Can't Control Yourself? Monitor those Bad Habits

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Abstract

Little is known about how people go about successfully controlling their unwanted habits. Because most past research focused on the strategies used to control responses to affective temptations, we began by comparing the control of habits with temptations. We conducted two episode-sampling diary studies to identify the self-control strategies that people use in their daily lives. Bad habits, unlike responses to temptations, were controlled most effectively through vigilant monitoring of behavior and reminders not to perform the undesired response. Stimulus control and distraction were of little use for strong habits, despite their success at controlling temptations. Because so little is known about habit control, we replicated in a laboratory experiment the effectiveness of vigilant monitoring for strong habits. We discuss the implications of these findings for behavior change interventions.

Keywords: self-control; habits; temptations; behavior change

Can't Control Yourself? Monitor those Bad Habits

In daily life, people engage in many attempts to change their thoughts, feelings, and behaviors. In so doing, they exert self-control in order to overcome the power of stimuli automatically to elicit reactions. Research on self control has addressed the strength of the self-regulatory resource (Muraven & Baumeister, 2000) and the mechanisms by which people detect that self-regulation is necessary (Carver & Scheier, 2007). Less is known about the behavioral strategies by which people exert control over stimulus cues. We investigate this in the present article.

People exert self-control when they override the expression of an emotion, desire, or response tendency (see Baumeister & Heatherton, 1996). Current understanding of how people exert such control is limited largely to responses to temptations. In Metcalfe and Mischel's (1999) classic analysis of delay of gratification, children attempted to override the impulse to eat a small, tempting treat now in order to receive a larger treat later. Also, Fishbach and Trope (2005, 2007) proposed a number of counteractive control strategies that people can use to derail momentary, low-priority temptations that threaten long term, higher-priority goals. The present research opens up investigation of the range of stimulus-driven responses that people are challenged to control in daily life and focuses in particular on the control of unwanted or bad habits. As we explain below, habit cuing necessitates a unique form of self-control.

In this article, we used a two-stage approach to understand how people control unwanted habits. Because existing research on self-control has focused largely on temptations, we began our investigation of habit control by building on this literature. We conducted two experience-sampling diary studies of people's ongoing attempts to inhibit unwanted responses. Specifically, we examined the explicit, conscious strategies that people spontaneously use to inhibit habits as opposed to temptations.[1] Then, to provide a firm basis on which to draw conclusions about habit

control, we took the successful habit control strategy from the diary study and examined its effects systematically in a controlled experiment.

Inhibition of Temptations

To investigate the strategies that people use to control unwanted habits, we first considered the evidence on control of temptations. Hot, affective stimuli trigger responses by activating *visceral factors* such as hunger, thirst, and sexual desire (Loewenstein, 1996). People control such hot, emotional reactions by overriding their affect with a cool cognitive memory system (Metcalfe & Mischel, 1999). By the cool system, people engage in attention management to avoid thinking of the hot features of the affective stimulus (e.g., taste, smell).

What control strategies do people use to manage their attention and thus avoid succumbing to a temptation? Children were successful at delaying gratification when they decreased the activation of the hot food cues in memory by removing or obscuring the small food treat, such as placing it out of sight or ignoring it (Mischel, Shoda, & Rodriguez, 1989). This strategy is reminiscent of behavior modification techniques by which people control unwanted responses by controlling the performance environment (Follett & Hayes, 2001). Thus, addicts may be counseled to avoid triggers that promote affective cravings (e.g., Witkiewitz & Marlatt, 2004). Similarly, people wishing to avoid overeating are counseled to reduce the salience of food cues in their environment (Wansink, 2006). Also, in stages of change models, stimulus control strategies are believed to promote progression through the different stages, especially movement through the action and maintenance periods of behavior change (Prochaska, DiClemente, & Norcross, 1992). We refer to such strategies as *stimulus control*.

In the delay of gratification paradigm, children also were effective when they distracted themselves with cues other than the tempting stimulus, by, for example, playing with something else (Metcalfe & Mischel, 1999). In so doing, they apparently focused their attention away from the hot properties of the stimulus onto less affectively-laden concerns that do not activate

impulsive responding. We refer to this focus of attention away from the response cue as *distraction.*

One control strategy that does not appear to be effective for delaying gratifying responses is careful monitoring of one's reactions to the stimulus. When food temptations were displayed prominently, the salience of their hot affective properties apparently increased, thereby automatically eliciting the consumption response and impairing children's ability to delay gratification (Mischel & Ebbeson, 1970). In perhaps an analogous process, ironic control mechanisms that monitor for instances of an unwanted thought have been found to unwittingly increase the likelihood of that thought (Wegner, 1997). We refer to a heightened attentional focus on behavior as *vigilant monitoring.*

Inhibition of Habitual Responses

There is good reason to believe that the strategies people use to control responses to temptations will not be effective with the control of habits. Even though affective temptations and habits are both forms of automated responding (see Moors & De Houwer, 2005), their characteristic features establish unique challenges for self-control. With temptations, the challenge is to reduce sensitivity to hot stimulus features so as to curb impulses. However, with habits, the challenge is to control an already activated response that is accessible in memory by virtue of its association with features of the performance environment (Neal, Wood, & Quinn, 2006; Wood & Neal, 2007). Habits form when people repeat responses in contiguity with features of performance contexts. Then the simple perception of the context feature can automatically activate the associated response (Neal, Lally, Wu, & Wood, under review). Controlling habits is thus a process of suppressing performance of an accessible response.

Given the nature of habit cuing, we hypothesize that distraction will not be an effective form of willpower. Consider, for example, a person trying to limit food intake by controlling a habit of cleaning her plate. If she is distracted by talking with others or watching TV, then she is

not attending fully to how much she is consuming, and her clean-plate habits are likely to be activated by the remaining food. Thus, habit performance often requires only limited attention to the stimulus, and reducing attention through distraction will not likely promote habit control. In fact, being distracted may increase the likelihood of performing an unwanted habit. This possibility is suggested by studies of action slips, especially *habit intrusions*, which are highly automated action sequences that emerge inadvertently when a person intended another (less habitual) response (Reason, 1990, aka *capture errors*, Norman, 1981). In Reason's (1992) diary studies of everyday behavior, habit intrusions were especially common when people were distracted or otherwise preoccupied and not attending to what they were doing.

We anticipate that vigilant monitoring of the unwanted response is an effective form of willpower over habits. Monitoring involves heightening attention towards behavior and reminding oneself not to perform the associated response. Unlike temptations, which gain strength through enhancing desires and hot impulses, habit cues gain strength through repeated associations with the response. Once this association has been made, habit cues activate the response automatically with minimal conscious processing. For this reason, increased attention to and monitoring of a habitual behavior is not likely to further increase the cue's power to activate a habit response. Instead, increasing attention and monitoring should enable people to identify the imminent triggering of an unwanted habit and engage inhibitory processes that prevent response performance.

