Research Article

Psychological Science
1–12

DOI: 10.1177/0956797619868812
www.psychologicalscience.org/PS

Predicting Exercise With a Personality Facet: Planfulness and Goal Achievement

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Abstract

Establishing reliable predictors of health behavior is a goal of health psychology. A relevant insight from personality psychology is that facets can predict specific behaviors better than broad traits do. We hypothesized that we could predict physical activity with a facet of conscientiousness related to goal pursuit—planfulness. We measured the relationship between Planfulness Scale scores and physical activity in 282 individuals over a total of 20 weeks, using a piecewise latent growth curve model. We additionally tested whether planfulness uniquely relates to activity when compared with related constructs. Finally, ratings of participants' written goals were correlated with these personality traits and physical activity. We found that planfulness was positively associated with average visits to a recreational center, that planfulness explained unique variance in activity, and that planfulness correlated with the descriptiveness of written goals. We conclude that the Planfulness Scale is a valid measurement uniquely suited to predicting goal achievement.

Keywords

goal achievement, health, personality, self-regulation, planning, open data, open materials, preregistered

Received 12/14/18; Revision accepted 7/16/19

Daily life can be viewed as a series of goals that one must achieve. Waking up early, eating breakfast, and arriving to work on time are familiar examples of small, short-term goals. The struggle to achieve these goals with regularity is also familiar, even though they are nestled within a daily routine. It should come as no surprise, then, that the most challenging goals to achieve are those that require a lifestyle change (Berkman, 2018). Quitting an addiction, spending less money, and being healthier are long-term goals that require a change in one's routines and habits. Previous work suggests that individual differences in personality traits such as conscientiousness can predict long-term goal outcomes. But what are the underlying processes, presumably linked with those traits, that contribute to goal progression? We examined whether individual differences in the use of specific goal-related cognitive processes, *planfulness*, are related to long-term advancement of health goals through physical activity.

Traits and Processes Related Prospectively to Life Outcomes

The Big Five domain *conscientiousness* describes the degree to which people are orderly, responsible, and dependable (John & Srivastava, 1999). Decades of research have established the relationship between conscientiousness and life outcomes, including health across the life span. People high in conscientiousness are more likely to engage in health-promoting behaviors, such as exercise, and less likely to engage in unhealthy behaviors, such as smoking (Bogg & Roberts, 2004), and these associations with specific behaviors may lead to benefits for overall physical health (Hampson, Goldberg, Vogt, & Dubanoski, 2007; Lodi-Smith et al., 2010). However, the association of these outcomes with conscientiousness is of limited value for understanding the contributing psychological processes because conscientiousness is a broad construct that encapsulates many facets, only some of which are relevant to the pursuit of long-term goals. This *bandwidth–fidelity trade-off* is well known in the personality literature and is among the reasons why researchers have developed specific, facet-level measurement tools to complement existing tools at the domain level

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(Hogan & Roberts, 1996). The association of conscientiousness facets with life outcomes that depend on consistent goal-driven behavior has been repeatedly demonstrated. For example, evidence suggests that engaging in preventative health behaviors is positively correlated with facets of responsibility and order (Roberts, Chernyshenko, Stark, & Goldberg, 2005), whereas long-term physical health is particularly associated with the facets of orderliness, industriousness, and responsibility (Chopik, 2016).

A small set of psychological processes may underlie the observed relationships of conscientiousness and its facets to health-encouraging behavior. Network analysis has revealed self-control and future orientation as prominent features driving formation into the singular personality domain (Costantini & Perugini, 2016), and these same processes have been repeatedly shown in experimental literature to predict goal progress (Kleiman, Trope, & Amodio, 2016; Van Gelder, Luciano, Weulen Kranenbarg, & Hershfield, 2015). Further, Corker, Oswald, and Donnellan (2012) found that the process of strategically setting achievement goals mediated the relation between conscientiousness and academic achievement.

The accrued evidence suggests that more focused, narrow constructs under the broad conscientiousness umbrella should predict progress on health goals, particularly if a construct is rooted in the processes of self-control, future orientation, and strategy setting. Planfulness was intentionally defined as one such process-focused construct and therefore was hypothesized to predict goal achievement.

Planfulness and Goal Achievement

Planfulness is a facet of conscientiousness that describes the degree to which individuals engage in goal-promoting cognition and behavior (Ludwig, Srivastava, & Berkman, 2018). Its hypothesized three-facet structure derives from the evidence in the experimental-psychology literature on processes that, when manipulated, are causally linked to goal attainment. *Cognitive strategies* are tactics to maintain goal progress, such as implementation intentions (Gollwitzer, 1999). *Mental flexibility* reflects the capability to transition from conceptualizing abstract goals to concrete decisions and behavior—for example, by imagining achievement to estimate its distance from the present (Oettingen, 2000). Finally, *temporal orientation* assesses a person's present or future orientation, as research has shown that having a future orientation relates to making sacrifices in the present to further long-term goals (Hall, Fong, & Cheng, 2012; Hall, Fong, Yong, et al., 2012). Highly planful people tend to use these strategies to set their goals and monitor progress through to achievement.

The Planfulness Scale is a 30-item measure that assesses individual differences in planfulness (Ludwig et al., 2018). In contrast to other measures of conscientiousness facets, items on the Planfulness Scale reflect psychological processes validated in experimental research rather than lexical development. The scale has been validated across multiple large, independent samples and has been shown to prospectively predict goal progress over the course of a 3-month period.

