not at the other two testing sessions.

In summary, as in the earlier studies, the present study demonstrated that in deciding whether to undertake a useful but temporarily unpleasant test, participants thought about the test in ways that compensated for its unpleasantness. Performing a test at midnight is much less convenient than performing it in the early evening. This, however, did not diminish interest in the midnight test. On the contrary, participants attached greater importance and emotional value to performing the midnight test than to performing the early evening test. These self-control efforts prevented the midnight testing hour from impairing participants' performance. However, when the test was scheduled at an extremely inconvenient hour (3:30 a.m.), the attempts to boost the value of the test weakened, and performance drastically dropped. As predicted by the CCT instrumentality assumption, then, self-control efforts were an inverted U-shaped function of the unpleasantness of the test. Initially, higher levels of unpleasantness intensified self-control efforts. Such efforts were apparently perceived as instrumental for test performance. However, when the unpleasantness of the test became too extreme to be compensated for by self-control efforts, these efforts lost their instrumental value and were no longer used. In itself, unpleasantness acted to impair performance. At moderate levels, however, this negative effect of unpleasantness was more than compensated for by intensified self-control. As a result, extreme levels of unpleasantness were required to impair participants' performance.

Study 5: Priming Tempting Alternatives, A Field Study

A potential obstacle to acting according to one's long-term interests is thinking about tempting alternatives. Consider, for example, a student who needs to prepare for an important exam. The student may want to focus on his or her studies, but thoughts about the pleasure of spending time with friends might somehow be primed and undermine the student's motivation to study. However, to the extent that the exam is important, the priming of competing social motives may intensify self-control efforts and thus help the student maintain a high level of motivation to study. Instead of reducing the motivation to study, priming of competing social motives may enhance the motivation to study and thus enable the student to prepare for the exam and even perform well on it.

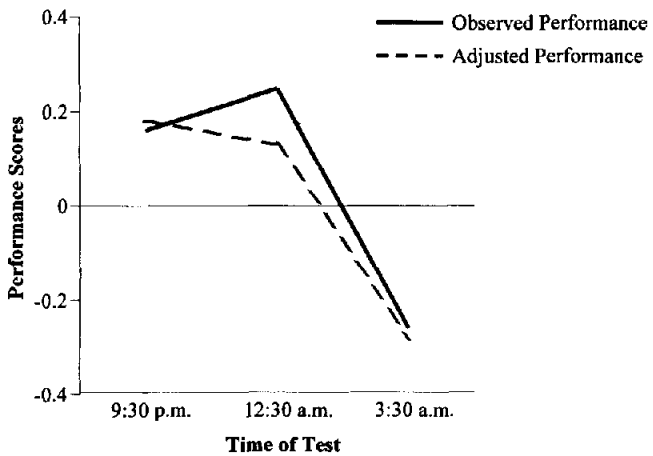

Figure 7. Observed performance vs. adjusted performance by time of test (Study 4). Performance scores are z transformed scores.

According to the CCT instrumentality assumption, self-control efforts serve the purpose of enabling people to choose and carry out a preferred activity. Hence, the priming of tempting alternatives should elicit self-control attempts before rather than after performing a preferred activity. Before an exam, bolstering the value of studying may help students better prepare for the exam, whereas after the exam, studying is no longer an important goal and bolstering its value can only reduce dissonance and regret (Aronson, 1997; Cooper & Fazio, 1984; Festinger, 1957; Shultz & Lepper, 1996). According to CCT, then, the priming of social motives should lead students to bolster the importance of studying before performing the exam but not after performing it.

These predictions were tested in a real-life setting. Our participants were nursing school students taking a midterm exam in an introductory psychology course. Social motives were primed by asking the students to answer a series of open-ended questions regarding their social life. This was done either 1 week before or 1 week after the exam. The design was, then, Social Priming (yes vs. no) × Time (before vs. after exam). We examined how priming of social motives affected the students' evaluation of the importance of studying and the students' grades on the midterm exam. It was hypothesized that the priming of social motives before (rather than after) the exam would lead students to boost the subjective value of studying for the exam, which should, in turn, act to prevent the priming of social motives from lowering the students' grades on the midterm exam.

