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The Steps That Can Take Us Miles: Examining the Short-Term Dynamics of Long-Term Daily Goal Pursuit

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Cybernetic models suggest that to achieve one's long-term goals, one must create specific plans, enact these plan, monitor progress toward the goal, and resist temptations. Although many studies have examined these proposals in laboratory settings, few studies have examined such processes in daily life. This was the explicit purpose of the current investigation. Participants identified 4 long-term goals during an orientation session. They then completed a diary protocol in which they reported on these self-regulatory processes. The results were largely consistent with predictions. Of the 20 hypotheses examined, 17 were significant in the expected direction. For example, testing led to the initiation of long-term goal operations, which in turn led to goal progress. Likewise, temptations led to self-control operations, which in turn led to the successful resistance of temptations. The investigation thus suggests that cybernetic principles have broad relevance to understanding goal pursuit in daily life.

Keywords: long-term goals, self-regulation, self-control, daily life, cybernetic models

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"A journey of a thousand miles begins with a single step"
—Chinese philosopher, Lao-Tzu

On New Years' Day, a college student reflects on her sedentary lifestyle and decides to make a change. She will improve her physical health. How can she achieve this goal? The answer is far from simple. She cannot achieve this goal in a day or a week. Instead, she must continually strive for it over long periods of time. Although this may make her goal seem very far away, the above quote from Lao-Tzu illustrates that the only way she can achieve it is one step at a time. This is true of virtually any long-term goal. The goals of college graduation, career success, or a satisfying romantic relationship all involve a long series of very small steps.

The purpose of this study is to examine these short-term steps underlying long-term goal pursuit. It is important to note that we examined these processes in participants' daily lives themselves. Although there is an abundance of laboratory research, self-regulatory processes have seldom been examined in daily life (see Hofmann, Baumeister, Forster, & Vohs, 2012a, for a discussion). Thus, we know very little about how people pursue goals in daily life. Beyond this, long-term goal pursuit cannot be fully understood via brief laboratory experiments (e.g., lasting an hour). To understand long-term processes, researchers must repeatedly assess goal pursuit over time.

When we set out to conduct this study, it quickly became apparent that no single theory had fully incorporated the relevant self-regulatory processes. As such, we sought to integrate insights from several models ourselves. Although we cannot claim the resulting model is fully exhaustive, it is arguably more inclusive than past models. It specifically integrates proposals from cybernetic theories (Austin & Vancouver, 1996; Carver & Scheier, 2012; Inzlicht, LeGault, & Teper, 2014; Miller, Galanter, & Pribram, 1960; Powers, 1973) with theories of planning (e.g., Gollwitzer, 2012; Locke & Latham, 1990), and self-control (Fishbach & Trope, 2008; Fujita, 2011; Hofmann et al., 2012a). The resulting model suggests a person must develop a plan, implement that plan, assess their progress, and resist temptations to achieve a long-term goal.

We then simultaneously tested how these different processes contribute to goal pursuit in daily life. To our knowledge, no prior study has examined so many different self-regulatory processes simultaneously. We believe that this endeavor should have important implications for many areas of psychology, as it applies basic theory and research from cognitive (Miller et al., 1960; Powers, 1973) and social (Carver & Scheier, 2012) psychology to understand how people pursue long-term goals relevant to many applied areas, including health, educational, and industrial psychology.

Cybernetic Feedback Loop

Self-regulation is typically defined as those processes that allow a person to purposefully move toward a desired end-state or goal (e.g., Carver & Scheier, 2012; Fujita, 2011). Cybernetic theories (Austin & Vancouver, 1996; Carver & Scheier, 2012; Hyland, 1988; Miller et al., 1960; Powers, 1973) suggest that human goal self-regulation can be understood in terms of the same processes underlying simple cybernetic devices. Consider the thermostat, a simple cybernetic device that has the goal of maintaining a specified room temperature. To achieve this goal, a *test* process first compares the thermostat's current status (i.e., the current temper-

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ature) to its desired status (i.e., the user-specified temperature). If a discrepancy is noted (e.g., the room is colder than desired), this initiates *operations* designed to reduce it (e.g., the furnace is activated). These operations alter its current status (i.e., raise the room temperature), resulting in a feedback loop which can continue until the desired state is achieved.

Figure 1 (upper panel) shows how a basic cybernetic feedback loop can be used to move a person toward their goal. Our health-motivated student must first test for discrepancies between her current and desired health status. When she notices that she is gaining weight, eating poorly, and rarely exercising, she becomes anxious about how this will affect her future health. This motivates her to initiate jogging operations to improve her health. As a result, her health status is improved. The test and operate processes are reciprocally connected, forming a feedback loop that can maintain goal-related behaviors until the goal is achieved.

Classically, cybernetic models have emphasized the role of conscious awareness and effort. For example, states of self-consciousness encourage test processes (Carver & Scheier, 2012). Furthermore, the persistent effort needed to obtain long-term goals is thought to rely on limited resources (e.g., Baumeister, Vohs, & Tice, 2007; Kurzban, Duckworth, Kable, & Myers, 2013). In the current study, we followed this classic emphasis. Nonetheless, it should be briefly noted that testing can sometimes proceed unconsciously (e.g., Nieuwenhuis, Ridderinkhof, Blom, Band, & Kok, 2001) and well-practiced habits can further goal pursuit effortlessly (Wood & Neal, 2007).

Self-Control and Resisting Temptations

Although the adoption of cybernetic principles was invaluable to self-regulatory theorizing, there are nonetheless important differences between humans and thermostats. Whereas a thermostat has only one goal (i.e., to maintain a specified room temperature), humans pursue multiple goals. Thus, these goals sometimes come into conflict with one another. If our health- motivated student sees that her favorite TV show is coming on, she may be tempted to skip her planned workout. Following the lead of others (e.g., Fujita, 2011; Hofmann, Schmeichel, & Baddeley, 2012b), we use the term *self-control* to refer to those processes involved in resisting a temptation that conflicts with a long-term goal. Self-control is thus distinguished from the broader concept of *self-regulation,* which refers more globally to all processes involved in purposefully moving toward a desired end-state.

Recently, Hofmann et al. (2012a) developed a model of self-control in daily life (depicted in Figure 1, lower panel), which we build on here. Desires are elicited when one directly encounters an affect-laden stimulus. When our health-motivated student sees her favorite TV show coming on, she feels an urge to watch it rather than exercise. It would be so much easier than jogging. Sometimes, desires do not conflict with other goals and are thus frequently enacted. For our health-motivated student, though, this desire does conflict with her health goal. Although she is filled with the desire to watch her favorite show, she also wants to improve her health. She feels torn; pulled in two directions at once. Thus, this desire is deemed a problematic temptation. Hofmann and colleagues suggested that the detection of such conflicts initiates self-control operations to resist the temptation (cf. Botvinick, Braver, Barch, Carter, & Cohen, 2001; Inzlicht et al., 2014). These self-control attempts can of course be successful or not, resulting in either the enactment of the temptation or its successful resistance. Consistent with this model, Hofmann et al. found that temptations predicted self-control attempts in daily life, which in turn predicts successful resistance.

The Integrated Cybernetic Model

In Figure 2, we present a model that integrates insights from the models reviewed above. According to this integrated cybernetic model, test and operate processes can be harnessed to pursue different goals. In the upper left corner, these processes are harnessed to pursue a long-term goal. Our health-motivated student first tests her weight and notices it is greater than desired (path 1a). This creates anxiety and motivates jogging operations (path 1b), ultimately resulting in an improved health status (path 1c). In the lower left corner, these processes are instead harnessed to satisfy a momentary temptation. An ad for her favorite TV shows leads her to test and notice the absence of the desired state (i.e., watching her favorite TV show; path 2a). This could lead her to initiate operations to fulfill this temptation—that is, settling in to watch her show (path 2b). If she does so, this will undermine her health goal (path 2c).

