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More Than Resisting Temptation: Beneficial Habits Mediate the Relationship Between Self-Control and Positive Life Outcomes

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Why does self-control predict such a wide array of positive life outcomes? Conventional wisdom holds that self-control is used to effortfully inhibit maladaptive impulses, yet this view conflicts with emerging evidence that self-control is associated with *less* inhibition in daily life. We propose that one of the reasons individuals with better self-control use less effortful inhibition, yet make better progress on their goals is that they rely on beneficial habits. Across 6 studies (total $N = 2,274$), we found support for this hypothesis. In Study 1, habits for eating healthy snacks, exercising, and getting consistent sleep mediated the effect of self-control on both increased automaticity and lower reported effortful inhibition in enacting those behaviors. In Studies 2 and 3, study habits mediated the effect of self-control on reduced motivational interference during a work–leisure conflict and on greater ability to study even under difficult circumstances. In Study 4, homework habits mediated the effect of self-control on classroom engagement and homework completion. Study 5 was a prospective longitudinal study of teenage youth who participated in a 5-day meditation retreat. Better self-control before the retreat predicted stronger meditation habits 3 months after the retreat, and habits mediated the effect of self-control on successfully accomplishing meditation practice goals. Finally, in Study 6, study habits mediated the effect of self-control on homework completion and 2 objectively measured long-term academic outcomes: grade point average and first-year college persistence. Collectively, these results suggest that beneficial habits—perhaps more so than effortful inhibition—are an important factor linking self-control with positive life outcomes.

Keywords: self-control, habit, goal pursuit

> . . . we must make automatic and habitual, as early as possible, as many useful actions as we can . . . The more details of our daily life we can hand over to the effortless custody of automatism, the higher mental powers of mind will be set free for their own proper work.
>
> ~William James *The Principles of Psychology*, 1890

> . . . when I first started working with Tracy [personal trainer], finding motivation was hard. She advised me to think of exercise as an automatic routine, no different from brushing your teeth, to avoid getting distracted. Now it is part of my life—I exercise Monday to Friday at 10 a.m. and always stick with it.
>
> ~Gwyneth Paltrow Interview with *The Telegraph*, 2013

Self-control is defined as the ability to voluntarily regulate attention, emotion, and behavior in the service of more valued goals (Tangney, Baumeister, & Boone, 2004). The benefits of self-control are now well-documented. It predicts better academic performance (Duckworth & Carlson, 2013), higher earnings (Moffitt et al., 2011), better physical health (Moffitt et al., 2011), and better social relationships (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Tangney et al., 2004). So it is little surprise that some psychologists have called self-control the "greatest human strength" (Baumeister & Tierney, 2011).

How do individuals with better self-control manage to stick to their goals? This question has received surprisingly little attention outside of laboratory studies. Thus, very little is known about how, exactly, individuals with better self-control fulfill long-term aspirations. The most obvious explanation is that self-control enables "in the moment" inhibition of maladaptive impulses. Recent studies call this view into question: Better self-control is, paradoxically, associated with *less* inhibition of immediately available temptation (Hofmann, Baumeister, Förster, & Vohs, 2012; Imhoff, Schmidt, & Gerstenberg, 2013). Across six studies, we test the hypothesis that one of the reasons individuals with better self-control use less effortful inhibition, and correspondingly make better progress on their goals, is because they rely on beneficial habits.

Effortful Inhibition and Its Limitations

Just say no! Just do it! From drug prevention campaigns to sports ads, the term self-control—and its most common synonym, willpower—conjures images of using brute force to align behavior with valued goals. Indeed, it is intuitive to liken self-control to a muscle that must be flexed in order to inhibit maladaptive impulses in the heat of the moment (Baumeister, Vohs, & Tice, 2007;

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Muraven & Baumeister, 2000). The connotations of effortful inhibition inherent in the very language of "willpower" do have some empirical justification. Studies show, for example, that self-report and informant-report ratings of self-control are modestly correlated with performance on executive function tasks that require withholding a prepotent but maladaptive response (Duckworth & Kern, 2011; Sharma, Markon, & Clark, 2014).

Though the capacity to effortfully inhibit maladaptive impulses is advantageous, doing so can lead to failures of self-regulation in a subsequent situation (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Hagger, Wood, Stiff, & Chatzisarantis, 2010). In addition, effortful inhibition can be impaired by common everyday experiences, including fatigue (Hagger et al., 2010), engaging in cognitively demanding tasks (Schmeichel, Vohs, & Baumeister, 2003), prior decision-making (Vohs et al., 2008), rumination (Denson, Pedersen, Friese, Hahm, & Roberts, 2011), and stress (Glass & Singer, 1972; Oaten & Cheng, 2005). Effortfully inhibiting impulses is also prone to backfiring. That is, suppressing an unwanted impulse can, ironically, make it more likely to influence behavior. In one demonstration of this effect (Johnston, Bulik, & Anstiss, 1999), female participants were first asked to spend 5 min putting together a hypothetical dessert menu. Participants assigned to a suppression condition were asked to "try not to think about chocolate" while completing the task. As expected, suppression was helpful in reducing chocolate-related thoughts: Participants in the suppression condition mentioned chocolate less often than participants in a no-manipulation control condition. However, participants asked to suppress thoughts of chocolate ended up earning *more* chocolates on a subsequent work task than individuals who were not asked to suppress their thoughts.

The unreliability of effortful inhibition suggests that the adaptive value of self-control for fulfilling long-term goals extends beyond single acts of inhibiting maladaptive impulses (Fujita, 2011). Indeed, this possibility is supported by a recent experience sampling study of daily temptation (Hofmann et al., 2012). In this study, approximately 200 adults provided momentary reports of desire strength, motivational conflict, attempts to inhibit temptation, and behavioral enactment. Consistent with the idea that self-control supports positive life outcomes through means other than effortful inhibition, individuals with better self-control were *less* likely to report attempts to inhibit temptation than were individuals with lower self-control. Results of Hofmann et al. (2012) are further supported by a meta-analysis surveying over 100 studies of the effect of self-control on numerous desirable (e.g., studying) and undesirable (e.g., smoking) behaviors (de Ridder et al., 2012). Results indicated that self-control was more predictive of behaviors coded by researchers as being under automatic control (e.g., condom use) rather than deliberate control (e.g., quitting smoking). For example, the effect size correlation of self-control on desirable automatic behaviors ($r = .36$) was more than double the effect size of self-control on desirable controlled behaviors ($r = .15$).

Building on this research, we propose that one of the reasons individuals with better self-control use less effortful inhibition, yet make better progress on their goals, is that they rely on beneficial habits. Of course, the possibility that habit might explain the association between self-control and positive life outcomes assumes that in daily life, behaviors that align with enduringly valued goals are by nature feasible to execute routinely and in manner that is conducive to habit formation. As such, we first provide a brief overview of habit and its relation to goal adherence.

Habit and Goal Adherence

Habits are automatic response tendencies that are triggered by contextual cues (Lally, Van Jaarsveld, Potts, & Wardle, 2010; Neal, Wood, & Quinn, 2006; Ouellette & Wood, 1998; Verplanken, 2010; Wood & Neal, 2007). Habits are formed via the gradual development of mental associations between a frequently repeated behavior (e.g., buckling a seatbelt) and recurring situational cues (e.g., getting into a car; Lally et al., 2010; Wood & Neal, 2007). Once these associations are forged, perceiving the appropriate cues will automatically retrieve the response from memory and trigger an impulse to initiate it. For example, habitual popcorn eaters consume more stale popcorn in a movie theater but not in a conference room (Neal, Wood, Wu, & Kurlander, 2011), presumably because conference rooms do not provide the appropriate triggering cues associated with previous popcorn consumption. Many common experiences are seemingly guided by habits: Experience sampling studies indicate that nearly 50% of behaviors are repeated in the same circumstances almost every day (Wood, Quinn, & Kashy, 2002).

Habits are not mediated by active mental representations of goals (Dickinson, 1985; Wood & Neal, 2007). This is to say that once habits are formed, they are enacted even in the absence of conscious intent (Ouellette & Wood, 1998). For example, Ji and Wood (2007) showed that intentions to buy fast food actually predicted buying fast food only for individuals with weak fast food habits. Among individuals with strong fast food habits, however, intentions did not predict behavior. Thus, for habits, what we *tend* to do in the present is what we have *tended* to do in the past whether we intend to do so or not.

Goal-independent automaticity explains why bad habits are so pernicious—they lock people into patterns of maladaptive behavior despite better intentions. Yet this very same mechanism also explains why beneficial habits can be advantageous—they lock people into adaptive patterns of behavior. William James (1899) famously contended that "our virtues are habits as much as our vices" (p. 64). Because they are triggered automatically by contextual cues, beneficial habits and routines can function to remove numerous impediments to goal pursuit. Habits are not disrupted by lapses of attention (Botvinick & Bylsma, 2005; Wood et al., 2002), changes in motivation (Dickinson, 1985), stress (Schwabe & Wolf, 2009), or impairments in effortful inhibition (Neal, Wood, & Drolet, 2013). Beneficial habits may also help to circumvent the supporting cognitions ("Do I *really* have to do this now?") and justifications ("I can do this later") that give license to avoid carrying out effortful, goal-relevant activities. Freed from the burden of having to effortfully inhibit these interfering thoughts and conflicting motivations, individuals with beneficial habits should be better able to remain more loyal to their enduringly valued goals.

The relation between habits and goal adherence is anecdotally appreciated in the biographies of notable writers, artists, musicians, and athletes (Currey, 2013). Anthony Trollope—author of over 50 books—wrote 3,000 words every day starting at 5:30 a.m. before heading to his postal service job; the Nobel Prize-winning poet, Maya Angelou, wrote from about 7:00 a.m. to 2:00 p.m. in

the same rented hotel room. Kellogg (1994) argues in *Psychology of Writing* that these routines are conducive to productivity, "The room, the time of day, or ritual selected for working may enable or even induce intense concentration or a favorable motivational or emotional state" (p. 186). The utility of such habits and routines is bolstered by research showing that elite violin students—rated by their professors as having potential for careers as international soloists—engaged in periods of intensely effortful practice at roughly the same time each day (Ericsson, Krampe, & Tesch-Romer, 1993). In contrast, violin students rated by researchers as likely to become music teachers did not have distinct deliberate practice routines.

Might Beneficial Habits Mediate the Relationship Between Self-Control and Positive Life Outcomes?

The majority of human behavior is energized and guided by goals (Kruglanski, 1996), yet goal pursuit is not always easy or straightforward. Insofar as self-control predicts goal adherence and positive life outcomes, we propose that it may do so—at least in part—through beneficial habits. Although it may run counter to conventional views, it makes sense to think that individuals with better self-control would rely on habits to fulfill long-term goals. Consider, for example, eating oatmeal. The most important benefits of eating oatmeal—healthy body weight, lower cholesterol—are deferred in time. A person will also have to eat oatmeal on numerous occasions to experience its salutary effects. Yet eating oatmeal also carries immediate costs: It does not taste as good as a donut, a bagel with cream cheese, or a sugary cereal. Although eating oatmeal over the long-run is rewarding, eating oatmeal *right now* may not be. As such, each separate act of eating oatmeal may be vulnerable to psychological and situational forces that tilt behavior toward immediate gratification, including negative mood (Tice, Bratslavsky, & Baumeister, 2001) and the presence of temptation.