Method

Participants. Participants were 77 (69 female, 8 male) undergraduate students enrolled in an introductory psychology course in the Nursing School at Tel-Aviv University. Participants were randomly assigned to the four conditions comprising the Social Priming × Time design.

Procedure. The study was conducted during class meetings of an introductory psychology course either 1 week before or 1 week after the midterm exam in this course.[2] The grades were posted 3 weeks after the exam, so all participants were unaware of their grades during the experiment. Participants received a booklet that contained instructions and a questionnaire. The first part of the booklet was designed to prime social motives. Participants in the priming condition were asked to imagine themselves in a pleasant social situation and to answer three open-ended

[2] Note that bolstering was measured either before or after the exam in conjunction with the priming manipulation. It would have been ideal to add a condition in which the priming is manipulated before the exam and bolstering is measured after the exam. This condition would have enabled us to assess the effect of priming before the exam on bolstering after the exam. Unfortunately, it was impossible to include this condition in the present field study, because we were allowed only one session with each class (either before or after the exam), and this additional condition required two sessions (priming before the exam and measuring bolstering after the exam).

questions regarding their social life: (a) "How important is it to you to be sociable? Explain why," (b) "Try to remember a situation in which you acted in a sociable manner. Please describe what you did and what happened," and (c) "Describe what you can do to be sociable and what is involved in behaving in a sociable manner." Participants in the no-priming control condition did not answer these questions. All participants answered the second part of the questionnaire that assessed the value of studying for the exam. Participants rated on 11-point scales, ranging from 1 (*not at all important*) to 11 (*very important*), the importance of (1) getting good grades, (2) studying for exams, (3) devoting efforts to studying for exams, (4) studying for exams during spare time, (5) being a good student; and (6) overcoming a lack of interest in studying. After the grades were posted, participants were asked to report their grade on the exam and were then thoroughly debriefed.

Results and Discussion

The six importance ratings were combined into a measure of bolstering the value of studying (α = .85). A Social Priming (present vs. absent) × Time (before vs. after the exam) ANOVA on this bolstering measure yielded significant main effects for social priming, $F(1, 65) = 9.96$, $p < .01$, and time, $F(1, 65) = 3.57$, $p = .06$, indicating more favorable evaluation of studying before (rather than after) the exam and following social priming (rather than no priming). These effects, however, reflected a Social Priming × Time interaction, $F(1, 65) = 7.97$, $p < .01$. As can be seen in Figure 8, this interaction indicates that before the exam participants viewed studying more favorably when social motives were primed ($M = 9.13$) than when these motives were not primed ($M = 7.10$), $t(36) = 4.47$, $p < .001$. After the exam, however, the subjective value of studying was low, regardless of whether or not social motives were primed (Ms = 7.48 and 7.49, respectively). Consistent with CCT, these results demonstrated that priming of social motives before an exam produced counteractive bolstering of the value of studying. After the exam, when studying was no longer an important goal, priming of social motives did not produce counteractive bolstering of the value of studying.

An ANOVA of participants' grades showed no significant effect of social priming or time (Fs < 1). The grade means in the four experimental conditions ranged from 81 to 86 (on a scale from 0 to 100), indicating that social priming did not affect participants' performance. A series of regression analyses were conducted to partition the unmediated null effect of social priming on grades ($\beta = -.11$, $p = .62$) into a direct effect and an indirect effect by

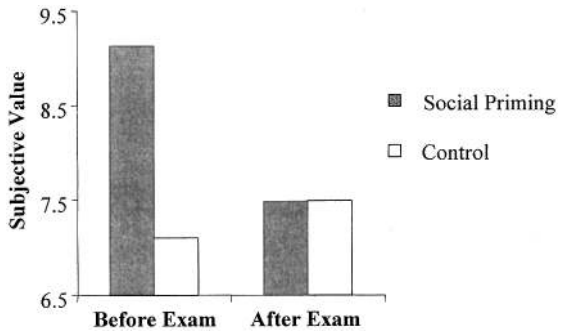

Figure 8. Subjective value of studying as a function of social priming before or after an exam (Study 5).