Planfulness has been shown to exhibit a unique relationship with self-reported goal progress when compared with other facets of conscientiousness, including grit and impulsivity. However, the Planfulness Scale has not yet been tested using outcome measures that do not rely on self-report. It is possible that people low in metacognitive ability report being planful and perceive goal progress without this actually being the case. The purpose of the current study was to assess whether Planfulness Scale scores are indeed associated with directly observed behavior carried out in pursuit of a goal.

The Present Study

This research used an objective behavioral measure to index the pursuit of a health goal in a real-world setting. We recruited people with physical activity goals and passively recorded the number of times they visited a campus recreation center over 10 weeks. Data from a previous 10-week period were also retrieved to permit within-subjects comparisons of visits before and after the documentation of health goals. We tested two primary hypotheses based on the theoretical foundation of the Planfulness Scale (Ludwig et al., 2018). First, we expected that Planfulness Scale scores would relate to goal progress over time, as indexed by recreation-center visits. Goal progress in our study could be modeled in two ways, so this prediction was tested with two complementary statistical analyses. Second, we expected to replicate previous results found using self-report outcomes showing that the relation of Planfulness Scale scores to goal progress will persist even when other measures in the conscientiousness domain (e.g., grit, self-control) are accounted for.

We also tested three secondary hypotheses about written descriptions of personal goals that were provided by participants. First, we proposed that Planfulness Scale scores would positively correlate with independent ratings of the descriptiveness of participants' written goals. Second, we predicted that independent ratings of the planfulness of participants' written goals would positively correlate with Planfulness Scale scores. Third, we expected recreation-center visits, and persistence over time, to correlate with the ratings of the descriptiveness of written goals. All of

these hypotheses were preregistered on the Open Science Framework (OSF) at https://osf.io/28s7n/.

Method

Participants

Participants were 282 individuals who had previously used the recreation center at the University of Oregon and who therefore were voluntarily subscribed to the recreation center's mailing list. Sample size was unrestricted in that we endeavored to include as many participants as were eligible; the final sample of 282 represents all individuals who consented and were eligible to participate.

In early January 2017, potential participants were notified of the study via an e-mail sent by the researchers to everyone on the mailing list. Recipients included current and former University of Oregon students, faculty, and staff, as well as members of the broader Eugene, Oregon, community. The sample included a majority of individuals who self-identified as female (59%) and as White and not of Hispanic origin (71%). All participants were between the ages of 18 and 40 years (M = 22.91, SD = 4.33) and were native English speakers. Additionally, all participants confirmed prior to study enrollment that they had not been enrolled in courses at the recreation center during the fall or winter academic terms and that they intended to use the recreation center as their primary location of exercise during the winter academic term. Participants were compensated $7.00 for completion of the survey and for granting permission to have their swipe-in records at the recreation center collected for the fall and winter academic terms.

Materials and measures

Participants first completed a survey that contained four scales and one free-response item. The four scales were selected to represent facets of conscientiousness that tap into processes likely related to goal achievement and that had previously demonstrated an association with positive life outcomes. These scales were the 30-item Planfulness Scale (McDonald's ω = 0.92; Ludwig et al., 2018), the 13-item Brief Self-Control Scale (BSCS; ω = 0.87; Tangney, Baumeister, & Boone, 2004), the 60-item Big Five Inventory–2 (BFI-2; Extraversion: ω = 0.90, Agreeableness: ω = 0.85, Conscientiousness: ω = 0.89, Neuroticism: ω = 0.93, Openness: ω = 0.87; Soto & John, 2017), and the 12-item Grit Scale (ω = 0.88; Duckworth, Peterson, Matthews, & Kelly, 2007). Participants responded to each scale's items using a 5-point Likert scale (Grit Scale and BSCS: 1 = *Not at all like me*, 3 = *Somewhat like me*, 5 = *Very much like me*; Planfulness Scale and BFI-2: 1 = *Strongly disagree*, 3 = *Neither disagree nor agree*, 5 = *Strongly agree*). Items from the scales include, "Developing a clear plan when I have a goal is important to me" (Planfulness Scale); "I am good at resisting temptation" (BSCS); "Is systematic, likes to keep things in order" (BFI-2 Conscientiousness); and "I finish whatever I begin" (Grit Scale). No scale took more than 15 min to complete, and presentation order to participants was randomized among scales.

After completing these scales, participants were presented with the free-response goal-recording measure. The purpose of this measure was twofold: first, to solicit qualitative information about the physical activity or exercise goals that participants were trying to achieve over the 10-week winter term and, second, to provide space for participants to detail a progress plan, should they wish to do so. Importantly, the measure was worded in such a way as to avoid explicit mention of "goals." Instead, the measure prompted participants by asking, "Do you have any personal projects for this term that are related to your use of the rec center?" This measure was adapted from Palfai and Weafer (2006; using the approach described in McGregor & Little, 1998), and took no longer than 15 min to complete; the full text is available on the project's OSF page (https://osf.io/4bsw8/).

Three raters rated each free-response entry on two items: "descriptiveness" (from 1, *not at all descriptive*, to 3, *very descriptive*) and "planfulness" (from 1, *low planfulness*, to 5, *high planfulness*). The raters were instructed to follow "a rule of thumb . . . that the descriptiveness has to do with the detailing of the goal itself, while planfulness specifically speaks to how a person plans to achieve that goal." The full text of the raters' instructions is available on the project's OSF page. If a participant did not provide a response, the raters were instructed to score both categories as zero, and that participant was removed from related analyses. Intraclass correlations were calculated to measure the reliability of the raters' assessment of the free-response entry (Shrout & Fleiss, 1979).

