A Microlongitudinal Study of the Linkages Among Personality Traits, Self-Regulation, and Stress in Older Adults

Karen Hooker, Ph.D., Soyoung Choun, Ph.D., Shannon Mejia, M.S.,
Tuan Pham, M.S., & Ron Metoyer, Ph.D.
Oregon State University

Author Note
Karen Hooker, School of Social and Behavioral Health Sciences and Center for Healthy Aging Research, Oregon State University; Soyoung Choun, School of Social and Behavioral Health Sciences, Oregon State University; Shannon Mejía, School of Social and Behavioral Health Sciences, Oregon State University; Tuan Pham, School of Electrical Engineering and Computer Science, Oregon State University; Ron Metoyer, School of Electrical Engineering and Computer Science, Oregon State University.

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Correspondence concerning this article should be addressed to Karen Hooker, School of Social and Behavioral Health Sciences, Oregon State University, Corvallis, OR 97331. E-mail: hookerk@oregonstate.edu
Abstract
Personality traits and daily self-regulation of health goals, social goals, and perceived stress were examined over 100 days to better understand how traits may influence self-regulation. This study was conducted with a sample of 99 older adults via web-based surveys. Results showed that, as predicted, traits of neuroticism, conscientiousness, and extraversion were significantly related to goal progress: those high in neuroticism made less social goal progress and those high in conscientiousness and extraversion made more health and social goal progress over the 100 day period. On days that were perceived as more stressful older adults made less goal progress overall. Health goal and social goal progress were related, although individuals did not always make progress on both goals simultaneously. Stress interacted with neuroticism and conscientiousness, uncovering relationships between goal progress and stressful days that were not evident when examining just direct effects. This study provides empirical evidence for linkages in the six-foci model of personality that are consistent with the idea that trait structures can shape processes.

*Keywords:* Personality, self-regulation, intraindividual variability, stress, microlongitudinal
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A Microlongitudinal Study of the Linkages Among Personality Traits, Self-Regulation, and Stress in Older Adults

The introduction to this Special Issue (Diehl & Hooker, 2013) provides the theoretical underpinnings to the rationale for studying personality dynamics of intraindividual variability. In this article we take to heart the call to action for more empirical research on interdependencies between structure and process. Although many studies have documented the associations of personality traits and life outcomes (e.g., Caspi, Roberts, & Shiner, 2005; Ozer & Benet-Martinez, 2006), less is known about process-oriented personality constructs, such as goals and self-regulation (Hooker, Hoppmann, & Siegler, 2010). Our research, guided by the six-foci model of personality (Hooker & McAdams, 2003), aims to examine a core assumption of the model – how adults’ internal processes of self-regulation around goals may be shaped by personality traits. The six-foci model has been compared to a dual backbone model (Mroczek et al., 2006) that pairs structures with processes, in a levels-of-analysis framework. The structures are traits, personal action constructs (or goals), and life stories. Traits are relatively stable, and are paired with state processes that change and even bring about trait change (cf. to Fleeson, 2001). Many studies have now documented changes in traits over the lifespan (Roberts, Walton, & Viechtbauer, 2006) and it has been shown that even among centenarians (e.g., Adkins, Martin, & Poon, 1996) traits are malleable. Personal action constructs change in relation to normative developmental tasks and life events; and self-regulatory processes (self-efficacy, outcome expectancy) in domains where goals exist make these goals more or less likely to be achieved. Self-evaluation, regulation of emotion, and goal-setting are among the most established and potent of these self-regulatory processes (Staudinger & Kunzmann, 2005). Life stories are generated via narrative processes that – while showing continuity, constantly evolve to fit the sociohistorical moment and be responsive
to what the “audience” affords (Adams, Smith, Pasupathi, & Vitolo, 2002).

Self-regulation is broadly defined as the deliberate attempt to manage actions to facilitate positive adaptation (McClelland, Ponitz, Messersmith, & Tominey, 2010), and the ability to self-generate goals and goal-directed behaviors are tied to these processes (Carver & Scheier, 1998). By setting and working towards goals, individuals may achieve resources that facilitate adaptation to loss (e.g., Carver & Scheier, 1998; Locke & Latham, 2006), which becomes increasingly important in old age (Baltes, Lindenberger, & Staudinger, 2006). The six-foci model, grounded in developmental systems theory (Ford & Lerner, 1992), unites the structures of traits with processes of self-regulation. This model predicts that over time, the dynamisms of self-regulation may modify the structures of traits. In such a framework the linkages between structure and process are bidirectional, leaving open the possibility for change in personality structures over the lifespan. Because people work on multiple goals simultaneously, we examine goals in two domains that previous research shows are important for well-being in later life – health and social relationships (e.g., Hooker, 1992; Hoppmann, Gerstorf, Smith, & Klumb, 2007). The daily goal processes examined in our study are conceptualized as indicators of self-regulation, but do not encompass all of the constructs that fit under the broad umbrella of self-regulation.