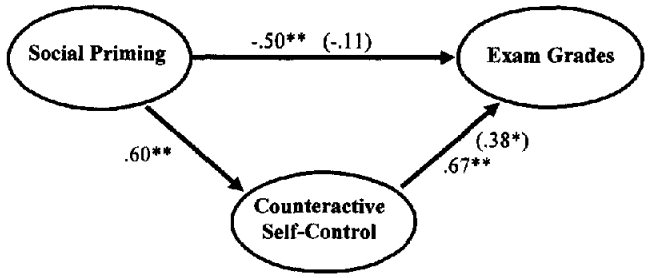

Figure 9. Path model of the influence of social priming before an exam on grades (Study 5). Numbers in parentheses are zero-order standardized betas. *$p < .07$. **$p < .05$.

means of counteractive bolstering of the value of studying. These analyses were performed only on the data from the before-exam condition. (In the after-exam condition, social motives were primed after the exam and therefore could not influence the grades.) It can be seen in Figure 9 that social priming produced a negative direct effect on grades, as indicated by the regression of grades on priming, controlling for bolstering ($\beta = -.50$, $p < .05$). Thus, in itself, social priming impaired performance on the exam. However, this negative direct effect of social priming was counteracted by its positive indirect effect. Specifically, social priming led participants to bolster the value of studying, as indicated by the regression of bolstering on priming ($\beta = .60$, $p < .01$). Bolstering, the value of studying, in turn, predicted relatively high grades on the exam, as indicated by the regression of grades on bolstering, controlling for priming ($\beta = .67$, $p < .01$). Thus, social priming acted to increase participants' grades on the exam by means of counteractive bolstering of the value of studying. This positive indirect effect of social priming cancelled its negative direct effect, so that, overall, social priming did not impair participants' performance on the exam.

The results of this study suggest that it is necessary to take into account self-control processes in predicting the motivational and behavioral consequences of priming a motive. When the primed motive threatens the attainment of one's long-term goals, one may engage in counteractive control that shields these goals against the primed motive. In the present study, the priming of social motives before an exam threatened participants' ability to study for an exam. In response to this threat, participants boosted the value of studying. Instead of weakening the motivation to study, the priming of social motives strengthened the motivation to study. This, in turn, prevented the priming of social motives from impairing participants' performance on the exam. After the exam, studying for the exam was no longer an important goal that needed to be shielded against competing wishes, and the priming of social motives therefore did not necessitate counteractive boosting of the value of studying.

General Discussion

What are the motivational consequences of attaching negatively valenced outcomes to an activity? A simple hedonic rule would predict that negative outcomes diminish the motivation to perform the activity. The present research suggests, however, that people may violate this rule when the negative outcomes are short-term

costs (e.g., temporary physical discomfort) of undertaking an activity that has high long-term value (e.g., a diagnostic medical test). People may perceive such costs as posing a threat to their ability to undertake the activity. In response to such threat, people may engage in counteractive control processes designed to boost the value of the activity and, thereby, maintain a high probability of acting according to their long-term interests. Attaching moderately (but not extremely) negative outcomes to an activity may, therefore, increase rather than decrease the value of the activity. For example, telling people that a medical test is somewhat unpleasant may not weaken people's willingness to undergo the test and may even enhance their positive evaluation of the test. In general, people may be no less and possibly even more motivated and intent on performing a preferred activity when it is associated with short-term negative outcomes than when it is not associated with such outcomes.