Procedure

This study was approved by the University of Oregon Research Compliance Services prior to data collection. The e-mail sent to the recreation center's LISTSERV included exclusion criteria and explained that a primary component of the study was recording swipe-in access to the center. If individuals met the study criteria and consented to participate, they were invited to click a hyperlink to the initial survey, hosted using Qualtrics survey software (https://www.qualtrics.com/). After providing online consent, participants were presented

with the four scales in a randomized order; they were then presented with the free-response "personal-projects" item. Participants who answered 50% or fewer of a scale's items were coded as missing on that scale. On completion of the survey, participants were presented with a reminder that the experimenters needed to collect the ID number associated with the participant's recreation-center account to record swipe-in access to the center. At this point, participants were given an additional opportunity to voluntarily withdraw from the experiment; if they did, their answers were not recorded or included in any analyses. If participants indicated continuing consent, they were redirected to a separate Qualtrics survey that provided them with a randomized ID so their identifying information could not be connected to their survey responses. In this second Qualtrics survey, participants provided their recreation-center ID and were thanked for their participation. This data-collection process began prior to the writing of our preregistration, but our preregistration was completed and made available on the OSF before any data were viewed.

Recreation-center managerial staff then provided the lead author of this article with supervised access to the center's entry-monitoring software to obtain swipe-in data from enrolled participants. Data were recorded from the term prior to the onset of the study (fall 2017, September–December) and following the onset of the study (winter 2018, January–March) for a total of 20 weeks' worth of observations. Every time participants used their ID to access the recreation center, a time-stamped data point was recorded; however, because of a known issue with the software producing duplicate data points, any data point that repeated within 3 min was considered a duplicate and removed. If no swipe-in access was recorded by the software during a term for a particular participant, the participant was recorded as having 0 swipe-ins for that term (rather than being excluded); therefore, data for each participant was represented in both the fall and winter terms. Additionally, we preregistered and carried out a blinded review of the distribution of only the swipe-in data points (i.e., with no scale data included) prior to conducting other analyses. This was to determine whether there were any errant patterns or outliers (e.g., participants checking in multiple times per hour).

Statistical analyses

We collected participants' swipe-ins to the recreation center for each of 20 weeks across two terms. From the collected data, we modeled two outcome variables to reflect our hypotheses. *Count* was generated as a variable simply representing the raw total number of times an individual swiped into the recreation center by the end of a term. *Persistence*, meant to reflect the change in student recreation-center swipe-in activity over the 10 weeks of a term, was modeled as person-level linear slopes of swipe-in counts from the beginning to the end of the winter term in some of our analyses.

We used a variety of statistical techniques to test our hypotheses. First, we ran two iteratively reweighted least-squares robust regression models with Huber weights to test whether scores on the Planfulness Scale predicted counts of recreation-center swipe-ins per term. We decided during our blinded screening to use robust regression as a way to minimize the influence of skew and outliers in the count data. Next, we built a piecewise linear latent growth curve model to test whether planfulness scores moderated goal persistence over each of the two 10-week terms. This model included three key parameters. The first was an intercept representing individual differences in frequency of visits to the recreation center (*i*). The second parameter represented the increase (or, if negative, the decrease) in recreation-center visits at the onset of the winter term (*wi*); that is, it reflected the difference between the mean number of visits during the fall term, before participants engaged in the personal-projects exercise, and the number of visits at the start of the winter term, after participants engaged in the exercise. These two parameters captured the mean number of swipe-ins per term, and the *wi* parameter afforded a statistical test of the difference. Finally, to represent goal persistence, we included a third parameter: a within-winter linear slope (*s*), centered on the first week of the winter term, to model the count of recreation-center swipe-ins across each of the 10 weeks in the winter term; a value near zero indicated that a participant's recreation-center visits were sustained throughout the winter term, whereas a negative value indicated a drop-off in weekly visits. Model code in the R programming environment (Version 3.6.0; R Core Team, 2019) is available on the project's OSF page.

Planfulness Scale scores (mean-centered for interpretability) were then regressed on these intercepts and slopes. Our original plan in the preregistration was to calculate a persistence score and analyze it in a regression. The linear slope *s* represented persistence as a latent factor instead of a manifest variable, making it a more sensitive test with fewer assumptions (such as heterogeneity of error variances). The decision to change the analysis strategy was made after preregistration but before we ran any analyses, and it was the only way we tested this hypothesis. Figure 1 depicts this model (without the intercept and slope weights).

We also ran analyses to determine whether a finding reported by Ludwig et al. (2018) using a self-report