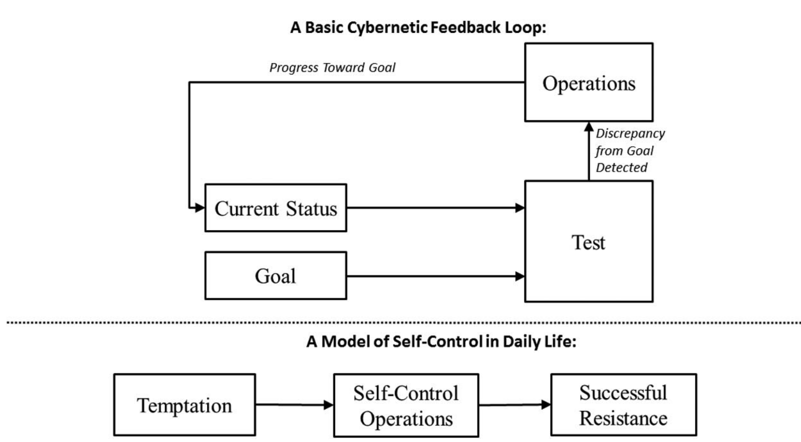

Figure 1. Depiction of component models of self-regulation and self-control.

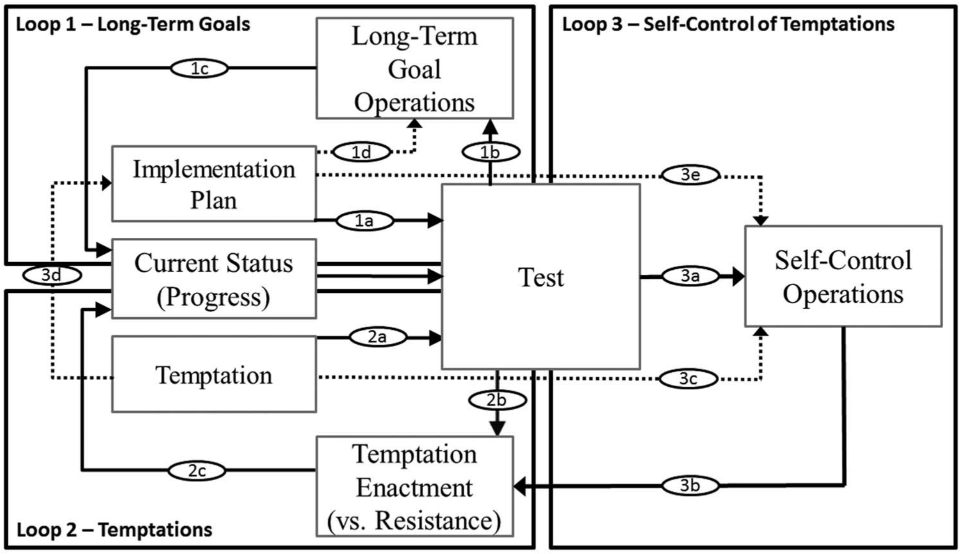

Figure 2. A visual depiction of the integrated cybernetic model. Solid lines form the core pathways constituting each feedback loop. Dotted lines depict additional (automatic and proactive) pathways.

Building on Hofmann et al.'s (2012a) model, we propose that self-control represents a third feedback loop, which inhibits temptations in support of long-term goals. This is depicted in the right side of Figure 2. When our health-motivated student detects the conflict between her health goal and her desire to watch TV, self-control operations can be initiated (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Inzlicht et al., 2014; path 3a). If successful, these operations inhibit the temptation to watch her favorite show (path 3b).

It is important to clarify several implications of this model. First, it suggests that temptations are external stimuli that feed into test processes. This can result in two divergent effects. Loop 2 can be triggered, supporting the enactment of the temptation. If our student notices the discrepancy between her immediate desire to watch her show and her current status, this can initiate temptation-supporting operations (i.e., settling into watch her show). However, Loop 3 can also be triggered, supporting self-control. If she notices the conflict between her TV-watching desire and her long-term health goal, self-control operations can instead be initiated to inhibit this temptation.

Second, this model also makes a distinction between long-term goal operations and self-control operations (Fujita, 2011; Hofmann et al., 2012b). Because this distinction has not always been made, it is important to clarify it. Long-term goal operations refer to actions that directly advance one toward a goal. By contrast, self-control operations refer to the inhibition of actions which would undermine the same goal. Jogging represents a long-term goal operation for our health-motivated student because it directly improves her physical health. By contrast, resisting the temptation to watch TV represents a self-control operation. This distinction is important because long-term goal operations can many times occur in the absence of self-control operations. If our health-motivated student experienced no temptations whatsoever as she heads out for a jog, self-control operations would not be needed at all.

Planning How to Achieve Your Goals

Beyond the need to resist temptations, human goal pursuit differs from simple cybernetic devices in other ways. Thermostats have the means to achieve their goals directly built into their design (e.g., activating a furnace). This is rarely the case for human goal pursuit. To improve her physical health, our student could cut out unhealthy snacks, reduce high-carbohydrate foods, eat more vegetables, jog, swim, left weights, use a pogo stick, take up Turkish belly dancing, and so forth.

As such, we humans must create plans to achieve our long-term goals (Gollwitzer, 2012; Inzlicht et al., 2014; Locke & Latham, 1990). Plans are often needed to specify the operations to be executed. Beyond this, they facilitate test processes. An inherent problem with temporally distant goals is that direct signs of goal progress are slow to appear and difficult to detect (Locke & Latham, 1990). Our health-motivated student may step on a scale multiple times a day, but actual weight reductions will appear only slowly. Implementation plans thus provide a more specific behavior that can be more easily monitored. Specific plans (e.g., "Each afternoon after my last class, I will run five miles.") are easier to assess then either ambiguous plans (e.g., "I will try to jog as often as I can.") or direct signs of goal progress (e.g., weight reductions). As such, Figure 2 depicts implementation plans as a direct input into test processes (path 1a). By monitoring the successful enactment of her jogging plans, our health-motivated student is effectively monitoring progress toward her long-term goal.

Gollwitzer (2012) and colleagues have also suggested that implementation intentions can further goal pursuit by automatically activating goal-relevant behaviors. Implementation intentions are if-then plans which indicate when and where a specific goal-relevant behavior should be executed (e.g., After my last class each day, I will jog five miles). They have been found to improve goal achievement (Gollwitzer & Sheeran, 2006) by heightening vigilance for the specified *if* event (e.g., noticing when one's afternoon class is over) and by automatically activating the *then* response (e.g., going for a job; Webb & Sheeran, 2007). As such, a path is included in Figure 2 which allows implementation plans to circumvent conscious test processes and automatically activate long-term goal operations (path 1d). Because plans, which are only moderately specified (e.g., I will go jogging some days in the afternoon), should not have such automatic effects, the consciously mediated pathway is maintained (i.e., paths 1a & 1b).

Automatically Initiated and Proactive Self-Control

Although research has traditionally focused on self-control attempts that are intentionally initiated in reaction to temptations, even a brief inspection of the literature indicates that self-control can be initiated in a more automatic or proactive manner. Studies indicate that the repeated exertion of self-control in the same context can eventually lead to its automation (e.g., Houben & Jansen, 2015; Verbruggen, McLaren, & Chambers, 2014). If our health-motivated student always sees an ad for her favorite show as she is heading out for a jog, the mere sight of this ad can initiate self-control operations. Figure 2 thus depicts temptations as a direct and automatic initiator of self-control (path 3c).

In their counteractive control theory, Fishbach and Trope (2008) also proposed that self-control can be initiated proactively (cf. Gollwitzer, Parks-Stamm, Jaudas, & Sheeren, 2008; Fujita, 2011). When a person anticipates encountering a temptation, he or she can create plans to resist it. This can be done by avoiding the tempting stimulus altogether (Ent, Baumeister, & Tice, 2015; Hofmann et al., 2012a; Milyavskaya, Inzlicht, Hope, & Koestner, 2015), precommitment (e.g., Locey & Rachlin, 2012), self-imposition of rewards or punishments (Trope & Fishbach, 2000), or creating implementation intentions for how a temptation can be resisted (Gollwitzer et al., 2008). For example, our health-motivated student can make plans to record her favorite show and watch it at another time. Figure 2 thus includes a path from temptations to implementation planning (path 3d) and from planning to self-control operations (path 3e).