**Health and Social Goal Processes**

The self-regulation of goals involves goal setting, goal pursuit, and goal accomplishment (Maes & Karoly, 2005; Bolkan & Hooker, 2012). Previous research has shown that goals in the health and social domain are important, especially in older adulthood. Working towards a health goal may support positive health behaviors, such as proper nutrition and daily exercise, which support an optimal trajectory of aging (Renner, Knoll, & Schwarzer, 2000). By working towards social goals, older adults are able to customize their social environment to support developmental
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and emotional needs (Lang, Reschke, & Neyer, 2006). Health and well-being in older adulthood are tightly linked to positive and supportive social relationships (Rook, Mavandadi, Sorkin, & Zettel, 2007). Older adults’ efforts to shape and manage social resources represent successful strategies of adapting to changing needs in older adulthood (Lang & Heckhausen, 2006).

Research on goal pursuit often examines a single specific domain (e.g., Hennecke & Freund, 2010). However, in the context of daily life adults usually work towards multiple goals simultaneously. Goals may even, at times, be in conflict with one another. For example, focusing on spending more time with a significant other to increase closeness in social relationships may detract from one’s ability to maintain a health goal of getting to the gym more often. In this study, because we examine goals in two different domains, we explore the extent to which progress in the health domain is linked to progress in the social domain – that is, their day-to-day co-regulation within individuals.

Self-Regulation under Stress

Stress is deleterious to health and well-being across the lifespan (Aldwin & Gilmer, in press), and especially in older adulthood, vulnerabilities to stress increase (Charles, 2010). The ability to “stay the course” with one’s goals in the context of daily life, depends on self-regulatory processes. Previous work has shown that the effects of personality traits on health and well-being are magnified under conditions of extreme or chronic stress, such as caregiving (Hooker, Monahan, Bowman, Frazier, & Shifren, 1998). We hypothesize that this may be due, in part, to the increased variance in self-regulation that may occur when people are “thrown off” their goal pursuits by stress. Part of this increased variance may be related to personality traits – as these are tendencies to think, feel, and act in consistent ways (Costa & McCrae, 2003) and are thought to be a driving force leading to how individuals plan for and achieve their goals. In our study we
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examine relationships between traits and self-regulation on days with and without stress in order to understand how stress may amplify or activate the effects of personality on self-regulation.

We term the covariation of stress and goal progress on a given day sensitivity – where those with higher sensitivity have a stronger negative association between perceived stress and goal progress, thus being more likely to be thrown “off-track” with their goal on a high stress day. Those with lower sensitivity would have a weaker association of stress with goal progress – remaining stalwart in pursuit of their goal. Examining these links requires an intraindividual research design where relationships between traits, self-regulation of goals and stress can be examined over time within individuals.

Linking Traits to Pursuit of Health and Social Self-Regulatory Processes

We chose to examine neuroticism, extraversion, and conscientiousness as three personality traits of the Big Five (Digman, 1990) that previous research indicates might be expected to shape how people pursue goals. Individuals high in neuroticism (N) are more likely to be self-critical, sensitive to other people’s opinions, perceive more stress, and experience negative feelings more often compared to those with low scores (e.g., Costa & McCrae, 2003; Lahey, 2009). This trait has been extensively studied in health research because studies have shown that individuals high in N are more likely to experience higher occurrence of minor daily illness (Larsen & Kasimatis, 1991), demonstrate fewer self-care behaviors (Kressin, Spiro, Bosse, & Garcia, 1999), have worse health outcomes (Turiano et al., 2012), poorer health behaviors, and earlier death (Mroczek, Spiro, & Turiano, 2009; Lahey, 2009).

Individuals high in conscientiousness (C) are likely to be task-oriented, plan ahead, work persistently toward achieving goals, and follow rules (Bogg & Roberts, 2004; Taylor & Kluemper, 2012). Studies have found that high C is significantly related to reduced risk of illness and greater
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longevity (Friedman & Martin, 2007; Hill, Turiano, Hurd, Mroczek, & Roberts, 2011), longer survival with chronic medical illness (et al., 2002), and people high in C are more likely to participate in health enhancing behaviors (Duberstein et al., 2011) and be less likely to respond to negative events (Taylor & Kluemper, 2012).

Individuals high in extraversion (E) are high in assertiveness and warmth, tend to have a strong need for social contact, attention and fun, and are energetic, enthusiastic, and optimistic (Costa & McCrae, 2003). Research has shown that individuals high in E are likely to be more engaged in positive events (e.g., Zautra, Affleck, Tennen, Reich, & Davis, 2005).

Predictions of relationships between traits and goal progress. We hypothesize that people high in N will be less likely to make progress on their health and social goals over time, and that stress would exacerbate these effects. Those high in N are expected to have weaker self-regulatory skills to stay on track with their goals on days they perceive as stressful, displaying high sensitivity. On the other hand, individuals high in C are thought to have strong self-regulatory skills, thus we predict that their goal progress will be less sensitive to daily variation in perceived stress. Furthermore, we expect that individuals high in C will make more overall progress on their health goals over the course of the study. Given the lack of literature linking E to health goals, we have no predictions in the realm of health, but we do expect that individuals high in E would make more progress on their social goals over time given the likely importance of such goals to their well-being.

The Current Study

In the current study we examine the extent to which personality traits are related to concurrent regulation of health and social goals in the context of daily variation of perceived stress in a sample of healthy older adults. To examine the extent to which N, C, and E may shape goal
regulation in the context of daily stress perceptions, we utilize an analytical approach in which we allow sensitivity – the covariation of perceptions of stress and goal progress – to vary across participants, and then examine linkages in this parameter across health and social goal domains.