We were uncertain whether stimulus control would be effective at controlling habits. On the one hand, Wood, Tam, and Guerrero Witt (2005) found that changes in performance environments that occurred when students transferred to a new university disrupted performance of everyday habits (e.g., reading the newspaper, exercising). In addition, people can intentionally change triggering stimuli in everyday life when they are able to identify and alter the triggering cues. For temptations, these triggers typically are affectively prominent (e.g., smell, sight of

chocolate cake) and tied directly to the impulsive response (e.g., eating). Thus, temptation cues should be relatively easy to identify. On the other hand, cues for habit performance may be more difficult to identify because they can include any element of the context (e.g., preceding actions, location) that has consistently covaried with the habitual response in the past. For example, a smoker may be unaware that the entrance to their workplace has come to cue their habit through the many breaks they spent in that location smoking. Thus, whereas stimulus control should be an effective strategy for temptations, it might gain little traction over habits.

The Present Research

In our two-stage approach to understanding habit control, we first conducted two diary studies using an event-sampling procedure to determine whether self-control of temptations in daily life corresponds to experimental research findings and whether habit control strategies function similarly to temptations. Then, to further our understanding of habit control, we conducted a third, laboratory study that evaluated the efficacy of the habit control strategies that emerged as successful within the daily diary.

Participants in the diary studies made contemporaneous reports when they recognized the need for self control—when they felt that they should not do something. They recorded the response that they wanted to inhibit and rated the strategies they used (if any) to do so. We initially evaluated a range of self-control strategies, but some, such as the reward strategy used in counteractive self-control, were not used with sufficient frequency to permit analyses.

To test our hypotheses, we first determined what kinds of responses participants were trying to control. Responses were classified as cued by affective temptations if, despite being unwanted, participants reported that performance would produce more immediately positive than negative affect. Responses were classified as strongly habitual if they had been performed often in the past and usually in the same location. We were able to classify fully 88% of the reports as one or the other type of response.[2]

To test our hypotheses that self-control strategies are differentially effective for habits and temptations, we constructed regression models predicting success at self-control from the type of response being controlled (habits versus temptations) and use of each self-control strategy. We anticipated replicating prior findings in the delay of gratification literature with respect to the benefits of distraction. Specifically, we predicted that distraction, by reducing focus on hot, affective stimulus features, would be especially successful at controlling responses to temptations. However, distraction also reduces conscious attention to responses and thus might promote inadvertent habit performance. Thus, the benefits of distraction for temptations should not extend, and may be reversed, for habits. Vigilant monitoring of responses, in contrast, should promote the inhibition of habit cuing. However, vigilant monitoring that focuses attention on hot affective stimulus properties may not control responses to temptations. Finally, stimulus control might be difficult to implement successfully for habits as people may generally be unaware of the relevant cues, whereas tempting stimulus cues might be easier to identify and thereby change or avoid. Thus, we anticipated significant interactions between type of response controlled and use of each of the control strategies.

Method

Participants

Study 1a. Sixty-one female and 38 male undergraduate students at Duke University participated for partial fulfillment of a requirement in their introductory psychology course.

Study 1b. Thirty-three students from Duke University and the University of North Carolina, Chapel Hill participated in return for $40 payment.

Data from five additional participants in Study 1a and two additional participants in Study 1b were excluded because they reported during the debriefing session that they had recorded 50% or fewer of their attempts at self control.

Procedure

The two diary studies used slightly different response formats. In the first study, participants reported only on responses that they were trying to inhibit. Study 1b extended reports of change efforts to include attempts to implement desired behaviors as well as to inhibit undesired ones. Because our hypotheses concern only self-control, we conduct and report analyses only on inhibitory attempts. Nonetheless, by assessing self-control in multiple ways, we ensured that the diary findings were not a product of specific reporting instructions.

Both studies consisted of three phases: an introductory session, a recording period, and continuation sessions in which participants provided additional information.

Phase 1: Introductory session. Participants attended in groups of about 25 (Study 1a) or 3 (Study 1b) in a study of how people change their thoughts, feelings, and behaviors. They tracked their responses for the next seven (Study 1a) or fourteen (Study 1b) days, making written reports on diary forms provided by the experimenter. Participants received pocket-sized booklets containing the diary forms to be used during the recording period and detailed instructions about how to complete them. Participants also received examples of completed diary reports (e.g., "not overeating, not tripping over a crack in the sidewalk, not sleeping during an early morning class, not smoking, and avoiding nervous thoughts prior to a big test)."

Because the research aimed to investigate the full range of successful and unsuccessful attempts at self-control, instructions emphasized that participants complete a report even when they felt they *should* change a response but made no effort to do so. Participants were instructed to carry the booklets with them at all times and to make diary reports within 15 minutes of the events' occurrence in order to maximize accurate reporting. To ensure that participants understood the instructions, they listed behaviors that they might try to inhibit (Study 1a) or change (Study 1b) during a typical day and completed a sample form for one of their listed behaviors. Participants also signed a "contract," by which they agreed to keep a complete diary. Participants then scheduled the first follow-up session.

Phase 2: Recording behaviors. For Study 1a, participants reported "every time you try not to do some unwanted activity." For Study 1b, participants kept "track of the times that you think about or feel the need to change your behavior – to stop doing some unwanted act or to start doing something different."

Phase 3: Continuation sessions. Participants returned to the lab every two to three days for continuation sessions in which they first rated the success of each attempt at response change listed in their diary, along with additional questions (see "*Success at Behavior Change"* below). Success ratings were obtained after the actual diary reports so as to accurately record instances in which initial success at self-control was followed by failure (e.g., a decision not to ruminate that is successful only for a few minutes). Participants turned-in completed diary booklets, received blank ones, and scheduled their next session.

Continuation meetings were held every 2-3 days to make certain that participants accurately remembered the success of their control efforts and to ensure that participants provided recordings across the entire period. During the recording period, participants attended approximately three (Study 1a) or six (Study 1b) continuation sessions, the last concluding with a debriefing.

Measures

Diary behavior reports: (a) content of behavior. Participants gave a brief written description of each activity they desired to inhibit/change. Participants in Study 1b also described the type of change attempt by circling whether it involved *trying to <u>stop</u> doing something*, *trying to <u>start</u> doing something*, or *both*. We focus here on only the 51% of reports that were attempts at inhibiting or trying to stop, but we note also that 27% were attempts at initiating or trying to start, and 23% were a combination.