Habits and routines provide structure to daily life such that the desired behavior—eating oatmeal—will be reliably triggered in the appropriate circumstances, even when it might not be easy to deliberately enact it. Habits thus offer a potentially powerful strategy that we argue individuals with better self-control use to safeguard their long-term goals from being derailed. Relying on habits should also have important downstream consequences. In the immediate term, it might mean that goal-relevant behaviors can be initiated automatically and effortlessly. If true, the relationship to habits may help explain the surprising observation that self-control is associated with *less* effortful inhibition in daily life. In the medium-term, it might mean making steady progress toward important goals. And the cumulative effect of beneficial habits, over long periods of time, should be evident in goal attainment.

Support for our theoretical assumptions thus crucially depends on demonstrating evidence for an association between self-control and beneficial habits. We are aware of one study that found an association between self-control and bad habits. In this recent study (Adriaanse, Kroese, Gillebaart, & de Ridder, 2014), 77 female undergraduates completed self-report measures of self-control and of the habit for eating unhealthy snacks. Participants then completed a food diary for 7 days in which they logged daily intake of unhealthy snacks. Better self-control predicted weaker unhealthy snacking habits, which in turn predicted lower daily consumption of unhealthy snacks. No association was found between self-control and the habit for eating fruit or daily fruit consumption. According to the authors, fruit consumption (which is rated as both healthy and tasty) does not represent a typical self-control problem.

In the current investigation, we sought to extend this prior study by focusing on adaptive behaviors that are known to rely on self-control and that are conducive to habit formation. We chose beneficial habits because self-control is associated with positive outcomes as much as it is with the avoidance of negative outcomes (de Ridder et al., 2012). In this way, we examined the strategies that individuals with better self-control use to facilitate attainment of desired ends rather than what they avoid doing to prevent bad outcomes.

Overview of the Current Investigation

The primary objective of this investigation was to test whether self-control is in fact related to beneficial habits. We tested this hypothesis in six studies involving over 2,200 participants, and spanning adolescents to middle-age adults. Based on the above considerations, we predicted that self-control would be reliably associated with beneficial habits. In order to provide more generalized evidence for an association between self-control and beneficial habits, we sampled from a wide range of behaviors, including exercising, eating healthy food, and sleep (Study 1), studying and doing homework (Studies 2, 3, 4, and 6), and practicing mindfulness meditation (Study 5). To further support the aim of broader generalizability, we assessed self-control using multiple different self-report measures as well as direct behavioral assessments.

Complementary to the main objective, we also tested whether habits might explain the relationship between self-control and positive life outcomes, in the short-term, medium-term, and long-term. Studies 1 through 3 focused on the short-term outcomes of relying on beneficial habits, including reduced effortful inhibition and motivational interference, and greater resilience in difficult circumstances. In Study 1 for example, we measured effortful inhibition using health-related behaviors that represent typical self-control dilemmas—in which a temptation or maladaptive impulse must be inhibited—including exercise, eating healthy food, and going to sleep and waking up on time. In Study 2, we measured motivational interference as the amount of intrusive thoughts, level of distractibility, and behavioral impairment following a work-leisure conflict. In Study 3, we measured resilience as the ability to study under difficult circumstances (e.g., when under stress, when in a bad mood).

Study 4 focused on medium-term outcomes of relying on beneficial habits, whereas Studies 5 and 6 focused on long-term outcomes. Study 4 was a study of high school seniors that examined teacher-reported classroom engagement and homework completion. Study 5 was a 3-month prospective longitudinal study of teenage youth that examined accomplishing mindfulness meditation practice goals. Study 6 was a multiyear longitudinal study of high school seniors that incorporated measures of medium-term academic outcomes (turning in homework on time) and long-term academic outcomes: high school grades and college persistence.

Study 1: Short-Term Outcomes—Habits and Less Effortful Inhibition

Health behaviors, such as going for a run or eating a healthy breakfast, typify goal-relevant actions that must be repeated over time in order to be worthwhile. No one who goes for a run one time should realistically expect to relish the long-term health benefits of exercise. Given the need for repetition and effort across extended periods of time, many health goals should benefit from habits. However, for many people health goals also represent a chronic tug-of-war against the temptation to do something more immediately gratifying (Hall & Fong, 2007). Given the links to both habit and self-control, health-related behaviors provide a useful preliminary test of our theoretical assumptions.

In Study 1, a large sample of adults completed a one-time online survey during which they answered questions about self-control, habits for eating healthy snacks, exercising, and sleeping, as well as other questions regarding the amount of effortful inhibition needed to carry out each behavior and the perceived automaticity of exercising. We hypothesized that self-control would be associated with beneficial health habits, less effortful inhibition, and greater automaticity. Further, we hypothesized that health habits would mediate the association between self-control and both effortful inhibition and behavioral automaticity.

Method

Participants and procedure. The sample included 500 participants (M_{age} = 33.13 years, SD = 12.3) recruited through Amazon Mechanical Turk who completed a one-time survey in exchange for payment. Recruitment of study participants was limited to individuals residing within the United States. According to self-reported demographic information, 75% of participants were White, 44% were female, and 39% had at least a college degree. After providing informed consent, participants completed several self-report questionnaires. Measures were administered in random order across participants.

Measures.

Habit strength. Like self-control, individuals differ in the relative strength of their habits. In the psychological literature, habit strength is assessed using two different self-report methods, both of which we administered in the current investigation. One method is to combine self-reported ratings of behavioral frequency with the stability of the performance context (Wood & Neal, 2009). This measurement approach follows logically from the idea that habits represent the repeated pairing of a behavioral response with stable and recurring contextual features, including the physical location and time of enactment. To assess frequency of past behavior, we used both subjective estimates (e.g., never to always) and the recall of specific instances of the behavior (e.g., how many times in a typical week). Stability of performance context was measured using subjective evaluations (e.g., always in the same place to never in the same place). Following recommendations from Wood and Neal (2009) and others (Danner, Aarts, & de Vries, 2008), we multiplied the scales together to produce a measure of habit strength such that strong habits indicated frequent enactment in stable circumstances. The validity of measuring habit strength as a combination of behavioral frequency and context stability can be inferred to the extent that this measure correlates with behavioral automaticity, a defining feature of habit. As such, the other self-report questionnaire we used to measure habit strength tapped perceptions of behavioral automaticity (Verplanken & Orbell, 2003), or the degree to which the target behavior is enacted without conscious intent.

With this in mind, exercise and healthy snacking habits were calculated as the product of past behavior frequency and stability of context with regard to the previous 3 months (Wood, Tam, & Witt, 2005). Specifically, we multiplied participants' ratings of behavior frequency (1 = *a few times per month or less*, 2 = *at least once a week*, 3 = *a few times per week*, 4 = *just about every day*), the location for performing each behavior (1 = *rarely or never in the same place*, 2 = *sometimes in the same place*, 3 = *usually or always in the same place*), and the time of day during which they normally performed each behavior (1 = *rarely or never at the same time of day*, 2 = *sometimes as the same time of day*, 3 = *usually or always at the same time of day*). For each item, participants could also indicate that they did not enact the behavior in the last 3 months (scored as 0). Multiplying the items together resulted in a habit scale that ranged from 0 to 36, with higher scores reflecting frequent engagement in stable contexts (strong habits).

To assess sleep habits, we took a slightly different approach. Participants reported their typical bedtimes and wake times during both weekdays (Monday through Thursday) and weekend days (Friday through Saturday). Data were first screened for incorrect responses (e.g., the same bedtime and wake times, incorrect a.m./p.m. designation). Also, to be conservative we included data for individuals who reported no more than 12-hr differences between typical bedtimes (or wake times) on weekdays versus weekend days. Sleep data were used from 450 participants. Bedtime sleep habits were calculated as the difference (rounded to the nearest half hour) between typical bedtime on weekdays versus weekend days. Wake time sleep habits were calculated using the same procedure. This resulted in two count scores, one for bedtimes and one for wake times, with a possible range between 0 and 12 hr. Higher scores indicated greater inconsistency (and thus *weaker* habits) between sleep behaviors (either going to bed or waking up) on weekend days versus weekdays.

Exercise automaticity. Participants completed the 12-item Self-Reported Habit Index (SRHI; Verplanken & Orbell, 2003) that was modified to assess exercise behaviors. The SRHI measures three aspects of habit: behavioral frequency, automatic activation of behavior, and relevance of behavior to self-identity. In the current investigation, we focused on four items related to behavioral automaticity (e.g., "Exercising is something I do without having to consciously remember," "Exercising is something I do automatically"). Items were endorsed on a 7-point scale, where 1 = *disagree strongly* and 7 = *agree strongly*. A scale score was calculated as the mean of the four items, in which higher scores indicated higher perceived automaticity for exercise (α = .92).

We relied on the four-item automaticity version of the SRHI, rather than the full 12-item version, for theoretical reasons. Automaticity is a central feature of habit (Gardner, Abraham, Lally, & de Bruijn, 2012; Lally & Gardner, 2013), and the four-item measure therefore offers a more parsimonious and targeted assessment of the "active ingredient" of the habit process. This four-item scale demonstrates acceptable internal reliability consistency estimates and evidence of comparable convergent and predictive validity

with the full scale (Gardner et al., 2012). We note that results were checked using the 12-item scale and no major differences emerged.

Self-control. Participants completed the 13-item Brief Self-Control Scale (Tangney et al., 2004), a widely used measure of trait self-control. Items (e.g., "I am good at resisting temptation") were endorsed on a 5-point scale, where 1 = *not at all like me* and 5 = *very much like me*. A scale score was calculated as the mean of all items, in which higher scores indicated better self-control ($\alpha = .89$).

Effortful inhibition. Participants were asked to recall, in separate questions, the most recent instance of exercising, eating healthy snacks, and going to bed and waking up. Then, we asked them a question about how much effort it took to initiate each behavior, "How hard was it for you to [for example, get yourself to exercise, choose to eat a healthy snack, get yourself to go to bed on time]?" from 1 = *Not hard at all. I did not have to use a lot of willpower to* [behavior] to 7 = *Very hard. I had to use a lot of willpower to* [behavior]. They also answered a question, "How long did it take for you to decide whether or not to [for example, exercise]?" which they rated from 1 = *I didn't even have to think about it. I made the decision to* [behavior] automatically to 7 = *I thought about it for a long time. It took me a while to make the decision to* [behavior]. Next, they answered two more questions about effortful inhibition, "In general, how often do you have to resist/overcome the temptation to do something other than [behavior]?" and "In general, how difficult is it to resist the temptation to do something other than [behavior]?," from 1 = *I never have to overcome the temptation to do something other than* [behavior] (*It is very easy to resist the temptation to do something other than* [behavior]) to 7 = *I always have to overcome the temptation to do something other than* [behavior] (*It is very difficult to resist the temptation to do something other than* [behavior]). We created a composite effortful inhibition score calculated as the mean of standardized scores for each item, for which higher scores indicated the need for more effortful inhibition to perform each of the four behaviors in question (i.e., exercise, eating healthy snacks, going to bed, waking up; all αs $> .68$).