Our study has three aims: 1) To determine the extent to which personality traits of N, C, and E explain between-person variation in daily goal progress in the health and social domains; 2) To address the question of whether the effects of traits on self-regulation become more powerful under conditions of stress; and 3) To identify the extent to which intraindividual variation in sensitivity (association between stress and goal progress) is linked across health and social domains. In this study we predict that on days when stress is perceived to be high, this will “activate” traits so that those high in N make less progress on goals and those high in C make more progress.

Method

Study Design

The current study uses data from the 100-day web-based Personal Understanding of Life and Social Experiences (PULSE) project. The PULSE project used a within-person microlongitudinal design (Nesselroade, 1990), which allows for the examination of both within-person dynamic covariation of participants’ goals with experiences in their daily lives, and between-person differences in these processes. We chose 100 days as the sampling frame for occasions within persons. This time frame is based on research indicating that practice of new behaviors requires 3 – 6 months to avoid a relapse (Gruber, 2010). We did not want to unduly burden older adult participants so designed the length of our study to be just slightly over the 3 month minimum. To our knowledge this is the first microlongitudinal study of older adults conducted entirely via the internet.
Participants and Study Procedure

The PULSE participants were recruited via email from an existing human participant registry of 450 members. To enroll in the study, participants followed a link embedded in the recruitment email. Given the intensive nature of data collection (every day for 100 days) a relatively large percentage of registry participants – 105 older adults – agreed to participate in the study. Characteristics of the participants were: 88% women; 97% White; ages 52 – 88 (mean = 63), 93% rated their health as good, 73% were married, and 47% retired. Census data in Oregon for adults over age 65 (not wholly comparable since our sample was a bit younger on average) show that participants were more likely to have a marital partner, less likely to be retired, and more likely to be female and White. Statistical tests between our sample and adults over age 65 in the state were not conducted since the groups are not comparable; our sample can be characterized as a healthy, young-old sample that is not representative of older adults in Oregon.

Participants received $10 compensation for completing the initial survey, and participants who completed at least 80% of the daily surveys (n = 99) received an additional $50. An ancillary aim of the PULSE project was to examine methodological issues regarding whether a burst design (four seven-day bursts of measurement) would be equivalent to the daily design for measuring variability, and thus 25% of the sample was randomly assigned to be in the burst group rather than the daily group. There were no significant differences in demographics between the two groups ($t^2 = .05, F(1,2) = .76, ns$).

The PULSE project began with an initial survey, and was followed by a series of 100 daily surveys (28 for the burst group spread over the 100 day period). Participants completed the initial survey immediately after signing up for the project; this survey assessed demographic information and several psychological measures. The median number of minutes spent on the initial survey
was 52, (interquartile range = 33). The daily surveys were activated once the researchers had reviewed the initial survey for completion. Once activated, participants were sent daily email reminders, which included a link to their survey for that day. People were instructed to complete the survey in the evening so that they could reflect on their day as a whole. The time-stamped nature of the web-based data collection showed conclusively (i.e. not simply self-report) that 83% of sessions were completed in the evening. Daily sessions had a median duration of 3.66 minutes (interquartile range = 3.86). Data collection took place between June, 2010, and October, 2010.

**Initial Survey Measures**

**Health and social goals.** Participants were asked to create a goal in both the health and social domains to work toward over the 100-day study. The health goal prompt was: “Choose one goal that is important to you in the realm of health that you expect to be working on over the next four months.” The social goal prompt was: Chose one goal that is important to you in the realm of social relations (family and/or friends) that you expect to be working on over the next four months.” Participants were then asked to describe each goal in as much detail as possible in an open-ended text box, and then describe why each was important to them. Finally, participants were asked to choose a few cue words that could be used to represent each goal in their own personalized daily surveys. These words were programmed to automatically populate the health and social goal questions in their daily surveys.

**Personality traits.** Personality traits were measured using the *NEO-Five Factor Inventory*, a 60-item scale that measures the trait domains of neuroticism, extraversion, openness, agreeableness, and conscientiousness (NEO-FFI, Costa & McCrae, 1989, 1997). In this study we used the traits of neuroticism ($\alpha = .92$), conscientiousness ($\alpha = .84$), and extraversion ($\alpha = .86$). Response categories were measured with a five-point scale ranging from strongly disagree (0) to
strongly agree (4). Higher scores equate to higher levels of the respective trait. We utilized the recommended \( T \)-scores for the NEO-FFI (Costa & McCrae, 1989).

**Daily Measures**

Health goal progress, social goal progress, and perceived stress were measured daily on a web application designed by the research team, which instructed participants to respond based on experiences *for that day*. Participants answered survey questions by using their mouse to move a handle along a slider. To encourage participants to assess each day independently, the actual numbers on the scale were invisible to participants, but automatically submitted to the database (Brose & Ram, 2012; Hooker, 1991).

**Daily health goal progress.** Participants reported their daily progress on their health goal by responding to a prompt that described their goal using the cue words from the initial survey: “Rate your progress towards your goal of [for example] *exercise with weights.*” Participants reported their progress on that day by moving the slider between *no progress* (0) and *much progress* (100).