(b) strategies. Participants also checked the strategies they used to keep from performing the unwanted act. The set of strategies had been identified through extensive pretesting and

included the following: (a) vigilant monitoring, which was assessed with respect to inhibition (Study 1a) as *thinking "don't do it" or watching carefully for mistakes* and with respect to general behavior change (Study 1b) as *monitoring my behavior carefully*, (b) *distracting myself*, (c) stimulus control of *removing myself from the situation or removing the opportunity to do it*, or (d) *nothing – I did not try to stop this time*.[3]

(c) habit strength of unwanted responses. Participants rated how often they had performed the unwanted behavior in the past, with options of 1 (*monthly or less often*), 2 (*at least once a week*), 3 (*just about every day*), or 4 (*several times per day*). They also indicated the extent to which they performed the unwanted act in the same location each time, with acts that *usually occurred* in the same location coded 1, and acts that *rarely* or *sometimes occurred* in the same location coded 0. To calculate the habit strength of each diary report, the context stability measure was multiplied by participant ratings of past performance frequency (see Ji & Wood, 2007; Wood et al., 2005). The resulting habit measure ranged from 0 (*weak habit/nonhabit*) to 4 (*strong habit*).

(d) temptation strength. Participants rated "right now, how much would performing the unwanted behavior make you feel good,' and "right now, how much would performing the unwanted behavior make you feel bad" on scales ranging from 1 (*not at all*) to 5 (*extremely*). Temptation was calculated by subtracting anticipated negative feelings from anticipated positive feelings.

Success at behavior change. At each follow-up session, participants rated the overall success of each attempt to change their behavior from 1 (*unsuccessful*) to 7 (*successful*).[4] Obtaining success ratings at the follow-up sessions, separately from the diary reports, allowed us accurately to tap longer-term success (e.g., as when people are able to resist immediately a second helping of dessert, but then succumb to the temptation).

Results

The richness of the data can be seen in the content of the diary reports listed in Table 1. The reports spanned an array of self-control domains pertaining to consumatory behaviors, social interactions, health-related activities, decision-making, and coping with everyday events (see Table 1).

Participants reported a mean of 23.94 (*SD* = 10.01) unwanted responses during the seven days of Study 1a and 19.94 (*SD* = 14.75) unwanted responses during the two weeks of Study 1b (see Table 2). Apparently, participants were consciously aware of their own attempts to inhibit unwanted thoughts, feelings, and acts at an average rate of 3.50 times per day for Study 1a and 1.42 change attempts per day for Study 1b.[5] In addition, participants reported only a modest overall level of success at inhibiting the unwanted responses, with a mean success rate on the 7-point scale of 3.57 (*SD* = 1.04) for Study 1a and 3.85 (*SD* = 2.04) for Study 1b.

Participants' ratings of the strength of the habitual and tempting nature of the responses that they were trying to control are given in Table 2. The percentage of unwanted responses that were strong habits, performed almost daily and usually in the same context in Study 1a was 25% and in Study 1b was 22%. The percentage of unwanted responses that were hot affective reactions to temptations, yielding more immediately positive than negative affect in Study 1a was 40% and in Study 1b was 36%.

The analyses were conducted combined across the data from the two studies. To evaluate the feasibility of this approach, we included study as a predictor in all models. Providing support, study was not a significant main effect predictor in any analysis, nor did it interact with any other predictors in the results we report below.

Frequencies of Strategy Use

Table 3 shows the frequencies with which respondents reported using each strategy. Monitoring for errors was the most frequently used strategy for control of all responses, followed

by the default strategy of doing nothing. Less often used were the strategies of distracting myself and stimulus control of removing myself from the situation.

Success at Self-Control of Habits and Temptations

We first evaluated whether stronger habits and stronger temptations were more difficult to overcome than weaker ones. As expected, a regression model predicting success from habit strength of the unwanted response revealed that participants were less successful at inhibiting stronger habits, $B = -0.18$, $SE = 0.04$, $t(91) = -4.38$, $p < .01$. Also as expected, a regression model predicting success from strength of affective temptation revealed that participants were less successful at inhibiting stronger temptations, $B = -0.08$, $SE = 0.03$, $t(92) = -2.97$, $p < .01$. Given that our hypotheses concerned the control of strong habits and strong temptations, we conducted focused tests on these responses in particular, and we excluded from further analyses the reports involving weak habits and weak temptations.[6]

The data structure resulting from the diary design was hierarchical, with individual diary reports nested within participants. To account for the nonindependence of individual diary reports, we used multilevel modeling techniques (Kenny, Kashy, & Bolger, 1998; Raudenbush & Bryk, 2002). Continuous predictors in the multilevel models were grand-mean centered and dichotomous predictors were left uncentered. All models were estimated allowing for random intercepts and slopes. The degrees of freedom were estimated using the Satterthwaithe (1941, 1946) approximation.

To test our hypotheses about the effectiveness of different strategies to control habits as opposed to temptations, we constructed a series of regression models predicting success from effect coded predictors representing use or nonuse of each of the strategies, the type of response being controlled (habits vs. temptations), and the interaction between these. These variables were analyzed at the level of reports. Because we were uncertain whether men and women would

differ in success, we entered participant sex as a covariate in all analyses. No main effect was found for sex, nor did it interact with strategy use or type of response.

In the regression models predicting success at self-control, the predicted interactions between the type of response to be inhibited and the use or nonuse of strategies emerged for vigilant monitoring, $B = 0.15$, $SE = 0.07$, $t(138) = 2.05$, $p < .05$, and distraction, $B = -0.78$, $SE = 0.35$, $t(102) = -2.26$, $p < .05$. In addition, a marginally significant interaction emerged for stimulus control of removing self from the situation, $B = -0.54$, $SE = 0.33$, $t(90) = -1.81$, $p = .07$. Along with the predicted interactions, main effects emerged in these models such that strong habits were more difficult to inhibit than strong temptations (all ps $< .08$).[7] No other effects were significant.

To interpret the interactions, we examined simple comparisons between the use versus nonuse of the relevant strategy within each type of response. As depicted in Figure 1, for vigilant monitoring, inhibition of strong habits was more successful when respondents used monitoring ($M = 3.59$) than when they did not ($M = 2.89$), $F(1, 136) = 20.11$, $MSE = 4.65$, $p < .01$. However, successful inhibition of temptations was not affected by use ($M = 3.72$) or nonuse of monitoring ($M = 3.52$, $F < 1$, *ns*). As depicted in Figure 2, for distraction, inhibition of habits was marginally less effective when respondents used distraction ($M = 2.82$) than when they did not ($M = 3.48$), $F(1, 150) = 3.23$, $MSE = 4.67$, $p < .08$. In contrast, inhibition of response to temptations was more successful when respondents used distraction ($M = 4.08$) than when they did not ($M = 3.54$), $F(1, 106) = 9.26$, $MSE = 4.67$, $p < .01$. As shown in Figure 3, for stimulus control of removing myself from the situation, inhibition of habits did not vary with use ($M = 3.30$) or nonuse of the strategy ($M = 3.34$), $F < 1$, *ns*. The inhibition of temptations when using stimulus control of removing myself ($M = 4.15$) was significantly more effective than when not using the strategy ($M = 3.51$), $F(1, 107) = 14.26$, $MSE = 4.68$, $p < .01$.