Results and Discussion

Analytic plan. Our primary theoretical interest was in whether habits would mediate the association between self-control and outcomes (e.g., less effortful inhibition). To this end, we first examined whether the conditions for mediation were met by testing zero-order correlations between self-control, habit strength, and outcomes. Next, we tested for the indirect (or mediational) effect of habit strength between self-control and outcomes using bias-corrected 95% confidence intervals based on 5,000 bootstrapped samples (Preacher & Hayes, 2008). Continuous variables were standardized prior to mediation analyses to facilitate interpretation of indirect effects in standard deviation units. In path models, missing data were handled using full information maximum likelihood which produces less biased and more efficient results than other methods, such as listwise or casewise deletion (Baraldi & Enders, 2010; Schafer & Graham, 2002).

Self-control is associated with beneficial habits and behavioral automaticity. Our hypothesis that self-control would be associated with beneficial habits was supported. As shown in Table 1, individuals with better self-control had stronger habits for exercise, $r = .25$, $p < .001$, and eating healthy snacks, $r = .18$, $p < .001$. Self-control also related to more stable bedtime and wake time sleep habits. Individuals with better self-control tended to go to bed, $r = -.17$, $p < .001$, and wake up, $r = -.14$, $p = .003$, at more consistent times throughout the week.[1] Finally, self-control and exercise habits were also positively correlated with perceived automaticity of exercise behaviors (rs = .24 and .53, respectively, ps $< .001$). This latter correlation of $r = .53$ between habit strength and behavioral automaticity supports the validity of measuring habit strength via behavioral frequency and context stability.

Self-control and habit are associated with less effortful inhibition. Also shown in Table 1, individuals with better self-control reported using less effortful inhibition in order to enact each behavior (rs = $-.34$ to $-.25$, ps $< .001$). Stronger habits for exercise, eating healthy snacks, and sleep were also associated with less effortful inhibition for enacting each of the respective behaviors (rs = $-.52$ to .21, ps $< .001$).

Strong habits mediate the effect of self-control on both effortful inhibition and behavioral automaticity. As shown in Table 2, the effect of self-control on reduced effortful inhibition was mediated by habits in all four models: for eating healthy snacks ($\beta_{indirect} = -.05$, $p < .001$, 95% CI [$-.08$, $-.02$]), for exercising ($\beta_{indirect} = -.12$, $p < .001$, 95% CI [$-.16$, $-.08$]), for going to bed ($\beta_{indirect} = -.04$, $p = .011$, 95% CI [$-.06$, $-.01$]), and for waking up ($\beta_{indirect} = -.02$, $p = .02$, 95% CI [$-.04$, $-.004$]). That is, self-control predicted stronger eating, exercise, bedtime and wake time sleep habits, which in turn predicted reduced need for effortful inhibition in order to initiate each behavior.

Mediation was conceptually replicated when using self-reported exercise automaticity as another outcome variable. Specifically, exercise habits mediated the effect of self-control on exercise automaticity ($\beta_{indirect} = .13$, $p < .001$, 95% CI [.08, .17]).[2] See Table 2.

Of course, these results rest on the assumption that participants were indeed tempted to do something other than exercise, eat healthy snacks, and go to bed or wake up on time. If participants were not tempted to do something else, then habits would not matter much for lowering effortful inhibition. To account for this possibility, we reran mediation analyses this time controlling for participants' responses to the question, "How often do you have to resist/overcome the temptation to do something other than [for example, exercise, go to bed on time]?" In these sensitivity analyses, effortful inhibition was recalculated as the average of the three other questions described previously (i.e., how hard was it to enact the behavior, how long did it take to decide to enact the

[1] To correct for the nonlinear distribution of sleep habits, analyses were rerun using nonparametric (Spearman) correlations and negative binomial regression models. The pattern of association between self-control, sleep habits, and effortful inhibition was similar across different analytic approaches.

[2] We note here that we also tested an alternate mediation pathway—in which stronger habits predicted better self-control, and in turn, better outcomes—in Studies 1, 2, 3, 4, and 6. In most cases, we found support for this alternative pathway. For clarity of exposition we do not report the results of each alternate mediation analysis in the manuscript. We do, however, provide detailed commentary on this issue in the General Discussion.

Table 1
Bivariate Correlations Between Self-Control, Health Habits, and Effortful Inhibition (Study 1)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Self-control	3.41	0.76	—	.18**	−.28**	.25**	.24**	−.34**	−.17**	−.25**	−.14**	−.32**
2. Healthy snack habit	14.18	10.73		—	−.32**	.36**	.24**	−.21**	.05	−.13**	.01	−.08
3. Snack effortful inhibition[1]	0.00	1.00			—	−.19**	−.20**	.34**	.02	.28**	.06	.29**
4. Exercise habit	15.60	11.86				—	.53**	−.52**	−.01	−.18**	−.01	−.16**
5. Exercise automaticity	3.25	1.65					—	−.65**	−.04	−.10*	.01	−.13**
6. Exercise effortful inhibition[1]	0.00	1.00						—	.02	.22**	.06	.27**
7. Bedtime habit	0.99	1.06							—	.25**	.53**	.23**
8. Bedtime effortful inhibition[1]	0.00	1.00								—	.22**	.63**
9. Wake time habit	1.53	1.59									—	.21**
10. Wake time effortful inhibition[1]	0.00	1.00										—

[1] Measures of effortful inhibition are *z*-standardized.
* $p < .05$. ** $p < .01$.

behavior, and how difficult was it to resist the temptation to do something else). As expected, frequent experience of temptation was associated with a greater reliance on effortful inhibition to enact each of the target behaviors ($rs > .40$, $ps < .001$). Results of the mediation analyses, however, were largely unchanged. Even after taking into account the frequency of feeling tempted, habits continued to mediate the effect of self-control on effortful inhibition.

In a final analysis, and using exercise as the target behavior, we fit a path model in which self-control predicted lower effortful inhibition via habits and automaticity. This indirect path was significant ($\beta_{indirect} = -.06$, $p < .001$, 95% CI [−.09, −.04]). As shown in Figure 1, better self-control predicted stronger exercise habits, which predicted greater exercise automaticity, and, in turn, lower effortful inhibition. Thus, by exercising repeatedly in stable circumstances, individuals with better self-control had relatively automatic exercise tendencies that required little effortful inhibition to initiate.

In sum, Study 1 generated two main findings. First, self-control was associated with stronger habits for numerous health behaviors. That is, individuals with better self-control reported exercising and eating healthy snacks more frequently and under stable circumstances. Moreover, individuals with better self-control had more stable bed time and wake time sleep routines: They tended to go to bed and wake up at similar times regardless of the day of the week. These results provide the first empirical evidence to date that individuals with better self-control do in fact rely on beneficial habits and routines. Second, beneficial habits mediated the effect of self-control on the amount of effortful inhibition needed to initiate each behavior and perceived behavioral automaticity. Self-control predicted stronger habits, which in turn predicted the ability to initiate valuable behaviors automatically and without needing to exert as much effort, without taking much time to decide whether or not to enact the behavior, and without the need to inhibit strong temptations.

Study 2: Short-Term Outcomes—Habits and Reduced Motivational Interference

In Study 1, we showed habits alleviated some of the burden of having to use effortful inhibition to enact important health behaviors. These findings are consistent with our theoretical assumptions that strong habits can be initiated automatically and without effort. Recall also that we suggested habits may function to reduce cognitive intrusions and justifications that would otherwise need to be inhibited to adhere to goals. Therefore, in Study 2, we extended findings from Study 1 by testing whether habits would reduce the amount of motivational interference resulting from a work-leisure conflict.

In Study 2, we focused on academics—a different area of life relevant to both habit and self-control. Studying and doing homework require prolonged repetition for maximal payoff: Successful students do not study just once they study over and over again. Yet choosing to study when faced with opportunities to do something more fun is a common predicament (Grund, Brassler, & Fries, 2014). And even if a student decides in favor of studying, the joys

Table 2
Mediation Models Examining the Indirect Effect of Habit Between Self-Control and Effortful Inhibition (Study 1)

Full path	α Path	β Path	Total effect	Direct effect	Indirect effect	LCI	UCI
SC→Exercise Habit→Exercise Effortful Inhibition	.25**	−.46**	−.34**	−.22**	−.12**	−.16	−.08
SC→Snack Habit→Snack Effortful Inhibition	.18**	−.28**	−.28**	−.23**	−.05**	−.08	−.02
SC→Bedtime Habit→Bedtime Effortful Inhibition	−.17**	.22**	−.26**	−.23**	−.04*	−.06	−.01
SC→Wake Time Habit→Wake Time Effortful Inhibition	−.14**	.16**	−.34**	−.31**	−.02*	−.04	−.004
SC→Exercise Habit→Exercise Automaticity	.25**	.50**	.24**	.12**	.13**	.08	.17

Note. Standardized regression parameters are based on 5,000 bootstrapped samples. α Path = effect of independent variable (self-control, SC) on mediator (habit). β Path = effect of mediator on dependent variable (effortful inhibition, automaticity) while simultaneously controlling for independent variable. Total Effect = effect of independent variable on dependent variable. Direct Effect = effect of independent variable on dependent variable while simultaneously controlling for mediator. LCI = Lower 95% Confidence Interval. UCI = Upper 95% Confidence Interval.
* $p < .05$. ** $p < .01$.

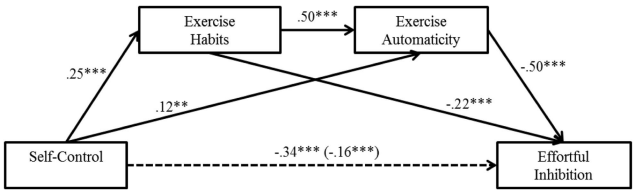

Figure 1. Mediation analysis of the effect of self-control on effortful inhibition through exercise habits and exercise automaticity (Study 1). The first coefficient on the path from self-control to effortful inhibition represents the total effect without mediators in the model; the second coefficient on this path (in parentheses) represents the direct effect when mediators are included in the model. Path loadings represent standardized regression coefficients. ** $p < .01$, *** $p < .001$.

of the foregone activity may not be soon forgotten. The decision to *not* meet up with friends, for example, can linger in a student's mind even while he or she tries to study (e.g., "Am I missing something fun?;" "Maybe I should meet up with them after all"). Focusing on studying when simultaneously brooding over missed opportunities would be, at minimum, difficult; the quality of learning will be impaired and the student will likely not persist for very long on difficult material (Grund et al., 2014).

We suggest that just as habits reduce the amount effortful inhibition needed to perform the behavior, so too should they diminish the motivational interference following a work–leisure conflict. Alternative activities may have less immediate influence over cognition, motivation, and behavior for individuals that use daily routines and habits to structure the completion of important academic activities. Insofar as students with superior self-control are more capable of adhering to academic goals during difficult situations, we argue that they do so—at least in part—through the use of strong study habits. We therefore hypothesized that habits would be associated with reduced motivational interference following study–leisure conflict, and further, that habits would mediate the association between self-control and motivational interference.

Method

Participants and procedure. The sample included 142 college students (M_{age} = 20.91 years, SD = 1.41) recruited through Amazon Mechanical Turk who completed a one-time online survey in exchange for payment. Recruitment of study participants was limited to individuals residing within the United States who also self-identified as being current college students. According to self-reported demographic information, 73% of participants were White and 50% were female. After providing informed consent, participants completed several self-report questionnaires. Measures were administered in random order across participants.

