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# Daily Cognitive Complaints and Engagement in Older Adulthood: Personality Traits Are More Predictive Than Cognitive Performance

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Cognitive complaints and engagement in cognitive activities are two consistent predictors of cognitive aging outcomes, including risk for nonnormative decline. Though research has considered predictors of complaints and engagement in general, little work has attended to the fact that these fluctuate at the daily level. The current study examined individual difference predictors of means and variability for engagement and complaints across 10 days in a sample of older adults ($n$ = 136; $M_{age}$ = 70.45 years). When comparing personality traits to indicators of cognitive performance, personality differences appeared better unique predictors for these measures of daily cognitive life. Specifically, even when accounting for demographics, measures of cognitive performance, and the other personality traits investigated, older adults higher on openness to experience reported fewer daily cognitive complaints and more engagement on average, as well as greater daily variability in engagement. In addition, higher neuroticism predicted greater variability in reports of cognitive complaints across days. Implications are discussed with respect to how these findings advance our understanding of cognitive complaints and engagement in daily life.

*Keywords:* cognitive complaints, cognitive engagement, personality, daily assessments, older adulthood



Over the past decade, research on aging has shifted toward a stronger appreciation of "microlevel" variations in cognitive functioning, as it has become more apparent that cognitive performance can vary substantially in-between successive assessments spread years, days, or even moments apart. For instance, recent work has demonstrated that cognitive functioning can vary both from one day to the next as well as within a given day (Sliwinski et al., 2018; Sliwinski, Smyth, Hofer, & Stawski, 2006), often with nontrivial effect sizes. Even within a single task, cognitive performance can fluctuate from trial to trial, with older adults typically showing greater intraindividual variability than younger adults (Castel, Balota, Hutchison, Logan, & Yap, 2007; Payne & Stine-Morrow, 2014). However, it remains unclear whether individuals in fact perceive these differences in functioning at the daily level. In support, some research does show that individuals vary from one day to the next with respect to their reports of cognitive complaints and engagement (Aschwanden, Luchetti, & Allemand, 2019). That said, these daily reports are likely a reflection both of the individual's cognitive status as well as their dispositional tendency to attend to such concerns, leading to the need to consider the explanatory power for each of these influences. The current study examined individual differences in personality traits, using the Big Five taxonomy (John & Srivastava, 1999), and cognitive performance as relative predictors of older adults' daily reports for cognitive complaints and cognitive engagement (mean daily levels). Moreover, we examined whether these individual differences predicted which older adults also experienced more variability over days in complaints and engagement (variability across days).

## Implications of Personality Development During Older Adulthood for Cognitive Science

A primary impetus for considering personality traits as predictors of cognitive complaints and engagement comes from the increasing recognition that personality trait development occurs throughout the life span. Contemporary perspectives on personality traits underscore that (a) they reflect relatively enduring tendencies across time and situations and (b) are composed of actions, thoughts, and feelings that manifest at the state level, with the belief that fluctuations in these states may ultimately provide insights into changes at the broader trait level (Roberts, 2009; Roberts & Jackson, 2008). In line with these new theoretical

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perspectives, work is still needed to consider the extent that traits predict daily cognitive and behavioral manifestations.

This theoretical perspective is aligned with the work over recent decades regarding whether and how individuals change on personality traits across the life span. Specific to older adulthood, there is now significant evidence for mean-level changes both in studies using chronological age (Roberts, Walton, & Viechtbauer, 2006) and time-to-death analyses (Wagner, Ram, Smith, & Gerstorf, 2016). Researchers have described these trends using classic life span theories of development, such as work underscoring how the life tasks set forth by Havighurst (1972) can be used for discussing why personality traits change even into older adulthood (Hutteman, Hennecke, Orth, Reitz, & Specht, 2014). For instance, research demonstrates that the social role transitions circumscribed by these life tasks influence patterns of change and stability of personality traits in adulthood (Lucas & Donnellan, 2011; Specht, Egloff, & Schmukle, 2011).

Perhaps of greater importance, research also has consistently demonstrated that older adults differ in their patterns of individual trait change (Allemand, Zimprich, & Martin, 2008; Small, Hertzog, Hultsch, & Dixon, 2003). In other words, in addition to the evidence for mean-level changes on the Big Five traits, multiple studies have shown that older adults have the potential to deviate from these trends in more or less adaptive fashions. These individual-level changes have significant consequences, given that how individuals change on personality traits during middle and older adulthood predicts mortality risk (Mroczek & Spiro, 2007) and may serve as a warning sign for later or ongoing cognitive decline (Robins Wahlin & Byrne, 2011).

Again, though traits evidence strong stability, the capacity for change during this period holds great implications for investigations linking personality and cognitive science. For one, it suggests that any evidence for personality traits as predictors of cognitive outcomes should not be taken as findings that someone is "destined" for certain cognitive outcomes as a result of their entrenched personality. In addition, it underscores the value of considering the daily cognitive manifestations associated with personality traits. If traits can be viewed as constellations of state-level thoughts and behaviors (Roberts, 2009), then it is of interest to consider how traits predict daily cognitive life.

## Understanding Daily Cognitive Complaints

Researchers have demonstrated the importance of studying subjective cognitive complaints in older adulthood, in part due to their predictive value for later cognitive change, even when controlling for initial levels of cognitive functioning (for a review, see Mendonça, Alves, & Bugalho, 2016). As such, it may be surprising that the associations between subjective cognitive complaints and objective cognitive performance often are relatively modest in magnitude (Burmester, Leathem, & Merrick, 2016). Indeed, that meta-analysis found a mean effect size of only $r = -.13$ between cognitive complaints and overall cognitive performance, and $r = -.10$ for complaints and memory performance. Similar findings though occur when adults are asked to report on their memory capacities rather than issues. For instance, measures of memory self-efficacy often hold only modest associations with actual memory performance (Beaudoin & Desrichard, 2011). Moreover, memory self-efficacy beliefs may fail to predict memory performance at all, once one accounts for a general cognitive composite (Payne et al., 2017). One concern though is that these studies typically involve single assessments of self-reported cognitive complaints (or capabilities), and it has been shown that complaints are variable from one day to the next (Aschwanden et al., 2019). Therefore, it is important to consider the associations between performance and complaints at the daily level, but it is likely that additional individual difference factors will play a role in predicting daily complaints, beyond indicators of cognitive performance.