Discussion

Overall, participants in our diary studies were not especially successful at inhibiting everyday habits and impulses to succumb to temptations, averaging a middle level of success on the rating scale. As would be expected, they were less successful at inhibiting unwanted responses that were more strongly habitual or more strongly affectively tempting.

Willpower over strong temptations in daily life closely paralleled Metcalfe and Mischel's (1999) experimental research on delay of gratification. Because the hot stimulus properties of temptations are likely to elicit automatic, impulsive responses, effective control should involve replacing or muting hot cues with cool cognitions. Thus, participants inhibited their impulses by distracting themselves and by removing themselves from the tempting stimulus cues. Especially noteworthy is that vigilant monitoring was not a successful form of self-control for temptations. The findings for vigilant monitoring even provided some (nonsignificant) suggestive support for Metcalfe and Mischel's (1999) idea that monitoring for unwanted responses can undermine control by increasing focus on the hot stimulus qualities propelling the unwanted response. These patterns for temptations establish that our paradigm provides a valid context for studying types of willpower. Thus, it allows us to examine strategies for habit control.

Strong habits required a unique set of self-control strategies. With habits, perception of context cues activates cognitive representation of a response, and effective control strategies inhibit acting on the response. Thus, the most successful control strategy for habits involved vigilant monitoring of behavior to ensure nonperformance. No other strategy provided any traction in inhibiting habits. In fact, use of distraction marginally reduced participants' ability to successfully control habits. We had anticipated that distraction would impair habit control, given that action slips in daily life often occur when people are distracted and respond automatically in habitual ways.

We speculate that removing oneself from the situation was not an effective strategy for control of habits because people may not have had sufficient knowledge of the situational cues

that trigger habits to avoid them successfully. Because hot cues to temptations are likely to be highly salient, they plausibly are more amenable to strategies of stimulus control.

Readers might wonder whether the vigilant monitoring strategy is a kind of broader motivational orientation, especially an avoidance orientation to prevent an unwanted outcome (Higgins, 1997). We evaluated this possibility in a number of ways, but we did not find any evidence linking use of vigilant monitoring to avoidance motives. In each study, we assessed several individual difference measures during the introductory session, and conducted analyses relating these to the diary outcomes. Use of monitoring was not related to scores on trait prevention and promotion scales in Study 1a (Lockwood, Jordan, & Kunda, 2002), on desire for control in Study 1a (Burger, 1992), on trait prevention and promotion in Study 1b (Higgins, Friedman, Harlow, Idson, Ayduk, et al., 2001) or on trait self-control in Study 1b (Tangney, Baumeister, & Boone, 2004). Also, none of these measures predicted the frequency or success of reported inhibitory attempts. Additionally, we initially included strategies in the diary rating forms that were directly related to the motivational orientations of avoiding negative outcomes and approaching positive ones (see Footnote 3). However, these strategies were not systematically linked to successful control and furthermore were unrelated to vigilant monitoring. Given that monitoring appears to be independent of broader control motives, we follow precedent of interpreting it as a specific control strategy (see Metcalfe & Mischel, 1999).

In these first studies, we built on understanding of self-control strategies for temptations to pinpoint the strategies likely to be successful at controlling habits. The strategies effective in controlling temptations involve muting or removing perceptions of the hot stimulus properties of tempting cues. However, evidence for successful habit control strategies is less secure, resting primarily on the current diary investigations. Furthermore, past research on vigilant monitoring has emphasized its counterproductive, ironic effects in heightening tempting stimulus cues, and therefore it is important to demonstrate under controlled conditions that monitoring can be a

successful form of willpower. Thus, we followed a two-stage approach in which our initial diary studies were supplemented with a second, experimental study to document with greater certainty that monitoring is useful in habit control. Convincing demonstration of the effects of vigilant monitoring requires experimentation in which both the strength of habit cues and the use of monitoring are manipulated independently.

Study 2

To provide an experimental test of vigilant monitoring as a form of self control over habits, we adapted a classic paradigm for the study of habits from cognitive psychology (Hay & Jaccoby, 1996, 1999). In this procedure, participants first form habits in an experimental task and then attempt to inhibit their performance. This procedure echoes other demonstrations of habit formation in the laboratory (e.g. DeWall, Baumeister, Gailliot, & Maner, 2008)

In the task, participants first practiced giving a particular response word to a stimulus word. They repeated the response frequently to form strong habits or less frequently to form weak ones. Then, in the second phase of the study, they told that an alternate response word would be correctly associated with the stimulus word. Finally, they were tested for how well they could inhibit the habitual response and instead give the intended, correct response.

To evaluate the success of vigilant monitoring, we instructed some participants to carefully monitor their responses during the final test. This experimental manipulation was designed to follow closely the way that vigilant monitoring was described in the diary investigations, which in turn was based on the descriptions that our pretest participants spontaneously gave for this form of self-control in our extensive pretesting of inhibitory strategies. It involved focusing on the possibility of performing the unwanted habit, thinking, “don’t do it,” and careful monitoring of behavior to ensure that the unwanted response, if activated, was not performed. We also included two comparison strategies. One was designed to enhance performance motivation and scrutiny of responses, although without monitoring for

unwanted responses. Other participants received no strategy instructions and simply used whatever strategy they wished. We anticipated that participants using a monitoring strategy would be more able than those using other strategies to inhibit strong habits and give the desired, accurate response.

Study 2: Method

Participants

Sixty-five undergraduate students (38 women and 27 men) at Duke University participated in partial fulfillment of a requirement in their introductory psychology course. Two additional participants were not included because their data were lost due to computer errors.

Procedure

The design closely followed the procedure used by Hay and Jacoby (1996, 1999), with the addition of a manipulation of self-control strategy. It consisted of two main phases: habit formation and habit inhibition. Participants completed the experiment individually on a personal computer.

Phase 1: Habit formation. The first phase of the experiment created habitual associations between stimulus and response words. Participants viewed pairs of words on the computer screen. Initially, these word pairs appeared with one word intact on the left side of the screen and another word on the right side missing some of its letters (e.g., knee-b_n_). Participants guessed silently how the word fragment would be completed to form a word related in meaning to the other word in the pair (i.e., the cue word). Shortly after the word pair appeared, a “correct” completion of the fragment was shown (e.g., knee-bend). Participants said aloud the correct completion word. Cue-fragment pairs appeared for 2 sec followed immediately by the presentation of the cue paired with its correct completion for 1 sec and a 500ms inter-trial interval before the next word pair. In total, the first phase consisted of five blocks of 80 trials.