Measures. Self-control was assessed using the Brief Self-Control Scale (α = .87, M = 3.16, SD = 0.75) as described in Study 1. Strength of study habits was assessed using four behavioral automaticity items from the Self-Reported Habit Index (α = .86, M = 3.52, SD = 1.39), also described in Study 1. We also measured habit strength as the product of frequency of homework behavior and stability of context. To assess past frequency, participants rated how often they studied in the past month (0 = *I did not study in the past month* to 4 = *several times per day*). To assess stability of context, participants read the following prompt (adapted from Danner et al., 2008):

> Now we want to you ask you about your study routine. In particular, we are interested in learning about the environment in which you study. By "environment," we mean the time (when you study: right after dinner?, at 10 p.m.?, etc.), the place (where you study: computer desk?, kitchen table?, at the library?, etc.), and the circumstances (what is going on around you: is the room quiet?, is the TV on?, are there other people around you?, etc.). Some students are in the same environment whenever they study. This means that they study at the same time, in the same place, and under the same circumstances. Other students are in a different environment whenever they study. This means that they study at a different time, in a different place, or under different circumstances.
>
> Think about the environment in which you study, and answer the following question using the scale below: Whenever you study, how similar is the environment?

Participants answered this question using an 8-point scale from 0 = *Not at all the same. I study in a different environment every time* to 7 = *Completely the same. I study in the same environment every time.* Multiplying the two items together resulted in a habit strength scale that ranged from 0 to 28 (M = 8.90, SD = 6.86), with higher scores reflecting frequent engagement in stable contexts (strong habits).

Motivational interference during study-leisure conflict. To frame the experience of a study-leisure conflict, we first asked participants to imagine themselves in the following scenario (adapted from Grund et al., 2014; Kilian, Hofer, Fries, & Kuhnle, 2010):

> It is the afternoon during a school day. You are sitting at your desk and you are just about to start studying for an exam when the phone rings. Your friends are calling to ask if you want to join them and go do something. They want to pick you up in 1 minute.
>
> Regardless of what you would *actually* do in this situation, imagine that you chose to study for the exam and not meet up with your friends.

Participants then answered 12 items, rated from 1 = *completely disagree* to 5 = *completely agree*, assessing how much interference they would experience as a result of this decision to study despite opportunities for leisure. Specifically, participants responded to statements about conflicting moods (e.g., "I'll be in a bad mood because I'll be sitting at my desk while the others are having fun"), intrusive thoughts (e.g., "I won't be able to concentrate properly because I'll always be thinking about what the others are doing"), persistence (e.g., "I'll give up studying early if I don't understand the material right away"), and quality of work (e.g., "I'll study superficially in order to be done sooner"). We created a composite interference score calculated as the mean of all 12 items, in which higher scores indicated higher motivational interference during study–leisure conflict (α = .90, M = 2.88, SD = 0.81).

Results and Discussion

Students with better self-control had stronger habits for studying, measured via perceptions of automaticity, r = .31, $p < .001$

and the combination of study frequency and context stability, $r = .23$, $p = .006$. Students with better self-control and stronger study habits also reported *less* motivational interference following a study-leisure conflict (rs = −.68. −.39, and −.34, ps < .001, respectively). Consistent with our theoretical predictions, study habits (measured as perceived automaticity) mediated the effect of self-control on motivational interference ($\beta_{indirect} = -.06$, $p = .015$, 95% CI [−.11, −.01]). A similar mediation effect emerged when measuring habit strength as the combination of study frequency and context stability ($\beta_{indirect} = -.04$, $p = .02$, 95% CI [−.08, −.01]).

Results of Study 2 showed that self-control again predicted stronger study habits—measured via perceptions of behavioral automaticity and the combination of frequency and context stability—which in turn predicted lower motivational interference during study–leisure conflict. Consistent with hypotheses, results suggest that strong study habits alleviate cognitive, motivational, and behavioral impairments resulting from the decision to study despite opportunities for leisure.

Study 3: Short-Term Outcomes—Studying During Challenging Circumstances

In Study 3, we extended prior findings by testing the hypothesis that study habits would facilitate positive outcomes even under difficult circumstances. In exchange for course credit, a sample of university undergraduates completed a one-time online survey during which they answered questions about their self-control and their habit for studying, as well as additional questions about studying under conditions that are well known to require self-control (i.e., when tempted to do something other than study, when stressed, when in a negative mood, and when feeling strong aversion toward the task). Similar to Studies 1 and 2, we predicted that self-control would be associated with beneficial study habits, and further, that stronger study habits would mediate the association between self-control and studying during challenging circumstances.

Method

Participants. The sample included 135 undergraduates (M_{age} = 19.5 years, SD = 1.16, 65% female) who completed a one-time online survey for course credit during the Fall semester.

Measures and procedure. After providing informed consent, participants completed the Brief Self-Control Scale as described in Study 1 (α = .86). Strength of study habits were calculated as the product of past frequency (1 = *a few times per month or less*, 2 = *about once per week*, 3 = *a few times per week*, 4 = *just about every day*) and the location in which they study (1 = *rarely or never in the same place*, 2 = *sometimes in the same place*, 3 = *usually or always in the same place*). For each item, participants could also indicate that they did not study in the past month (scored as 0). Multiplying the items together resulted in a habit scale that could range from 0 to 12, with higher scores reflecting frequent studying in the same place. Following conversations with several undergraduates, we decided to limit context stability to location only, rather than location and time. Most students said that their class schedules and sports and activity commitments varied from one day to the next, and that it was less common for them to be able to study at the same time each day. We note, however, that results were similar regardless of whether or not we included time of day in our measure of habit strength.

Study during difficult circumstances. Participants rated three items from 1 = *disagree strongly* to 7 = *agree strongly* about whether they are able to study: (a) when they do not feel like it, (b) on days when they are stressed out, (c) when they are in a bad mood; and one additional item, "In general, how often do you succeed in choosing to study when you are tempted to do something else?," from 1 = *I never succeed in resisting the temptation to do something other than study* to 7 = *I always succeed in resisting the temptation to do something other than study*. We created a composite score calculated as the mean of standardized scores for each item, in which higher scores indicated exerting effort on academic tasks even when it is difficult to do so (α = .78).

Results and Discussion

Students with better self-control had stronger habits for studying, $r = .26$, $p = .002$. Students with better self-control and stronger habits also reported greater ability to study during difficult circumstances (rs = .42 and .32, ps < .001, respectively). Moreover, habits mediated the effect of self-control on studying during difficult circumstances ($\beta_{indirect} = .06$, $p = .05$, 95% CI [.02, .14]).

Results of Study 3 indicated that self-control predicted stronger study habits, which, in turn predicted studying even when stressed, when tempted to do something other than study, when experiencing strong aversion, and when in a bad mood. Because strong habits are triggered automatically by recurring situational cues, they may help protect valued goals from being usurped by fleeting moods and fluctuations in motivation. However, Studies 1 through 3 only established that self-control and beneficial habits are in fact correlated, and that habits have important short-term consequences. In the remaining studies, we turned our attention to the question of whether beneficial habits facilitate medium-term and long-term outcomes.

Study 4: Medium-Term Outcomes—Classroom Engagement and Homework Completion

In Study 4, we extended the findings reported thus far using a larger sample of high school seniors from a racially and socioeconomically diverse high school. Although Studies 1 through 3 offered initial evidence for our hypothesis that strong study habits would mediate the association between self-control and positive outcomes, it is possible that shared method variance between measures of self-control, study habits, and outcomes may have confounded observed associations. In Study 4 we addressed this limitation by using a novel behavioral measure to assess self-control and by using teacher-reported ratings of classroom engagement and quality of completed homework to assess positive outcomes. We also included a measure of intelligence (matrix reasoning) to rule out the possibility that individual differences in intelligence explained the associations between self-control, habit, and outcomes. Our main hypothesis, however, remained unchanged: We predicted that homework habits would mediate the association between self-control and classroom engagement.

Method

Participants and procedure. The sample included 447 high school seniors (M_{age} = 17.91 years, SD = 0.52) from a public high school in the northeastern United States. According to school records, 39% of participants were Black, 37% were White, 21% were Asian, and 3% were Hispanic; 54% were female. Just over half of participants (51%) were from low-income households, as indicated by their qualification for free or reduced-price lunch. In the month of January, participants completed a battery of measures, including a behavioral measure of self-control, self-report questionnaires assessing self-control and homework habits, and a measure of intelligence during regular school hours on school computers. Later in the school year, classroom teachers completed questionnaire measures of classroom engagement.

Measures.

Self-report measure of self-control. Participants completed the Domain-Specific Impulsivity Scale for children (DSIS; Tsukayama, Duckworth, & Kim, 2013). This measure was originally designed to assess self-control *lapses* in the domains of schoolwork and interpersonal relationships. In the current study, items were reworded prior to administration such that higher ratings indicated less impulsivity (or, better self-control). Using four items per domain, participants answered questions related to their schoolwork self-control (e.g., "I pay attention and resist distractions in class") and their interpersonal self-control (e.g., "I can remain calm even when criticized or otherwise provoked") from 1 = *not at all true* to 5 = *completely true*. The two scales were positively correlated, r = .44, $p < .001$. A total self-control scale was computed as the average of all eight items, with higher scores indicating better self-control (α = .76).

Behavioral measure of self-control. Participants also completed a novel online task called the Academic Diligence Task (adapted from Galla et al., 2014). The task involves a split-screen interface with the choice to either complete single-digit subtraction problems ("Do Math") or watch YouTube video clips or play Tetris ("Play game or watch movie"). Participants first completed a 30-s practice block of single-digit subtraction problems, but without the option to watch videos or play Tetris. After completing the practice block, participants then read a cover story that emphasized the utility of completing the subtraction problems. The cover story was designed to make completing the math problems worthwhile. Specifically, participants read the following prompt: "New scientific research shows that students who practiced math by doing more subtraction problems went on to earn higher grades. Even doing simple and easy math problems can make you a better problem solver, which can help you in all areas of your life." Thus, if they desired, participants could reasonably see completing the math problems as useful for their academic skills and beyond. Participants also read that whenever they felt like it they were free to click on the opposite side of the screen to watch YouTube videos or play Tetris, but the more problems they completed, the more likely it is that their problem solving ability would improve.

Participants then began the test phase that consisted of three, 3-min blocks during which they were free to toggle between completing the skill-building activity or pass the time by engaging with the distractions (the program restricted engagement to one activity at a time). We derived two indices of self-control based on participants' engagement with the task: (a) productivity, and (b) time on task. Productivity represents the total number of math problems solved correctly, summed across all three task blocks (M = 144, SD = 83). Time on task represents the total percentage of time participants spent solving the math problems, averaged across all three task blocks (M = .64, SD = 0.30). Productivity and time on task were highly correlated, r = .89, $p < .001$, so we created a composite self-control score calculated as the mean of standardized scores for each item. Higher scores indicated better self-control.

In a large-scale validation study with a separate sample of high school seniors (N = 921; Galla et al., 2014), productivity and time on task demonstrated convergent validity with self-report ratings of Big Five conscientiousness and its facets, self-control and grit ($r_{average}$ = .13, $ps < .05$). Though small in magnitude, these effect size correlations are consistent with meta-analytically derived estimates of the association between questionnaire and behavioral measures of self-control (rs = .10 to .21; Duckworth & Kern, 2011). Productivity and time on task also demonstrated incremental predictive validity for objectively measured grade point averages (GPA), standardized math and reading achievement test scores, high school graduation, and college enrollment, over and beyond demographics, intelligence, and attitudes toward math. In the current study, the composite self-control score was correlated with scores on the DSIS described previously, r = .13, p = .008.