**Daily social goal progress.** Participants reported their daily social goal progress by responding to a prompt that included the cue words provided in the initial survey: “Rate your progress towards your goal of [for example] *closer to husband.*” Participants reported their progress on that day by moving the slider between *no progress* (0) and *much progress* (100).

**Daily perceived stress.** To measure daily variations in perceptions of stress we utilized the 4-item Perceived Stress Scale (PSS; Cohen & Williamson, 1988). The word “Today” was added to each item so that they were appropriate for daily measurement. An example stress item is: “*Today* I feel unable to control the important things in my life.” Items were rated on a continuous scale ranging from 0 – 49. The PSS score was created by summing the four items
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together, thus potential stress ratings ranged from 0 to 196. The PSS had an alpha coefficient of .84 on day one, suggesting that it was a reliable measure of stress in this population.

Covariates

We controlled for differences in age and gender because they are known to be involved in self-regulatory processes (Birditt & Fingerman, 2003; Hennecke & Freund, 2010) and stress (Birditt, Fingerman, & Almeida, 2005). To control for possible differences due to test exposure (28 days vs. 100 days), we also included a dummy variable to indicate group membership.

Analytic Plan

We analyzed the data by conducting a series of multivariate multilevel random coefficient models (Hox, 2010). These models account for observations nested within individuals, and also for the outcome variables of health and social goal progress to be clustered within individuals. To trace personality traits through the daily self-regulation, we considered both within-person (level 1) and between-person (level 2) models. The within-person model included daily variation in stress, which was centered around the participant’s mean to represent its link to goal progress on that day. We estimated the level 1 multivariate model as follows:

\[ Y_{ijk} = H_{ijk} \ast \left[ b_{0hi} + b_{1hi} \left( \text{Day}_{ik} \right) + b_{2hi} \left( \text{StressWP}_{ik} \right) + e_{ihk} \right] + S_{ijk} \ast \left[ b_{0si} + b_{1si} \left( \text{Day}_{ik} \right) + b_{2si} \left( \text{StressWP}_{ik} \right) + e_{isk} \right] \]  

The outcome variable \( Y_{ijk} \) represents goal progress for individual \( i \) for goal domain \( j \) (\( j = 1 \) for health goal, and \( j = 2 \) for social goal) on day \( k \). Accordingly, each participant has two records, and a maximum 200 observations. \( H_{ijk} \) and \( S_{ijk} \) activate the model to represent health or social goal progress. When \( H_{ijk} = 1 \), health goal progress is the outcome, and \( S_{ijk} = 1 \) the social goal progress is the outcome. The between person (level 2) model represents individual differences in self-regulatory processes. This model predicted individual differences in the intercept and coefficients for time (\( b_1 \)) and stress (\( b_2 \)) for both health and social goal progress. Level 2 variables were time
invariant, grand mean centered, and included N, E, and C, participants’ mean perceived stress and the study covariates. To trace personality traits through differences in stress sensitivity, we modeled cross-level interactions, where N, E, and C predicted differences in sensitivity to stress in both the health goal and social goal domains. To render data stationary (Ram et al., 2012), we examined model residuals across time, and found a linear growth parameter to sufficiently detrend both health and social goal progress. The autocorrelation of within-person residuals was accounted for with an AR(1) process. Models were constructed systematically, beginning with an unconditional model to establish a baseline and estimate the interclass correlation (ICC) to facilitate model comparisons. Models were assessed in terms of model fit (-2*LL), and the random estimates’ proportional reduction in variance \( R^2 = \left( \sigma^2_{ub} - \sigma^2_{um} \right) / \sigma^2_{ub} \) (Hox, 2010).

Analysis was conducted using SAS PROC MIXED, version 9.2 (SAS, 2008).

**Results**

Correlation matrices and descriptive statistics are displayed in Table 1. The variation in health goal progress and social goal progress was equally distributed across the within and between-levels of analysis indicating there was as much variation within individuals over the 100 days as between individuals. The unconditional multivariate model showed that health goal progress had an ICC of .49, and social goal progress had an ICC of .50. Daily perceived stress, with an ICC of .60, varied slightly more between individuals than it did within individuals.

**Personality Traits and Goal Progress**

To address our first aim, we modeled the personality traits N, C, and E to predict differences in overall health goal progress and social goal progress over the 100-day study period. We began with separate bivariate analyses of health and social goal progress with personality traits N, C, and E, adjusted for age, gender, and measurement group. The results are presented in
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Table 2. Higher N predicted lower social goal progress \((B = -.35, SE = .15, p = .01)\), but not health goal progress \((B = -.19, SE = .14, ns)\). Higher levels of C were linked to both higher health goal progress \((B = .36, SE = .16, p = .02)\) and social goal progress \((B = .37, SE = .17, p = .03)\) over the 100-day study. E also predicted higher overall goal progress in both health goal \((B = .41, SE = .13, p = .002)\) and social goal \((B = .49, SE = .14, p < .001)\) domains. To understand differences in explanatory power, we also modeled N, C, and E simultaneously to see how they predicted unique variation in goal progress. These results are displayed on Table 3, in Model 1. Extraversion explained unique variation in both health goal progress \((B = .36, SE = .15, p = .01)\) and social goal progress \((B = .40, SE = .17, p = .01)\). The effects for N and C were not significant in this model, neither were the controls for age, gender, or measurement group. Together the three personality traits explained 17% of the between-person variation in health goal progress and 15% of the between-person variation in social goal progress.