Stimuli consisted of 20 different cue words, each of which appeared four times per block in training. Cue words were paired with two different completion words. The frequency with which each completion appeared as the correct choice in training served as the manipulation of habit strength. In the *high-frequency* condition, one completion appeared with high frequency and the alternate completion appeared with low frequency. Pairing one completion with the cue word 75% of the time made that completion the strongly habitual response, whereas pairing the alternate completion with the cue on only 25% of the trials made that completion the nonhabit (Hay & Jacoby, 1996, 1999). In the *moderate-frequency* condition, each completion word appeared on half of the trials, resulting in the formation of weak habits. One of the two completions in the moderate frequency condition was arbitrarily designated the "frequent" response for use in statistical analyses. Participants were told that cue words would appear multiple times, that cues would be paired with more than one correct completion, and that some completions may appear more frequently than others.

Phase 2: Habit inhibition. After forming habits, participants were told that their responses would be tested, and that they should use a specific strategy during the upcoming tests. Specifically, we instructed participants to vigilantly monitor, to focus on successful performance, or we gave them no strategy instructions.

The *perform well strategy* was designed to provide an alternative to monitoring that was appropriate for the experimental task. Specifically, participants were told to think about successful performance, try to do well, and focus on and learn from their successes. Analyses revealed that this condition did not differ from the no-instruction controls on any measure. Thus, we combined these two groups into a single control condition in the reported analyses.

The *vigilant monitoring strategy* was designed to follow closely the wording from the diary reports (i.e., *thinking "don't do it" or watching carefully for mistakes/monitoring my behavior carefully).* Specifically, participants were told to:

"Be careful and avoid making mistakes. When you study the word lists, be vigilant and try to anticipate which words will be hardest to remember – this kind of precautionary studying will protect you from making incorrect responses in the tests. It might help to think to yourself, 'don't make mistakes.'"

All participants then received a short list of eight word pairs from the habit formation phase. Each stimulus-response pair appeared on the computer screen for 1 sec followed by a 500ms inter-trial interval. Participants studied these word pairs silently and attempted to remember them for the subsequent test. At the end of the list, a random 3-digit number appeared on the screen, and participants counted backwards by 3s from the number shown on the screen for 30 sec to prevent rehearsal. Next, participants completed the test in which they received stimulus words and cues to response words, and attempted to complete the fragment using the words recalled from Phase 2. The stimulus words remained on the screen until participants gave a verbal response, which was recorded by the experimenter.

Participants completed 20 study-test cycles. Across the 20 study lists, each cue word appeared eight times, and word pairs maintained their associative strength established in Phase 1 habit formation. That is, stimulus cues appeared with frequent response words 75% of the time and with infrequent words 25%, whereas moderate-frequency cues appeared with both completions 50% of the time. Test trials called for *habit performance* when they required participants to produce the strong or weak habitual responses from Phase 1 or *habit inhibition* when they required participants to inhibit habits from Phase 1 and respond with the words learned in Phase 2.

To evaluate self-control, we focus on performance in the habit inhibition trials. Habit performance trials were not informative regarding participants' ability to inhibit habitual response tendencies. In essence, these trials represent instances when people are trying to continue to perform existing habits. Overall, participants were successful at doing this, and the

only significant effect was for frequency of repetition in Phase 1. Greater success was found at performing strongly habitual, frequently practiced words (79%) than moderately practiced, less habitual words (68%, $p < .05$). The findings from habit performance trials are not discussed further.

Study 2: Results

Self-Control Performance

The percentage of correct inhibition trials was calculated for each participant, and these percentages were subjected to a Self-Control Strategy (monitoring for errors vs. control/perform well) X Repetition Frequency (high vs. moderate) X Gender analysis of variance design with training as a within subjects factor (see Figure 4). We included gender in the design because we were uncertain whether men and women would show the same inhibitory success.

A main effect for frequency of practice in Phase 1, $F(1, 62) = 14.41$, $MSE = 0.05$, $p < .01$, reflected that participants were less successful at self-control when trying to inhibit a high frequency, strong habit ($M = 63\%$) than a moderate frequency, weak habit ($M = 70\%$). A main effect for strategy, $F(1, 62) = 7.69$, $MSE = 0.27$, $p < .01$, reflected that participants using a monitoring strategy ($M = 81\%$) were more successful at inhibiting a habit than control participants—those using either no strategy or the perform well strategy ($M = 64\%$). Most importantly, the predicted two-way interaction, $F(1, 62) = 3.84$, $MSE = 0.01$, $p = .05$, reflected that, when attempting to inhibit a strong habit, participants were more successful when using a monitoring strategy ($M = 70\%$) than when using a control strategy ($M = 60\%$), $F(1, 62) = 9.14$, $MSE = 0.02$, $p < .01$. When trying to inhibit a weak habit, the control ($M = 70\%$) and monitoring ($M = 73\%$) strategy conditions did not differ ($F < 1$, *ns*).

Cognitive Processing Mechanisms in Self-Control

We anticipated that vigilant monitoring was an effective habit control strategy, not because it influenced habit strength (habits should still be strong), but because it heightened the

conscious control processes by which people override their unwanted habits. Using Jacoby's (1991) process dissociation analysis, we can estimate the strength of these two internal processes involved in self-control—the internal process stopping the response, which in this case is conscious recollection or intention, and the internal process promoting the response, which in this case is habit. The influence of conscious recollection is evident when people "produce a particular response when they intend to, but not produce that response when they intend not to," whereas automatic responses are those that occur regardless of participants' intentions (Payne, 2001, p. 183; see also Jacoby, 1991; Hay & Jacoby, 1996).