Building from the health psychology literature, it is expected that personality dispositions play an important role. A primary candidate is trait neuroticism, defined by a proclivity toward anxiety and emotional instability (John & Srivastava, 1999). Previous research found that neuroticism is associated with a greater likelihood to report health concerns, whether present or not (Costa & McCrae, 1985, 1987), which ultimately may explain the profound impact that personality trait holds for societal health care costs (Cuijpers et al., 2010). Though often framed through this negative light, work also points to how neuroticism is closely linked to greater vigilance for health concerns (Weston & Jackson, 2018). As such, insofar that individuals higher on neuroticism may be more concerned and watchful regarding their health, leading them to a greater propensity to witness and report problems, which may include cognitive complaints. Indeed, higher neuroticism is typically linked to a greater frequency of cognitive complaints and failures (e.g., Aschwanden, Kliegel, & Allemand, 2018; Könen & Karbach, 2018; Lange & Süß, 2014; Slavin et al., 2010; Snitz et al., 2015). Moreover, though further work is needed on identifying the cognitive signatures for different personality traits, the literature thus far on neuroticism has suggested that this trait is defined by greater cognitive "noise" (Robinson & Tamir, 2005); specifically, studies have suggested that neuroticism may be characterized by greater variability during tests of cognitive performance.

Though the other Big Five personality traits may play a role, there is less of a clear theoretical and empirical background for these predictions. The strongest case may be for conscientiousness, a trait defined by a proclivity toward greater industriousness and self-control (John & Srivastava, 1999), which has been associated with fewer cognitive complaints and failures in a few studies (Koller, Hill, Mogle, & Bhang, 2019; Könen & Karbach, 2018; Slavin et al., 2010; Snitz et al., 2015). Openness to experience (a tendency toward intellectualism, artistic pursuits, and engagement in novel activities, John & Srivastava, 1999; hereafter, openness), extraversion (defined with respect to greater gregariousness and energy), and agreeableness (defined by greater trustworthiness and cooperation) are usually not the target of analysis, and work has shown little evidence for consistent associations between these traits and subjective cognitive impairment (Koller et al., 2019). However, one study has suggested that these traits could hold negative associations with cognitive complaints (Snitz et al., 2015), and openness was a negative correlate of cognitive complaints in another study (Slavin et al., 2010).

## Predictors of Daily Cognitive Engagement

Findings on cognitive functioning and cognitive activity engagement are somewhat less equivocal relative to the work on functioning and complaints. Research on cognitive engagement tend to focus on activities that practice verbal ability, such as

crossword puzzles and reading, or abstract thinking, such as problem-solving and philosophical discussions (e.g., Parisi, Stine-Morrow, Noh, & Morrow, 2009). Given these behaviors, it is perhaps unsurprising that studies show that cognitive performance tends to correlate positively with intellectual and cognitive engagement (e.g., Parisi et al., 2009; Stine-Morrow, Parisi, Morrow, Greene, & Park, 2007), which has led researchers to suggest these forms of engagement may provide a pathway to cognitive maintenance in older adulthood (e.g., Smith, 2016). As such, cognitive performance should be expected to continue to predict engagement in these behaviors, though more research is needed to examine these effects when engagement is assessed at the daily level.

Personality traits have also been linked to cognitive engagement. Of the Big Five traits, openness has been most consistently associated with intellectual engagement, often with moderate associations (Parisi et al., 2009; Soubelet & Salthouse, 2010). Empirical evidence shows that open individuals engage more often in intellectual and creative activities (Stephan, Boiché, Canada, & Terracciano, 2014), particularly reading (Rohrer, Lucas, Donnellan, & Schlegel, 2018). Indeed, openness and engagement seem so intertwined that interventions promoting engagement also appear to promote openness among older adults (Jackson, Hill, Payne, Roberts, & Stine-Morrow, 2012). That said, none of these studies have considered these associations with respect to daily cognitive engagement. Concerning the remaining Big Five traits and cognitive engagement, there are some studies that report positive associations for extraversion (Wilson et al., 2005) and negative links for agreeableness (Jopp & Hertzog, 2010; McManus & Furnham, 2006), whereas findings for neuroticism and conscientiousness tend to be mixed (e.g., McManus & Furnham, 2006; Stephan et al., 2014; Wilson et al., 2005).

## Current Study

The current study employed the same data set as past work on daily cognitive behaviors (Aschwanden et al., 2019), and expanded upon that work to examine the between-subjects predictors of daily complaints and engagement. Specifically, we considered two sets of individual difference variables: cognitive performance in four abilities (short-term auditory memory, working memory, processing speed, verbal knowledge) and the Big Five personality traits. The broader aims of the study necessitated the assessment of prominent explanatory variables in cognitive aging research, as well as markers of crystallized and fluid intelligence; however, for the current purposes, we were primarily focused on considering these as four indicators of cognitive performance more broadly, rather than making specific predictions about certain domains. We expected cognitive performance (i.e., all four abilities) to negatively predict mean daily levels of cognitive complaints and positively predict mean daily levels of cognitive engagement; however, it is unclear whether performance would predict variability on these measures. One reason for the lack of predictions is that it is generally uncertain whether variability on either front is adaptive or maladaptive, a point discussed further in the discussion. With respect to the Big Five trait taxonomy (John & Srivastava, 1999), we expected neuroticism to positively predict both mean and variance in daily cognitive complaints. We also expected openness to positively predict daily cognitive engagement, though we refrained from making other predictions regarding whether personality will predict variability in engagement. We did not formulate hypotheses for the other personality traits given the lack or inconsistency of research findings, and instead we explored their links with daily cognitive outcomes to form the basis for more confirmatory future research.