Strength of homework habits. Homework habits were calculated as the product of frequency of homework behavior and stability of context. To assess past frequency, participants rated how many days in a typical week they do homework (from 0 to 7 days). To assess stability of context, participants read a prompt similar to the one described in Study 2 (adapted from Danner et al., 2008), and responded using a 7-point scale from 0 = *Not at all the same. I do my homework in a different environment every time* to 6 = *Completely the same. I do my homework in the same environment every time.* Multiplying the two items together resulted in a habit strength scale that ranged from 0 to 42, with higher scores reflecting frequent engagement in stable contexts (strong habits).

Intelligence. Intelligence was assessed with the matrix reasoning subtest of the Kaufmann Brief Intelligence Test (Kaufman & Kaufman, 1990). Participants were shown a series of patterns in which one portion of the pattern was missing. From a set of response options, participants determined the shape/pattern that completed the pattern. The current version of the task included a total of 36 matrix reasoning problems, and the task ended after four consecutive incorrect responses or completion of all problems. The number of correct answers before a ceiling of four incorrect trials in a row constituted the raw score, which was converted to an age-normed scaled score in accordance with the scoring manual.

Classroom engagement. English, social studies, and homeroom teachers rated each participant using two items: (a) "How often do you have to redirect this student during a typical class [*0 times to 5 or more times*]? Redirection might include a reminder to get back on task, to use appropriate language and tone of voice, or to obey class expectations;" and (b) "What percentage of assignments [*0%–100%*] does this student complete to a satisfactory level of quality and on time? Feel free to consult your gradebook—as precise an estimate as possible is ideal." To increase validity of our measure, we averaged the six items together ($r_{average}$ = .21) such that higher scores indicated *lower* classroom

engagement (i.e., more classroom disruptions and more unsatisfactory homework).

Results and Discussion

As shown in Table 3, self-control—assessed via self-control and performance on a behavioral measure—was correlated with homework habits (rs = .35 and .20, ps < .001, respectively). Self-reported self-control, behavioral self-control, and homework habits were each correlated with teacher-reported classroom engagement (rs = −.28, −.17, and −.25, ps < .01, respectively). That is, students with better self-control and stronger homework habits were less likely to disengage from classroom learning activities and less likely to turn in unsatisfactory homework assignments. Homework habits mediated the association between self-reported self-control and classroom engagement ($\beta_{indirect}$ = −.04, p = .011, 95% CI [−.07, −.01]). Likewise, homework habits mediated the association between performance on a behavioral measure of self-control and classroom engagement ($\beta_{indirect}$ = −.03, p = .006, 95% CI [−.06, −.01]).

We reran mediation models to determine whether the results were robust across the two self-control domains assessed by the DSIS: interpersonal self-control and work self-control. Unsurprisingly, homework habits mediated the effect of work self-control on classroom engagement ($\beta_{indirect}$ = −.04, p = .018, 95% CI [−.07, −.01]). More interesting, however, in a separate model homework habits also mediated the effect of interpersonal self-control on classroom engagement ($\beta_{indirect}$ = −.04, p = .003, 95% CI [−.06, −.01]).

Across Studies 3 and 4, self-control—assessed by multiple self-report questionnaires and a novel behavioral measure—reliably correlated with stronger study and homework habits. Moreover, strong habits predicted important academic behaviors, such as studying even when faced with conditions that normally require self-control and in terms of turning in homework on time and engaging during classroom learning activities. In Study 4, we relied on teacher-reported assessments of classroom engagement, alleviating concerns about shared method variance. Also of interest, in Study 4 students with better ability to regulate emotions and interpersonal behavior (e.g., allowing others to speak without interruption) also relied on strong homework habits to advance academic goals. Together, these results demonstrate that self-control predicts positive outcomes, in part, through its association with effective study and homework habits.

Study 5: Long-Term Outcomes—Accomplishing Meditation Practice Goals

While Studies 1 through 4 provided evidence for an association between self-control and beneficial habits, a possible criticism is that the evidence marshaled in these studies came from cross-sectional studies. It remains unclear whether self-control predicts habit strength at a later point in time, which in turn promotes long-term positive outcomes. Hence, the main goal of Study 5 was to address the predictive validity of self-control on habits using data from a prospective longitudinal study. In this study, we tracked a sample of teenage youth for 3 months and examined the development of mindfulness meditation practice habits. Specifically, we measured self-control before the start of an intensive 5-day meditation retreat, and 3 months after the retreat we measured meditation practice habit strength.

Mindfulness meditation practice has been studied with regard to its beneficial effects on self-control (e.g., Papies, Barsalou, & Custers, 2012). However, the actual practice of meditation itself can require self-control: Meditation can feel tedious and uninteresting, and for novice practitioners inexperienced in attending to their inner experience, meditation may initially increase feelings of distress. Indeed, Bhante Henepola Gunaratana (1990) begins his classic meditation manual, *Mindfulness in Plain English*, somberly: "Meditation is not easy. It takes time and it takes energy. It also takes grit, determination, and discipline. It requires a host of personal qualities that we normally regard as unpleasant and like to avoid whenever possible" (p. 1). Given competing time demands and more desirable alternative activities in the course of everyday life, we suggest that adolescents with better self-control will be more likely to continue practicing meditation after the structure and support of the meditation retreat has longed since passed.

As in Studies 1 through 4, we hypothesized that self-control would prospectively predict stronger meditation habits three months after the retreat, and that these habits would in turn mediate the association between self-control and positive outcomes. In Study 5, we again measured habit strength using the product of behavioral frequency and context stability as well as perceived behavioral automaticity to rule out the possibility that method effects in our habit strength measure may have explained prior results. As our outcome measure we relied on adolescents' self-assessments of the degree to which they had satisfactorily met their meditation practice goals.

Table 3
Bivariate Correlations Between Self-Control, Homework Habits, and Classroom Engagement (Study 4)

Variable	*M*	*SD*	Self-control (behavioral)	Homework habits	Intelligence	Classroom engagement
Self-control (self-report questionnaire)	3.63	0.60	.13**	.35**	−.01	−.28**
Self-control (behavioral measure)[1]	0.00	1.00		.20**	.24**	−.17**
Homework habits	17.37	10.46			.09	−.25**
Intelligence	94.91	21.01				−.08
Classroom engagement[1]	0.00	1.00				—

[1] Measures are z-standardized.
** p < .01.

Method

Participants and procedure. The sample included 132 youth (M_{age} = 16.76 years, SD = 1.48) who participated in any one of five, 5-day meditation retreats during Summer 2013. The participants were a self-selected group of typically developing adolescents interested in meditation practice; they were not selected on the basis of any preexisting psychiatric or stress-related conditions. According to self-reported demographic information, 65% of participants were White, 21% were of mixed race, 11% were Hispanic, and 3% were Asian; 62% were female. According to records obtained from the retreat organization, just under half (46%) of participants paid the full retreat price; the remaining 54% received either a full or a partial scholarship.

The summer meditation retreats were offered through Inward Bound Mindfulness Education (www.ibme.info), a nonprofit organization dedicated to improving the lives of adolescents and families through mindfulness training. Each of the five meditation retreats under study was facilitated by a staff of experienced meditation practitioners. The core of the retreat was the cultivation of moment-to-moment mindful attention. As such, mindfulness practice was embedded in all daily activities (e.g., eating, speaking, listening, athletic activities, and creative expressions), and the retreat included periods of extended sitting and walking meditation, small group relational mindfulness exercises, guided activity periods, and free time. The daily schedule can vary based on practical needs, but in general each day began at 6:30 a.m., with the first morning meditation at 7:00 a.m. The day ends around 10:30 p.m. The teens observed silence for about half the day, during which they engage primarily in periods of sitting and walking meditation.

Prior to the start of the meditation retreat, participants completed a battery of self-report questionnaires tapping multiple aspects of mental health and psychological functioning. Participants also provided basic demographic information and answered questions about their meditation practice history. Immediately after the retreat ended, but prior to leaving the retreat center, participants completed a posttest survey. Three months after the retreat, participants were sent instructions for how to complete the final assessment battery online or in hard copy. Participants were paid $25 if they completed all three assessments. Overall, 109 (83%) teens completed all three assessments. There were no statistically significant differences between participants who completed the three month follow-up assessment with those who did not based on their baseline demographic characteristics (i.e., gender, age, ethnicity, marital status of parents, baseline practice history, received financial scholarship).

Measures.

Preretreat survey.

Self-control. We assessed self-control using the 13-item Brief Self-Control Scale as described in Study 1 (α = .86).

Prior experience with meditation practice. Participants indicated (*yes* or *no*) whether they had experience with mindfulness meditation prior to the retreat. Sixty-four percent (n = 84) of teens indicated some meditation practice prior to the retreat.

Immediate postretreat survey.

Commitment to meditation practice. Participants rated 14 items from 1 = *not at all true of me* to 5 = *very true of me* about their overall commitment to continue practicing meditation following the retreat. Previous research has recommended that assessments of goal commitment should encompass more than goal intentions (Mann, de Riddler, & Fujita, 2013), and toward this end we took a broad measurement approach. Specifically, participants answered questions about their intentions to practice meditation (e.g., "I intend to practice meditation most days per week during the next 3 months"), their self-efficacy toward meditation practice (e.g., "I am confident that I will be able to meditate even when I don't want to during the next 3 months"), the importance of meditation practice (e.g., "meditation most days per week during the next 3 months would take a lot of time and be of little use to me" [reversed scored]), and their emotional commitment to meditation practice (e.g., "I will be disappointed if I do not meditate most days per week during the next 3 months"). We created a composite goal commitment score calculated as the mean of all 14 items, in which higher scores indicated a higher commitment to practice meditation following the retreat (α = .95).

Three month follow-up survey.

Strength of mindfulness meditation practice habits. Meditation habit strength was calculated as the product of past behavioral frequency and context stability (place and time). Participants first reported how often they practiced meditation in the last three months (1 = *I meditated a few times per month or less* to 4 = *I meditated just about every day*), and then reported how often they meditated in the same place (1 = *rarely or never in the same place* to 3 = *usually or always in the same place*) and at the same time (1 = *rarely or never at the same time* to 3 = *usually or always at the same time*). Participants could also select "0" for each question to indicate that they did not meditate.

Automaticity of meditation practice. Participants completed the four behavioral automaticity items on the Self-Reported Habit Index as described in Study 1 (α = .89).

Accomplishing meditation goals. Participants completed three items adapted from Schroder, Ollis, and Davies' (2013) assessment of goal accomplishment: (a) "To what degree have you met your intentions to practice meditation?" (0% to 100%); (b) "How successful have you been at following your intentions to practice meditation?" (1 = *very unsuccessful to* 7 = *very successful*); and (c) "As of today, how satisfied are you with the degree to which you have met your intentions to practice meditation?" (1 = *very dissatisfied to* 7 = *very satisfied*). We created a composite score calculated as the mean of standardized scores for each item, with higher scores indicating greater goal accomplishment (α = .91).