Success on habit performance trials involved giving high frequency responses, which could be achieved through consciously recalling the frequently repeated word from Phase 2 or through relying on habits formed in Phase 1. Thus, the probability of success on such trials can be represented by the probability of conscious intentional recall, R, plus the probability of habitual responding when recall failed, H(1 – R):

$$\text{Habit Performance} = R + H(1 - R).$$

To perform successfully on habit inhibition trials, participants gave infrequently repeated responses, which were achieved through intended recall of these words from Phase 2. For these trials, relying on habits caused participants to give the unwanted response. The likelihood that the habitual, frequent response would be produced erroneously when participants were trying to inhibit it is represented by the probability of habit use, H, when conscious, intended recall failed (1 – R):

$$\text{Habit Inhibition} = H(1 - R).$$

Given the probabilities of producing the habitual response under habit performance and habit inhibition instructions, it is possible to calculate an estimate of intended recall, R, through subtraction:

$$I = \text{Performance} - \text{Inhibition}.$$

Finally, solving for H using the estimate of intended recall, R, provides an estimate of the probability that habits influenced performance:

$$H = \text{Inhibition}/(1 - R).$$

To determine whether the vigilant monitoring strategy influenced conscious recall, we estimated habit and recall using the above formulas and analyzed these in two separate Strategy (monitoring vs. control/perform well) X Training Frequency (high vs. moderate) analysis of variance designs. Analyses on estimates of recall revealed only a significant main effect of strategy, $F(1, 129) = 16.32$, $MSE = 0.62$, $p < .01$. Conscious recall of the desired response was greater for participants using a monitoring strategy ($M = 50\%$) than for those using the two control strategies ($M = 36\%$). Analyses on habitual processing did not vary with strategy. Only the main effect of frequency of repetition in Phase 1 reached significance, $F(1, 129) = 33.69$, $MSE = 0.67$, $p < .01$. Participants relied on automatic processing mechanisms to a greater extent in the high frequency ($M = 63\%$) than in the moderate frequency condition ($M = 50\%$). This pattern, in which conscious controlled and automatic processes are differentially sensitive to strategy and habit strength, reflects the basic process dissociation model (Kelley & Jacoby, 2000). That is, controlled processes vary with influences on working memory, available cognitive resources, and in our study, self-control strategy, whereas automatic processes vary with strength of associative connections in memory or habit strength.

Study 2: Discussion

This experiment demonstrated that vigilant monitoring is an effective form of control for inhibiting strong habits. The experiment was designed to be a laboratory analogue of the everyday control of unwanted habits. The experiment examined inhibition of response habits in a laboratory task instead of the habits that people try not to perform in daily life. Also, the experiment formed strong habits through repeated practice instead of measuring habit strength through self-reports of past behavior in stable contexts. In the laboratory simulation, just as in

real life, participants who used a strategy of vigilant monitoring and focused on possible mistakes, thinking “don’t do it,” were better able to inhibit unwanted habits and give the desired response. Monitoring did not offer any particular benefits when participants had weak habits. When inhibition of habits was not a challenge, the strategy of monitoring was essentially as effective as any other form of self-control in giving the intended, correct response.

The experiment also provided insight into the mechanism through which monitoring promoted inhibition of strong habits. We anticipated that monitoring would not influence habit strength, which is a function of response repetition, but instead would increase the strength of conscious, intentional processes. The estimates from Jacoby’s (1991) process dissociation procedure revealed that monitoring did in fact strengthen intended, conscious recall and thereby helped participants to inhibit the automatic triggering of strong habits. By these effects, the strategy of vigilant monitoring functions much like age and other influences on executive control in enhancing inhibitory control (see Kelley & Jacoby, 2000). Monitoring apparently was not as useful for generating the desired response when habits were weak. With weak habits, participants did not have to override an unwanted response activated in memory in order to give the desired response. Thus, the increased cognitive control was not required in order for them to respond as they wished.

One promising implication of our findings is that people can be trained to engage in a monitoring strategy. Given the effectiveness of our monitoring instructions, it seems that people can consciously adopt this strategy and inhibit unwanted habitual behavior. Participants primed to monitor their behavior successfully inhibited unwanted habits in the lab, much like participants in the diary studies who spontaneously chose to use the strategy to control everyday bad habits.

General Conclusion

Are people stuck hopelessly repeating their bad habits? Our answer, from research on what people do in their everyday lives when trying to change their responses, is not necessarily. Participants in our studies were reasonably successful at exerting control over unwanted responses when they used self-control strategies that are tailored to the specific cuing mechanisms that produced the response (i.e., temptations vs. habits). Thus, as suggested in earlier research on delay of gratification, having sufficient control strength is not a guarantee of successful control. The participants in our diary and laboratory studies were most successful when they exerted control in ways best suited to inhibiting the habit mechanism that activated the unwanted response.

Motivation of course plays an important role in self-control. People change responses when they intend to do so and when they believe they have the efficacy to perform an alternative response. Accordingly, most traditional theories of persuasion, social influence, and behavior change have focused on people's desire to change (see Albarracín, Johnson, & Zanna, 2005). However, simply being motivated does not ensure that people will overcome effectively the conflicting automatic triggers in performance environments. Such exertion of self-control requires control over the automatic, undesired response to the cue.

We used a two-stage approach to study habit control. We first collected data on everyday control of habits and responses to temptations. In so doing, we replicated earlier research in which effective control over temptations involved distraction and control or removal of the stimulus (e.g., Metcalfe & Mischel, 1999). We were able to show that, although vigilant monitoring of behavior is not useful for temptations, it is an especially effective form of self-control for habits. Because habit responses are activated in memory upon perception of associated context cues, the challenge for habit control is to inhibit tendencies to perform that activated response (Neal et al., 2009). Careful monitoring for unwanted responses provided this control over habits. Distraction proved somewhat counterproductive, which is understandable

given that unwanted habits are especially likely to be cued by triggering stimuli when people's attention is otherwise engaged (Reason, 1992). After establishing the effectiveness of vigilant monitoring in everyday habit control and distinguishing it from the forms of self-control useful with temptations, we undertook an experiment to provide a systematic test of the effectiveness of monitoring as a habit control strategy. We instructed participants in the use of monitoring and found that this strategy yielded the same benefits for inhibiting unwanted habits as in the diary research.

Despite that participants' careful monitoring facilitated their attempts to suppress unwanted habits, there is reason to question the longer-term efficacy of this strategy. Successful exertion of inhibition over the long term has been found to increase negative affect, generate preoccupied thinking about the inhibited response (Polivy, 1998), and produce ironic effects involving increases in the unwanted responding (Wenzlaff & Wegner, 2000). In addition, it is unclear whether people can sustain effortful inhibitory efforts in daily life. People's capacity to inhibit strong habits is reduced with everyday fluctuations in their self-control resources (Muraven & Baumeister, 2000; Pascoe, Neal, Toner, & Wood, 2009).

We speculate that effortful inhibition contributes most productively to behavior change when the suppression of undesired responses is paired with learning and performing a new, desired response. That is, inhibition might be effective as a short-term strategy to suppress an unwanted habit so as to enable a new, more desired pattern of responding to be established. If the new response is repeated in contiguity with context cues, then new good habits might be formed. For example, a dieter's effortful inhibition of unhealthful eating habits may promote long-term behavior change only insofar as it creates a temporary window of opportunity in which to establish healthful eating patterns. In this view, the inhibition of cued responding is a short-term means of control that, although perhaps inherently unsustainable in itself, enables the development of new, more desired patterns of response consistent with goals. One limit to this

process is that, when newly-learned associations override older ones (e.g., extinction), the new learning is inherently unstable such that the original learning may readily recur under a variety of circumstances (Bouton, 2000). This spontaneous recurrence is one feature of habits that makes them difficult to change. Nonetheless, the monitoring strategy that we identified in the present investigation provides an initial handle on the challenge of altering unwanted habits.