## Method

### Participants and Procedure

The sample included 136 participants (58.8% female; 41.2% male) and ranged from 60 to 91 years ($M$ = 70.45, $SD$ = 6.27). The marital status of the participants was as follows: 7.4% single, 46.7% married, 2.2% separated, 30.4% divorced, and 13.3% widowed. About 19.1% of the participants had a high school degree or less, 50.0% had a college degree (or higher), and 30.9% indicated others (e.g., vocational training). The Swiss education system involves students being "tracked" into an educational path involving university study or vocational training after high school or basic education, and thus we considered this variable as trichotomous to reflect the categorical differences between these groups. None of the participants showed signs of cognitive impairment as assessed by the Mini Mental State Examination (scores <24; Folstein, Folstein, & McHugh, 1975) or depression as measured using the General Depression Scale (scores <18; Hautzinger & Bailer, 1993).

The study methods and procedures were approved by the ethics committee for psychological and related research at the University of Zurich. Data came from the Realizing Healthy Years Through Health Maintenance study in Switzerland, the primary goal of which was to understand older adults' engagement in different daily activities, and its role in maintaining health and functioning (see also Aschwanden et al., 2019). Participants gave their written informed consent prior to study participation. The study included three phases: predaily assessment, daily assessments, and postdaily assessment. On Day 1, participants came to the laboratory for a screening session and completed a series of cognitive tasks and self-report questionnaires, from which the current cognitive performance and personality measures were extracted. They were also provided with an Android mobile phone and were instructed on how to use the device during the daily assessment phase. The daily assessment phase consisted of multiple active and passive assessments per day (up to 3). For the present analyses, we considered end-of-day assessments taken across the 10 days following the initial assessment; the postdaily assessment was not included in the current study. The span of 10 days was chosen primarily to allow greater precision in estimating individual patterns of variability, as smaller timeframes would complicate this estimation. Participants were asked questions about their cognitive complaints and cognitive engagement on their mobile phone, triggered by a ring tone. Rings were timed randomly within a fixed time period in the evening (6:00–9:00 p.m.). If participants did not respond to a ring, they were reminded up to a total of 10 times. Participants had the option to delay responding and were then reminded again by a ring tone within the same time period. The software movisensXS Version 4474 (movisens GmbH, 2016) was employed to run the daily questions on the mobile phones. Participants were advised to call a study hotline if they faced any problems. They were paid 150 Swiss Francs (approx. US$153) for their participation. The com-

pliance of participants was high, as they completed at minimum 89% of the evening measurement occasions.

## Dispositional Measures

**Personality traits.** The Big Five Inventory (John & Srivastava, 1999; Rammstedt & John, 2005) was used to assess personality traits. Eight items measured neuroticism (e.g., can be moody; Cronbach's $\alpha = .84$), eight items assessed extraversion (e.g., is talkative; $\alpha = .81$), 10 items measured openness (e.g., has an active imagination; $\alpha = .75$), 10 items measured agreeableness (e.g., is generally trusting; $\alpha = .75$), and nine items assessed conscientiousness (e.g., is a reliable worker; $\alpha = .76$). Participants rated the items on a Likert scale ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). All scales were scored as means and higher scores indicate higher levels of the given trait.

**Cognitive performance.** Participants were administered a cognitive test battery measuring short-term auditory memory (digit span forward), working memory (digit span backward), processing speed (digit symbol substitution task), and verbal knowledge (spot-a-word task).

The digit span task (German Wechsler Adult Intelligence Scale–Revised; Tewes, 1991) involved both digit span forward and backward, which tap distinct but interdependent cognitive functions. The forward task primarily measures short-term auditory memory while the backward task assesses the ability to manipulate verbal information while in temporary storage (working memory). First, participants listened to and repeated a sequence of numbers said by the interviewer. In the second part, participants listened to a sequence of numbers and repeated them in reverse order. In both parts, the length of each sequence of numbers increased as the participant correctly responded. Each correct response was worth one point with a maximum of 14 for each task.

The digit symbol substitution task comprised 93 items (German Wechsler Adult Intelligence Scale–Revised; Tewes, 1991). Participants had to assign symbols to digits. For each item, a coding table that paired nine different symbols with the digits one to nine, respectively, was presented on the top. Below the table, the digits were presented, and participants had to fill in the corresponding symbols. The number of correctly answered items was scored (possible range = 0–93). After a practice run of seven items, participants had 90 s to work on the task.

The spot-a-word task consisted of 37 items taken from Version A of a widely used German vocabulary test Spot-a-Word test (MWT; Lehrl, 1999). For each item, one word and four pronounceable nonwords, which were similarly spelled or similarly sounding, were presented with increasing difficulty (e.g., *Bien— Bonu— Beni— Bein— Beini*). Participants were asked to select the word from the nonwords (i.e., the word in the presented example would be *Bein*, which means "leg" in German). The number of correct responses was scored (possible range = 0–37).

## Daily Measures

**Daily cognitive complaints.** Participants rated four items from the Nuremberg Self-Assessment List (Oswald & Fleischmann, 1995) to report retrospectively on their daily cognitive complaints (e.g., "I misplaced or lost an object such as keys or glasses"; see Appendix for all items). The items were responded on a Likert scale ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). The Cronbach's alpha estimates ranged from .41 to .64 across the daily assessments, reflecting the fact that this measure was designed to capture a broad array of potential cognitive issues.

**Daily cognitive engagement.** Participants rated a total of nine items from the Typical Cognitive Engagement questionnaire (Goff & Ackerman, 1992) to report retrospectively on their daily cognitive engagement (e.g., "I enjoyed thinking about a complicated problem"; see Appendix for all items). The items were rated on a Likert scale ranging from 0 (*strongly disagree*) to 6 (*strongly agree*). The Cronbach's alpha estimates ranged from .39 to .60 across the 10 days.

For the analyses, we first calculated individual means for engagement and complaints across the days. Means reflect the average score across days, and higher scores indicate greater mean engagement and complaints. We also calculated the standard deviations across the daily scores for each individual as the central metric for within-person variability.

## Covariates

Age, education, and subjective health were included as potential covariates. In line with the Swiss educational system, educational attainment was assessed with three categories: 1 = *high school degree or less*, 2 = *vocational training*, and 3 = *college degree or more*. Subjective health was measured using one item, asking participants to rate their general health status on a scale from 1 (*bad*) to 5 (*excellent*). On average, participants reported relatively good health ($M = 3.76$, $SD = 0.69$).