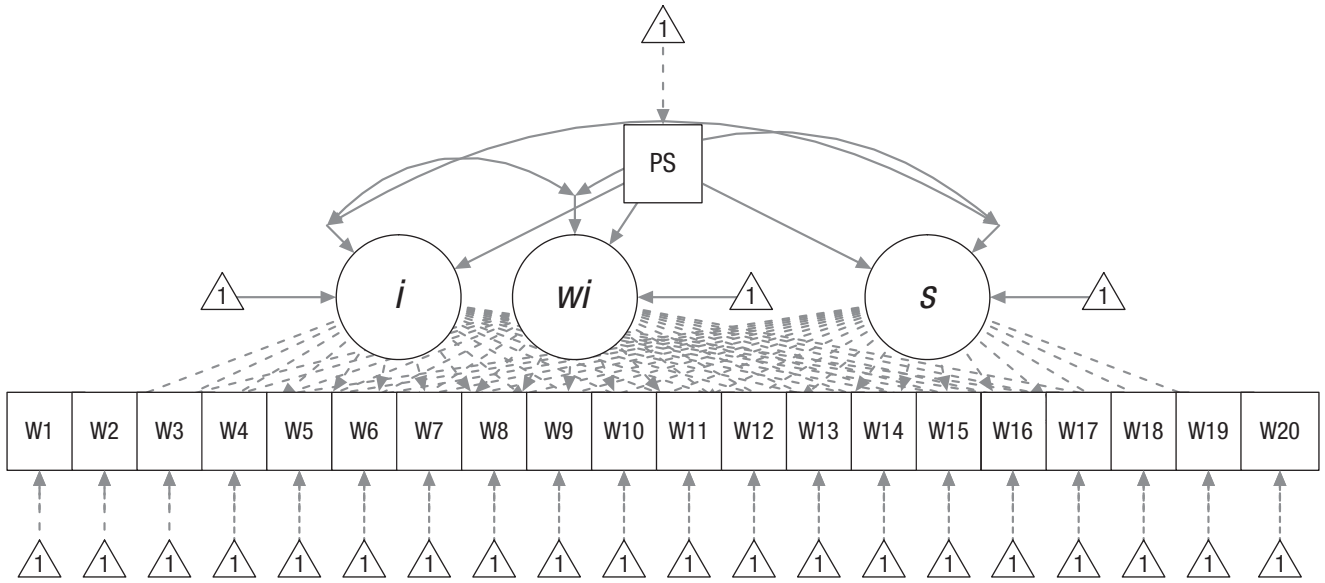

Fig. 1. Piecewise latent growth curve model testing moderation of recreation-center swipe-ins by scores on the Planfulness Scale (PS). The *i* intercept represents the mean count of swipe-ins during the fall term, *wi* is a parameter representing the increase (or decrease) in swipe-ins between fall and the start of the winter term (W), and *s* is the slope of the swipe-ins across the 10 weeks of the winter term. Circles represent latent variables, and squares represent observed indicators. Triangles represent means as constants in the model. Single-headed solid arrows represent regression paths, and dashed arrows depict the fixed coefficients of the modeled intercepts and slope. Double-headed arrows indicate covariances.

outcome measure could be replicated with an objective behavioral measure. Specifically, we ran two structural equation models using the method described by Westfall and Yarkoni (2016). Several scales were included in the same model as latent variables predicting the observed indicator variable of swipe-in count. This allowed us to determine whether any one latent variable explained variance in count over and beyond the others, even if they are highly colinear. We modeled latent variables for the Planfulness Scale, BFI-2 Conscientiousness, the Grit Scale, the BSCS, and BFI-2 Extraversion to account for participants' trait levels of being energetic, which could also explain their attendance at the recreation center (see Fig. 2). Finally, we ran a series of bivariate correlations to test our hypotheses regarding planfulness scores and the rater scores of the free-response items.

Results

Following our preregistration, we first proceeded with a blind inspection of the distribution of the count of swipe-ins to the recreation center per term. One participant was identified and removed during this inspection for having implausible swipe-in times (i.e., 30 more than the next largest number recorded in either term); full details of this decision can be found in the addendum to our initial preregistration, available at https://osf.io/vfkqu/. The following results were obtained after removing this participant (n = 281).

The distributions of the fall and winter term swipe-in counts both exhibited a slight right skew; that is, there were more people who recorded fewer swipe-ins to the recreation center (see Fig. 3). On average, there were more swipe-ins during the winter term (M = 34.79, count = 1–97, SD = 17.45) than the fall term (M = 22.03, count = 1–95, SD = 16.94), and swipe-ins at the start of both terms were higher than at the end—fall Week 1: M = 5.34, SD = 4.86; fall Week 10: M = 3.84, SD = 3.98; winter Week 1: M = 7.3, SD = 5; winter Week 10: M = 5.04, SD = 3.75 (see Fig. 4). The distributions of the scale scores appeared to be similar to each other: The scores on the Planfulness Scale (M = 3.62, SD = 0.47), BSCS (M = 3.28, SD = 0.62), Grit Scale (M = 3.41, SD = 0.58), and the Conscientiousness facet of the BFI-2 (M = 3.32, SD = 0.19) were all normal to left-skewed. The correlations among these scores ranged between moderate (r = .32) to high (r = .66); see Table 1 for scale correlations and covariances.

Primary hypotheses—planfulness and predictive validity

We ran two robust regression models, one per term, to determine whether the raw count of recreation-center swipe-ins was related to scores on the Planfulness Scale. Scores on the Planfulness Scale were positively associated with recreation-center activity during both the fall term, b = 5.92, β = 0.17, SE = 2.04, r = .17, $t(279)$ = 2.90, p = .004, and the winter term, b = 8.50, β = 0.23,