Examining Self-Regulatory Processes in Daily Life

In summary, the current study examined whether the integrated cybernetic model depicted in Figure 2 validly describes long-term goal pursuit in daily life. Table 1 summarizes the hypotheses derived from it. We grouped them into major subdivisions of the model (i.e., long-term goal pursuit, reactive self-control, & proactive self-control). Path numbers are provided for each hypothesis for easy comparison with Figure 1. It should be noted that because our focus was on long-term goal pursuit, we did not examine every prediction relevant to temptation enactment (i.e., loop 2 of Figure 2).

Because past theories have not always distinguished between long-term goal operations (i.e., "Operate" in Table 1) and self-control operations (i.e., "Self-Control" in Table 1), it is worth highlighting predictions that provide support for this distinction. First, we hypothesized that these two variables would exhibit no direct relationship with each other after other self-regulatory processes had been controlled. Beyond this, we expected these two variables to exhibit differential relationships with temptations and goal progress. Temptations were hypothesized to directly predict self-control (path 3c) but not long-term goal operations. This is because self-control operations are involved in resisting temptations, but long-term goal operations are not. By contrast, long-term goal operations were hypothesized to directly predict goal progress (path 1c), but self-control was not. This is because long-term goal operations are seen as directly involved in forwarding goal pursuit, whereas self-control is only indirectly involved. Thus, self-control operations were hypothesized to contribute to success only at the subgoal of successfully resisting temptations (path 3b).

Table 1
Summary of the Hypothesized Direct Effects

Theoretical subdivision	Predictor	Outcome	Pathway
Long-term goal pursuit	Planning	Test	1a
	Test	Operate	1b
	Operate	Goal progress	1c
	Planning	Operate	1d
Reactive self-control	Temptation	Test	2a
	Test	Self-control	3a
	Self-control	Successful resistance	3b
	Temptation	Self-control	3c
	Successful Resistance	Goal progress	2c
Proactive self-control	Temptation	Planning	3d
	Planning	Self-control	3e

Mediational Hypotheses

In addition to hypothesized direct effects, we also examined several mediational hypotheses (summarized in Table 2). As before, we grouped these into major subdivisions of the integrated cybernetic model. Many of these predictions require little elaboration beyond the discussion above (e.g., testing's effect on goal progress should be mediated by operations). In two cases, a self-regulatory process is hypothesized to have both a direct and indirect effect on another process (i.e., planning > operate; temptation > self-control). This allows the relevant process to sometimes function automatically (i.e., to have a direct effect) and other times to function consciously (e.g., to have an indirect effect through testing). In the interests of simplicity, we did not test mediational pathways which included four or more variables.

The Current Investigation

To test these predictions, we conducted a diary study of long-term goal pursuit in daily life. During an initial orientation session, participants identified four important long-term goals they were working toward on most days of their life. They were then asked to complete a 7-day diary protocol, in which they repeatedly answered questions about their pursuit of each goal. These questions specifically focused on recent plans, tests, operations, temptations, self-control attempts, successful resistance, and goal progress.

Method

Participants and Sample Size

Fifty-eight undergraduate psychology students (34 female, 24 male; *M* age = 19.7) from the University of Wyoming completed

Table 2
Summary of Mediational Hypotheses

Theoretical subdivision	Predictor	Mediator	Outcome
Long-term goal pursuit	Planning	Test (1a)	Operate (1b)+
	Test	Operate (1b)	Progress (1c)
	Planning	Operate (1d)	Progress (1c)
Reactive self-control	Temptation	Test (2a)	Self-Control (3a)+
	Test	Self-Control (3a)	Resistance (3b)
	Temptation	Self-Control (3c)	Resistance (3b)
	Self-control	Resistance (3b)	Progress (2c)
Proactive self-control	Temptation	Planning (3d)	Self-control (3e)+
	Planning	Self-control (3e)	Resistance (3b)

Note. + indicates that the direct pathway from predictor to outcome was hypothesized to be significant after controlling for mediators. Pathways from Figure 2 are provided in parentheses.

both the orientation session and the diary protocol in exchange for partial course credit. These participants provided a total of 670 usable diary reports on a total of 231 goals, resulting in a grand total of 2,658 observations for analyses. Thus, the statistical power to test predictions was quite strong. Twelve additional participants (5 female, 6 male, 1 nonreport; M age = 19.9) completed the orientation session but failed to provide any usable diary reports. As such, their data could not be included in analyses.

Procedure and Measures

Orientation session. Participants arrived at the laboratory and provided informed consent. They then completed a brief, computerized questionnaire that instructed them to

> Please think of 4 goals that you are currently trying to achieve. These goals can be about anything you'd like. However, they should be long-term goals that you will be working on many or most days through the end of the semester or further.

They then provided a brief written description of each goal. The most common categories were academic goals (41%), health/athletic goals (18%), social goals (12%), and job/career-oriented goals (9%). Participants also answered several questions about each goal and their personality. These latter measures are reported in a separate article.

The experimenter then provided instructions for the diary protocol. Participants were asked to complete a survey twice a day on seven different days (see Fulford, Johnson, Llabre, & Carver, 2010, for a similar procedure). They were given 14 days to do so. The web address for the survey was e-mailed to participants, so they could access it from any internet-connected computer. Participants were asked to complete the questionnaires at the middle and end of their day, with these times tailored to each participant's naturally occurring sleep–wake cycle. Automated text messages were sent to each participant at these times, reminding them to complete the questionnaire and the four goals they selected. To allow us to track goal progress over the course of the day, participants were told they needed to complete both the midday and end-of-day questionnaire on the same day to receive credit.

Diary protocol. Once participants accessed the online questionnaire, they were asked to type in a brief description of their first goal. Next, they answered several questions about their pursuit of this goal during either the first half (midday report) or second half (end-of-day report) of their day. Two questions asked about implementation planning (i.e., "Did you think of specific actions for how to achieve this goal?" & "Did you plan when and where you should perform specific actions to achieve this goal?"; items strongly related, $b = .82$, $p < .0001$). Two questions asked about test processes (i.e., "I evaluated how well I was progressing on this goal" & "I evaluated how well my current plan for reaching this goal was working"; items strongly related, $b = .88$, $p < .0001$). Two questions asked about operate processes ("I took action to reach this goal" & "I worked hard to reach this goal"; items strongly related, $b = .81$, $p < .0001$); and one question asked about goal progress (i.e., "How much progress did you make toward this goal?").

They were then asked one question each concerning temptations ("Were you tempted to do things which would interfere with this goal?"), self-control attempts ("Did you try to resist temptations that would interfere with achieving this goal?"), and successful resistance ("Did you successfully resist temptations that would interfere with achieving this goal?"). These latter questions were generally modeled after Hofmann et al.'s (2012a) items but were modified to refer to a long-term goal. Because our focus was on long-term goals, we did not include questions about desires which did not conflict with goals (as Hofmann et al., 2012a, did). Participants answered all questions on a 1 (*not at all*) to 9 (*definitely*) response scale. This procedure was repeated for each of the participant's four goals. They also answered questions about more global aspects of the time period in question (e.g., mood). These measures are reported in a separate article.

Data reduction. The response rate was quite high (82.7%; M = 11.58 out of the 14 requested surveys). Before beginning analyses, the reports were closely screened to ensure high-quality data. Any report containing a high number of response repetitions (i.e., 85% or greater) was deleted, resulting in the loss of 40 reports. The typed descriptions of each goal were also closely inspected to ensure that separate reports on the same goal were appropriately clustered together in analyses.

Results

Analytic Strategy

Overview. Multilevel modeling (Nezlek, 2012; Raudenbush & Bryk, 2002; Snijders & Bosker, 1999) was used to test all predictions. This analytic technique is ideally suited for diary studies, in that it can handle nested data structures and randomly missing data. All analyses were conducted in SAS Proc Mixed (Bell, Ene, Smiley, & Schoeneberger, 2013; Bell, Smiles, Ene, & Blue, 2014; Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006; Singer, 1998).