The Elicitation of Counteractive Control

To test these predictions, the present studies used a variety of short-term costs, such as abstinence from foods containing glucose, painful medical procedures, and inconvenient night testing hours. The present studies assessed the effects of these costs on a variety of self-control strategies, such as self-imposed penalties for failure to undertake a preferred activity, making rewards contingent on the activity, positively biased evaluation of the activity, and attaching emotional significance to the activity. Each of these measures yielded evidence for counteractive control, namely, a tendency to engage in proactive bolstering of the value of a preferred activity to the extent that the activity was associated with short-term costs. In Study 1, participants imposed on themselves a higher penalty for failure to take a medical test when this test required a long rather than short period of abstinence from tempting glucose-containing food. Study 2 demonstrated that when an exam involved a high level of physical discomfort, participants preferred to make the bonus contingent on taking the exam. Studies 3 and 4 found that participants attached greater importance and emotional significance to performing a test when it was described as more inconvenient. Finally, Study 5 demonstrated that priming short-term temptations (i. e., the social–emotional costs of studying) was sufficient to elicit counteractive control (i.e., bolstering the value of studying). Together, these studies cover a wide range of self-control strategies. It should be pointed out, however, that the value and importance of long-term goals was explicitly assessed (Studies 3–5). It therefore remains an interesting question for future research whether and how people spontaneously bolster their long-term goals when faced with tempting short-term outcomes.

The present research also supports the CCT assumption that counteractive control efforts serve as means to the end of ensuring that a preferred activity will be undertaken. First, Study 2 demonstrated that counteractive control in response to short-term costs of an activity depends on the long-term value of the activity. Thus, in deciding whether to undergo a medical test, the physical discomfort associated with the test elicited counteractive control only for participants who placed a high value on maintaining good health. Second, Study 4 found that self-control efforts were a nonmonotonic, inverted U-shaped function of short-term costs. Increasing the inconvenience (lateness) of a test initially enhanced participants' positive evaluation of the test. However, beyond a certain point, further increases in the level of inconvenience diminished participants' evaluation of the test. Participants apparently felt that they would be able to perform the minimally inconvenient test and unable to perform the extremely inconvenient test, regardless of their self-control efforts. Such efforts were, therefore, perceived as useless at extremely low and high levels of inconvenience. It was only at intermediate levels of inconvenience that self-control efforts were seen as useful because they could determine test performance.

Similar results were obtained by Trope and Neter (1994). These authors found that positive mood (compared with neutral or negative mood) enhanced people's willingness to receive negative feedback about their abilities. Positive mood apparently served as a resource in coping with the emotional costs of hearing negative feedback (Aspinwall, 1998; Aspinwall & Taylor, 1997; Reed & Aspinwall, 1998). More relevant here, Trope and Neter found that participants tried to self-induce a positive mood before receiving negative feedback by examining unrelated positive information about themselves. However, participants' attempts to self-induce a positive mood declined when the offered feedback was very negative and, therefore, too hard to receive. Consistent with the present findings, then, attempts to self-induce a positive mood were most intense when they could determine one's feedback-seeking decision, namely, when the offered feedback was moderately negative.

Third, Study 5 found that participants engaged in counteractive control before, but not after, performing a preferred activity. This study investigated boosting of the value of studying for an exam in response to priming of tempting alternatives before or after the exam. Only before the exam did priming of tempting alternatives to studying lead participants to boost the value of studying.

Behavioral Consequences of Counteractive Control

How does counteractive control affect people's actual choice and performance of activities that are associated with short-term costs? In themselves, these costs should act to decrease choice and performance of such activities. However, according to CCT, the elicited self-control processes act to maintain people's interest in an activity despite its short-term costs. Three of our studies tested these predictions. Study 3 showed that level of discomfort of a test affected participants' willingness to undertake the test in two ways. Directly, discomfort (low vs. high) reduced the willingness to undergo the test. Indirectly, however, discomfort increased bolstering of the value of the test, which, in turn, increased the willingness to undergo the test. This indirect effect prevented temporary unpleasantness from reducing participants' willingness to undergo the test.

Study 4 showed that in itself lateness of testing hour acted to impair performance. However, counteractive bolstering in anticipation of moderately inconvenient testing hours prevented the inconvenience of these testing hours from impairing performance. It is only when the anticipated testing hour was extremely late that counteractive bolstering diminished and actual test performance declined. Finally, Study 5 found that counteractive control (bolstering the value of studying) in response to the priming of social costs acted to offset the interference of these costs with participants' performance on the exam. Together, the results of these

studies suggest that counteractive control may actually help people overcome the influence of temptations and make choices according to their long-term interests.