## Statistical Analysis

Linear regression models were used to test the unique predictors for the daily cognitive outcomes. Model 1 included demographic variables (age, education, and subjective health) only. Education was included as a linear and quadratic effect to account for potential for college education to play a pronounced role on cognitive outcomes. Model 2 further included baseline cognitive performance (short-term auditory memory, working memory, processing speed, and verbal knowledge). Model 3 then included the Big Five personality traits (neuroticism, conscientiousness, openness, agreeableness, and extraversion). Analyses were conducted in R (R Core Team, 2018) and RStudio (RStudio Team, 2016) using the package *sjPlot* (Lüdecke, 2018), which displays unstandardized beta coefficients. In addition, standardized beta coefficients were obtained using the package *lm.beta* (Behrendt, 2014). Missing data was low and handled using pairwise deletion, resulting in $n = 133–136$ across analyses.

# Results

Table 1 presents the descriptive statistics for the demographic variables, baseline cognitive performance, and daily cognitive measures and the personality traits. Table 2 displays the correlations between these variables. Both cognitive performance and personality traits correlated with daily cognitive reports of behaviors at the zero-order level, yet we found more significant correlations with personality traits than indicators of cognitive performance. Of the demographics, higher age was associated with more

Table 1
*Descriptive Statistics of the Sample*

| Variable | % | *M* | *SD* | Min | Max |
|---|---|---|---|---|---|
| Demographics | | | | | |
| Age | | 70.45 | 6.27 | 60 | 91 |
| Education | | 2.31 | 0.77 | 1 | 3 |
| Subjective health | | 3.76 | 0.69 | 2 | 5 |
| Gender (male) | 41.2 | | | | |
| Baseline cognitive performance | | | | | |
| Short-term auditory memory | | 9.00 | 2.01 | 4 | 15 |
| Working memory | | 6.27 | 2.02 | 2 | 11 |
| Processing speed | | 46.43 | 8.87 | 26 | 70 |
| Verbal knowledge | | 32.83 | 2.42 | 24 | 37 |
| Personality traits | | | | | |
| Neuroticism | | 2.05 | 1.10 | 0.12 | 5.50 |
| Conscientiousness | | 4.56 | 0.82 | 2.11 | 6.00 |
| Openness | | 4.25 | 0.80 | 1.90 | 5.90 |
| Agreeableness | | 4.37 | 0.82 | 2.00 | 5.90 |
| Extraversion | | 3.94 | 0.98 | 1.00 | 6.00 |
| Daily cognitive outcomes | | | | | |
| Complaints mean | | 0.97 | 0.75 | 0.00 | 4.00 |
| Complaints variability | | 0.63 | 0.30 | 0.00 | 1.42 |
| Engagement mean | | 3.12 | 0.68 | 1.33 | 5.65 |
| Engagement variability | | 0.57 | 0.23 | 0.13 | 1.26 |

*Note.* $N = 133–136$. Min = minimum; Max = maximum. Education is reported on a scale from 1 to 3. In the analyses, education was entered as ordinal variable with three categories, that is, 1 = *high school degree or less* (19.1%), 2 = *other schooling (e.g., vocational training*, 30.9%), and 3 = *college degree or more* (50%).

cognitive complaints and better education was linked to more cognitive engagement. Likewise, better subjective health was associated with greater variability in engagement. Of further note, there was a negative correlation between mean complaints and variability in engagement. The regression models are shown in Tables 3–6, showing unstandardized beta coefficients. The standardized beta coefficients are summarized in Table 7.

## Daily Cognitive Complaints

Participants who reported worse subjective health reported more cognitive complaints (Table 3, Model 1 and Model 2), however this effect was reduced to nonsignificance when including the Big Five personality traits. As can be seen in Model 3 (see Table 3), openness emerged as the only personality trait that was associated with the mean of cognitive complaints. Controlling for sociodemographic variables and baseline cognitive performance, participants higher in openness reported fewer cognitive complaints ($b = -0.20$, 95% confidence interval [CI: −0.39, −0.02], $p < .05$). Model 3 explained 14.99% of the variance in the mean of cognitive complaints (adjusted $R^2 = .15$), $F(13, 121) = 2.82$, $p < .01$. Table 4 shows the results for the intraindividual variability of cognitive complaints. Participants with better verbal knowledge ($b = 0.03$, 95% CI [0.01, 0.06], $p < .05$) and higher levels of neuroticism ($b = 0.07$, 95% CI [0.01, 0.12], $p < .05$) showed more individual variability in cognitive complaints. Model 3 explained 5.92% of the variance in the variability of cognitive complaints (adjusted $R^2 = .06$), $F(13, 119) = 1.64$, $p = .084$.

## Daily Cognitive Engagement

Individuals who had a college degree or higher reported more cognitive engagement, but this effect was reduced to nonsignificance when accounting for personality traits (see Table 5). Higher openness was associated with more cognitive engagement on the mean daily level ($b = 0.22$, 95% CI [0.04, 0.39], $p < .05$). Model 3 explained 8.26% of the variance in the mean of cognitive engagement (adjusted $R^2 = .08$), $F(13, 121) = 1.93$, $p < .05$. The pattern of associations was similar for intraindividual variability of cognitive engagement (see Table 6). Subjective health was associated with greater variability ($b = 0.07$, 95% CI [0.01, 0.12], $p < .05$), but this link was attenuated when personality traits were included. Individuals with higher scores on openness reported more daily variability in engagement in cognitive demanding activities ($b = 0.07$, 95% CI [0.01, 0.13], $p < .05$). Model 3 explained 4.97% of the variance in the variability of cognitive engagement (adjusted $R^2 = .05$), $F(13, 120) = 1.54$, $p = .115$.