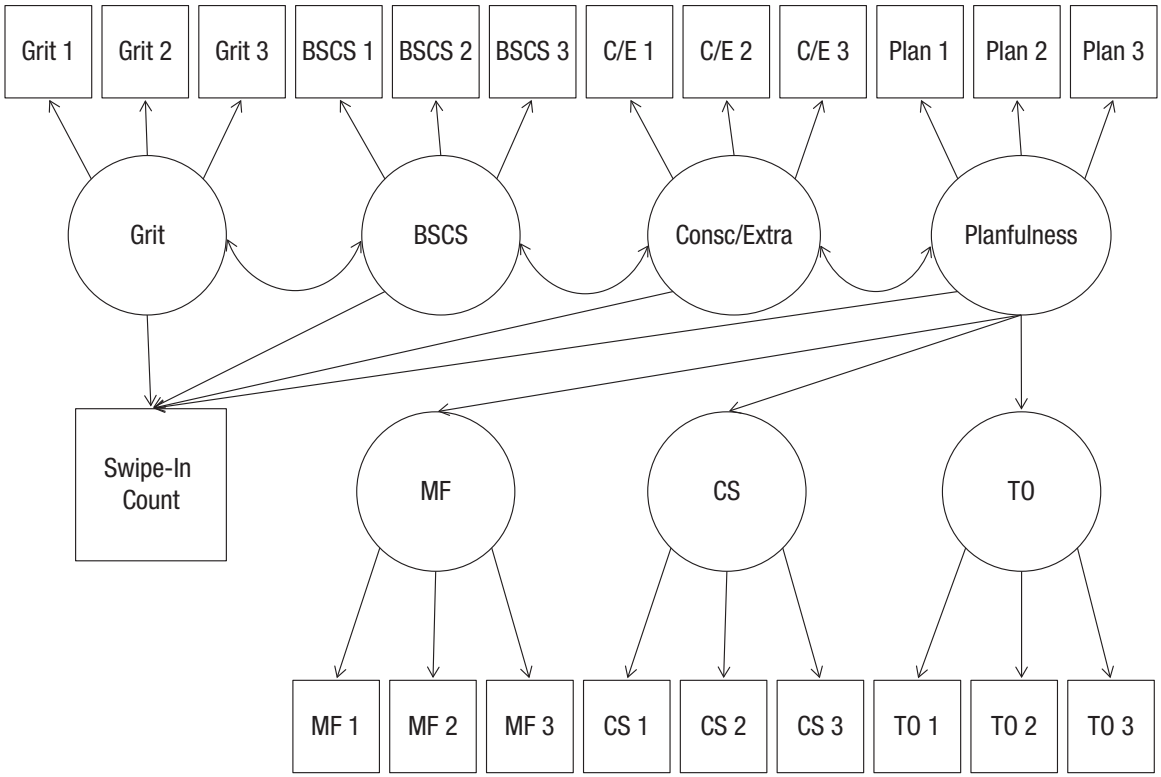

Fig. 2. Structural equation model assessing predictive performance of measured personality constructs. The two Big Five Inventory–2 facets, Conscientiousness (Consc) and Extraversion (Extra), are collapsed here for readability. Mental flexibility (MF), cognitive strategies (CS), and temporal orientation (TO) are facets of the Planfulness Scale (Planfulness). All latent construct factors explain the observed count of swipe-ins to the recreation center; all latent construct factors were allowed to covary with each other, although only neighbor covariances are depicted here for clarity. Models were run independently for each 10-week term; thus, two models were run. Circles represent latent variables, and squares represent observed indicators. Single-headed arrows represent regression paths, and double-headed arrows indicate covariances. Grit = Grit Scale; BSCS = Brief Self-Control Scale.

SE = 2.15, $r = .23$, $t(279) = 3.96$, $p < .001$. That is, an increase of 1 scale point on the Planfulness Scale corresponded to an additional 5.9 and 8.5 recreation-center visits across all 10 weeks of the fall and winter terms, respectively (see Fig. 5).

Next, the results of the latent growth curve model revealed whether and how strongly scores on the Planfulness Scale moderated the temporal trajectory of participants' recreational activity in the winter term. Consistent with the robust regression analyses reported

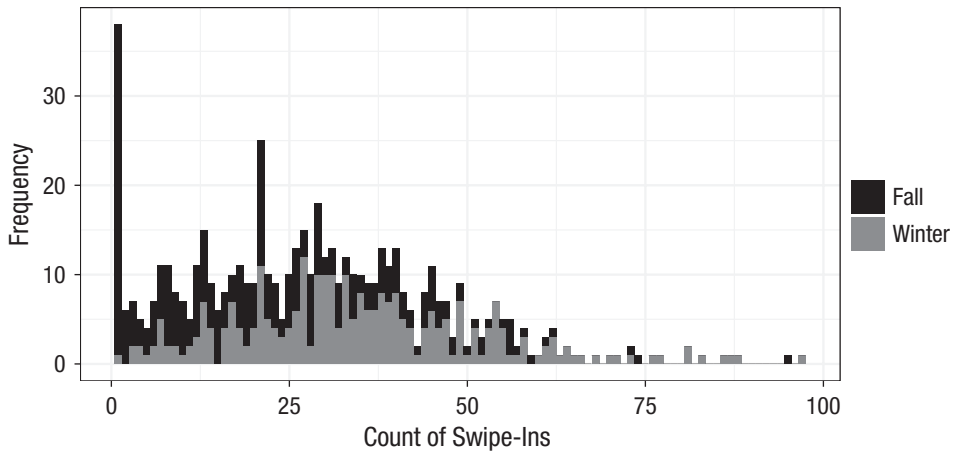

Fig. 3. Distribution of the number of swipe-ins to the recreation center recorded for each participant within each term. The number of swipe-ins ranged from 1 to 95 during the fall term and 1 to 97 during the winter term.