Personality and the Dynamics of Goal Regulation and Perceived Stress

Our second aim was to trace personality structure through the dynamic regulation of goal progress under daily variation in perceived stress. These results are displayed in Model 2, which included both within and between-person variation in perceived stress. Stressful days were associated with lower health goal progress \((B = -.17, SE = .02, p < .001)\) and social goal progress \((B = -.19, SE = .02, p < .001)\) on that day. Adding stress to the model activated N in the health domain \((B = .36, SE = .17, p = .04)\). However, contrary to our expectations, holding mean levels of stress constant, higher levels of N predicted higher goal progress over the 100-day study period. Adding a random coefficient for stress significantly improved model fit \(\chi^2(11) = 184.30, p < .001\), suggesting that sensitivity to perceived stress varied across individuals in both the health goal \((\text{random estimate} = .01, SE = .003)\) and social goal \((\text{random estimate} = .02, SE = .005)\).
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domains.

We succeeded in explaining variation in sensitivity to perceived stress in both the health goal and social goal domains. The interaction term N × Daily Stress significantly moderated stress sensitivity in both the health goal progress ($B = -0.003, SE = 0.002, p = .03$) and social goal progress ($B = -0.003, SE = 0.002, p = .04$). Consistent with our expectations, those higher in N were more sensitive to daily perceptions of stress (see Figure 1a). The N × Daily Stress interaction terms accounted for 3% of the variation in health and 9% of the variation in social goal progress. The C × Daily Stress interaction term significantly moderated the sensitivity to stress in the health goal domain ($B = -0.003, SE = 0.002, p = .03$) (see Figure 1b), and explained 6% of the variation in sensitivity to perceived stress on health goal progress and none on social goal progress. The E interaction was not significant, indicating no relationship between sensitivity and progress in either goal domain.

Covariation of Goal and Stress Processes

The final aim of our study was to examine the covariation of goal and stress processes, which are summarized in Table 3, Model 3. We found the variance component for the health goal intercept (random estimate = 273.65, $SE = 41.41$) and social goal intercept (random estimate = 2.73.65, $SE = 41.41$) to significantly covary (Cov(H,S) = 163.73, $SE = 33.58, p < .001$). This suggests regulatory skills extend across goal domains; those who reported higher health goal progress, also reported higher social goal progress. The random coefficients for stress, however, did not significantly covary across the health and social goal. This suggests that stress processes are not systematically linked across health and social domains within the individual. In other words, those who were more sensitive to stress in the health domain were not necessarily also more sensitive to stress in the social domain. Although the regulatory tendencies extended across
goal domains, sensitivity to stress did not.

Discussion

We examined whether the mechanism by which traits affect life outcomes could plausibly be through daily self-regulatory processes. The answer is an unequivocal “yes”. Personality traits were predictive of between-person differences in goal progress over 100 days, as well as within-person linkages between daily stress and daily goal progress. This study shows the crucial interplay of stress and goal processes on a daily basis and indicates that personality traits play a significant role in understanding daily self-regulation in service of important goals, adding to a growing body of literature on risk and resilience factors in stress processes (Almeida, Piazza, Stawski, & Klein, 2011).

The link between perceived stress and goal progress in different domains was not systematically linked within the person, as evidenced by the lack of significant correlation of variance terms. This is important because it suggests that when one goal is blocked, people can still make progress on a goal in a different domain. Past research has shown that well-being is preserved when people do not put all of their “identity eggs” in one basket, and self-complexity can be protective of well-being (Linville, 1985). Goal striving may be one of the processes underlying this phenomenon.

Traits and Goal Regulation under Stress

We found that personality traits predicted differences in how individuals regulate their health and social goals under daily variation in perceived stress.

Neuroticism. Differences in N are significantly related to self-regulation of goals over 100 days. Older adults with higher N made less progress on their social goals across all days, but the link between high N and lower health goal progress was not evident until stress was considered.
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High stress days did tend to pull those high in N “off course” with their health and social goals (cf. Hennecke & Freund, 2010), but when stress was held constant, these individuals made more progress on health goals. Individuals high in N are sensitive to their environment (Costa & McCrae, 2003), and we think the orchid metaphor discussed in relationship to biological sensitivity to context among children (e.g., Ellis & Boyce, 2008) may be apt for high N adults as well. Under the right circumstances, orchids flourish and are a flower of unusual beauty. Perhaps high N individuals can do exceptionally well at meeting their goals, but only under a narrow zone of ideal situations (cf., Lawton & Nahemow, 1973). Getting outside that zone more dramatically limits their adaptational capacities; an orchid outside the hot house does not thrive.

Prior research has shown that people high in N tend to perceive more stress (e.g., Bolger & Zuckerman, 1995) and we found that to be true in our study as well. Our findings expand upon this observation by showing that self-regulatory difficulties that occur on high stress days could be the mechanism linking N and the numerous negative life outcomes shown in many studies (e.g., Lahey, 2009). Future research measuring self-regulatory strength at various points throughout a stressful day could help elucidate this mechanism further.