Nested structure. The current dataset possessed a rather complex nested structure. Any observation (e.g., goal progress reported by Participant 5 on Tuesday evening for her jogging goal) is simultaneously nested within a timepoint (i.e., Tuesday evening) and a goal (i.e., jogging), which were in turn nested within a participant (i.e., Participant 5). Because research indicates that variables at each level of analysis (e.g., Participant level: personality traits; Goal level: commitment toward individual goals; State level: mood, ego depletion) can affect goal pursuit, it was necessary to model all three clusterings. We thus created a three-level multilevel model, with a cross-classification at Level 2. Observations were modeled at Level 1. Both goals and timepoints were modeled at Level 2, and participants were modeled at Level 3. For each variable, the means, standard deviations, and interclass correlations (ICCs) are reported in the online supplementary materials, supplemental Table 1. All variables exhibited highly significant variation at all three clusterings, all $ps < .0001$, establishing that it was indeed necessary to model all three clusterings (Luo & Kwok, 2009; Moerbeek, 2004).

Examining the hypothesized direct effects. To examine the hypothesized direct effects, we conducted analyses in which six of the measured variables were simultaneously entered as predictors of the remaining, seventh variable. Because there were no hypothesized predictors of temptation, no analysis was conducted with this variable as the outcome. We considered these unique effects to be the main test of the hypothesized direct effects, as they control for the possible confounding influences of other self-regulatory processes. However, it's possible that the results of these analyses could yield *suppression* effects; that is, effects which are only significant once other variables are controlled for. To guard against this possibility, we also examined zero-order relationships. To estimate zero-order effects, each relevant predictor variable was entered one at a time as a predictor of each outcome variable. Level 1 slopes were fixed across all clusterings (i.e., timepoints, goals, participants) in all analyses to increase the likelihood of model convergence.

Centering-related concerns. All predictor variables were grand-mean centered in all analyses. Please note that it was impossible to center predictors around cluster means in the current dataset (as is often recommended; e.g., Enders & Tofighi, 2007), as there were multiple clusterings (i.e., goals, timepoints, participants). To appropriately separate effects at the different levels of analysis, we instead added the mean value of each predictor within each cluster as a control variable (Enders & Tofighi, 2007; Kreft, de Leeuw, & Aiken, 1995; Raudenbush & Bryk, 2002). For example, to examine the effect of testing on operating, the observed value of testing (i.e., at time t, for goal g, and for participant p) was entered as the main, substantive predictor of observed operating (i.e., at the same timepoint t, goal g, for participant p). Three other variables were also added as control variables, which represented timepoint-level testing (i.e., testing averaged across all goals at time t for participant p), goal-level testing (i.e., testing averaged across all timepoints for goal g and participant p), and participant-level testing (i.e., testing averaged across all timepoints and goals for participant p). These cluster-mean effects were not of primary interest, but they are reported in the online supplementary Tables 2-4 for the interested reader.

Examining mediational hypotheses. To examine mediational hypotheses, we examined both the zero-order effect (i.e., between x and y) and the indirect effect (i.e., the effect of x on y through m). To ensure that indirect effects were not due to the confounding influence of other variables, we controlled for all other variables when calculating them. Statistical procedures for testing the indirect effect have advanced considerably in recent years, with most experts now recommending a bootstrapping procedure (e.g., Preacher, 2015). Unfortunately, we were unable to locate software that could conduct this bootstrapping analysis within a three-level model with cross-classifications at Level 2. As such, we used the more traditional Sobel (1982) test. Fortunately, the hypothesized indirect effects were either quite clearly significant or quite clearly nonsignificant. Thus, it is unlikely that alternative tests would yield different results.

Statistical significance. To guard against the inflation of study-wide alpha, several steps were taken. First, we only considered a hypothesized direct effect significant if its zero-order and unique effects were both significant in the same, predicted direction. This practice guards against the spurious reporting of either suppressor or confounded effects as true, direct effects. Likewise, we only considered a mediated effect significant if the relevant zero-order and indirect effects were both significant in the predicted direction. Second, we used a Bonferroni-adjusted alpha level for all analyses. Because we examined 6 different outcome variables, we adopted an alpha of .0083. Bonferroni-adjusted 99.17% confidence intervals (CIs) are thus provided for the unstandardized coefficients testing the hypothesized direct effects. If these CIs exclude zero, they can be considered statistically significant. More traditional p values are provided for the Sobel test of the indirect effect.

Effect-size index. Because the statistical power was quite strong (i.e., up to 2,658 observations, depending on missing data), one could argue that even these strict standards of significance are inappropriate for interpreting effects. It is possible for a predictor variable to explain a relatively trivial amount of the variance in the outcome but nonetheless achieve statistical significance. As such, we also report Edwards, Muller, Wolfinger, Qaqish, and Schabenberger's (2008) semipartial R^2_β statistic for all direct effects. This statistic reflects the amount of variance in the outcome uniquely explained by each predictor. The development of effect size statistics for indirect, mediated effects is currently an active area of research. Although such statistics have been developed for traditional OLS regression (Preacher & Kelley, 2011) and for MLMs involving Level 2 predictor variables (Stapleton, Pituch, & Dion, 2015), we could locate no effect-size statistic for mediational MLMs involving Level 1 variables only. Thus, no such statistic could be reported.

Interpreting the effect-size index. R^2_β in MLM can be interpreted using the same conventions Cohen (1988) developed for traditional OLS regression: An R^2_β of .02 can be considered small. An R^2_β of .13 can be considered medium, and an R^2_β of .26 can be considered large. These cutoffs should be regarded as the arbitrary conventions they are. Although they serve as benchmarks that facilitate interpretation, there is nothing magical about each number. When an outcome variable is especially important, some have argued that effects that would otherwise be considered trivial should be considered important (e.g., Prentice & Miller, 1992). Although Edwards et al.'s (2008) R^2_β statistic overcomes many of the problems associated with prior variance-explained statistics for MLM (see Nezlek, 2012 for a discussion), it still suffers from some issues. For example, R^2_β can actually decrease when a strongly significant predictor is added to the model under some conditions. Issues such as these led Kreft, de Leuw, and Aiken (1995, p. 119) to conclude that, "In general, we suggest not setting too much store by the calculation of R^2_β [Level 2 variance] or R^2_W [Level 1 variance]". Thus, although R^2_β provides useful information, caution should be used when interpreting it.

Overview of Results

A complete presentation of all MLM analyses conducted is provided in Table 3. For ease of interpretation, tests of the hypothesized direct effects are more simply summarized in Table 4, and tests of the hypothesized mediational effects are presented in Table 5. To guide the reader through each hypothesis, we review the relevant tests in a theoretically based order. For readers who may have skipped the detailed analytic strategy section above, a direct effect is considered significant if the Bonferroni-adjusted 99.17% CIs for both the zero-order and unique effect exclude zero in the predicted direction. Effect sizes are evaluated according to Cohen's (1988) conventions (i.e., small = .02; medium = .13; large = .26), though caution is urged in interpreting this effect-size index (see Nezlek, 2012). Mediational hypotheses are considered significant if both the relevant *x-y* zero-order effect and *x-m-y* indirect effect are significant in the predicted direction. Bonferroni-adjusted CIs are provided for the zero-order effect. More traditional *p* values are provided for the Sobel test of the indirect effect. These *p* values should only be considered significant if they are below the Bonferroni-adjusted alpha of .0083.

Basic Long-Term Goal Pursuit

Regarding basic long-term goal pursuit, we first hypothesized that planning would uniquely predict greater testing. This hypothesis was supported, as both the relevant zero-order effect [b = .528, CI (.480, .576), semipartial R^2_β = .32, a large effect] and unique effect [b = .284, CI (.227, .342), semipartial R^2_β = .088, a small effect] were significant and nontrivial in size.