In sum, we identified three significant predictors of daily reports of cognitive behaviors: verbal knowledge, openness, and neuroticism. Higher neuroticism and higher verbal knowledge were associated with greater variability in cognitive complaints. More-

Table 2
*Correlations Between the Variables of Interest*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | | | | | | | | | | | | | | | |
| 2. Education | .01 | | | | | | | | | | | | | | |
| 3. Health | −.17* | −.00 | | | | | | | | | | | | | |
| 4. STA memory | −.12 | .26** | .00 | | | | | | | | | | | | |
| 5. Working memory | −.25** | .22* | .02 | .48** | | | | | | | | | | | |
| 6. Processing speed | −.39** | .20* | .18* | .22* | .46** | | | | | | | | | | |
| 7. Verbal knowledge | .04 | .41** | .09 | .26** | .31** | .32** | | | | | | | | | |
| 8. Neuroticism | .06 | −.01 | −.24** | −.01 | −.07 | −.11 | −.06 | | | | | | | | |
| 9. Conscientiousness | −.13 | .01 | .15 | .04 | .10 | .12 | −.04 | −.45** | | | | | | | |
| 10. Openness | −.24** | .33** | .33** | .06 | .07 | .19* | .16 | −.26** | .27** | | | | | | |
| 11. Agreeableness | .02 | −.03 | .18* | −.03 | .01 | −.03 | −.03 | −.41** | .41** | .15 | | | | | |
| 12. Extraversion | .08 | −.04 | .26** | −.06 | −.16 | −.11 | −.23** | −.40** | .28** | .30** | .25** | | | | |
| 13. Complaints, *M* | .22** | −.03 | −.29** | .02 | −.04 | −.19* | −.05 | .19* | −.22* | −.36** | −.21* | −.24** | | | |
| 14. Complaints, i*SD* | .07 | .01 | −.05 | .03 | −.06 | −.02 | .20* | .26** | −.24** | −.05 | −.09 | −.15 | .37** | | |
| 15. Engagement, *M* | .03 | .21* | .03 | .05 | −.05 | .02 | .01 | −.13 | .19* | .32** | .12 | .23** | .07 | .00 | |
| 16. Engagement, i*SD* | −.07 | .04 | .21* | −.11 | .02 | .01 | .10 | −.04 | −.00 | .25** | .08 | .10 | −.22* | −.04 | .09 |

*Note.* $N = 133–136$. STA = short-term auditory; i*SD* = individual standard deviation (variability).
* $p < .05$. ** $p < .01$.

Table 3
*Predicting Mean of Daily Cognitive Complaints*

| Predictor | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | *b* | 95% CI | *b* | 95% CI | *b* | 95% CI |
| Intercept | 0.55 | [−1.09, 2.19] | 1.09 | [−1.40, 3.58] | 3.38* | [0.53, 6.23] |
| Age | 0.02* | [0.00, 0.04] | 0.02 | [−0.00, 0.04] | 0.02 | [−0.01, 0.04] |
| Education (linear) | −0.05 | [−0.28, 0.17] | −0.04 | [−0.29, 0.22] | 0.07 | [−0.19, 0.33] |
| Education (quadratic) | 0.08 | [−0.14, 0.30] | 0.08 | [−0.15, 0.30] | 0.10 | [−0.11, 0.32] |
| Health | −0.29** | [−0.47, −0.11] | −0.27** | [−0.46, −0.09] | −0.14 | [−0.32, 0.05] |
| Attention | | | 0.02 | [−0.05, 0.09] | 0.02 | [−0.05, 0.09] |
| Working memory | | | 0.01 | [−0.06, 0.09] | 0.01 | [−0.07, 0.08] |
| Processing speed | | | −0.01 | [−0.03, 0.01] | −0.01 | [−0.03, 0.01] |
| Verbal knowledge | | | −0.01 | [−0.07, 0.05] | −0.02 | [−0.08, 0.04] |
| Neuroticism | | | | | −0.03 | [−0.16, 0.11] |
| Conscientiousness | | | | | −0.05 | [−0.22, 0.13] |
| Openness | | | | | −0.20* | [−0.39, −0.02] |
| Agreeableness | | | | | −0.11 | [−0.28, 0.05] |
| Extraversion | | | | | −0.11 | [−0.26, 0.03] |

*Note*. $N = 135$. CI = confidence interval. Unstandardized beta coefficients are reported. For the mean of cognitive complaints, the sum of square residual of Model 1 was 66.60. By adding baseline cognitive performance, Model 2 accounted for additional 0.74, which was, however, a nonsignificant change in the sum of squares. The $R^2$ increased by 0.01 in Model 2. By adding personality, Model 3 accounted for further 7.63, which was a significant change in the sum of squares. The $R^2$ increased by 0.10 in Model 3.
* $p < .05$. ** $p < .01$.

over, higher openness was related to fewer cognitive complaints on the daily mean level, and to greater variability and a higher mean level in cognitive engagement.

## Discussion

Given the predictive value of cognitive complaints (Mendonça et al., 2016) and cognitive engagement (Smith, 2016) for risk of cognitive decline, it is important to understand which older adults are more likely to report these in daily life. At the zero-order level, multiple individual differences in both personality and cognitive performance were shown to associate with mean daily complaints and daily engagement. Fewer associations were found with respect to daily variability for both constructs. However, when all individual difference variables were included in one model, only personality traits proved to be significant unique predictors across all outcomes of interest; in only one case did an indicator of cognitive performance prove a significant predictor when controlling for personality traits. Put differently, personality traits may matter more when predicting daily cognitive complaints and engagement, relative to cognitive performance. The implications for future research on cognitive complaints and engagement are discussed below.

Table 4
*Predicting Intraindividual Variability of Daily Cognitive Complaints*

| Predictor | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | *b* | 95% CI | *b* | 95% CI | *b* | 95% CI |
| Intercept | 0.46 | [−0.23, 1.16] | −0.34 | [−1.36, 0.68] | −0.47 | [−1.69, 0.75] |
| Age | 0.00 | [−0.01, 0.01] | 0.00 | [−0.01, 0.01] | 0.00 | [−0.01, 0.01] |
| Education (linear) | 0.00 | [−0.09, 0.10] | −0.05 | [−0.15, 0.06] | −0.05 | [−0.16, 0.06] |
| Education (quadratic) | −0.00 | [−0.09, 0.09] | −0.01 | [−0.10, 0.08] | 0.01 | [−0.08, 0.10] |
| Health | −0.02 | [−0.09, 0.06] | −0.03 | [−0.10, 0.05] | −0.01 | [−0.09, 0.07] |
| Attention | | | 0.01 | [−0.02, 0.04] | 0.01 | [−0.02, 0.04] |
| Working memory | | | −0.02 | [−0.05, 0.01] | −0.02 | [−0.05, 0.01] |
| Processing speed | | | −0.00 | [−0.01, 0.01] | −0.00 | [−0.01, 0.01] |
| Verbal knowledge | | | 0.03** | [0.01, 0.06] | 0.03* | [0.01, 0.06] |
| Neuroticism | | | | | 0.07* | [0.01, 0.12] |
| Conscientiousness | | | | | −0.05 | [−0.12, 0.02] |
| Openness | | | | | 0.02 | [−0.06, 0.09] |
| Agreeableness | | | | | 0.02 | [−0.05, 0.09] |
| Extraversion | | | | | 0.00 | [−0.06, 0.06] |