Conscientiousness. Consistent with previous literature, we found that those higher in C are exposed to lower levels of stress (e.g., Friedman & Martin, 2007; Taylor & Kluemper, 2012). However, our examination of regulatory processes over time suggests that when those higher in C are confronted with stress, they are more sensitive to variation in perceived stress than those lower in C. Interestingly, the examination of within-person processes may have uncovered an aspect of conscientiousness that was previously unknown – the conscientious individuals’ heightened sensitivity to stress when it is perceived. Those high in C may rarely have high stress days, but when they do, it may mean that their usual goal pursuit strategies will not be enacted on that day.
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In late life, as optimization and compensation strategies become compromised (Charles, 2010), it may ironically be those who have had life-long high C who have more difficulty under stress. Long-term longitudinal studies will be necessary to address this issue.

**Extraversion.** Those higher in E made better goal progress across the 100-day study in both the health and social domains. We expected this association in the social domain, but were surprised to find it in the health domain as well. It appears that in later life E plays an important role in self-regulation in multiple domains. Goal pursuit strategies often involve support from others (e.g., a friend with whom to exercise, a daughter who provides transportation to a medical appointment), so perhaps extraverts’ strong social ties are particularly adaptive for goal regulation across all domains in later life. Another potential explanation for the unexpected finding that those high in E made better goal progress in both domains is that E is linked to the behavioral approach system (BAS) as opposed to a behavioral inhibition system (BIS). These two general motivations systems may represent underlying differences in the neural system (e.g., Carver & White, 1994) that make some individuals more sensitive to rewards and activation of goals (BAS). Lucas, Le, and Dyrenforth (2008) found that extraverts are higher in happiness and positive affect – which have been linked to goal progress and attainment. Future research should examine the role that E plays in self-regulation and social support processes.

Extraversion did not, however, play a role in understanding differences in sensitivity to stress. This suggests that in the process of regulating goals in the context of stress E does not heighten or dampen that association.

**Goal Regulation in the Health and Social Domains**

We were uniquely positioned to be able to examine the concurrent regulation of health goals and social goals, both of which are important for the well-being of older adults. To get a
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better window into self-regulation and goal striving we examined *in vivo* perceptions of variation in daily stress. On average, perceived stress creates an equal distraction from goal progress in both the health and social domains. Daily variation in stress is negatively related to goal progress in both health and social domains on that day. Thus, we demonstrated at the person level that stress does harm people’s ability to meet their goals. The ability (or inability) to make goal progress generates emotions (Lazarus, 1999) that, over time, link to physiological pathways that affect health (Aldwin & Gilmer, in press). It will be important in future research to examine emotions or affect in relationship to goal progress at the intraindividual level.

We also examined sensitivity to perceived stress across individuals. The variance components of the model showed that sensitivity to stress in the health goal and social goal domains did not significantly covary. This means that those with the highest sensitivity to perceived stress in the health domain are not the same individuals as those with the highest sensitivity to perceived stress in the social domain. This finding is in line with research on younger adults (e.g., Hoppmann & Klumb, in press) showing stress sensitivity is not systematically linked. For example, though stress may throw off an older adult’s goal to make a new friend, it may not necessarily also disrupt a goal to eat a more healthy diet. The exception to this finding is for individuals high in N. In our study we found N to explain variation in sensitivity to perceived stress on both health goal progress and social goal progress. This suggests that older adults high in N are not so easily able to compartmentalize and make goal progress on a goal even if progress on another one is low on a given day. Thus, self-regulation may be more “all of a piece” for them. This lack of resilience to stress across goal domains is a vulnerability that, if known, could perhaps be prevented. Programs to teach coping skills to high N individuals under stress could emphasize that when things go awry in one important life area it is important not to
overgeneralize to other life domains.

An important limitation in our study is the self-selected nature of the sample. It is not representative and those who agree to be in a study for 100 days are likely different from the general population in many ways. Conscientiousness, for example, might be expected to be particularly high – however, Choun (2012) showed that C scores for this sample of older adults do not differ from published norms.

Conclusions

These results provide one of the first empirical tests of linkages in the six-foci model (Hooker & McAdams, 2003) as our findings link personality traits to self-regulatory processes by demonstrating trait differences in overall goal progress in two domains. Importantly, we discovered effects of traits on self-regulation that would not be evident in a cross-sectional study or even a prospective study with few occasions of measurement. The effect of N on regulation of health and social goals and of C on regulation of health goals were not fully evident until they were activated by individual differences in levels of sensitivity to variation in daily perceptions of stress. Such a link could only be found in a design that allows for intraindividual variation to be considered empirically. Our findings dovetail with the recommendation of Gerstorf and Ram (2012) to use stress as a way to examine mechanisms influencing individuals’ development.