Second, we hypothesized that testing would directly predict greater operating. This hypothesis was also supported. The rele-

Table 3
Results of All Multilevel Modelling Analyses

	Outcome: Planning				Testing			
Predictor	b	R^2_β	b'	$R^2_\beta{}'$	b	R^2_β	b'	$R^2_\beta{}'$
Temptation	**.19 [.14, .24]***	**.05 S**	**.07 [.03, .11]***	**.012**	**.16 [.12, .21]***	**.04 S**	**.06 [.02, .10]***	**.010**
Planning	—	—	—	—	**.53 [.48, .58]***	**.32 L**	**.28 [.23, .34]***	**.09 S**
Test	.61 [.55, .66]*	.32 L	.31 [.25, .37]*	.09 S	—	—	—	—
Operate	.53 [.48, .58]*	.34 L	.16 [.09, .23]*	.02 S	.51 [.47, .55]*	.36 L	.32 [.26, .39]*	.10 S
Self-control attempt	.31 [.26, .36]*	.13 M	.09 [.04, .14]*	.01	.23 [.19, .28]*	.09 S	.01 [−.03, .06]	<.001
Successful resistance	.34 [.29, .39]*	.16 M	.05 [.00, .10]*	.004	.28 [.23, .32]*	.12 S	.02 [−.03, .07]	.001
Goal progress	.55 [.50, .61]*	.31 L	.22 [.15, .29]*	.04 S	.45 [.39, .50]*	.23 M	.01 [−.05, .08]	<.001
	Operate				Self-control attempts			
Predictor	b	R^2_β	b'	$R^2_\beta{}'$	b	R^2_β	b'	$R^2_\beta{}'$
Temptation	.13 [.07, .18]*	.02	.00 [−.04, .03]	<.001	**.28 [.22, .34]***	**.08 S**	**.22 [.17, .27]***	**.07 S**
Planning	**.63 [.58, .69]***	**.34 L**	**.13 [.08, .19]***	**.02 S**	**.44 [.37, .51]***	**.13 M**	**.15 [.07, .23]***	**.013**
Test	**.70 [.64, .76]***	**.36 L**	**.30 [.24, .35]***	**.09 S**	**.38 [.31, .46]***	**.09 S**	**.02 [−.07, .11]**	**<.001**
Operate	—	—	—	—	.38 [.32, .44]*	.12 S	.03 [−.06, .12]	.001
Self-control attempt	.32 [.27, .37]*	.12 S	.01 [−.03, .06]	<.001	—	—	—	—
Successful resistance	.44 [.39, .50]*	.22 M	.10 [.06, .15]*	.02	.51 [.46, .57]*	.25 M	.42 [.36, .48]*	.16 M
Goal progress	.79 [.75, .84]*	.53 L	.53 [.48, .59]*	.27 L	.39 [.31, .46]*	.10 S	.02 [−.07, .11]	<.001
	Successful resistance				Goal progress			
Predictor	b	R^2_β	b'	$R^2_\beta{}'$	b	R^2_β	b'	$R^2_\beta{}'$
Temptation	.06 [.00, .12]*	.004	−.11 [−.16, −.06]*	.02	.09 [.04, .14]*	.01	−.02 [−.06, .02]	.001
Planning	.47 [.40, .53]*	.16 M	.08 [.00, .16]*	.004	.56 [.51, .61]*	.31 L	.18 [.13, .24]*	.04 S
Test	.44 [.37, .52]*	.12 S	.04 [−.04, .12]	.001	.52 [.46, .58]*	.23 M	.01 [−.05, .07]	<.001
Operate	.51 [.45, .56]*	.22 M	.19 [.11, .28]*	.02	**.67 [.63, .71]***	**.53 L**	**.52 [.46, .57]***	**.28 L**
Self-control attempt	**.49 [.44, .55]***	**.25 M**	**.38 [.33, .44]***	**.16 M**	.27 [.22, .32]*	.10 S	.01 [−.03, .05]	<.001
Successful resistance	—	—	—	—	**.39 [.35, .44]***	**.21 M**	**.09 [.05, .14]***	**.017**
Goal progress	.53 [.47, .60]*	.21 M	.18 [.10, .27]*	.02	—	—	—	—

Note. Boldface type indicates a hypothesized effect; * = statistically significant at Bonferroni-adjusted level; S = small effect size; M = medium effect size; L = large effect size; b = unstandardized coefficient for zero-order effect; b' = unstandardized coefficient for unique effect. Bonferroni-adjusted confidence intervals are presented in brackets. R^2_β indicates total variance explained by a predictor; whereas $R^2_\beta{}'$ indicates unique (semipartial) variance explained by a predictor after controlling for other self-regulatory processes.

Table 4
Tests of the Hypothesized Direct Effects

Theoretical subdivision	Predictor	Outcome	b	R^2_β	b'	$R^2_\beta{}'$
Long-term goal pursuit	Planning	Test	.53 [.48, .58]*	.32 L	.28 [.23, .34]*	.09 S
	Test	Operate	.70 [.64, .76]*	.36 L	.30 [.24, .35]*	.09 S
	Operate	Goal progress	.67 [.63, .71]*	.53 L	.52 [.46, .57]*	.28 L
	Planning	Operate	.63 [.58, .69]*	.34 L	.13 [.08, .19]*	.02 S
Reactive self-control	Temptation	Test	.16 [.12, .21]*	.04 S	.06 [.02, .10]*	.010
	Test	Self-control	.38 [.31, .46]*	.09 S	.02 [−.07, .11]	<.001
	Self-control	Successful resistance	.49 [.44, .55]*	.25 M	.38 [.33, .44]*	.16 M
	Temptation	Self-control	.28 [.22, .34]*	.08 S	.22 [.17, .27]*	.07 S
	Successful resistance	Goal progress	.39 [.35, .44]*	.21 M	.09 [.05, .14]*	.017
Proactive	Temptation	Planning	.19 [.14, .24]*	.05 S	.07 [.03, .11]*	.012
Self-control	Planning	Self-control	.44 [.37, .51]*	.13 M	.15 [.07, .23]*	.013

Note. * = statistically significant at Bonferroni-adjusted levels; S = small effect size; M = medium effect size; L = large effect size; b = unstandardized coefficient for zero-order effect; b' = unstandardized coefficient for unique effect. Bonferroni-adjusted confidence intervals are presented in brackets. R^2_β indicates total variance explained by a predictor, whereas $R^2_\beta{}'$ indicates unique (semipartial) variance explained by a predictor after controlling for other self-regulatory processes.

vant zero-order effect [$b = .700$, CI (.641, .759), semipartial $R^2_\beta = .356$, a large effect] and unique effect [$b = .296$, CI (.239, .353), semipartial $R^2_\beta = .094$, a small effect] were both significant and nontrivial in size.

Third, we hypothesized that operating would directly predict greater goal progress. Once again, the hypothesis was supported. The relevant zero-order effect [$b = .667$, CI (.628, 808), semipartial $R^2_\beta = .530$, a large effect] and the unique effect [$b = .517$, CI (.464, .570), semipartial $R^2_\beta = .275$, a large effect] were significant and large in size.

Fourth, we hypothesized that planning would uniquely predict greater operating. This hypothesis was also supported, as both the relevant zero-order effect [$b = .635$, CI (.579, .690), semipartial $R^2_\beta = .336$, a large effect] and unique effect [$b = .133$, CI (.076, .190), semipartial $R^2_\beta = .021$, a small effect] were significant and nontrivial in size.

Beyond direct effects, three mediational predictions were made regarding basic long-term goal pursuit. First, we predicted that the effect of planning on operating would be partially mediated by testing. This hypothesis was supported, as both the zero-order effect of planning on operating [$b = .635$, CI (.579, .690), semipartial $R^2_\beta = .336$, a large effect], and the relevant indirect effect were significant ($Z = 9.43$, $p < .0001$).

Table 5
Tests of the Mediational Hypotheses

Theoretical subdivision	Prediction (x-m-y)	x-y Effect (zero-order)	x-m-y (indirect)
Long term	Planning–test–operate	.63 [.58, .69]*	9.43*
Goal pursuit	Test–operate–progress	.52 [.46, .58]*	12.05*
	Planning–operate–progress	.56 [.51, .61]*	5.96*
Reactive	Temptation–test–self-control	.28 [.22, .34]*	0.60
Self-control	Test–self-control–resistance	.44 [.37, .52]*	0.61
	Self-control–resistance–progress	.27 [.22, .32]*	5.23*
	Temptation–self-control–resistance	.06 [.00, .12]*	9.67*
Proactive	Temptation–planning–self-control	.28 [.22, .34]*	3.32*
Self-control	Planning–self-control–resistance	.47 [.40, .53]*	4.66*

Note. Direct effects reflect unstandardized coefficients from the multilevel modeling analysis. Indirect effects represent Z values from the Sobel tests. * indicates a statistically significant effect at the Bonferroni-adjusted level of $p < .0083$.