Alternative Interpretations

A different interpretation of the present findings would suggest that they reflect regret or dissonance reduction processes (Aronson, 1997; Cooper & Fazio, 1984; Shultz & Lepper, 1996). According to this interpretation, evaluative bolstering reflects an attempt to justify engagement in a costly course of action. The greater the costs associated with a course of action, the greater the need to justify engaging in it. Several aspects of the present research argue against this interpretation. First, self-justification processes should occur only after engaging in an activity. In the present studies, however, participants exhibited evaluative bolstering before engaging in an activity and even before choosing it. For example, in Studies 1–4, participants showed enhanced evaluations of an unpleasant test after receiving information about the test but before indicating whether they would actually take it. Even if these participants implicitly decided to take the test, they were still free to reverse their decision. Study 5 demonstrated that priming of the social costs of studying produced evaluative bolstering of studying before but not after the exam. Before the exam, thinking about the social costs of studying could threaten preparation for the exam, whereas after the exam, thinking about these costs could only produce regret. It seems that evaluative bolstering served to maintain effective preparation for the exam rather than to avoid feelings of regret.

Second, dissonance and regret produced by engaging in an activity should be a monotonously increasing function of the costs of the activity. Contrary to this prediction, the present research (Study 4) shows that evaluative bolstering of an activity is a nonmonotonic, inverted U-shaped function of the costs of the activity. Third, reduction of dissonance or feelings of regret do not seem to readily explain self-imposed penalties and contingencies for receiving rewards. Why should short-term costs of an activity lead a dissonance reducer to self-impose costs for failing to perform the activity? Imposing on oneself a monetary penalty for failure to perform a painful test would not reduce dissonance or regret for taking the activity. Instead, as CCT assumes, these self-control strategies might help people act according to their long-term interests despite short-term costs.

This is not to deny that people may exert self-control efforts after making a decision. Anticipated short-term costs of actually carrying out an activity may prompt, according to CCT, evaluative bolstering of the activity and other counteractive control efforts. Such efforts may shield the intention to perform the activity against tempting alternatives. In this respect, CCT is consistent with Gollwitzer's (Gollwitzer, 1990, 1993; Gollwitzer & Bayer, 1999; Gollwitzer & Brandstatter, 1997) mind-set theory and Kuhl's (Goschke & Kuhl, 1993; Kuhl, 1982, 1984, 1986; Kuhl & Beckmann, 1985) action control theory. These self-regulation theories suggest that after choosing a course of action, people focus on how to effectively implement the chosen course of action and disregard or downplay alternatives (see also Brickman, 1987; Jones & Gerard, 1967). The present research suggests that self-control efforts, such as promoting the value of a preferred activity and downplaying alternative activities, may sometimes be elicited prior to making a choice. Self-control efforts may thus be exerted not only to ensure implementation of a preferred course of action, but also to ensure choice of such a course of action.

Conclusions and Implications

Everyday life observations and a considerable amount of research suggest that immediate temptations often prevent people from acting according to their long-term preferences (see Ainslie, 1992; Hoch & Loewenstein, 1991; Loewenstein, 1996; Loewenstein & Thaler, 1989; Metcalfe & Mischel, 1999; Mischel, 1974; Platt, 1973; Rachlin, 1995; Wegner & Wenzlaff, 1996). People often fail to maintain a healthy diet, engage in safe sex, or seek constructive solutions of interpersonal conflicts (see reviews by Baumeister & Heatherton, 1996; Baumeister, Heatherton, & Tice, 1994). Counteractive control strategies may be used in anticipation of such self-regulation failures. People may learn that certain temptations are difficult to overcome on-line and that it is necessary to bolster the value of their long-term goals in advance and even irreversibly precommit themselves to achieving these goals.