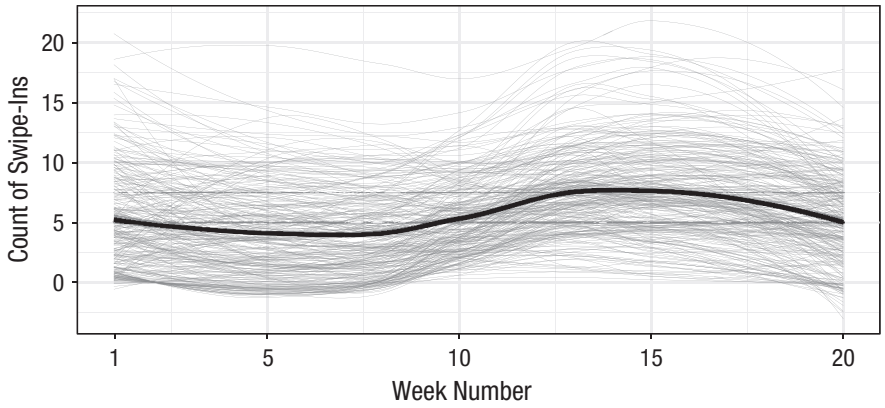

Fig. 4. Count of swipe-ins recorded per participant across all 20 weeks of observation. Weeks 1 through 10 occurred during the fall term, and Weeks 11 through 20 occurred during the winter term. The locally estimated scatterplot smoothing line is shown in black, and individual observations are shown in gray.

earlier, this analysis revealed that there was again a statistically significant positive association between scores on the Planfulness scale and the intercept (*i*), $b = 0.67$, $\beta = 0.19$, $SE = 0.22$, $p = .002$. However, there was no statistically significant relationship between planfulness and the difference in recreation-center check-ins between the average of fall and the start of winter (*wi*), $b = 0.30$, $\beta = 0.08$, $SE = 0.25$, $p = .23$. Additionally, contrary to our hypotheses, results showed that scores on the Planfulness Scale did not moderate the slope of recreation-center activity across the 10 weeks of the winter term (*s*), $b = 0.0$, $\beta = 0.0$, $SE = 0.03$, $p = .93$. That is, during the winter term, planfulness did not significantly relate to the degree to which recreation-center activity changed over time (see Table 2).

Finally, we ran two models, one per term, to test whether the unique predictive relationship of goal-related outcomes with planfulness was replicated when those outcomes were observed rather than self-reported. Both models included measures of planfulness, grit, conscientiousness, extraversion, and self-control. During the fall term, none of the measures were found to maintain a statistically significant association with the number of swipe-ins recorded. Interestingly, during the winter term—the term following the personal-projects exercise—planfulness emerged as the only measure with a statistically significant association with the count of recreation-center swipe-ins, $b = 10.72$, $\beta = 0.33$, $SE = 3.68$, $p = .004$, replicating the previous finding. None of the other construct measures were related to swipe-in

Table 1. Correlations and Covariance Between Key Variables

Variable	Planfulness	Grit	Self-control	Conscientiousness	Count of swipe-ins	Descriptiveness rating	Planfulness rating
Planfulness	—	0.18	0.18	0.04	2.21	0.04	0.11
Grit	.66	—	0.23	0.04	1.65	0.04	0.08
Self-control	.62	.63	—	0.04	1.15	0.04	0.13
Conscientiousness	.46	.35	.32	—	0.59	0.0	0.02
Count of swipe-ins	.27	.16	.11	.18	—	1.10	2.75
Descriptiveness rating	.19*	.13	.15	.08	.13	—	0.35
Planfulness rating	.23*	.15	.21	.11	.16	.72*	—

Note: The table shows covariance (above the diagonal) and correlations (below the diagonal) between collected personality traits (planfulness, grit, self-control, and conscientiousness), count of swipe-ins to the recreation center during the winter term, and ratings of participants' personal-projects free-response task. Mean scores for the scales are as follows: Planfulness Scale: 3.62, Grit Scale: 3.41, Brief Self-Control Scale: 3.28, Conscientiousness scale from the Big Five Inventory–2: 3.32. Ratings of free-response-goal level of detail (descriptiveness) and specificity of achievement method (planfulness) were averaged over all three independent raters.
*$p < .05$.

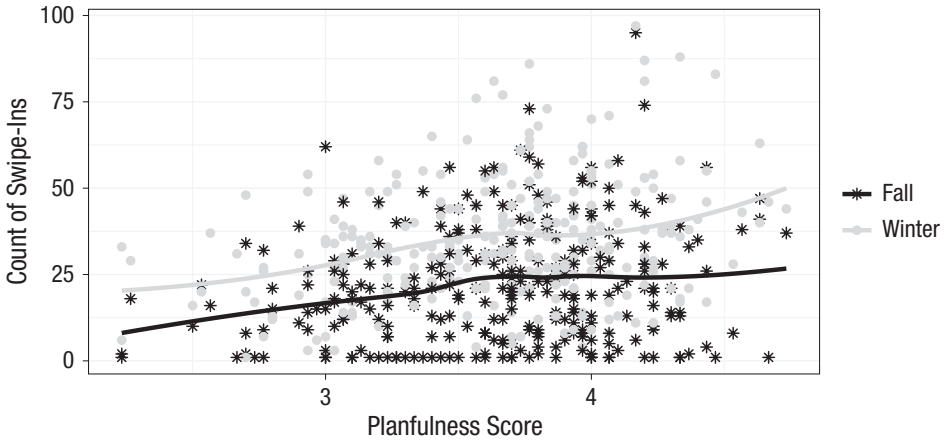

Fig. 5. Scatterplot showing the relationship between Planfulness Scale scores and count of recreation-center visits, separately for the fall and winter terms. Locally estimated scatterplot smoothing lines are shown for each term's data.

count, and the covariances (*r*s) among constructs ranged between .25 and .80. See Table 3 for factor variances and covariances; full code and data to generate output for the fall term are availble on the OSF.