Second, we hypothesized that the effect of testing on goal progress would be mediated by operating. This hypothesis was also supported, as the zero-order effect of testing on goal progress was significant [$b = .517$, CI (.458, .576), semipartial $R^2_\beta = .231$, a medium effect), as was the relevant indirect effect ($Z = 12.05$, $p < .0001$).

Finally, we hypothesized that the effect of planning on goal progress would be mediated by operating. Once again, the hypothesis was supported, as the direct effect of planning on progress was significant [$b = .559$, CI (.506, .611), semipartial $R^2_\beta = .309$, a large effect], as was the relevant indirect effect ($Z = 5.96$, $p < .0001$).

In summary, all hypothesized direct and indirect effects regarding basic long-term goal pursuit were supported. This suggests that long-term goal pursuit can be understood as a feedback loop in which planning increases testing, which increases operating, which leads to goal progress. Consistent with work on the automatic effects of implementation intentions, planning also directly increased operating.

The Reactive Self-Control of Temptations

We now move to hypotheses related to the reactive self-control of temptations. We first hypothesized that temptations would predict increased testing. This prediction received modest support. The relevant zero-order effect was significant and nontrivial in size [$b = .163$, CI (.116, .210), semipartial $R^2_\beta = .045$, a small effect]. The relevant unique effect was also significant [$b = .061$, CI (.022, .099), semipartial $R^2_\beta = .010$]. However, its effect size failed to meet the convention for a small effect size. Thus, one could potentially argue that this effect is not important enough to focus on. We return to this issue in the Discussion section, below.

Second, we hypothesized that testing would uniquely predict increased self-control operations. This hypothesis was not supported. Although the zero-order effect of testing on self-control was significant and nontrivial in size [$b = .385$, CI (.308, .461), semipartial $R^2_\beta = .09$, a small effect], the unique effect was not significant [$b = .02$, CI (−.067, .107), semipartial $R^2_\beta < .001$]. Furthermore, its effect size approached zero. Thus, testing did not directly predict self-control operations, but it may have indirectly contributed to self-control through other variables examined here.

Third, we hypothesized that self-control operations would uniquely predict successful resistance. This hypothesis was supported, as both the relevant zero-order effect [$b = .492$, CI (.439, 545), semipartial $R^2_\beta = .252$, a medium effect] and unique effect [$b = .384$, CI (.329, .440), semipartial $R^2_\beta = .159$, a medium effect] were significant and medium in size.

Fourth, we hypothesized that temptations would directly predict increase self-control operations. This hypothesis was supported, as both the relevant zero-order effect [$b = .282$, CI (.223, .341), semipartial $R^2_\beta = .083$, a small effect] and unique effect [$b = .222$, CI (.170, .273), semipartial $R^2_\beta = .068$, a small effect] were significant and nontrivial in size.

Finally, we hypothesized that successful resistance would directly predict goal progress. This hypothesis received modest support. The relevant zero-order effect was significant and medium in size [$b = .394$, CI (.346, 442), semipartial $R^2_\beta = .211$]. The unique effect was also statistically significant [$b = .394$ (.048, .138), semipartial $R^2_\beta = .017$] but narrowly missed the convention for a small effect.

In addition to direct effects, we also hypothesized four mediated effects pertaining to reactive self-control. However, two of these hypotheses were rendered untenable by the nonsignificant direct effect of testing on self-control. Formal examinations showed that the temptation–testing–self-control indirect effect was indeed nonsignificant ($Z = 0.60$, $p = .55$), as was the testing–self-control–success resistance indirect effect ($Z = 0.61$, $p = .54$).

We next hypothesized that the effect of temptations on successful resistance would be mediated by self-control. This hypothesis received support. The zero-order effect of temptations on successful resistance [$b = .064$, CI (.003, .123), semipartial $R^2_\beta = .004$) was significant but failed to reach the criterion for a small effect. However, a trivial effect size is not entirely unexpected from a theoretical point of view, given that temptations also trigger the countervailing desire to enact the temptation. More important, then, is the fact that the relevant indirect effect was highly significant ($Z = 9.67$, $p < .0001$).

Finally, we hypothesized that the effect of self-control operations on goal progress would be mediated by successful resistance. This hypothesis was fully supported, as both the zero-order effect of self-control on progress [$b = .273$, CI (.223, .322), semipartial $R^2_\beta = .105$, a small effect] and the relevant indirect effect ($Z = 5.23$, $p < .0001$) were significant.

The Proactive Control of Temptations

We next consider hypotheses related to the proactive control of temptations. In this regard, we first hypothesized that temptations would uniquely predict planning. This hypothesis received modest support. The relevant zero-order effect was statistically significant and nontrivial in size [$b = .190$, CI (.140, .240), semipartial $R^2_\beta = .053$, a small effect size]. The unique effect of temptations on planning was also statistically significant [$b = .07$, CI (.03, .110), semipartial $R^2_\beta = .012$]. However, it failed to reach the convention for a small effect size.

Second, we hypothesized that planning would uniquely predict greater self-control. This hypothesis also received modest support. The zero-order effect of planning on self-control operations was significant and nontrivial in size [$b = .438$, CI (.368, .508), semipartial $R^2_\beta = .134$, a medium effect size]. The unique effect of planning on self-control was also statistically significant [$b = .150$, CI (.068, .233), semipartial $R^2_\beta = .013$]. Once again, though, this effect failed to reach the convention for a small effect size.

Beyond these two direct effects, we hypothesized two mediated effects. First, we hypothesized that the effect of temptations on self-control operations would be partially mediated by planning. This hypothesis was supported, in that both the zero-order effect of temptations on self-control [$b = .282$, CI (.223, 341), semipartial $R^2_\beta = .083$, a small effect size] and the relevant indirect effect ($Z = 3.32$, $p = .0009$) were significant.

Finally, we hypothesized that self-control operations would mediate the effect of planning on successful resistance. This hypothesis was also support, as both the zero-order effect of planning on successful resistance [$b = .465$, CI (.398, .533), semipartial $R^2_\beta = .159$, a medium effect size] and the relevant indirect effect ($Z = 4.66$, $p < .0001$) were significant.

In summary, all hypotheses related to proactive self-control were statistically significant. Temptations prompted planning, which in turn prompted self-control attempts. However, questions could be raised about the size and importance of some effects. We discuss this issue in greater depth in the General Discussion section.

Nonhypothesized Effects

Beyond hypothesized effects, it is important to consider whether any nonhypothesized effects unexpectedly obtained significance. Other than effects that reflected the reverse of a hypothesized effect (e.g., operating > testing), 10 effects were not hypothesized to reach significance. Of these, three unexpectedly reached significance. The effect of planning on goal progress was significant, as both the relevant zero-order effect [$b = .559$, CI = (.506, .611), semipartial $R^2_\beta = .309$, a large effect] and unique effect [$b = 182$, CI = (.126, .238), semipartial $R^2_\beta = .040$, a small effect] were significant and nontrivial in size.

Second, the nonhypothesized effect of planning on successful resistance also received modest support. The relevant zero-order effect was significant and medium sized [$b = .465$, CI = (.398, 533), semipartial $R^2_\beta = .159$]. The relevant unique effect narrowly achieved significance [$b = .081$, CI = (.001, 160), semipartial $R^2_\beta = .004$], though it failed to reach the convention for a small effect size. In fact, this effect explained less than half a percent of the variance in successful resistance. Thus, it is not discussed further.

Third, the nonhypothesized effect of successful resistance on operating received modest support. The relevant zero-order effect was significant and medium-sized. [$b = .445$, CI = (.393, 496), semipartial $R^2_\beta = .224$]. The unique effect was also significant [$b = .103$, CI = (.057, .148), semipartial $R^2_\beta = .019$] but narrowly failed to reach the convention for a small effect size. The reverse effect (i.e., of operating on successful resistance) was also significant (see Table 3). Because this effect was quite close to reaching the criterion for a small effect size, it is discussed further below.