The present research suggests that people can recognize the threat posed by immediate temptation to their long-term goals, that such threats elicit counteractive control strategies, and that the use of these strategies acts to offset the influence of temptation on choice and performance. The present research also identifies limiting conditions on counteractive control (important long-term goals, moderate temptations, and being in a preaction phase). However, even when these conditions are satisfied, many questions regarding the availability, activation, and application of self-control strategies remain open for future research. How are the strategies acquired? What determines which specific self-control strategy will be activated and how effective it will be? How are different self-control strategies related? Are the strategies substitutable? Are the strategies activated and applied deliberately or automatically? These are some of the questions we are currently investigating in an attempt to advance the understanding of the theoretically interesting and socially significant issue of self-control.

References

Ainslie, G. (1975). Specious reward: A behavioral theory of impulsiveness and impulse control. *Psychological Bulletin, 82,* 463–496.

Ainslie, G. (1992). *Picoeconomics: The strategic interaction of successive motivational states within the person.* Cambridge, England: Cambridge University Press.

Aronson, E. (1997). The theory of cognitive dissonance: The evolution and vicissitude of an idea. In C. McGarty & A. Halsam (Eds.), *The message of social psychology: Perspective on mind in society* (pp. 20–35). Cambridge, MA: Blackwell.

Aspinwall, L. G. (1998). Rethinking the role of positive affect in self-regulation. *Motivation and Emotion, 22,* 1–32.

Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: Self-regulation and proactive coping. *Psychological Bulletin, 121,* 417–436.

Atkinson, J. W., & Feather, N. T. (Eds.). (1966). *A theory of achievement motivation.* New York: Wiley.

Bandura, A. (1976). Self-reinforcement: Theoretical and methodological considerations. *Behaviorism, 4,* 135–155.

Bandura, A. (1977). *Social-learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1986). *Social foundation of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1989). Self-regulation of motivation and action through goal systems. In L. A. Pervin (Ed.), *Goal concept in personality and social psychology* (pp. 19–85). Hillsdale, NJ: Erlbaum.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173–1182.

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,* 1–15.

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.

Becker, H. S. (1960). Notes on the concept of commitment. *American Journal of Sociology, 66,* 32–40.

Beckmann, J., & Kuhl, J. (1984). Altering information to gain action control: Functional aspects of human information processing in decision making. *Journal of Research in Personality, 18,* 224–237.

Brehm, J. W. (1966). *A theory of psychological reactance.* New York: Academic Press.

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

Brehm, J. W., Wright, R. A., Solomon, S., Silka, L., & Greenberg, J. (1983). Perceived difficulty, energization, and the magnitude of goal valence. *Journal of Experimental Social Psychology, 19,* 21–48.

Brehm, S. S., & Brehm, J. W. (1981). *Psychological reactance: A theory of freedom and control.* New York: Academic Press.

Brickman, P. (1987). *Commitment, conflict, and caring.* Englewood Cliffs, NJ: Prentice Hall.

Cooper, J., & Fazio, R. H. (1984). A new look at dissonance theory. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 17, pp. 229–264). Orlando, FL: Academic Press.

Festinger, L. (1957). *A theory of cognitive dissonance.* Evanston, IL: Row, Peterson.

Gollwitzer, P. M. (1990). Action phases and mind-sets. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 53–92). New York: Guilford Press.

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 4, pp. 141–185). London: Wiley.

Gollwitzer, P. M., & Bayer, U. (1999). Deliberative versus implemental mindsets in the control of action. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 403–422). New York: Guilford Press.

Gollwitzer, P. M., & Brandstatter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology, 73,* 186–199.

Gollwitzer, P. M., & Moskowitz, G. B. (1996). Goal effect on thought and behavior. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 361–399). New York: Guilford Press.

Goschke, T., & Kuhl, J. (1993). Representation of intentions: Persisting activation in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1211–1226.

Green, L., & Rachlin, H. (1996). Commitment using punishment. *Journal of the Experimental Analysis of Behavior, 65,* 593–601.

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

Jones, E. E., & Gerard, H. B. (1967). *Foundations of social psychology.* New York: Wiley.

Kenny, D. A., Kashy, D., & Bolger, N. (1998). Data analysis in social psychology. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (Vol. 1, pp. 233–265). New York: McGraw-Hill.

