Evaluations of a Previous Day as a Pathway between Personality and Healthy Cognitive Aging

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Abstract

Objectives: To examine the association between Five Factor Model personality traits and how individuals evaluate a recent day in their lives (yesterday) and whether these evaluations mediate personality and cognitive function over time.

Methods: Participants were a subsample from the Health and Retirement Study who completed personality measures in 2008/2010, the day evaluation in 2011, and cognitive tasks in 2012 (*N*=3,454).

Results: Lower Neuroticism and higher Extraversion, Openness, Agreeableness, and Conscientiousness were associated with a more engaging day, fewer negative feelings, better subjective health and less time spent alone. Active engagement and subjective health were associated with cognitive function and mediated the prospective associations between Neuroticism, Openness, and Conscientiousness and cognitive function.

Discussion: Personality is associated with how individuals evaluated their previous day, which contributes to cognition over time. The present research contributes to a mechanistic model that aims to identify pathways through which personality contributes to cognitive aging.

Keywords

Five-Factor Model; Cognition; Activity; Self-rated Health; Day Reconstruction; Alone

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Personality traits, as defined by the Five Factor Model (FFM; McCrae & John, 1992), are associated with cognitive outcomes in older adulthood (Chapman et al., 2017), including cognitive decline (Caselli et al., 2016; Luchetti, Terracciano, Stephan, & Sutin, 2016) and risk of cognitive impairment (Kaup, Harmell, & Yaffe, 2019; Terracciano, Stephan, Luchetti, Albanese, & Sutin, 2017; Wilson, Schneider, Arnold, Bienias, & Bennett, 2007). Much of what is known about personality and cognition comes from research on the long-term predictive power of traits on cognitive outcomes (Segerstrom, 2018). Less research has addressed potential mechanisms through which traits may contribute to cognition. The purpose of the present research is to use a shorter time scale to identify novel daily

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mechanisms that may help explain the relation between personality and cognitive function over time. Thus, rather than show an association between personality and cognition, the present research seeks to better understand the daily mechanisms that contribute to this well-established relation.

The FFM operationalizes an individual's characteristic ways of thinking, feeling, and behaving along five broad dimensions (McCrae & John, 1992): Neuroticism (the tendency to experience negative emotions and vulnerability to stress), Extraversion (the tendency to be cheerful, outgoing, and active), Openness (the tendency to be creative, open-minded, and unconventional), Agreeableness (the tendency to be cooperative and trusting), and Conscientiousness (the tendency to be organized, disciplined, and responsible). Under the five broad domains, there are more specific traits, or facets, that make up each trait. Conscientiousness, for example, is composed of facets that reflect self-discipline, order, dutifulness, and achievement striving (Costa & McCrae, 1992; Roberts, Chernyshenko, Strark, & Goldberg, 2005).

These broad dimensions and more specific facets have been associated with numerous cognitive outcomes. Individuals who score lower in Neuroticism and higher in Conscientiousness, for example, have better episodic memory (Allen, Laborde, & Walter, 2017), higher verbal fluency (Sutin et al., 2011), and tend to maintain cognitive function into old age (Luchetti et al., 2016). These associations ultimately culminate in a lower risk of Alzheimer's disease (Terracciano et al., 2014) and dementia (Terracciano et al., 2017). Openness is likewise associated with higher cognitive function (Soubelet & Salthouse, 2011), especially greater verbal ability (Noftle & Robins, 2007). The association between Agreeableness and Extraversion with cognitive outcomes are less consistent across studies (Terracciano et al., 2014). Less work has addressed how facets are associated with cognitive outcomes, but there is evidence that the facets of Conscientiousness are implicated in dementia risk. For example, individuals who score higher on facets that measure order, discipline, and dutifulness have lower risk of Alzheimer's disease (Terracciano et al., 2014) and dementia (Sutin, Stephan, & Terracciano, in press). Such facet-level approaches help to identify which specific aspects of the broad domains contribute to cognitive outcomes.