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Table 1.

Unwanted Activities Frequently Reported in Participants' Diaries: Study 1.

Activity domain	Proportion of diary reports in Study 1	Proportion of diary reports in Study 2	Examples from participants' dairies: "trying not to…"
Sleeping	.23	.13	sleep too late; fall asleep in class; stay up too late
Eating	.17	.17	eat junk food; have fries with lunch; snacking because I'm stressed
Procrastinating, inactivity	.10	.21	…procrastinate on [homework]; being lazy and not going to the gym; goof off while trying to study…
Excessive entertainment	.09	.08	watch TV; playing video games instead of getting much needed rest; talking on-line
Unwanted emotions	.07	.02	feeling depressed about all the things that are going wrong in my life; stressing out over a paper due tomorrow; be mad at my mom for waking me up
Making mistakes, forgetting	.06	.05	trip while walking up the stairs; …being late to class; …shoot badly while playing basketball; forget about a meeting
Daydreaming, inattention	.05	.03	getting distracted in class; mind wandering while I was trying to read
Nervous habits	.05	.04	biting my nails; crack my knuckles; I keep straightening my hair, a habit I picked up in middle school
Negative social interactions	.04	.08	saying something sarcastic/obnoxious to a friend…; …get in a fight with [girlfriend]; arguing
Socializing	.04	.02	…socializing – I need to exercise instead; socialize instead of study; go out
Cigarettes, alcohol	.02	.01	smoking a cigarette after class; …party too much; trying not to get too drunk
Inappropriate speech	.02	.01	cursing; talking about other people; gossip
Unwanted thoughts	.02	.01	thinking bad thoughts; having unpleasant thoughts about the future; thinking about my ex-boyfriend
Other	.04	.01	

Note. Proportions were computed for each participant and the mean value that is reported in the table was calculated across participants in the sample.

Table 2.

Means and Standard Deviations of Variables Assessed in Studies 1a & 1b.

Variable	*Study 1a*	*Study 1b*
Number of unwanted acts per participant	23.94 (10.01)	20.03 (14.79)
Number of unwanted acts per participant per day[a]	3.50 (1.40)	1.43 (0.60)
According to participant ratings:		
Success at inhibition	3.57 (1.04)	3.96 (0.96)
Habit strength	1.16 (0.59)	1.03 (0.60)
Immediate positive feelings from performance	3.24 (0.80)	2.86 (0.85)
Immediate negative feelings from performance	3.32 (0.65)	3.19 (0.60)
Net positive feelings (positive minus negative)	-0.08 (1.15)	-0.33 (1.09)

Note. Success at inhibiting the unwanted response was rated on a scale ranging from 1 (unsuccessful) to 7 (successful), habit strength of the unwanted response was scored to range from 0 (weak/no habit) to 4 (strong habit), and immediate anticipated positive and negative feelings were rated on scales ranging from 1 (not at all) to 5 (extremely). The values in the table first were aggregated within participants and then were averaged across participants.

[a] Because a few participants provided data for fewer than the required number of days (5 in Study 1a, 7 in Study 1b), the diary reports per day were calculated for each participant by dividing the total number of reports by the number of days of participation.

Table 3.

Frequencies of Use of Strategies of Self-Control for Temptations and Habits: Studies 1a and 1b.

	Temptations		*Habits*	
Strategy used	*Strong*	*Weak*	*Strong*	*Weak*
Vigilant monitoring	.44 (.50)	.58 (.49)	.45 (.50)	.54 (.50)
Distracting myself from the situation	.06 (.24)	.08 (.27)	.06 (.23)	.08 (.27)
Stimulus control: Removing myself from situation	.11 (.32)	.08 (.27)	.10 (.29)	.09 (.29)
No strategy used ("I did not try to stop this time")	.33 (.47)	.16 (.36)	.31 (.46)	.21 (.41)

Note: Proportions were computed for each participant, and the mean value that is reported in the table was calculated across participants in the sample. Proportions do not total to 100% in each column because participants used a smattering of other strategies that did not reveal systematic effects and thus are not reported.

Figure Captions

Figure 1. Participant-rated success of self-control varies with unwanted behavior and use of monitoring strategy: Studies 1a and 1b.

Figure 2. Participant-rated success of self-control varies with unwanted behavior and use of distraction strategy: Studies 1a and 1b.

Figure 3. Participant-rated success of self-control varies with unwanted behavior and use of stimulus control strategy: Studies 1a and 1b.

Figure 4. Success of self-control varies with habit strength and use of monitoring strategy: Study 2.