Results and Discussion

As shown in Table 4, self-control measured before the retreat was correlated with meditation habits, r = .26, p = .006, greater perceived automaticity of meditation practice, r = .33, p < .001, and goal accomplishment, r = .27, p = .005, all measured 3 months after the retreat. To test our hypothesis that habits would mediate the association between self-control and goal accomplishment, we fit a path model with meditation habits (measured as automaticity) as the mediator variable. All paths controlled for prior meditation experience, measured before the start of the retreat, and goal commitment, measured immediately after the retreat. As expected, self-control predicted automaticity of meditation practice (β = .25, p = .008), and automaticity in turn predicted goal accomplishment (β = .54, p < .001). Importantly,

Table 4
Bivariate Correlations Between Self-Control, Meditation Habits, Meditation Automaticity, and Accomplishing Meditation Goals (Study 5)

Variable	*M*	*SD*	Meditation practice history	Self-control	Goal commitment	Meditation habits	Meditation automaticity	Accomplishing meditation goals
Before retreat								
Meditation practice history	64%		—	.17	.04	.15	.23*	.28**
Self-control	3.01	0.77		—	.20*	.26**	.33**	.27**
Immediate Postretreat								
Goal commitment	3.84	0.79			—	.27**	.25*	.14
3-month follow-up								
Meditation habits	10.10	8.96				—	.33**	.60**
Meditation automaticity	2.55	1.06					—	.59**
Accomplishing meditation goals[1]	0.00	1.00						—

[1] Measure is *z*-standardized.
* $p < .05$. ** $p < .01$.

automaticity mediated the effect of self-control on goal accomplishment ($\beta_{indirect} = .14$, $p = .016$, 95% CI [.03, .25]).

Results were conceptually replicated when using meditation habits, measured as frequency and context stability, as the mediator variable. As predicted, meditation habits (marginally) mediated the association between self-control and goal accomplishment ($\beta_{indirect} = .11$, $p = .05$, 95% CI [.00, .22]).

Using a longitudinal design, Study 5 showed that better self-control prospectively predicted beneficial habits. Specifically, self-control, measured before the start of a 5-day meditation retreat, predicted stronger meditation habits three months later. Importantly, these effects were consistent regardless of whether habits were measured as the product of behavioral frequency and context stability or as perceived behavioral automaticity. Furthermore, effects were independent of prior meditation experience and goal commitment. Extending the findings of Studies 3 and 4, we also provided evidence that strong habits mediated the association between self-control and successfully accomplishing long-term goals. Together, these findings indicate that adolescents with better self-control were better able to stick to their long-term meditation practice goals through beneficial habits.

Study 6: Long-Term Outcomes—Earning Higher Grades and Persisting in College

Across five studies we have demonstrated that self-control reliably correlates with beneficial habits, measured as stable behavioral routines enacted under similar circumstances and as behavioral automaticity. Moreover, we have provided evidence that beneficial habits mediate the association self-control and positive outcomes across multiple time frames. However, in Studies 1 through 5, our outcome measures were reliant upon self-report and informant-report questionnaires. Therefore, in Study 6, we used two objectively measured indicators of long-term outcomes: grades earned in high school and college persistence. In a large sample of high school seniors ($N = 918$) from three racially and socioeconomically diverse high schools, we administered measures assessing self-control, homework habits, and homework completion. Subsequently, from school records we collected senior year GPA, and from the National Student Clearinghouse (NSC) we collected college enrollment data. Extending the path model examined previously, we predicted that self-control would influence long-term academic outcomes through a combination of homework habits and medium-term outcomes, measured as homework completion.

Method

Participants and procedure. The sample included 918 high school seniors ($M_{age} = 18.05$ years, $SD = 0.66$) from three public high schools in the northeastern United States. According to school records, 29% of participants were Black, 28% were White, 22% were Hispanic, 16% were Asian, and 4% were of mixed ethnicity; 49% were female. About 66% qualified for free or reduced-price lunch. During the Spring semester, participants completed a battery of self-report questionnaires, including measures of self-control, homework habits, and homework completion. Participants also completed a computerized test of intelligence. All measures were completed on school computers during regular school hours. School records containing demographic information and academic performance were then collected several months later at the end of the school year. Approximately 1 year after participants finished high school, we collected college enrollment data from the National Student Clearinghouse.

Measures.

Self-report ratings of self-control and homework habits. Participants completed the Domain-Specific Impulsivity Scale for children as described in Study 4 ($\alpha = .78$). Similarly, strength of homework habits was calculated as the product of past behavioral frequency and stability of place and time.

Homework completion. Participants completed two items related to successful homework completion (adapted from Trautwein, Ludtke, Schnyder, & Niggli, 2006): (a) "I get into trouble for not turning my school assignments in on time," and (b) "I don't finish my school assignments by the due date." Participants rated each item from 1 = *not at all like me* to 5 = *very much like me*, and items were coded and averaged such that higher scores indicated grater homework completion. The observed internal reliability consistency was $\alpha = .65$.

Intelligence. Intelligence was assessed using the Matrix Reasoning Test as described in Study 4.

GPA. From school records, we recorded overall senior year GPA. To accommodate the different grading scales between the three schools, we first standardized the three sets of GPA scores

within each school, and then subsequently, standardized this new variable to create a fully standardized GPA variable with $M = 0$ and $SD = 1$.

College persistence. We collected college enrollment data from the NSC (www.studentclearinghouse.org). The NSC is a nonprofit organization created in connection with the student financial aid lending industry to gather enrollment verification data for student borrowers (Schoenecker & Reeves, 2008). In the years since its inception, the NSC database has become an important tool for researchers interested in tracking college enrollment because of its extremely high coverage rate (Dynarski, Hemelt, & Hyman, 2013), and because objective student enrollment records can be collected without the need to contact individual schools or students. Using the NSC data, we created a binary indicator (0 = *did not persist*, 1 = *persisted*) of whether or not each participant was continuously enrolled in college full-time (at either a 2-year or 4-year institution) for the entire academic year after high school. At the time of our data request (April 2014), approximately 36% of the sample persisted through the first year of college as a full-time student.

Results and Discussion

As shown in Table 5, students with better self-control reported stronger homework habits, $r = .29$, $p < .001$, and greater homework completion, $r = .28$, $p < .001$. Moreover, self-control, homework habits, and homework completion were each associated with senior year GPA (rs = .17 to .43, ps < .001) and college persistence (rs = .13 to .31, ps < .001).

We next tested for mediation using senior year GPA and first-year college persistence as the dependent variables. In these models, we included a series of dummy variables for school, gender, free and reduced-price lunch status, and race/ethnicity, as well as an additional control for intelligence. As in prior studies, continuous variables were standardized prior to running analyses to facilitate interpretation of indirect effects in standard deviation units. As is illustrated in Figure 2, homework habits mediated the effect of self-control on homework completion ($\beta_{indirect} = .08$, $p < .001$, 95% CI [.05, .10]). Homework habits also mediated the effect of self-control on senior year GPA ($\beta_{indirect} = .06$, $p < .001$, 95% CI [.04, .09]). Furthermore, homework completion mediated the effect of homework habits on senior year GPA ($\beta_{indirect} = .09$, $p < .001$, 95% CI [.06, .12]). The full path model was also significant: The indirect effect from self-control to senior year GPA via homework habits and homework completion was significant ($\beta_{indirect} = .03$, $p < .001$, 95% CI [.02, .04]).[3]

We next fit a logistic path model with college persistence (a binary variable) as the dependent variable. The full path model is illustrated in Figure 3. Homework habits mediated the effect of self-control on homework completion ($b_{indirect} = .08$, $p < .001$, 95% CI [.05, .10]). Habits also mediated the effect of self-control on college persistence ($b_{indirect} = .14$, $p < .001$, 95% CI [.07, .20]). Furthermore, homework completion mediated the effect of homework habits on college persistence ($b_{indirect} = .17$, $p < .001$, 95% CI [.10, .24]). The full path model was also significant: The indirect effect from self-control to college persistence via homework habits and homework completion was significant ($b_{indirect} = .05$, $p < .001$, 95% CI [.03, .08]).

In a replication of results from Study 4, homework habits also mediated the effect of both interpersonal self-control and work self-control (in separate models) on homework completion, senior year GPA, and college persistence.

Study 6 showed that better self-control predicted stronger homework habits, which in turn predicted completing homework on time, and ultimately, earning higher grades in high school and a persisting in college. This latter finding is particularly noteworthy when considering that students who remain continuously enrolled full-time during the first year of college have a much greater chance of earning a degree (Ryu, 2012). For example, African American students who earn at least 20 college credits during their first year of college (indicating a year of full-time enrollment) have a 61% chance of earning a bachelor's degree within 5 years. Conversely, African American students who do not earn 20 college credits during their first year of college have only a 21% chance of earning a baccalaureate degree within 5 years. The effect of full-time enrollment versus non-full-time enrollment on later degree completion is equally striking for White (78% vs. 35%) and Hispanic (61% vs. 22%) students.

Importantly, these results were significant above and beyond the effect of the high school attended, demographic characteristics, and intelligence. Moreover, we used objectively measured academic outcomes, thereby minimizing the problem of shared method variance. The prospective longitudinal design of this study also gives us greater confidence that homework habits were responsible for the observed correlations with academic outcomes rather than the other way around. Extending the results of prior studies, we also showed that medium-term positive outcomes (homework completion) mediated the effect of homework habits on both GPA and college persistence.

General Discussion

It has been commonly assumed that self-control enables positive outcomes through "in the moment" inhibition of temptation. While these descriptions are understandable given the connotations of closely associated terms such as willpower, the current research suggests that self-control is also reliably associated with beneficial habits, those automatic action dispositions forged by repeating a particular behavior in stable circumstances (Wood & Neal, 2007). Specifically, individual differences in self-control—measured using valid self-report questionnaires and behavioral measures—correlated with habits for exercising, eating healthy snacks, and sleeping (Study 1), as well as for studying and doing homework (Studies 2, 3, 4, and 6). Results of Study 5 also indicated that

[3] For students at two of the three schools ($n = 589$), we were able to record junior year GPA data from school records. Using this subset of students, we reran the full path model examining change in GPA, which is to say, senior year GPA controlling for junior year GPA. The results of this analysis replicated those reported using the entire sample. Homework habits mediated the effect of self-control on homework completion ($\beta_{indirect} = .05$, $p < .001$, 95% CI [.02, .08]). Homework habits also mediated the effect of self-control on change in GPA ($\beta_{indirect} = .02$, $p = .021$, 95% CI [.003, .04]). Furthermore, homework completion mediated the effect of homework habits on change in GPA ($\beta_{indirect} = .05$, $p = .001$, 95% CI [.02, .07]). The full path model was also significant: The indirect effect from self-control to change in GPA via homework habits and homework completion was significant ($\beta_{indirect} = .01$, $p = .004$, 95% CI [.003, .02]).

Table 5
Bivariate Correlations Between Self-Control, Homework Habits, Homework Completion, and Academic Outcomes (Study 6)

Variable	*M*	*SD*	College persistence	Self-control	Homework habits	Homework completion
GPA senior year (standardized)	0.00	1.00	.47**	.17**	.37**	.43**
College persistence	36%		—	.13**	.28**	.31**
Self-control	3.73	.62		—	.29**	.28**
Homework habits	11.90	8.32			—	.33**
Homework completion	3.85	.95				—

** $p < .01$.

self-control prospectively predicted beneficial meditation habits—measured as the combination of behavioral frequency and context stability and as behavioral automaticity—three months after the end of a meditation retreat.