There is thus replicated evidence that personality is associated with cognitive outcomes. Less is known, however, about the mechanisms through which personality is associated with cognition. Consistent with current models of personality and health (Friedman, Kern, Hampson, & Duckworth, 2014), most research on pathways has focused on the role of clinical and behavioral risk factors. In addressing the relation between personality and cognitive outcomes, clinical and behavioral risk factors are often included as covariates to determine whether personality maintains its predictive power once common risk factors associated with both personality and dementia risk are accounted for. For example, hypertension, diabetes, obesity, smoking, and physical activity are common modifiable risk factors for dementia (Norton, Matthews, Barnes, Yaffe, & Brayne, 2014) that are also intertwined with personality (Goodwin & Friedman, 2006; Hakulinen et al., 2015; Sutin, Ferrucci, Zonderman, & Terracciano, 2011). And yet, although these factors reduce slightly the association between personality and cognition, they do not account for it completely

(Luchetti et al., 2016; Terracciano et al., 2017). This pattern indicates that there are other mechanisms through which personality may contribute to cognitive function.

Although clinical and behavioral factors are certainly important in personality-cognition relations, there are other pathways relevant to cognition that may also contribute to this association. Previous cross-sectional work on Neuroticism, for example, suggests that intrusive thoughts and anxiety mediate the relation between this trait and attention-demanding cognitive tasks (Munoz, Sliwinski, Smyth, Almeida, & King, 2013) and intelligence (Moutafi, Furnham, & Tsaousis, 2006), respectively. And, in a sample of older adults, cognitive complaints did not mediate the effect of Neuroticism on cognitive performance over 12 years (Aschwanden, Kliegel, & Allemand, 2018). These studies are limited by their cross-sectional design or sole focus on Neuroticism. Parallel literatures have documented the predictive power of cognitive engagement (Wang, MacDonald, Dekhtyar, & Fratiglioni, 2017), negative affect (Korthauer et al., 2018), subjective health (Montlahuc et al., 2011), and social integration (Wilson, Krueger, et al., 2007) on cognitive outcomes. As described below, these potential mechanisms have been associated with personality and may be additional pathways that help explain the association with cognition.

Cognitive engagement.—The process of being actively and deeply involved in cognitively stimulating activities (Stine-Morrow et al., 2014) is associated with better cognitive outcomes, including experimental evidence that greater engagement increases memory and executive function in the short term (Carlson et al., 2008) and epidemiological evidence that engagement in cognitive stimulating activities is protective against Alzheimer's disease and other dementias in the long-term (Verghese et al., 2003; Wang et al., 2017). Personality has likewise been associated with daily activities related to cognitive engagement (Chapman & Goldberg, 2017). Of the five traits, Openness tends to have the strongest positive associations with engaging in intellectual and creative activities (Stephan, Boiché, Canada, & Terracciano, 2013), particularly reading (Rohrer & Lucas, 2018). And, on days that individuals act more open, they also tend to engage in more cognitive activities (Aschwanden, Luchetti, & Allemand, 2018). In addition, Conscientiousness is associated with more time spent at work (Rohrer & Lucas, 2018), although the relation with leisure-time cognitive activities is less consistent (Stephan et al., 2013).

Negative affect.—The definition of Neuroticism is the frequent experience of negative emotions (Costa & McCrae, 1992), and, indeed, individuals higher in Neuroticism report more negative emotions, as measured by state (Soto, 2013), trait (Beer, Watson, & McDade-Montez, 2013), and ecological momentary assessment (Miller, Vachon, & Lynam, 2009). Conscientiousness, in contrast, while not an emotional trait by definition, is associated consistently with lower negative affect, particularly less stress (Ebstrup, Eplov, Pisinger, & Jørgensen, 2011), lower stressor-related negative affect (Leger, Charles, Turiano, & Almeida, 2016) and faster recovery from stress (Javaras et al., 2012). Negative affect, in turn, increases dementia risk (Korthauer et al., 2018).