Secondary hypotheses—planfulness and goal descriptions

Seven participants did not provide responses to the free-response goal-recording measure and were removed from the following analyses, resulting in 274 observations. The interrater reliability across all three raters was high, both for the descriptiveness of the written goals—intraclass correlation coefficient, or ICC(2,3) = .72, 95% confidence interval, or CI = [.65, .78]—and for the planfulness exhibited in those written goals—ICC(2,3) = .86, 95% CI = [.82, .89]. The average descriptiveness rating across all three raters was 1.51 (out of a maximum of 3), while the average planfulness rating across all raters was 2.06 (out of a maximum of 5).

Our hypothesis that ratings of the planfulness and descriptiveness of the written goals would correlate with scores on the Planfulness Scale was partially supported. There was a small but statistically significant relationship between planfulness scores and the rated descriptiveness of the free responses ($r = .19$, $p = .02$), as well as between planfulness scores and planfulness ratings ($r = .23$, $p < .001$). The count of participant swipe-ins to the recreation center during the winter term did not correlate with ratings of the written goals. The ratings of the written goals also did not exhibit a relationship with any of the related construct measures of conscientiousness, self-control, and grit; see Table 1. Furthermore, allowing ratings of descriptiveness to covary with the slopes of recreational activity across the 10 weeks of the winter term in a latent growth curve model revealed no statistically significant relationship between these ratings and goal persistence, $r = -.05$, $p = .53$.

Discussion

This study investigated whether planfulness, a conscientiousness facet specific to the tendency to utilize mental processes that promote goal achievement, could

Table 2. Parameter Estimates From a Piecewise Latent Growth Curve Model Testing Whether Planfulness Moderated Goal Progress Over the Two 10-Week Terms

Variable	*b*	*SE*	β	*p*
Planfulness				
i	0.67	0.22	0.19	< .001
wi	3.00	0.25	0.08	.23
s	< .001	0.03	< .001	.93
Covariance				
i				
wi	−1.37	0.22	−0.49	< .001
s	0.03	0.02	0.12	.20
wi				
s	−0.09	0.03	−0.41	< .001
Intercept				
i	2.21	0.10	1.3	< .001
wi	1.98	0.12	1.7	< .001
s	−0.15	0.01	−1.16	< .001

Note: Figure 1 depicts this model. The *i* intercept represents the mean number of swipe-ins during the fall term, the *wi* intercept represents the difference between the mean number of swipe-ins during the fall and winter terms, and *s* represents the slope of the swipe-ins across the 10 weeks of the winter term. Model-fit statistics are as follows: $\chi^2(218) = 893.448$, comparative fit index = .83, root mean square error of approximation (RMSEA) = 0.105, 95% confidence interval for RMSEA = [0.098, 0.112].

Table 3. Parameter Estimates From a Model Comparing Prediction of Swipe-In Count During the Winter Term Among Related Constructs

	Factor loadings				Measurement errors		
Variable	*b*	*SE*	β	*p*	*b*	*SE*	β
Planfulness					0.29	0.04	1.00
Count	10.72	3.68	0.33	.004			
Mental flexibility	1.00	—	1.02	< .001	−0.01	0.01	−0.03
Temporal orientation	0.67	0.06	0.91	< .001	0.03	0.01	0.18
Cognitive strategies	0.94	0.08	0.87	< .001	0.08	0.02	0.24
Grit					0.34	0.04	1.00
Count	0.97	3.89	0.03	.80			
Parcel 1	1.00	—	0.89	< .001	0.09	0.01	0.20
Parcel 2	0.91	0.05	0.81	< .001	0.15	0.02	0.34
Parcel 3	0.86	0.06	0.77	< .001	0.27	0.02	0.40
Conscientiousness					0.32	0.04	1.00
Count	4.30	4.18	0.14	.30			
Parcel 1	1.00	—	0.80	< .001	0.18	0.02	0.36
Parcel 2	1.15	0.07	0.89	< .001	0.11	0.02	0.21
Parcel 3	1.01	0.07	0.84	< .001	0.16	0.02	0.30
Extraversion					0.32	0.04	1.00
Count	−1.55	1.96	−0.06	.43			
Parcel 1	1.00	—	0.86	—	0.18	0.02	0.36
Parcel 2	1.03	0.06	0.89	< .001	0.11	0.02	0.21
Parcel 3	1.04	0.06	0.86	< .001	0.16	0.02	0.30
Self-control					0.35	0.04	1.00
Count	−6.79	4.01	−0.23	.10			
Parcel 1	1.00	—	0.85	< .001	0.14	0.02	0.29
Parcel 2	0.96	0.06	0.78	< .001	0.21	0.02	0.39
Parcel 3	0.97	0.06	0.87	< .001	0.11	0.01	0.25
Covariance							
Planfulness							
Grit	0.24	0.03	0.74	< .001			
Conscientiousness	0.21	0.03	0.69	< .001			
Extraversion	0.17	0.03	0.47	< .001			
Self-control	0.22	0.03	0.68	< .001			
Grit							
Conscientiousness	0.25	0.03	0.76	< .001			
Extraversion	0.17	0.03	0.43	< .001			
Self-control	0.26	0.03	0.74	< .001			
Conscientiousness							
Extraversion	0.14	0.03	0.36	< .001			
Self-control	0.27	0.03	0.80	< .001			
Extraversion							
Self-control	0.10	0.03	0.25	< .001			