*Note*. $N = 133$. CI = confidence interval. Unstandardized beta coefficients are reported. For the individual variability of cognitive complaints, the sum of square residual of Model 1 was 11.50. Model 2 and Model 3 accounted for additional 0.75 and 0.93, respectively, which were both nonsignificant changes in the sum of squares. The $R^2$ increased by 0.07 in Model 2 and by 0.08 in Model 3.
* $p < .05$. ** $p < .01$.

Table 5
*Predicting Mean of Daily Cognitive Engagement*

| Predictor | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | *b* | 95% CI | *b* | 95% CI | *b* | 95% CI |
| Intercept | 2.69*** | [1.14, 4.23] | 3.43** | [1.09, 5.77] | 1.40 | [−1.28, 4.08] |
| Age | 0.00 | [−0.01, 0.02] | 0.00 | [−0.02, 0.02] | 0.01 | [−0.01, 0.03] |
| Education (linear) | 0.24* | [0.03, 0.46] | 0.29* | [0.05, 0.53] | 0.18 | [−0.07, 0.42] |
| Education (quadratic) | 0.06 | [−0.15, 0.27] | 0.06 | [−0.16, 0.27] | 0.04 | [−0.17, 0.24] |
| Health | 0.03 | [−0.13, 0.20] | 0.03 | [−0.14, 0.21] | −0.09 | [−0.27, 0.09] |
| Attention | | | 0.02 | [−0.05, 0.08] | 0.02 | [−0.05, 0.08] |
| Working memory | | | −0.04 | [−0.11, 0.03] | −0.03 | [−0.10, 0.04] |
| Processing speed | | | 0.00 | [−0.01, 0.02] | 0.00 | [−0.01, 0.02] |
| Verbal knowledge | | | −0.02 | [−0.08, 0.03] | −0.01 | [−0.07, 0.04] |
| Neuroticism | | | | | 0.01 | [−0.11, 0.14] |
| Conscientiousness | | | | | 0.08 | [−0.08, 0.24] |
| Openness | | | | | 0.22* | [0.04, 0.39] |
| Agreeableness | | | | | 0.03 | [−0.13, 0.19] |
| Extraversion | | | | | 0.09 | [−0.05, 0.23] |

*Note*. $N = 135$. CI = confidence interval. Unstandardized beta coefficients are reported. For the mean of cognitive engagement, the sum of square residual of Model 1 was 59.11. Model 2 accounted for additional 1.07 (nonsignificant change in the sum of squares). The $R^2$ increased by 0.93 in Model 2. By adding personality, Model 3 accounted for further 6.61, which was a significant change in the sum of squares and the $R^2$ increased by 0.83.
* $p < .05$. ** $p < .01$. *** $p < .001$.

## Predicting Cognitive Complaints

Of the cognitive variables, only verbal ability proved a unique predictor of a daily cognitive variable when personality was included in the regression models, and perhaps counterintuitively, it positively predicted variability in cognitive complaints. Though this finding merits replication before much speculation, one possibility is that individuals higher on verbal ability are more cognizant of their failures in conversation, or have a greater expectancy of strong verbal performance, leading them to report greater variability in complaints when this proficiency does not occur. However, the broader gestalt from this work aligns with a related literature on cognitive failures (i.e., minor errors in thinking), that likewise suggests that cognitive failures tend to be unassociated with cognitive performance (Carrigan & Barkus, 2016). Nevertheless, both cognitive complaints and failures are often interpreted as early indicators of cognitive decline (Dufouil, Fuhrer, & Alpérovitch, 2005; Hohman, Beason-Held, & Resnick, 2011) and pathology of Alzheimer's disease (Amariglio et al., 2012; Jonker, Geerlings, & Schmand, 2000). In general, therefore, it seems that cognitive complaints might be an indicator of cognitive aging that

Table 6
*Predicting Intraindividual Variability of Daily Cognitive Engagement*

| Predictor | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | *b* | 95% CI | *b* | 95% CI | *b* | 95% CI |
| Intercept | 0.42 | [−0.10, 0.94] | 0.46 | [−0.32, 1.25] | 0.11 | [−0.85, 1.06] |
| Age | −0.00 | [−0.01, 0.00] | −0.00 | [−0.01, 0.00] | −0.00 | [−0.01, 0.01] |
| Education (linear) | 0.00 | [−0.07, 0.08] | 0.01 | [−0.07, 0.09] | −0.03 | [−0.11, 0.06] |
| Education (quadratic) | 0.04 | [−0.03, 0.11] | 0.05 | [−0.02, 0.12] | 0.05 | [−0.02, 0.13] |
| Health | 0.07* | [0.01, 0.12] | 0.07* | [0.01, 0.12] | 0.04 | [−0.02, 0.11] |
| Attention | | | −0.02 | [−0.04, 0.00] | −0.02 | [−0.04, 0.00] |
| Working memory | | | 0.01 | [−0.01, 0.03] | 0.01 | [−0.01, 0.04] |
| Processing speed | | | −0.00 | [−0.01, 0.00] | −0.00 | [−0.01, 0.00] |
| Verbal knowledge | | | 0.01 | [−0.01, 0.03] | 0.01 | [−0.01, 0.03] |
| Neuroticism | | | | | 0.01 | [−0.03, 0.06] |
| Conscientiousness | | | | | −0.03 | [−0.08, 0.03] |
| Openness | | | | | 0.07* | [0.01, 0.13] |
| Agreeableness | | | | | 0.01 | [−0.04, 0.07] |
| Extraversion | | | | | 0.01 | [−0.04, 0.06] |

*Note*. $N = 134$. CI = confidence interval. Unstandardized beta coefficients are reported. For the variability of cognitive engagement, the sum of square residual of Model 1 was 6.68. Model 2 accounted for additional 6.41 but this was not a significant change in the sum of squares. The $R^2$ increased by 0.90 in Model 2. Model 3 accounted for further 6.09, which was a nonsignificant change in the sum of squares and the $R^2$ increased by 0.85.
* $p < .05$.