Subjective health.—Subjective health refers to an individual's own assessment of their overall health status (Idler & Benyamini, 1997). Individuals who score higher in

Neuroticism tend to report lower subjective health, whereas individuals who score higher in Extraversion and Conscientiousness tend to report higher subjective health (Löckenhoff, Sutin, Ferrucci, & Costa, 2008). Subjective health has likewise been associated with greater declines in cognition over time (Bendayan, Piccinin, Hofer, & Muniz, 2017) and risk of dementia (Montlahuc et al., 2011).

Time alone.—Research on personality and time use in the Health and Retirement Study indicates that individuals higher in Extraversion are less likely to spend time alone on a previous day and are more likely to socialize (Newton, Pladevall-Guyer, Gonzalez, & Smith, 2016). Surprisingly, this same study found that Conscientiousness was associated with a greater likelihood of spending time alone; the other traits were not included in this study. Social isolation, in turn, is associated with greater risk of dementia (Sutin, Stephan, Luchetti, & Terracciano, 2018).

Present Research

This previous literature indicates both personality and cognition are associated with how individuals spend their time, feel about their activities, and evaluate their health. The present research builds on this foundational literature in three ways. First, previous research has primarily examined the associations at a general level rather than at a specific point in time. For example, participants are asked about their activities over the last month or how they rate their health in general. The present research adopts a framework adapted from the day reconstruction method (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) to assess a recent specific day in participants' lives (yesterday) rather than a summary evaluation. The value of this approach is that it moves closer to obtaining real-time assessments of what participants are doing and how they evaluate their time spent. Second, previous research has not considered the four experiential factors (active engagement, negative feelings, subjective health, time alone) as mechanisms of the relation between personality and cognition. As described above, mechanisms of the personality-cognition relation have generally focused on behavioral and clinical risk factors. Behavioral and clinical factors, however, are only partial mediators, which indicates that other mechanisms operate in this pathway. Third, for Conscientiousness, we consider the associations at the facet level, in addition to the broad domain. The more specific facets of personality tend to have greater predictive power than the broad domains (Paunonen, 1998).

In summary, the present research takes a mechanistic approach to address whether personality prospectively predicts how individuals evaluate a recent day in their lives and whether this evaluation subsequently predicts cognitive functioning and mediates the relation between personality and cognition over time (Figure 1). We test the hypothesis that the daily evaluations mediate the prospective association between personality and cognitive performance. We expect, for example, that negative feelings will mediate the association between Neuroticism and cognition and that greater engagement and better subjective health will mediate the association between Conscientiousness and cognition.

Method

Participants and Procedure

Participants from the Health and Retirement Study (HRS) who completed the 2011 Internet Survey were used in this study. Inclusion criteria for participation in this off-year study were either participation in the 2009 Internet Survey or a random subsample drawn from current HRS participants with Internet access. A total of 5,742 participants were contacted to take part in the survey, and 4,590 completed it (79.9% response rate; http://hrsonline.isr.umich.edu/modules/meta/2011/internet/desc/net11_dd.pdf). In this survey, participants provided information about their day yesterday (see below). Domain-level personality and the facets of Conscientiousness were measured in HRS in the 2008 leave behind questionnaire for a random half of the HRS sample; the other half completed both measures in 2010 (see below). The combined 2008/2010 personality assessment was used as the baseline. Cognition was measured at the 2012 HRS assessment; for some analyses, cognition concurrent with baseline personality was also used. The timeline of measurement is thus baseline personality measured in 2008/2010, the daily factors measured in 2011, and cognition measured in 2012 (Figure 1). All participants with complete data on the Internet Survey, the domain and facet measures of personality, cognition in 2012, and socio-demographic characteristics were included in the analyses; there were no exclusion criteria. A total of 3,454 participants had the necessary data to be included in the analysis (Table 1). Of the 4,590 participants who completed the 2011 Internet Survey, 790 participants (17%) did not have complete information on personality, of those with personality, 341 participants (7%) did not have cognition at both baseline and follow-up, and another 5 participants (.1%) did not have information on the evaluations of yesterday even though they completed other parts of the Internet Survey. Information about HRS and how to obtain the data can be found here: http://hrsonline.isr.umich.edu/.