Kuhl, J. (1982). Action vs. state-orientation as a mediator between motivation and action. In W. Hacker, W. Volpert, & M. Von Cranach (Eds.), *Cognitive and motivational aspects of action* (pp. 67–85). Amsterdam: North-Holland.

Kuhl, J. (1984). Volitional aspects of achievement motivation and learned helplessness: Toward a comprehensive theory of action control. In B. A. Maher (Ed.), *Progress in experimental personality research* (Vol. 13, pp. 99–171). New York: Academic Press.

Kuhl, J. (1986). Motivation and information processing: A new look at decision making, dynamic change, and action control. In R. M. Sorrentino & E. T. Higgins (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 404–434). New York: Guilford Press.

Kuhl, J., & Beckmann, J. (1985). *Action control from cognition to behavior.* New York: Springer-Verlag.

Kukla, A. (1974). Performance as a function of resultant achievement motivation (perceived ability) and perceived difficulty. *Journal of Research in Personality, 7,* 374–383.

Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Process, 65,* 272–292.

Loewenstein, G., & Thaler, R. H. (1989). Anomalies: Intertemporal choice. *Journal of Economic Perspectives, 3,* 181–193.

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

Mischel, W. (1974) Processes in delay of gratification. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 249–292). San Diego, CA: Academic Press.

Mischel, W. (1984). Convergences and challenges in the search for consistency. *American Psychologist, 39,* 351–364.

Mischel, W., Cantor, N., & Feldman, S. (1996). Principles of self-regulation: The nature of willpower and self-control. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 329–360). New York: Guilford Press.

Mischel, W., Shoda, Y., & Peake, P. K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology, 54,* 687–696.

Platt, J. (1973). Social traps. *American Psychologist, 28,* 641–651.

Rachlin, H. (1995). Self-control: Beyond commitment. *Behavioral and Brain Sciences, 18,* 109–159.

Rachlin, H. (1996). Can we leave cognition to cognitive psychologists? Comments on an article by George Loewenstein. *Organizational Behavior and Human Decision Process, 65,* 296–299.

Rachlin, H. (1997). Self and self-control. In J. G. Snodgrass & R. L. Thompson (Eds.), *The self across psychology: Self-recognition, self-awareness, and the self concept. Annals of the New York Academy of Sciences* (Vol. 818, pp. 85–97). New York: New York Academy of Sciences.

Rachlin, H., & Green, L. (1972). Commitment, choice, and self-control. *Journal of the Experimental Analysis of Behavior, 17,* 15–22.

Reed, M. B., & Aspinwall, L. G. (1998). Self-affirmation reduces biased processing of health-risk information. *Motivation and Emotion, 22,* 99–132.

Schelling, T. C. (1978). Egonomics, or the art of self-management. *American Economic Review, 68,* 290–294.

Schelling, T. C. (1984). Self-command in practice, in theory, and in a theory of rational choice. *American Economic Review, 74,* 1–11.

Shoda, Y., Mischel, W., & Peake, P. K. (1990). Predicting adolescent cognitive and self-regulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental Psychology, 26*, 978–986.

Shultz, T. R., & Lepper, M. R. (1996). Cognitive dissonance reduction as constraint satisfaction. *Psychological Review, 103*, 219–240.

Strotz, R. H. (1956). Myopia and inconsistency in dynamic utility maximization. *Review of Economic Studies, 23*, 166–180.

Thaler, R. H. (1994). *Quasi rational economics.* New York: Russell Sage Foundation.

Thaler, R. H., & Shefrin, H. M. (1981). An economic theory of self-control. *Journal of Political Economy, 89*, 392–406.

Trope, Y., & Neter, E. (1994). Reconciling competing motives in self-evaluation: The role of self-control in feedback seeking. *Journal of Personality and Social Psychology, 66*, 646–657.

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*, 34–52.

Wegner, D. M., & Wenzlaff, R. M. (1996). Mental control. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 466–492). New York: Guilford Press.

Received August 10, 1999
Revision received February 29, 2000
Accepted March 10, 2000 ■