Table 7
*Standardized Beta Coefficients for All Models*

| | Cognitive complaints | | | | | | Cognitive engagement | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M*, β | | | Variability, β | | | *M*, β | | | Variability, β | | |
| Predictor | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 | Model 3 |
| Age | 0.18 | 0.16 | 0.13 | 0.07 | 0.01 | 0.01 | 0.03 | 0.03 | 0.07 | −0.04 | −0.09 | −0.05 |
| Education (linear) | −0.04 | −0.03 | 0.05 | 0.01 | −0.09 | −0.10 | 0.20 | 0.24 | 0.14 | 0.01 | 0.02 | −0.07 |
| Education (quadratic) | 0.06 | 0.06 | 0.08 | 0.00 | −0.02 | 0.02 | 0.05 | 0.05 | 0.03 | 0.11 | 0.13 | 0.13 |
| Health | −0.27 | −0.25 | −0.12 | −0.04 | −0.07 | −0.02 | 0.03 | 0.04 | −0.09 | 0.20 | 0.20 | 0.13 |
| STA memory | | 0.05 | 0.04 | | 0.06 | 0.05 | | 0.05 | 0.05 | | −0.19 | −0.19 |
| Working memory | | 0.03 | 0.02 | | −0.13 | −0.11 | | −0.12 | −0.10 | | 0.08 | 0.11 |
| Processing speed | | −0.10 | −0.11 | | −0.03 | 0.00 | | 0.05 | 0.05 | | −0.11 | −0.10 |
| Verbal knowledge | | −0.03 | −0.07 | | 0.28 | 0.27 | | −0.09 | −0.05 | | 0.11 | 0.12 |
| Neuroticism | | | −0.04 | | | 0.24 | | | 0.02 | | | 0.07 |
| Conscientiousness | | | −0.05 | | | −0.13 | | | 0.09 | | | −0.09 |
| Openness | | | −0.21 | | | 0.04 | | | 0.25 | | | 0.23 |
| Agreeableness | | | −0.12 | | | 0.06 | | | 0.04 | | | 0.05 |
| Extraversion | | | −0.15 | | | 0.01 | | | 0.13 | | | 0.05 |

*Note*. $N = 133–136$ across analyses. STA = short-term auditory. Standardized beta coefficients were obtained using the package *lm.beta* (Behrendt, 2014).

is not detected by the typical single-occasion cognitive assessment (cf. Burmester et al., 2016).

With respect to personality correlates, in addition to neuroticism, all Big Five personality traits actually correlated with the mean of daily cognitive complaints. Although our primary prediction was for neuroticism, this finding is aligned with recent work showing a more prominent role across traits for predicting self-reports of cognitive failure (Könen & Karbach, 2018). Only openness though provided unique predictive value for mean cognitive complaints, counter to expectations that neuroticism would prove the strongest correlate. That said, neuroticism did significantly positively predict daily variability in complaints. It is interesting then to note the previous research linking this trait and greater cognitive "noise" (Robinson & Tamir, 2005) using the metric of trial-to-trial fluctuations in response times. As noted above, research is needed to better understand whether variability in cognitive complaints is adaptive or maladaptive in nature, given that zero variability could be indicative either of having no complaints or a consistent number every day. However, bringing together our findings for neuroticism with the previous work on trial-to-trial variability, one might expect that greater variability could be generally problematic in nature. Future research though should consider the predictive value of variability in complaints for later nonnormative cognitive issues.

Given the potential relevance of cognitive complaints, particularly given that the absence of complaints may help rule out mild cognitive impairment (Mitchell, 2008; Mitchell, Beaumont, Ferguson, Yadegarfar, & Stubbs, 2014), these findings support calls for greater integration between the personality science and cognitive aging fields (Hill & Payne, 2017; Payne & Lohani, in press). These findings suggest that older adults higher on openness may be less prone to report cognitive complaints, which may be due to at least two different rationales. First, measures of openness do tap individuals' self-perceptions of intellectual ability and creativity (Goldberg, 1999; John & Srivastava, 1999). Having a stronger belief in one's intellectual capacities may lead to fewer perceived cognitive issues in daily life, because any such incident may seem like a poor reflection of one's typical functioning. Second, individuals higher on openness may employ higher-order cognitive functioning more frequently, by virtue of their curiosity and desire for intellectual activities. Future research is needed to tease apart the self-perception or cognitive employment pathways, given that both positive perceptions and greater practice may prove valuable for promoting healthy cognitive aging.

## Predicting Cognitive Engagement

In line with predictions, the current findings provide further support that openness is the personality trait most strongly associated with cognitive engagement, although the magnitude of these associations again show that openness and cognitive engagement are empirically distinct constructs. However, these findings add to the literature by demonstrating that openness also appears to be associated with greater daily variability in cognitive engagement. Though we did not make any predictions regarding engagement variability, these findings align with discussions on the behavioral signature of openness. Recent work has found that openness in older adulthood is more associated with a greater diversity of activities, relative to either hours spent in any one activity or greater total hours in cognitively engaging activities (Jackson, Hill, Payne, Parisi, & Stine-Morrow, 2019). If true, openness may be better described as increasing older adults' willingness to explore and try new things, rather than promoting concentrated engagement in any one activity, which may explain why the trait led to greater variability in cognitive engagement.