Implications for Self-Control Research

In addition to highlighting the association between self-control and beneficial habits, these findings extend research linking self-control to positive life outcomes in two important ways. First, no prior studies have shown why individuals with better self-control rely less on effortful inhibition to enact behaviors that track long-term goals. Results of Study 1 and 2 addressed this issue directly: Beneficial habits mediated the association between self-control and both effortful inhibition and motivational interference. Specifically, in Study 1, self-control predicted stronger habits, which in turn predicted the initiation of desirable health behaviors (for exercising, eating healthy snacks, and going to bed on time) automatically and with little need for effortful inhibition. In Study 2, self-control predicted stronger study habits, which in turn reduced the amount of intrusive thoughts, negative mood, and behavioral impairment following a work–leisure conflict. These data suggest that by relying on stable habits and routines, individuals with better self-control can enact important behaviors more automatically and effortlessly.

Second, the current research demonstrated that habits explain the relationship between self-control and numerous positive life outcomes. Specifically, beneficial habits mediated the effect of self-control on short-term outcomes, measured as the ability to study when stressed, in a bad mood, or tempted to do something else (Study 3), and medium-term outcomes, measured via teacher-reported classroom engagement (Study 4). Over extended periods of time, habits also mediated the effect of self-control on accomplishing meditation practice goals three months after a meditation retreat (Study 5), and earning higher grades in high school and persisting in college (Study 6). Beneficial habits, perhaps more so than individual acts of effortful inhibition, therefore represent an important though often neglected factor linking self-control to positive life outcomes.

Taken together, the current investigation offers some of the first empirical evidence outside of laboratory settings exploring the mechanisms underlying the association between self-control and positive life outcomes. In doing so, the current research adds to a growing literature calling for a broader conceptualization of self-control as more than just the effortful inhibition of impulses (de Ridder et al., 2012; Fujita, 2011). It also integrates research on self-control with a well-established body of research examining the determinants of goal pursuit more generally (Gollwitzer, 1990; Mann et al., 2013). Further, the variety of samples (adolescents, high school students, college students, and adults living in the United States), methods (cross-sectional and longitudinal studies) and procedures used (self-report and behavioral measures of self-control, multiple measures of habit), combined with the diversity of life domains assessed, provides more generalized evidence for a reliable association between self-control and beneficial habits.

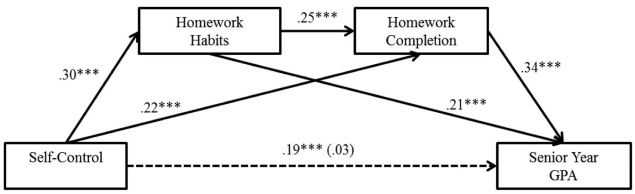

Figure 2. Mediation analysis of the prospective effect of self-control on senior year GPA through homework habits and homework completion (Study 6). The first coefficient on the path from self-control to GPA represents the total effect without mediators in the model; the second coefficient on this path (in parentheses) represents the direct effect when mediators are included in the model. All paths controlled for the effect of school, gender, free and reduced price lunch status, race/ethnicity, and intelligence. Path loadings represent standardized regression coefficients. *** $p < .001$.

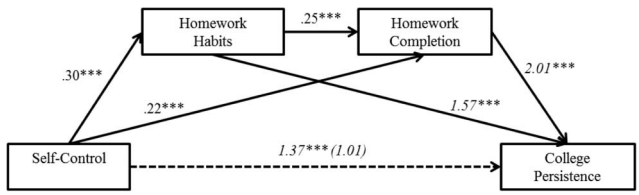

Figure 3. Logistic mediation analysis of the prospective effect of self-control on college persistence through homework habits and homework completion (Study 6). The first coefficient on the path from self-control to college persistence represents the total effect without mediators in the model; the second coefficient on this path (in parentheses) represents the direct effect when mediators are included in the model. All paths controlled for the effect of school, gender, free and reduced price lunch status, race/ethnicity, and intelligence. Path loadings to college persistence are *odds ratios* (italicized); all other loadings represent standardized regression coefficients. *** $p < .001$.

Potential Criticisms and Limitations

We see at least two potential criticisms of the current study. We offered theoretical reasons for why individuals with better self-control might rely on beneficial habits. However, it is also plausible that beneficial habits facilitate better self-control, which in turn predicts positive life outcomes. We tested this reverse pathway in each study (except for Study 5 because self-control was only measured before the meditation retreat). In most cases, we found support for this alternative hypothesis. On this very point, William James (1890) conjectured that habits may help shield our limited cognitive capacity from being unnecessarily squandered on trivial tasks. In a complementary way, habits may also help prevent mental fatigue that would otherwise impair self-control for when it is needed most, for example, during unpredictable encounters with strong temptation. This reverse pathway, from habits to self-control to positive outcomes, suggests interesting avenues for future research. For example, it may be the case that individuals who are thrown off their existing habits and routines due to a change in circumstances (e.g., travel to an unfamiliar place, moving to a new town, the birth of a baby) experience more self-control difficulties and greater difficulty sticking to their goals.

A second potential criticism of the present research is that habits might themselves be seen as a positive outcome. If so, it might make less sense to differentiate habits from the outcomes that they are expected to predict (at least as measured in the current research). Our decision to differentiate habit from positive outcomes is based on both theoretical grounds—in which habits are seen as distinct from and at the same time related to goal pursuit (Wood & Neal, 2007)—and prior empirical research (Adriaanse et al., 2014). Nonetheless, we offer several empirical arguments against the possibility that habits were coextensive with our outcomes. The correlations between self-control, habit, and outcomes in each study hovered around $r = .20$ to .40. Although this is traditionally viewed as a moderate sized effect, correlations of this magnitude only account for 4% to 16% of the shared variance. Confirmatory factor analyses also revealed that treating self-control, habit, and outcomes as separate factors fit the data better than a single-factor solution, or any two-factor combination of the different constructs. Using data from Study 6, for example, a three-factor solution fit the data better than a two-factor solution in which indicators for homework habits and homework completion were loaded onto a single factor and indicators for self-control were loaded onto another factor, $\Delta\chi^2(2) = -188.80$, $p < .001$.

The criticism that habits and positive life outcomes are one in the same thing may derive in part from the inclusion of behavioral frequency in the assessment of habit strength (Ajzen, 2002). After all, frequently enacting an important behavior can be seen as an end in itself. This issue was partially addressed by using a measure of behavioral automaticity to assess habit strength (Studies 1, 2, and 5), as well as by measuring sleep habits independently of behavioral frequency. To further address this concern, however, we reanalyzed data from Study 6 to explore whether simply having a stable routine, but *independent of the frequency of this routine*, would predict positive outcomes. We used data from Study 6 in this exploratory analysis given the power to detect smaller effects. Specifically, we created a measure of homework habit strength by multiplying together the two ratings of context stability (time and place), but *excluding* ratings of behavioral frequency. We then reran our mediation model using this new habit measure. Results were unchanged. Self-control predicted more stable homework routines (doing homework in the same place at the same time) which in turn predicted greater homework completion and long-term academic outcomes (senior year GPA and full-time college enrollment). Results of this exploratory reanalysis further confirm that self-control does in fact predict reliable routines—even independently of their frequency—and that these routines in turn facilitate positive life outcomes.

Despite the consistency of our results across six studies, there are several limitations. First, although the prospective longitudinal design of Study 5 supports some inferences about the direction of effects, our studies were nonexperimental. Therefore, causal relations between self-control, habit, and positive life outcomes cannot be confirmed unequivocally. And although we quantified habit strength using the two most common measures in social psychology (as the product of frequency and context stability, and as perceived behavioral automaticity), we nevertheless relied on traditional retrospective self-report measures. Future studies might incorporate ecological momentary assessments of behavior (Lally et al., 2010; Wood et al., 2002) to examine the association between self-control and daily routines.

Directions for Future Research

How is self-control related to beneficial habits? In Study 1 for example, we demonstrated that exercising frequently and in the same place and time predicted greater exercise automaticity. Yet this study did not examine *how* individuals with better self-control managed to exercise in a manner conducive to the development of automaticity. We suggest that for long-term goals, self-control can be strategically deployed to organize situations and remove temptations that obstruct continued repetition of goal-relevant behavior, and hence, the development of automaticity.

An important question for future research then is whether different self-control strategies are of equal value for developing beneficial habits (Duckworth, Gendler, & Gross, 2014). We doubt that this is the case. Habit development is facilitated to the degree that direct valuation of competing goals is minimized (Wood & Neal, 2007; Yin & Knowlton, 2006). That is, behaviors that require goals or intentions to be actively represented every time they are enacted will likely not become habits. For example, students who must decide each day anew whether to do homework while simultaneously tempted by the TV will likely find that the decision to do homework becomes no easier over time. This view argues that self-control strategies that operate prior to encountering temptations may be more beneficial in creating habits compared to strategies that operate after encountering temptation. Proactive self-control strategies that preemptively remove competing alternative goals (Duckworth et al., 2014; Gollwitzer, 1999; Gross, 1998) should reduce the need to reevaluate the desired behavior (e.g., do homework) in relation to an available alternative (e.g., watch TV), which in turn may clear the way for repetition of the desired behavior, and hence, the development of automaticity. In contrast, reactive self-control strategies (including effortful inhibition) involve deliberate and direct comparisons of conflicting goals ("Should I do homework or watch TV?"). Relying on ef-

fortful inhibition every time a desired behavior must be enacted could therefore stall the development of automaticity. Research comparing different self-control strategies would not only provide theoretical insights about how best to develop beneficial habits, but also practical benefits to individuals struggling to repeat valued behaviors.

Concluding Remark

In his meditation on habits, William James (1890) said "there is no more miserable human being than one in whom nothing is habitual but indecision, and for whom the lighting of every cigar, the drinking of every cup, the time of rising and going to bed every day, and the beginning of every bit of work, are subjects of express volitional deliberation. Full half the time of such a man goes to the deciding, or regretting, of matters which ought to be so ingrained in him as practically not to exist for his consciousness at all" (p. 122). Consistent with these observations, we demonstrated across six studies the salutary effects of beneficial habits for reducing effortful inhibition (Study 1) and motivational interference (Study 2), facilitating greater goal adherence (Studies 3, 4, 5, and 6), and promoting long-term outcomes (Study 6). We also showed that self-control—thought mainly to involve the effortful inhibition of single maladaptive impulses—enabled positive life outcomes through the deployment of beneficial habits. Collectively, these results offer a revised portrait of the self-controlled person as someone who relies upon beneficial habits to adhere to, and ultimately attain, enduringly valued goals.

References

Adriaanse, M. A., Kroese, F. M., Gillebaart, M., & De Ridder, D. T. D. (2014). Effortless inhibition: Habit mediates the relation between self-control and unhealthy snack consumption. *Frontiers in Psychiatry, 5,* 444.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review, 6,* 107–122. http://dx.doi.org/10.1207/S15327957PSPR0602_02

Baraldi, A. N., & Enders, C. K. (2010). An introduction to modern missing data analyses. *Journal of School Psychology, 48,* 5–37. http://dx.doi.org/10.1016/j.jsp.2009.10.001

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. http://dx.doi.org/10.1037/0022-3514.74.5.1252

Baumeister, R., & Tierney, J. (2011). *Willpower: Rediscovering the greatest human strength*. New York, NY: Penguin.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science, 16,* 351–355. http://dx.doi.org/10.1111/j.1467-8721.2007.00534.x

Botvinick, M. M., & Bylsma, L. M. (2005). Distraction and action slips in an everyday task: Evidence for a dynamic representation of task context. *Psychonomic Bulletin & Review, 12,* 1011–1017. http://dx.doi.org/10.3758/BF03206436

Currey, M. (2013). *Daily rituals: How artists work*. New York, NY: Knopf Doubleday.