Measures

Personality

Domain-level personality.: Personality was assessed with the Midlife Development Inventory (MIDI; Lachman & Weaver, 1997), a 26-item measure of FFM personality traits. The MIDI included items that measured Neuroticism (e.g., moody), Extraversion (e.g., talkative), Openness (e.g., creative), Agreeableness (e.g., helpful), and Conscientiousness (e.g., organized). Participants rated each item on a scale that ranged from 1 (*a lot*) to 4 (*not at all*). Items were reverse scored when necessary in the direction of the label of the trait such that higher scores on each of the traits indicated higher levels of Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness, respectively. The median alpha across the five scales was .74.

Facets of Conscientiousness.: Six facets of Conscientiousness were assessed with a 24-item measure (Roberts et al., 2005): self-control (e.g., "I rarely jump into something without first thinking about it."), order (e.g., "I hardly ever lose or misplace things."), industriousness (e.g., "I have high standards and work toward them."), traditionalism (e.g., "I support long-established rules and traditions."), virtue (e.g., "If the cashier forgot to charge me for an item, I would tell him/her."), and responsibility (e.g., "I carry out my obligations to the best

of my ability."). There were four items per facet. Items were rated on a scale from 1 (*strongly disagree*) to 6 (*strongly agree*). The median alpha across the six scales was .51. Alpha reliability was lower for this measure of the facets because content coverage of each facet was prioritized over internal consistency (Roberts et al., 2005). This measure does has high retest reliability (median r=.85; Green, O'Connor, Gartland, & Roberts, 2016), and retest reliability has been found to be a better predictor of validity than internal consistency (McCrae, Kurtz, Yamagata, & Terracciano, 2011).

Evaluations of Yesterday

Feelings and engagement.: Participants were asked a number of questions about what they felt and did yesterday. These items were adapted from the day reconstruction method (Kahneman et al., 2004) to assess participants' evaluation of their day yesterday rather than an evaluation of engagement in specific activities, such as watching TV. As such, this measure evaluates the whole day rather than activity-specific affect and motivation. Specifically, participants were asked: "The next questions are about your feelings for some part of the day yesterday. Yesterday did you feel…" The items were calm, frustrated, happy, bored, and sad. In addition, they were asked: "Was yesterday a routine day for you?" "Did you feel well-rested yesterday morning (that is you slept well the night before)?" "Did you smile or laugh a lot yesterday?" "Did you learn or do something interesting yesterday?" "Did you feel stressed yesterday?" "Is there something that you had to force yourself to do yesterday?" "In some part of the day, did you feel that time seemed to drag?" "Were you pre-occupied with something at any time of the day yesterday?" Participants responded yes or no to each item. The items were aggregated into two scale scores based on a principal components analysis of these items: Active Engagement and Negative Feelings. Active Engagement was the sum of 5 items (learned something interesting, smile and laughed, happy, bored [reverse scored], time dragged [reverse scored]; alpha=.64). Negative Feelings was the sum of 8 items (stressed, frustrated, forced self to do something, sad, preoccupied, calm [reverse scored], day routine [reverse scored], well-rested [reverse scored]; alpha=.71).[1] The correlation between the two scale scores was −.45, p<.01.

Subjective health.: Subjective health was measured with the item, "How was your health yesterday? Was it excellent, very good, good, fair, or poor?" Ratings were made on a scale from 1 (excellent) to 5 (poor) and reverse scored in the direction of better subjective health.

Time spent alone.: Participants were asked to report the amount of time spent at home alone. Specifically, they were asked, "Overall, about how much time yesterday did you spend at home alone? That is, when you were not talking with someone on the phone or the Internet and no one else was at home with you?" Participants reported time alone to the nearest hour.