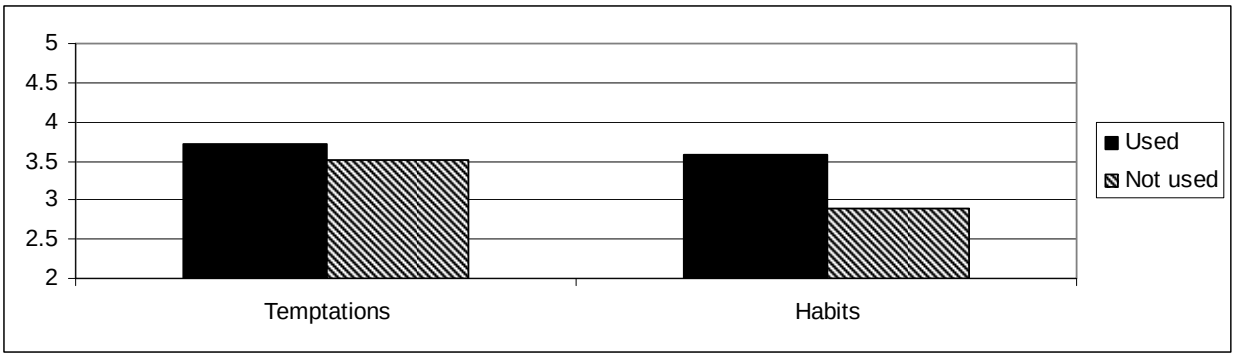

Fig 1

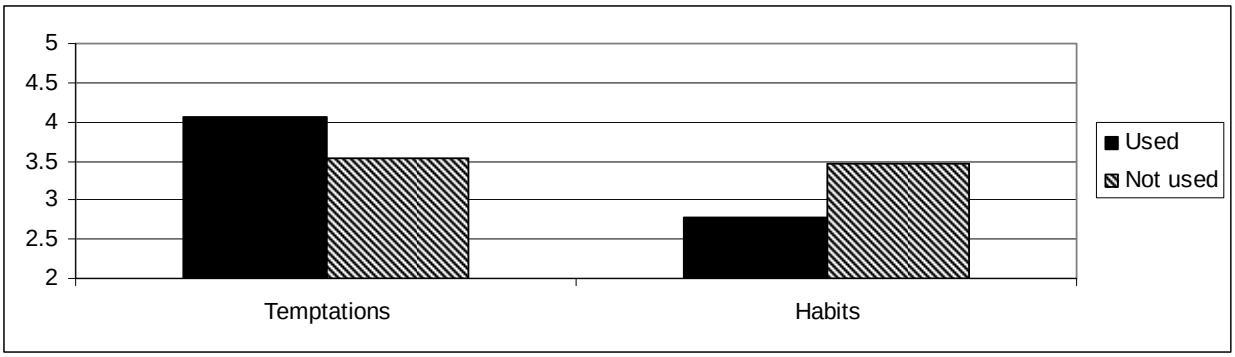

Fig 2

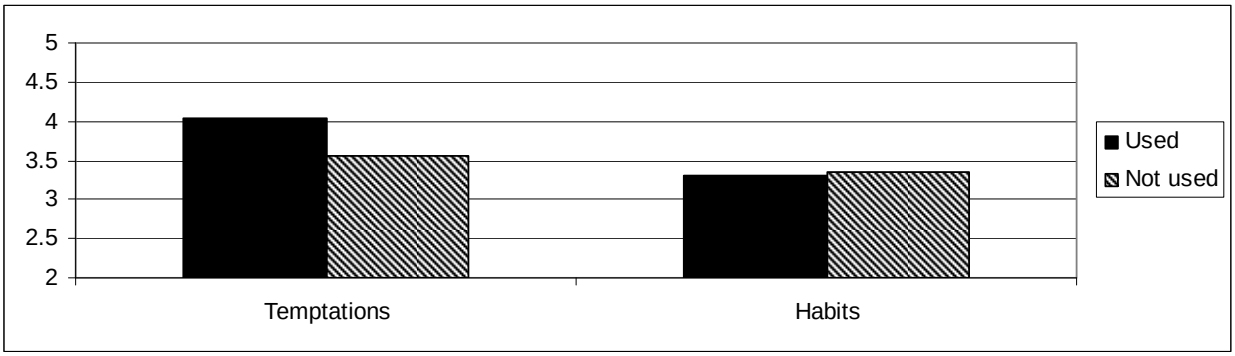

Fig 3

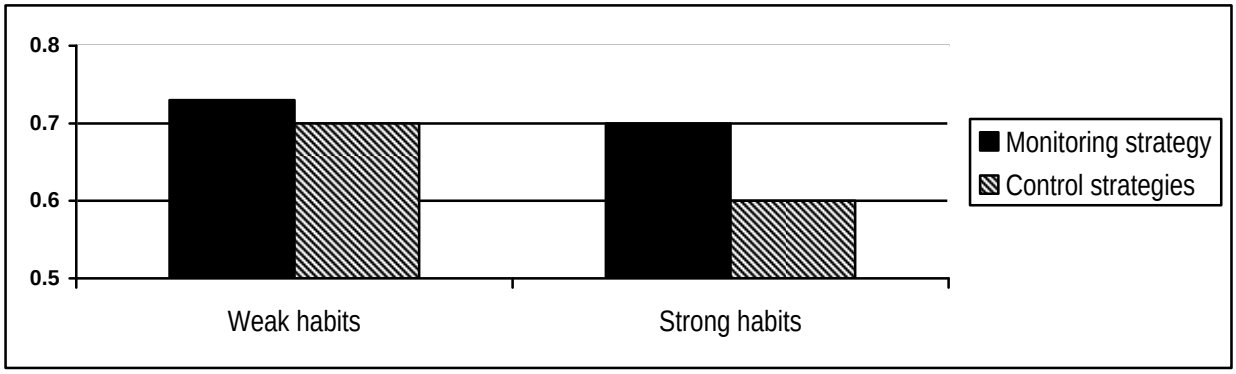
0.8
0.7
0.6
0.5
Weak habits
Strong habits
Monitoring strategy
Control strategies

Fig 4

Footnotes

[1] Self-control also emerges through automatic mechanisms, as when people who have a goal to be thin activate that goal automatically when faced with temptations such as dessert that would thwart goal attainment (see Fishbach & Shah, 2006). We speculate that such automatic self-regulation emerges in part through people's repeated practice of the kinds of effortful self-control investigated in the present research.

[2] We excluded from the analysis the 12% of reports that were classified as both strong habits and strong temptations in that they were performed often and with more immediately positive than negative affect. As might be expected, these multiply-cued responses were not vulnerable to any particular types of self-control.

[3] During pretesting, respondents listed a number of additional strategies. In our analyses, these did not yield any systematic effects, and we do not report them further: *thinking about reasons why "it's not worth it," talking to someone, seeking support, thinking about how I really want to act, thinking about what I ought to do, thinking of ideal performance, putting myself in a situation to succeed, and being eager to find opportunities for success*.

[4] The continuation questionnaire also assessed a number of items that failed to produce interpretable results and are not discussed further including: the difficulty of inhibition, amount of effort and thought required for inhibition, relevance of the unwanted act to the participant's self-concept (i.e., whether it "defines you as a person"), perceived importance of inhibition, reasons for exercising self-control, experience of stress-related feelings, and timing of self-control attempts (i.e., before or after beginning to perform the unwanted act). In addition, participants were allowed to report using multiple strategies simultaneously, but the number of concurrent strategies endorsed did not predict ratings of successful self-control.

[5] The number of reported change attempts per day in Study 1b is somewhat lower than in Study 1a. One possible reason is that Study 1b took place during the summer, when students had fewer demands on their time and thus fewer reasons to try to change their responses. It also might be that the longer reporting period in this study increased fatigue and thus the number of overall reports each participant provided.

[6] Weaker habits and weaker temptations comprised 48% of reports.

[7] Given that habits were more difficult to control than responses to temptations, it might be that the success of the different strategies for habits and temptations reflected the strength of the cue. To investigate this possibility, we computed a series of regression models including as predictors continuous measures of habit strength and temptation strength. However, there was no evidence that monitoring was effective for especially strong habits and temptations. Instead, the few effects that emerged support our interpretation in terms of type of cue. For example, in the analyses on habits but not temptations, a significant interaction emerged between distraction use and habit strength. Inspection of the simple effects indicated that use of the strategy was more effective for moderately strong habits and less effective for very strong habits.