Note: Figure 1 depicts this model. Model-fit statistics are as follows: $\chi^2(192) = 469.82$, comparative fit index = .93, root mean square error of approximation (RMSEA) = 0.072, 95% confidence interval for RMSEA = [0.064, 0.080]. All variances of variables are significant ($p < .001$), except for an observed moderate Heywood case for the mental-flexibility latent variable ($p = .49$).

predict an objective measure of health-goal progress over time. We tracked the attendance of participants at a recreation center during two 10-week academic terms, one before and one after we asked them to report on their physical activity goals. Using a variety of statistical analyses, we found that Planfulness Scale scores were related to the number of goal-relevant behaviors, though we did not find a strong association between scores and goal narratives.

Although the average number of recreation-center visits tracked positively with Planfulness Scale scores, adding a temporal component in our latent growth

curve model revealed that planfulness did not moderate the slope of swipe-ins over time. Participants' recreational activity generally declined across the 10 weeks of the winter term regardless of planfulness. This may be due to context specific to our sample, namely college students spending their time at the end of the term studying for finals (in line with the pattern in Fig. 4, barring a positive blip the week after Thanksgiving), or it could reflect a general tendency for people's goal progress to decline over time. Although not every participant in our sample was a student, we cannot adjudicate between either possibility in the current study. The latent growth curve model also revealed that the amount of change in recreation-center visits from the fall term to the winter term did not vary by planfulness. Thus, these results support a main effect: Planful people in our sample tended to go to the recreation center more frequently regardless of time.

Our results also replicated a previous finding that Planfulness Scale scores are positively associated with goal progress even when included in a model with other related conscientiousness facets. We take this result as additional support for the robustness and generalizability of this relationship. Providing some context for this interpretation is a limitation of this study; we made the intentional design choice not to measure goal progress at the end of the observation period. A benefit of recording the number of swipe-ins is that it allowed us to collect data on a variety of health goals rather than restricting us to a specific subset of goals that could be objectively measured. This approach allowed us to include goals such as increasing muscle mass, losing weight, and improving running times with one measure, rather than collecting specific measures that would restrict the types of goals we could observe in our participants. Future research may focus on particular health outcomes to track objective goal progress over time, but the value of the current study lies in demonstrating the replicated relationship of scores on the Planfulness Scale regardless of specific goals.

The results of the free-response data analyses were mixed. Participants' Planfulness Scale scores were correlated with independent raters' assessments of the descriptiveness and planfulness evidenced in their writing, although we note that the effect sizes were small. These results provide qualified support for the hypotheses that planfulness is reflected in the way people write about their goals and that planfulness reflects a tendency to think about goals in certain ways. The correlations of the written response ratings were small across all related constructs as well, including conscientiousness. This pattern could suggest that effective task planning does not necessarily entail detailed written elaboration of one's goals, although that could certainly be a strategy used by some people. Alternatively, the pattern could also indicate that conscientiousness does not translate perfectly to writing, or that participants overall were not engaged enough with the free-response task to be as detailed as they would be when planning their goals on their own time. The multiple interpretations here suggest that the relationship between goal planning and writing is a ripe area for further study.

Finally, we see this work as making two key incremental advancements in the fields of personality and goal-achievement research. First, the process-focused nature of the Planfulness Scale illuminates a possible pathway by which trait conscientiousness relates to life outcomes. The results of the structural equation models, which included all measured conscientiousness facets, support the interpretation that the specificity of the Planfulness Scale permits a robust relationship with real-world goal progress. In conjunction with the results from the free-response analysis, our evidence indicates that planfulness might drive the positive association between conscientiousness and successful long-term goal achievement because it correlates with how people think about their goals and how they intend to reach them. Second, our study design permitted us to test whether a facet of conscientiousness predicted real-world goal-achievement behavior over several months, a time scale that is between that of traditional laboratory studies (e.g., Van Gelder et al., 2015) and studies of lifelong outcomes (e.g., Hampson et al., 2007). Our objective measurement recorded incremental progress as it occurred for a variety of exercise goals. Taken together, the evidence shows that Planfulness Scale scores are associated with ecological goal-achievement behavior and that specific cognitive processes might explain this association.

In sum, the results from this study support the validity of the Planfulness Scale for measuring the propensity of individuals to make progress toward their goals in the real world. While further testing is necessary, the accrued evidence to date suggests that measuring planfulness may be uniquely useful for researchers investigating a variety of goal-directed behaviors, including the pursuit of health and lifestyle goals.

Action Editor

Brent W. Roberts served as action editor for this article.

Author Contributions

All authors developed the research concept and contributed to the study and analysis design. R. M. Ludwig collected and analyzed the data. R. M. Ludwig drafted the manuscript, and S. Srivastava and E. T. Berkman provided critical revisions. All authors approved the final version of the manuscript for submission.

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Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Open Practices

All data and materials have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/4bsw8/. The design and analysis plans for the experiments were preregistered at https://osf.io/28s7n. Following the planned inspection of the data detailed in the text, we conducted an additional analysis that can be found at https://osf.io/vfkqu.The complete Open Practices Disclosure for this article can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797619868812. This article has received badges for Open Data, Open Materials, and Preregistration. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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