Linking personality to daily self-regulation has applicability to many areas of importance to public health. For example, personalized tailoring of health engagement programs to maximize health outcomes (e.g., Gruber, 2010) is an area of high interest for health care systems worldwide. Understanding how to motivate people to stay “on-track” with their health behaviors seven days a week throughout the course of their lives is essential (e.g., Glasgow, 2010; Hennecke & Freund, 2010) and tailoring interventions based on personality information could be uniquely effective.
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Recent research has shown that personality traits are also highly variable within persons (Noftle & Fleeson, 2010), and thus a next step in our line of research would be to understand how variation in self-regulatory processes may influence personality traits. The bidirectional relationships between personality processes and structures play a key role in understanding adaptation, growth, and change over the lifespan. On the horizon is the exciting possibility of embedding microlongitudinal modules into long term longitudinal studies. This will allow for in-depth understanding of the ups and downs of everyday life that, over time, form the arc of one’s life story and provide understanding for processes that shaped it.
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References


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doi:10.1016/j.jrp.2009.03.016


doi:10.1146/annurev.psych.57.102904.190127


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Table 1
*Correlation Matrix and Descriptive Statistics of Between-Person Characteristics*

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Health Goal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Social Goal</td>
<td>.68***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Stress</td>
<td>-.45***</td>
<td>-.50***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Neuroticism</td>
<td>-.21*</td>
<td>-.26**</td>
<td>.62***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Conscientiousness</td>
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<td>.24**</td>
<td>-.39***</td>
<td>-.55***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Extraversion</td>
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<td>.33***</td>
<td>-.36***</td>
<td>-.46***</td>
<td>.40***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Age</td>
<td>-.05</td>
<td>.04</td>
<td>.06</td>
<td>-.08</td>
<td>.01</td>
<td>.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Gender</td>
<td>-.10</td>
<td>-.14</td>
<td>.12</td>
<td>.10</td>
<td>-.12</td>
<td>-.03</td>
<td>.00</td>
<td></td>
<td></td>
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<tr>
<td>9. Group</td>
<td>.32***</td>
<td>.12</td>
<td>-.20*</td>
<td>-.06</td>
<td>.11</td>
<td>-.06</td>
<td>-.17</td>
<td>.02</td>
<td></td>
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<tr>
<td>Mean</td>
<td>59.62</td>
<td>62.83</td>
<td>45.87</td>
<td>48.06</td>
<td>46.40</td>
<td>50.27</td>
<td>63.29</td>
<td>.88</td>
<td>.77</td>
</tr>
</tbody>
</table>

Note. Characteristics health goal, social goal, and stress reflect intraindividual means across the study period. Raw scores on neuroticism, conscientiousness, and extraversion were converted to t-scores to reflect deviation from population norm of 50 and standard deviation of 10. Gender is coded as 1 = female, 0 = male. Group coded as 1 = daily, 0 = burst. *p < .05, **p < .01, ***p < .001.
Table 2  Adjusted Bivariate Analysis of Personality Traits and Health and Social Goal Regulation

<table>
<thead>
<tr>
<th>Trait</th>
<th>Health Goal</th>
<th>Social Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>-.19</td>
<td>-.35**</td>
</tr>
<tr>
<td></td>
<td>(.14)</td>
<td>(.15)</td>
</tr>
<tr>
<td></td>
<td>(-.47, .08)</td>
<td>(-.64, -.06)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.36*</td>
<td>.37*</td>
</tr>
<tr>
<td></td>
<td>(.16)</td>
<td>(.17)</td>
</tr>
<tr>
<td></td>
<td>(.06, .67)</td>
<td>(.04, .71)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.41**</td>
<td>.49***</td>
</tr>
<tr>
<td></td>
<td>(.13)</td>
<td>(.14)</td>
</tr>
<tr>
<td></td>
<td>(.15, .67)</td>
<td>(.21, .77)</td>
</tr>
</tbody>
</table>

Note. Estimates based on multivariate mixed effects models, and are adjusted for, age, group, and gender. Trends modeled as linear, with random coefficient. Autocorrelation of within person residuals modeled with an AR(1) process.