Moreover, activity diversity also provided the best explanation of the link between openness and cognitive performance in that previous study (Jackson et al., 2019), relative to time spent in certain activities. As such, it is valuable to consider whether variability in cognitive engagement could be adaptive, rather than evidence that the individual is failing to engage on a regular basis. To the extent that variability in engagement provides a proxy for efforts to try new things (cognitive or otherwise), the current findings can be interpreted as supporting two different pathways

by which openness promotes healthy cognitive aging: (a) a greater likelihood for cognitively engaging activities in daily life, a frequent target of cognitive interventions (Parisi et al., 2009; Stine-Morrow et al., 2007), and (b) greater variability in daily activity, which may help individuals to practice activities like task switching and lead engaging lives. Indeed, research has suggested that greater variety in lifestyle activities promotes cognitive functioning (Carlson et al., 2012). Future research should examine both variability in daily cognitive engagement as well as in overall activity engagement to test this second explanation, and whether openness predicts greater variability in cognitive engagement because those individuals are in fact "replacing" that engagement with different activities. Given that openness appears predictive of greater longevity (Turiano, Spiro, & Mroczek, 2012), and that dispositional curiosity has been discussed as a pathway to adaptive cognitive and physical functioning in older adulthood (Sakaki, Yagi, & Murayama, 2018), adding to our understanding of how openness influences daily cognitive life is needed to help explain these linkages.

## Implications for Understanding Cognitive Complaints and Engagement

Although the primary findings center on how personality appears important for predicting daily cognitive reports, other important results come from the current work. First, again, there was limited evidence that objective cognitive performance provided explanatory value for daily complaints or engagement, particularly after accounting for demographics and health. Furthermore, neither measure of memory was associated with complaints, even at the zero-order level, which is somewhat surprising given that the complaints measure captures daily forgetfulness. It will be valuable to test these findings with alternative memory measures, to understand the extent to which they depend on the memory test conducted. However, the lack of associations lends further credence to the notion that cognitive self-perceptions may be relatively distinct from markers of actual performance (Burmester et al., 2016). Research therefore is needed to better understand the differential roles that cognitive perception and performance play in cognitive aging, which includes considering the extent to which positive perceptions promote engaged living, and in turn healthy aging.

Second, relatedly, it is interesting to note that mean reports of complaints and engagement were unrelated in the current study. One possibility is that these null results reflect the presence of two different groups of individuals. For some individuals, greater engagement may lead to reporting fewer complaints, as a result of more cognitive practice. However, for others, cognitive engagement could lead to more complaints, because these older adults are trying to engage in different activities but realizing difficulties as a result. Future research though is needed to identify whether such groups of older adults occur, to better understand complaint-engagement associations.

Third, across all outcomes, the amount of variance explained in the final regression models never exceeded 15%. These findings suggest that a great deal of variability in engagement and complaints remains unexplained, even when considering cognitive performance, personality traits, and demographic variables. One possibility is that the Big Five personality traits are relatively broad in scope, and more specific personality measures could have better predictive value. For instance, it would be important to consider other known personality predictors of cognitive functioning in older adulthood, such as sense of purpose (Boyle, Buchman, Barnes, & Bennett, 2010; Lewis, Turiano, Payne, & Hill, 2017), and to consider specific lower-order facets of the Big Five personality traits, because they could have more predictive power than the trait itself (Paunonen, Haddock, Forsterling, & Keinonen, 2003). However, it also is likely that much of the variance in daily engagement and complaints can be explained by the daily stressors ongoing for participants. Previous research has shown that daily stress and daily cognitive performance are coupled, with older adults often performing better on tasks when it was a low-stress day (Sliwinski et al., 2006). As such, future research should similarly consider whether daily stressors may increase the likelihood for complaints while decreasing the potential for cognitive engagement.

## Limitations and Future Directions

The current study is not without its limitations that should direct future research. First, the sample was collected from a fairly racially homogeneous region, and thus may not be representative of other areas. Second, again, prior to making any strong claims regarding the associations with cognitive performance, it would be valuable to revisit this question with a broader array of cognitive tasks. The current study employed the cognitive tasks available, which were selected for theoretical reasons related to the broader study's goals, and thus it would be important to consider other cognitive functions in future research. For instance, given the nature of the cognitive complaint items, and their focus on memory difficulties, it would be valuable to include cognitive performance measures that tapped additional components of memory, such as episodic memory and prospective memory. Third, though studies have demonstrated an empirical and conceptual distinction between openness and the typical intellectual engagement scale (e.g., Ackerman & Goff, 1994; Goff & Ackerman, 1992), there is need for additional work on this distinction particularly with respect to the specific facets of openness. The moderate-though-not-strong association between openness and mean cognitive engagement provides further evidence for a distinction, but future research is needed to consider distinctions at the facet level.

In sum, it appears that personality traits can provide valuable predictive power for cognitive complaints and cognitive engagement, particularly with respect to openness and neuroticism. Though the unique predictive value was modest in most cases, these effect sizes were accounting for multiple measures of cognitive functioning and demographics, as well as the other four personality traits. These findings have important implications for future interventions to promote healthy cognitive aging, in that they both speak to multiple pathways by which personality traits may play a role, and also underscore the potential for older adults to differ in their reporting of cognitive concerns. As such, future cognitive interventions (particularly those focused on engagement) may wish to incorporate personality measures more into their programs, to better identify which participants are benefitting from their programs and why. Indeed, past research has demonstrated that individual dispositions have been linked to intervention efficacy (Cerino, Hooker, Goodrich, & Dodge, 2019; Payne et al.,

2012), and the current findings point to the need for work to consider daily cognitive life as an explanation for why personality characteristics matter for interventions.

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## Appendix

## Measures for Daily Cognitive Engagement and Complaints

The following items were used to measure daily cognitive engagement: "I focused on an abstract problem," "I watched an educational or documentation movie," "I avoided a complicated duty that required thinking" (reverse coded), "I felt competent because I concerned myself with a difficult duty," "I enjoyed thinking about a complicated problem," "I philosophized about things," "I enjoyed thinking about an issue even when the results of my thoughts have no effect on the outcome of the issue," "I listened to a speech," and "I was bored" (reverse coded).

The following items were used to measure daily cognitive complaints: "I had difficulties to focus on a task or to follow a conversation," "I misplaced or lost an object (e.g., keys, glasses)," "I had difficulties to remember a name," and "I forgot something (e.g., birthday, grocery item, medication)."

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