It is also worth noting that one additional effect (i.e., of temptation on successful resistance) was significant at both the zero-order and unique level. However, these effects were in opposite directions (i.e., a positive zero-order effect but a negative unique effect; see Table 3). According to the criteria we adopted to guard against suppression effects (i.e., significant effects in the same direction at both the zero-order and unique level of analysis), this effect should not be counted as truly significant.

Discussion

General Summary

In the current study, we used a diary protocol to examine whether an integrated cybernetic model describes how people pursue their long-term goals in daily life. Of the 11 hypothesized direct effects, 10 were significant. Of the nine mediational hypotheses, seven were significant. In our opinion, this suggests that the integrated cybernetic model is overall quite viable. Nonetheless, there were exceptions to this overall pattern. Three interrelated hypotheses (all related to testing and self-control operations) were not supported. Furthermore, three nonhypothesized effects were unexpectedly significant. Finally, questions could be raised about the importance of effects that were significant but explained relatively little variance in the dependent measure. In the following sections, we discuss each of these findings and their theoretical implications.

A Word on Trivial Effect Sizes

Before discussing specific findings, though, a brief word on "trivial" effect sizes is warranted. Four hypothesized direct effects (i.e., temptation > planning, planning > self-control attempts, temptation > testing, and resistance > progress) were significant but failed to reach Cohen's (1988) convention for a small effect size. Some may therefore suggest that these effects are thus too trivial in size to warrant theoretical attention. We would caution against such a premature dismissal for several reasons. First, several statistical experts have suggested that caution should be used when interpreting variance-explained statistics in MLM (e.g., Kreft et al., 1995; Nezlek, 2012). These statistics exhibit several characteristics that make them far from a literal translation of variance-explained statistics used in OLS regression (see Analytic Procedures section). Furthermore, these effects have arguably been held to a far more rigorous standard than is typical, as five closely related variables have been statistically controlled for at four different levels of analysis (i.e., observations, goals, timepoints, and participants).

Furthermore, Cohen (1988) himself suggested that his conventions should be used only as benchmarks to facilitate interpretation. There is nothing holy about a semipartial R^2 of .02, at least no more so than a p value of .05. To illustrate, if an R^2 of .01 had been designated as the small effect-size criterion, all four relevant effects would be considered nontrivial. Cohen (1988) and others (Prentice & Miller, 1992) argued that effect sizes should ultimately be judged in terms of their practical importance. If an outcome variable is particularly important or difficult to improve, then even effects that could otherwise be dismissed as trivial should be considered vastly important. At least in some instances, self-regulatory processes could be considered critically important (e.g., when they help a person overcome a terminal illness, save a person's career, or save a marriage from possible divorce). More research is needed before the practical importance can be accurately assessed. In the meantime, we simply suggest that these hypotheses have received modest support.

Straightforward Support for Core Cybernetic Principles

The core proposal of the Integrated Cybernetic Model is that a feedback loop involving test and operate processes enables progress toward one's long-term goals (Austin & Vancouver, 1996; Carver & Scheier, 2012). This is depicted in Loop 1 of the Figure 2. Recall the example of our health-motivated student from the introduction. If she first tests and notices that it is time for her daily jog, she will be more likely to initiate jogging operations (path 1b). This, in turn, will move her closer to her goal of physical health (path 1c). This aspect of the model received unambiguous support. All hypothesized effects were significant and nontrivial in size. Testing uniquely predicted operating. Operating uniquely predicted goal progress, and operating mediated the effect of testing on goal progress. Thus, the continued application of these basic cybernetic principles to daily life appears to be a fruitful avenue for future research.

Implementation Planning and Basic Long-Term Goal Pursuit

Beyond this, hypotheses concerning planning and long-term goal pursuit received clear support. Implementation planning consists of developing specific plans for when, where, and how a goal will be pursued. As can be seen in Loop 1 of Figure 2, planning was first expected to facilitate testing (path 1a). If our health-motivated student develops a specific plan to jog every afternoon after her last class, this is easier to assess than ambiguous plans (e.g., going jogging as often as possible) or progress toward the long-term goal itself (i.e., weight reductions are slow to appear). Building on Gollwitzer's (2012) theory of implementation intentions, we also hypothesized that very well-developed plans would automatically initiate long-term goal operations, independently of conscious test processes (path 1d). These predictions received unambiguous support. All hypothesized effects were significant and nontrivial in size. Planning uniquely predicted both testing and operating. Beyond this, testing partially mediated the effect of planning on operating. Finally, operating partially mediated the effect of planning on goal progress.

If anything, planning's relationship with goal progress was more robust than expected. Even after controlling for all other self-regulatory variables, planning exhibited a unique, significant, and nontrivial relationship with goal progress. There are several possible explanations for this. First, it's possible that the mere creation of a plan can be considered progress. If our health-motivated student is unsure how to improve her health, merely deciding to go for a jog after her last class every day may seem like progress to her subjectively, even though her physical health is unchanged. Beyond this, it is possible that planning leads to the initiation of relatively low-effort behaviors which were not captured by our measure of operations. Gollwitzer (2012) argued that extremely well-specified implementation intentions create an "instant habit," and research has shown that well-developed habits can promote goal-pursuit effortlessly (Wood & Neal, 2007). If Gollwitzer's (2012) instant habit hypothesis is correct, low-effort behaviors may mediate the residual effect of planning on progress.

Straightforward Support for the Core Self-Control Model

The current study also provided a clear replication of Hofmann et al.'s (2012a) model of self-control in daily life. All hypothesized effects were significant and nontrivial in size. Temptations uniquely predicted self-control operations (path 3c). Self-control operations uniquely predicted successful resistance (path 3b), and self-control operations mediated the effect of temptations on resistance. So when our health-motivated student was tempted to skip her planned jog to watch TV, she would often attempt to resist this temptation and many times succeed. Since Hofmann et al.'s protocol focused mainly on momentary desires rather than long-term goal pursuit, this represents a small but nevertheless important extension of their model (cf. Milyavskaya et al., 2015).

Support for a Distinction Between Long-Term Goal Operations and Self-Control

Following others (e.g., Hofmann et al., 2012b; Fujita, 2011), the integrated cybernetic model distinguishes between long-term goal operations (which directly advance a person toward their goal) and self-control operations (which inhibit actions that would move one away from the goal). Sometimes, our health-motivated student may go out for a jog without experiencing any temptation to do otherwise (i.e., long-term goal operations only). Other times, though, she may see her favorite TV show is coming on and have to resist the temptation to watch it instead (self-control operations).

The current study provided unambiguous support for this distinction. First, there was no unique relationship between these two variables once other variables were statistically controlled. Beyond this, these two variables exhibited differential relationships with temptations and goal progress. Temptations uniquely predicted self-control operations but not long-term goal operations. Moreover, long-term goal operations uniquely predicted goal progress, but self-control operations did not. Self-control operations only indirectly contributed to goal progress by promoting the successful resistance of temptations. These findings are all consistent with the theorized role of long-term goal operations in directly advancing goal pursuit and the theorized role of self-control operations in resisting temptations.

Cybernetic Principles and the Initiation of Self-Control

The integrated cybernetic model also proposes that temptations are an external stimulus that feeds into test processes (path 2a). When these test processes detect a conflict between competing motivations, self-control operations can be initiated (path 3a). So when our health-motivated student sees her favorite TV show coming on, she can notice the conflict between her desire to watch it and her planned exercise routine. If she does so, this can initiate self-control operations designed to inhibit the desire to watch her favorite TV show.

The support for these two predictions was mixed. Although the unique relationship between temptations and testing was statistically significant, it failed to reach the criterion for a small effect size. Moreover, the zero-order relationship between testing and self-control operations was quite clearly significant and nontrivial in size, but the unique relationship between these two variables was nonsignificant. This suggests that test processes only indirectly contribute to the initiation of self-control operations through some other variable.