*p < .05, **p < .01, ***p < .001
### Table 3

**Multivariate Multilevel Model of Personality Traits, Stress and Health and Social Goal Regulation.**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SE)</td>
<td>B (SE)</td>
<td>B (SE)</td>
</tr>
<tr>
<td><strong>Fixed Effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Goal Intercept</td>
<td>59.83*** (1.83)</td>
<td>59.69*** (1.70)</td>
<td>59.70*** (1.70)</td>
</tr>
<tr>
<td>Day</td>
<td>.07*** ( .02)</td>
<td>.06*** ( .02)</td>
<td>.06*** ( .02)</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>.11 ( .17)</td>
<td>.36* ( .17)</td>
<td>.44** ( .18)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.26 ( .19)</td>
<td>.12 ( .17)</td>
<td>.23 ( .17)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.36** ( .15)</td>
<td>.35** ( .14)</td>
<td>.33** ( .14)</td>
</tr>
<tr>
<td>Stress WP</td>
<td>-.17*** ( .02)</td>
<td>-.17*** ( .02)</td>
<td>-.17*** ( .02)</td>
</tr>
<tr>
<td>Stress BP</td>
<td>-.28*** ( .07)</td>
<td>-.28*** ( .07)</td>
<td>-.28*** ( .07)</td>
</tr>
<tr>
<td>N × Stress</td>
<td>-.003* ( .001)</td>
<td>-.003* ( .002)</td>
<td>-.003* ( .001)</td>
</tr>
<tr>
<td>C × Stress</td>
<td>-.000 ( .002)</td>
<td>-.000 ( .002)</td>
<td>-.000 ( .002)</td>
</tr>
<tr>
<td>E × Stress</td>
<td>-.001 ( .002)</td>
<td>-.001 ( .002)</td>
<td>-.001 ( .002)</td>
</tr>
<tr>
<td><strong>Social Goal Intercept</strong></td>
<td>63.31*** (1.89)</td>
<td>63.11*** (1.72)</td>
<td>63.12*** (1.72)</td>
</tr>
<tr>
<td>Day</td>
<td>.10*** ( .02)</td>
<td>.09*** ( .02)</td>
<td>.09*** ( .02)</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-.11 ( .18)</td>
<td>.14 ( .18)</td>
<td>.27 ( .19)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.11 ( .20)</td>
<td>-.01 ( .18)</td>
<td>.05 ( .18)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.40** ( .17)</td>
<td>.31* ( .15)</td>
<td>.33* ( .15)</td>
</tr>
<tr>
<td>Stress WP</td>
<td>-.19*** ( .02)</td>
<td>-.19*** ( .02)</td>
<td>-.19*** ( .02)</td>
</tr>
<tr>
<td>Stress BP</td>
<td>-.35*** ( .07)</td>
<td>-.35*** ( .07)</td>
<td>-.35*** ( .07)</td>
</tr>
<tr>
<td>N × Stress</td>
<td>-.003* ( .002)</td>
<td>-.003* ( .002)</td>
<td>-.003* ( .002)</td>
</tr>
<tr>
<td>C × Stress</td>
<td>-.000 ( .002)</td>
<td>-.000 ( .002)</td>
<td>-.000 ( .002)</td>
</tr>
<tr>
<td>E × Stress</td>
<td>-.001 ( .002)</td>
<td>-.001 ( .002)</td>
<td>-.001 ( .002)</td>
</tr>
<tr>
<td><strong>Variance</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Health Goal Intercept</td>
<td>318.57*** (47.68)</td>
<td>271.50*** (40.53)</td>
<td>273.65*** (41.14)</td>
</tr>
<tr>
<td>Social Goal Intercept</td>
<td>337.91*** (49.81)</td>
<td>280.09*** (41.71)</td>
<td>278.37*** (41.18)</td>
</tr>
<tr>
<td>Cov (health, social)</td>
<td>216.64*** (41.06)</td>
<td>162.95*** (33.46)</td>
<td>163.73*** (33.58)</td>
</tr>
<tr>
<td>H × Day</td>
<td>.01*** ( .00)</td>
<td>.01*** ( .003)</td>
<td>.01*** ( .003)</td>
</tr>
<tr>
<td>S × Day</td>
<td>.02*** ( .00)</td>
<td>.02*** ( .004)</td>
<td>.02*** ( .004)</td>
</tr>
<tr>
<td>Cov (h × day, s × day)</td>
<td>.01** ( .00)</td>
<td>.01* ( .002)</td>
<td>.01* ( .003)</td>
</tr>
<tr>
<td>H × Stress</td>
<td>.01*** ( .003)</td>
<td>.01*** ( .003)</td>
<td>.01*** ( .003)</td>
</tr>
<tr>
<td>S × Stress</td>
<td>.02*** ( .005)</td>
<td>.02*** ( .004)</td>
<td>.02*** ( .004)</td>
</tr>
<tr>
<td>Cov (h × stress, s × stress)</td>
<td>.000 ( .003)</td>
<td>-.001 ( .002)</td>
<td>-.001 ( .002)</td>
</tr>
<tr>
<td>Health Residual</td>
<td>377.20*** (6.69)</td>
<td>352.88*** (6.28)</td>
<td>352.88*** (6.28)</td>
</tr>
<tr>
<td>Social Residual</td>
<td>371.63*** (6.57)</td>
<td>341.62*** (6.07)</td>
<td>341.62*** (6.07)</td>
</tr>
<tr>
<td>Cov (Health, Social)</td>
<td>60.76*** (4.60)</td>
<td>42.83*** (4.27)</td>
<td>42.85*** (4.27)</td>
</tr>
<tr>
<td>Φ</td>
<td>.23** ( .01)</td>
<td>.22*** ( .01)</td>
<td>.22*** ( .01)</td>
</tr>
<tr>
<td>-2* LL</td>
<td>12,2820.4</td>
<td>12,208.5</td>
<td>12,1998.5</td>
</tr>
</tbody>
</table>

*Note.* Models control for age, gender, and burst versus daily group. Time is modeled as linear and with a random coefficient. Model included age, gender, and measurement group. The estimates were not significant. AR(1) process applied to control for autocorrelation of within person residuals.

* p ≤ .05, ** p ≤ .01, *** p ≤ .001
Figure 1. Variation in Health Goal Progress Sensitivity to Perceived Stress Across Differences in Neuroticism and Conscientiousness.

Average, high, and low levels of trait conscientiousness defined as:

44 > Normal < 55; Low < 44;

High > 55 (Costa & McCrae, 1992)