Danner, U. N., Aarts, H., & de Vries, N. K. (2008). Habit vs. intention in the prediction of future behaviour: The role of frequency, context stability and mental accessibility of past behaviour. *British Journal of Social Psychology, 47,* 245–265. http://dx.doi.org/10.1348/014466607X230876

Denson, T. F., Pedersen, W. C., Friese, M., Hahm, A., & Roberts, L. (2011). Understanding impulsive aggression: Angry rumination and reduced self-control capacity are mechanisms underlying the provocation-aggression relationship. *Personality and Social Psychology Bulletin, 37,* 850–862. http://dx.doi.org/10.1177/0146167211401420

de Ridder, D. T. D., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., & Baumeister, R. F. (2012). Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. *Personality and Social Psychology Review, 16,* 76–99. http://dx.doi.org/10.1177/1088868311418749

Dickinson, A. (1985). Actions and habits: The development of behavioural autonomy. *Philosophical Transactions of the Royal Society of London Series B, Biological Sciences, 308,* 67–78. http://dx.doi.org/10.1098/rstb.1985.0010

Duckworth, A. L., & Carlson, S. M. (2013). Self-regulation and school success. In B. W. Sokol, F. M. E. Grouzet, & U. Müller (Eds.), *Self-regulation and autonomy: Social and developmental dimensions of human conduct* (pp. 208–230). New York, NY: Cambridge University Press. http://dx.doi.org/10.1017/CBO9781139152198.015

Duckworth, A. L., Gendler, T. S., & Gross, J. J. (2014). Self-control in school-age children. *Educational Psychologist, 49,* 199–217. http://dx.doi.org/10.1080/00461520.2014.926225

Duckworth, A. L., & Kern, M. L. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality, 45,* 259–268. http://dx.doi.org/10.1016/j.jrp.2011.02.004

Dynarski, S. M., Hemelt, S. W., & Hyman, J. M. (2013). The missing manual: Using national student clearinghouse data to track postsecondary outcomes *NBER Working Paper: National Bureau of Economic Research*.

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100,* 363–406. http://dx.doi.org/10.1037/0033-295X.100.3.363

Fujita, K. (2011). On conceptualizing self-control as more than the effortful inhibition of impulses. *Personality and Social Psychology Review, 15,* 352–366. http://dx.doi.org/10.1177/1088868311411165

Galla, B. M., Plummer, B. D., White, R. E., Meketon, D., D'Mello, S. K., & Duckworth, A. L. (2014). The Academic Diligence Task (ADT): Assessing individual differences in effort on tedious but important schoolwork. *Contemporary Educational Psychology, 39,* 314–325. http://dx.doi.org/10.1016/j.cedpsych.2014.08.001

Gardner, B., Abraham, C., Lally, P., & de Bruijn, G.-J. (2012). Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the Self-Report Habit Index. *The International Journal of Behavioral Nutrition and Physical Activity, 9,* 102. http://dx.doi.org/10.1186/1479-5868-9-102

Glass, D. C., & Singer, J. E. (1972). *Urban stress: Experiments on noise and social stressors*. New York, NY: Academic Press.

Gollwitzer, P. M. (1990). *Action phases and mind-sets*. New York, NY: Guilford Press.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54,* 493–503. http://dx.doi.org/10.1037/0003-066X.54.7.493

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2,* 271–299. http://dx.doi.org/10.1037/1089-2680.2.3.271

Grund, A., Brassler, N. K., & Fries, S. (2014). Torn between study and leisure: How motivational conflicts relate to students' academic and social adaptation. *Journal of Educational Psychology, 106,* 242–257. http://dx.doi.org/10.1037/a0034400

Gunaratana, B. H. (1990). *Mindfulness in plain English*. High View, WV: Bhavana Society.

Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. D. (2010). Ego depletion and the strength model of self-control: A meta-analysis. *Psychological Bulletin, 136,* 495–525. http://dx.doi.org/10.1037/a0019486

Hall, P. A., & Fong, G. T. (2007). Temporal self-regulation theory: A model for individual health behavior. *Health Psychology Review, 1,* 6–52. http://dx.doi.org/10.1080/17437190701492437

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: An experience sampling study of desire, conflict, and self-control. *Journal of Personality and Social Psychology, 102,* 1318–1335. http://dx.doi.org/10.1037/a0026545

Imhoff, R., Schmidt, A. F., & Gerstenberg, F. (2013). Exploring the interplay of trait self-control and ego depletion: Empirical evidence for ironic effects. *European Journal of Personality*. Advance online publication.

James, W. (1890). *The principles of psychology* (Vol. I). New York: Henry Holt and Company.

James, W. (1899). *Talks to teachers on psychology and to students on some of life's ideals*. New York, NY: Holt and Company. http://dx.doi.org/10.1037/10814-000

Ji, M. F., & Wood, W. (2007). Purchase and consumption habits: Not necessarily what you intend. *Journal of Consumer Psychology, 17,* 261–276. http://dx.doi.org/10.1016/S1057-7408(07)70037-2

Johnston, L., Bulik, C. M., & Anstiss, V. (1999). Suppressing thoughts about chocolate. *International Journal of Eating Disorders, 26,* 21–27. http://dx.doi.org/10.1002/(SICI)1098-108X(199907)26:1<21::AID-EAT3>3.0.CO;2-7

Kaufman, A. S., & Kaufman, N. L. (1990). *Kaufman Brief Intelligence Test (KBIT)*. Circle Pines, MN: American Guidance Service.

Kellogg, R. T. (1994). *The psychology of writing*. New York, NY: Oxford University Press.

Kilian, B., Hofer, M., Fries, S., & Kuhnle, C. (2010). The conflict between on-task and off-task actions in the classroom and its consequences for motivation and achievement. *European Journal of Psychology of Education, 25,* 67–85. http://dx.doi.org/10.1007/s10212-009-0007-8

Kruglanski, A. W. (1996). *Goals as knowledge structures*. New York, NY: Guilford Press.

Lally, P., & Gardner, B. (2013). Promoting habit formation. *Health Psychology Review, 7,* S137–S158.

Lally, P., Van Jaarsveld, C. H., Potts, H. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology, 40,* 998–1009. http://dx.doi.org/10.1002/ejsp.674

Mann, T., de Ridder, D., & Fujita, K. (2013). Self-regulation of health behavior: Social psychological approaches to goal setting and goal striving. *Health Psychology, 32,* 487–498. http://dx.doi.org/10.1037/a0028533

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., . . . Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences of the United States of America, 108,* 2693–2698.

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126,* 247–259. http://dx.doi.org/10.1037/0033-2909.126.2.247

Neal, D. T., Wood, W., & Drolet, A. (2013). How do people adhere to goals when willpower is low? The profits (and pitfalls) of strong habits. *Journal of Personality and Social Psychology, 104,* 959–975. http://dx.doi.org/10.1037/a0032626

Neal, D. T., Wood, W., & Quinn, J. M. (2006). Habits—A repeat performance. *Current Directions in Psychological Science, 15,* 198–202. http://dx.doi.org/10.1111/j.1467-8721.2006.00435.x

Neal, D. T., Wood, W., Wu, M., & Kurlander, D. (2011). The pull of the past: When do habits persist despite conflict with motives? *Personality and Social Psychology Bulletin, 37,* 1428–1437. http://dx.doi.org/10.1177/0146167211419863

Oaten, M., & Cheng, K. (2005). Academic examination stress impairs self-control. *Journal of Social and Clinical Psychology, 24,* 254–279. http://dx.doi.org/10.1521/jscp.24.2.254.62276

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin, 124,* 54–74. http://dx.doi.org/10.1037/0033-2909.124.1.54

Paltrow, G. (2013, July 29). The knowledge: Gwyneth Paltrow on how to create a lean body shape. The Telegraph. Retrieved from http://fashion.telegraph.co.uk/news-features/TMG10204044/The-Knowledge-Gwyneth-Paltrow-on-how-to-create-a-lean-body-shape.html

Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful attention prevents mindless impulses. *Social Psychological & Personality Science, 3,* 291–299. http://dx.doi.org/10.1177/1948550611419031

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891. http://dx.doi.org/10.3758/BRM.40.3.879

Ryu, M. (2012). *The education gap: Understanding African American and Hispanic attainment disparities in higher education*. Washington, DC: American Council on Education.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147–177. http://dx.doi.org/10.1037/1082-989X.7.2.147

Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85,* 33–46. http://dx.doi.org/10.1037/0022-3514.85.1.33

Schoenecker, C., & Reeves, R. (2008). The National Student Clearinghouse: The largest current student tracking database. *New Directions for Community Colleges, 2008,* 47–57. http://dx.doi.org/10.1002/cc.335

Schroder, K. E. E., Ollis, C. L., & Davies, S. (2013). Habitual self-control: A brief measure of persistent goal pursuit. *European Journal of Personality, 27,* 82–95. http://dx.doi.org/10.1002/per.1891

Schwabe, L., & Wolf, O. T. (2009). Stress prompts habit behavior in humans. *The Journal of Neuroscience, 29,* 7191–7198. http://dx.doi.org/10.1523/JNEUROSCI.0979-09.2009

Sharma, L., Markon, K. E., & Clark, L. A. (2014). Toward a theory of distinct types of "impulsive" behaviors: A meta-analysis of self-report and behavioral measures. *Psychological Bulletin, 140,* 374–408. http://dx.doi.org/10.1037/a0034418

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72,* 271–324. http://dx.doi.org/10.1111/j.0022-3506.2004.00263.x

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology, 80,* 53–67. http://dx.doi.org/10.1037/0022-3514.80.1.53

Trautwein, U., Ludtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology, 98,* 438–456. http://dx.doi.org/10.1037/0022-0663.98.2.438

Tsukayama, E., Duckworth, A. L., & Kim, B. (2013). Domain-specific impulsivity in school-age children. *Developmental Science, 16,* 879–893.

Verplanken, B. (2010). Habit: From overt action to mental events. In C. R. Agnew, D. E. Carlston, W. G. Graziano, & J. R. Kelly (Eds.), *Then a miracle occurs: Focusing on behaviour in social psychology theory and research* (pp. 68–88). New York, NY: Oxford University Press.

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology, 33,* 1313–1330. http://dx.doi.org/10.1111/j.1559-1816.2003.tb01951.x

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self-control: A limited-resource account of decision making, self-regulation, and active initiative. *Journal of Personality and Social Psychology, 94,* 883–898. http://dx.doi.org/10.1037/0022-3514.94.5.883

Wood, W., & Neal, D. T. (2007). A new look at habits and the habit-goal interface. *Psychological Review, 114,* 843–863. http://dx.doi.org/10.1037/0033-295X.114.4.843

Wood, W., & Neal, D. T. (2009). The habitual consumer. *Journal of Consumer Psychology, 19,* 579–592. http://dx.doi.org/10.1016/j.jcps.2009.08.003

Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology, 83,* 1281–1297. http://dx.doi.org/10.1037/0022-3514.83.6.1281

Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology, 88,* 918–933. http://dx.doi.org/10.1037/0022-3514.88.6.918

Yin, H. H., & Knowlton, B. J. (2006). The role of the basal ganglia in habit formation. *Nature Reviews Neuroscience, 7,* 464–476. http://dx.doi.org/10.1038/nrn1919

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