Given this, the relationship between temptations, testing, and self-control operations needs to be reconsidered. After considerable reflection on these findings and Hofmann et al.'s (2012a) model, we offer the following proposals to be tested in future research: First, we propose that external stimuli can only be categorized as a temptation after test processes have been completed. If our health-motivated student does not consciously focus on her physical health goal, she can only say that she has a desire to watch her favorite TV show. She cannot say whether this desire is problematic or not. Once she has compared her TV-watching desire to her jogging plan and physical health goal, though, she can notice that that it conflicts with her jogging plan. Building on Hofmann et al.'s model, we propose that it is this detection of conflict that initiates self-control operations. Consistent with this, we found that temptations (i.e., the detection of goal–desire conflict) significantly mediated the relationship between testing and self-control attempts ($Z = 4.02$, $p < .0001$). Although we did not hypothesize this effect a priori, it nonetheless provides a sensible explanation, which can be further examined in future research.

This account leads to several other predictions. For example, testing should only lead to the detection of a goal–desire conflict when the person is actively experiencing a relevant desire. Thus, the apparent triviality of the testing-temptation relationship may be due to the fact that an essential moderator of the effect was not assessed. To examine such hypotheses, researchers will have to integrate experience-sampling reports of currently felt desires with reports on long-term goal pursuit (see Milyavskaya et al., 2015, Study 4, for a relevant design).

Proactive Self-Control

Building on counteractive self-control theory (Fishbach & Trope, 2008), we also predicted that temptations would increase planning (path 3d), which would in turn increase self-control operations (path 3e). If our health-motivated student learns that her favorite TV show always occurs at the time of her scheduled workout, she may record her show and make plans to watch it at a more opportune time. These hypotheses received modest support. The two hypothesized direct effects (i.e., temptation > planning & planning > self-control operations) were both significant but failed to reach the convention for a small effect size. Nonetheless, we are reluctant to dismiss these findings completely. Two related mediational hypotheses received clear support. The effect of temptations on self-control was partially mediated by planning. Furthermore, the effect of planning on successful resistance was significantly mediated by self-control.

We therefore propose that the seemingly trivial magnitude of the hypothesized direct effects is due to the lack of specificity in our planning measures. We did not distinguish plans which straightforwardly promote long-term goal pursuit from plans which promote the self-control of temptations. Although these plans may overlap and be integrated in reality, it is quite likely that they will promote different aspects of self-regulation. If our health-motivated student merely has a plan to go jogging every day at 4 p.m., this may be insufficient to resist the temptation to watch her favorite show when an ad for it comes on. By contrast, a plan to record the show may more effectively cultivate self-control. We therefore suggest that future studies should separately assess these two different types of plans. Plans which are specifically designed to overcome temptations may exhibit more robust effects with self-control.

Resisting Temptation and Goal Progress

Finally, we predicted that the successful resistance of temptations would predict goal progress (path 2c). If our health-motivated student successfully bypasses her favorite show to go jogging, it should promote her physical health goal. Surprisingly, this seemingly straightforward prediction received only modest support. This effect was significant, but it failed to reach the criterion for a small effect size.

We can think of two possible explanations for this. First, long-term goal operations may largely mediate the effect of successful resistance on goal progress. By resisting the temptation to watch her favorite TV show, our health-motivated student effectively engaged in jogging operations. It may be these long-term goal operations that are in fact critical to progress toward one's goals. Consistent with this, successful resistance uniquely and directly predicted long-term goal operations in the current study. (Though it should be acknowledged that the effect size narrowly missed the criterion for a small effect size.) Beyond this, we also found that long-term goal operations significantly mediated the effect of successful resistance on progress ($Z = 5.81$, $p < .0001$). Although we admit we were not prescient enough to predict these effects a priori, they are actually quite consistent with prior theories (e.g., Fujita, 2011; Hofmann et al., 2012b).

Beyond this, it is likely that the successful resistance of temptations serves to prevent movement away from one's goals. By not watching TV, our health-motivated student prevented any negative health effects that this activity would have had (i.e., snacking during this time; its sedentary nature, etc.). We used a standard measure of goal progress, which did not ask about movements away from a desired goal. There may have thus been a floor effect for detecting successful resistance's effects on goal progress; as we were largely unable to distinguish time periods in which a person moved away from their goal (i.e., regression) from time periods in which they just failed to move toward their goals (i.e., zero progress). We therefore suggest that future research should incorporate measures of regression away from one's goals.

Future Research Directions

In our view, the current study is just the tip of the iceberg. It opens up a vast array of questions pertaining to long-term goal pursuit in daily life—too many to be fully discussed here. Nonetheless, it is important to briefly discuss a few. First, our study focused solely on self-regulatory processes (Austin & Vancouver, 1996). It did not examine how goal characteristics (e.g., goal commitment, intrinsic motivation), temporary states (e.g., mood, ego depletion), or more permanent traits (e.g., trait self-control, mindful acceptance) affect goal pursuit in daily life. Goal pursuit in daily life cannot be fully understood without considering these processes, as commitment, mood, and traits are all integrally involved in successful goal achievement. It is likely that the self-regulatory processes examined in the current study may mediate the effect of such variables on goal progress. If a person is more committed toward a goal, they may apply more effort to attain it; while if they are in a fatigued or ego-depleted state, they may apply less effort. Supplementary Table 1 (see the online supplementary materials) indicates that variables at each level of analysis (i.e., goal characteristics, states, and traits) do influence self-regulatory processes, and thus this is a ripe avenue for future research.

Beyond this, higher level variables may moderate the relationship between the self-regulatory processes. Although the detection of goal-desire conflict typically leads to self-control, research suggests that individuals low in mindful acceptance (Teper, Segal, & Inzlicht, 2013) may frequently fail to do so. Supplementary Table 5 (see the online supplementary materials) indicates that most all of the relationships between self-regulatory processes vary randomly across goals, states, and participants. Thus, this is also a fruitful avenue for future research.

Although the integrated cybernetic model examined here is arguably more comprehensive than prior models, it is by no means exhaustive. Future research should thus examine other self-regulatory processes in daily life as well. To achieve a long-term goal, people must identify opportunities for goal advancement and overcome external obstacles. When a plan is not working, a new plan must be created. When a goal proves to be truly unattainable, a person should disengage from it to reallocate effort toward other more viable goals. Future studies should examine these processes.

The methodology could be refined in several fashions. One problem with diary protocols is that the direction of effects is notoriously difficult to establish. Thus, it is possible that any of the effects we examined are actually due to the reverse effect (e.g., testing may cause planning, rather than planning cause testing). This issue could be addressed through experience-sampling procedures which repeatedly ask participants about their current goal-related activities. Cross-lagged analyses across consecutive time-points could establish the direction of effects (e.g., planning at 10 a.m. could be associated with increased testing at noon).

Beyond this, the methodology could be improved to better assess the automaticity of effects. Although it will be difficult to definitively establish the automaticity of effects in daily protocols, scales have been developed that measure acts that were initiated habitually or without conscious forethought (Verplanken & Orbell, 2003). Moreover, participants' reports of the current activities often diverge from the retrospective recollections at a later point in time (Schwartz, 2012). Examination of these discrepancies could provide improved evidence of automaticity.

More objective measures of goal progress (e.g., grades, body-mass index, informant reports) should be incorporated to more definitively establish that self-regulatory processes are truly advancing goal pursuit. These processes should also be examined over a longer time period. Self-regulatory processes should only result in truly long-term progress toward one's goals if they are sustained over long periods of time. Finally, it would be useful to examine whether completing a daily protocol of this type actually improves goal progress (e.g., by increasing test processes). If so, it would suggest the protocols of this type are not only useful because they help researchers understand goal self-regulation processes, but they can actually be used to enhance them.

Conclusion

Hofmann et al. (2012a) noted that many basic questions about how people pursue their goals in daily life are currently unanswered, simply because motivation has seldom been examined in daily life. In the current investigation, we sought to address this gap. We specifically examined whether an integrated cybernetic model describes how people pursue their long-term goals in daily life. The results broadly supported predictions. In our opinion, these results suggest that cybernetic models have broad applicability to goal pursuit in daily life, and they should encourage more investigations of this type.

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