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[1]Negative Feelings is akin to depressive symptoms as many of the items are the same on both measures (e.g., feeling sad). A key difference is the time frame, with the items on Negative Feelings assessed as experienced at any time the previous day and the items on measures of depressive symptoms assessed as much of the time over a longer time frame (typically 1–4 weeks). In the 2011 Internet Survey, participants reported on their experience of depressive symptoms much of the time over the last week. There was a substantial correlation between the two measures (r=.60) that raised problems with collinearity to include both measures in the same model. We chose to focus on Negative Feelings to maintain consistency with the other yesterday evaluation measures.

Cognition—Cognition was assessed with the modified Telephone Interview for Cognitive Status (TICSm; Crimmins, Kim, Langa, & Weir, 2011). The TICSm consists of three cognitive tasks: immediate and delayed recall of 10 words (range 0–20 points), serial 7 subtraction (subtracting 7 from 100 five times; range 0–5 points), and backward counting (counting backward from 20 to 10; range 0–2 points). The total possible score is 27 points. HRS participants complete this cognitive assessment every two years. For the primary analysis, the first TICSm assessment after the Internet Survey (i.e., the 2012 assessment) was used. Follow-up analyses also included the TICSm assessment in the year that was concurrent with the facet assessment (2008 or 2010). At baseline, no participants scored below the cutoff for dementia, as defined by the TICSm (<7; Crimmins et al., 2011); 11 participants (.3%) scored in this range at follow-up. There was a significant decline in TICSm scores between baseline and follow-up ($M_{baseline}$=17.78 [SD=2.93] versus M_{2012}=17.08 [SD=3.46]; t(3453)=12.43, p<.001).

Sociodemographic Covariates—All sociodemographic information was self-reported. Age was age in years at the 2008/2010 baseline. Sex was self-reported male (=0) or female (=1). Education was years of education. Race was self-reported as white/Caucasian, Black or African American, other, or not obtained and dummy-coded into two variables that compared Black/African American (=1) and other/unknown (=1) to white (=0). Ethnicity was self-reported Hispanic (=1) compared to non-Hispanic (=0) across all races.

Statistical Analysis

To examine the association between personality and how participants evaluated their day yesterday, we used linear regression to predict the four evaluations (active engagement, negative feelings, subjective health, and time alone) from the domains and facets, controlling for age, sex, education, race, ethnicity, and year of personality assessment to account for the two-year difference in the baseline measurement (2008 versus 2010). We then assessed whether personality and the four evaluations were associated with cognition measured in 2012, controlling for the same set of sociodemographic factors and year of personality assessment. We repeated this analysis including the 2008/2010 cognitive assessment to test whether personality and the four evaluations were associated with change in cognition (Time 2 cognition regressed on Time 1 cognition), controlling for the same covariates. Finally, using the PROCESS 3.1 macro for SPSS (Hayes, 2018), we tested a multiple mediation model with the four evaluations of yesterday as mediators between personality and cognition, controlling for the same covariates, and change in cognition for the traits associated with cognition, controlling for the same covariates and baseline cognition. Missing data was deleted listwise. Due to the large sample size and number of tests, significance was set to p<.01 (two-tailed).

Results

Descriptive statistics for all study variables are shown in Table 1. Zero-order correlations between all study variables are shown in Supplemental Table S1. Table 2 shows the associations between personality and participants' evaluation of their previous day. A consistent pattern emerged across the five traits with small to medium effect sizes (Cohen,

1988). Specifically, participants who scored higher in Neuroticism reported a less engaging day, more negative feelings, worse subjective health, and more time spent alone the previous day. In contrast, participants higher in Extraversion, Openness, Agreeableness, or Conscientiousness had a more engaging day, experienced fewer negative feelings, had better subjective health, and spent less time alone (except for Openness and time spent alone). The facets of Conscientiousness followed the same pattern as domain-level Conscientiousness, with the strongest associations for the facets of order, industriousness, and responsibility (Table 2).

The relation between personality and cognition and evaluations of yesterday and cognition are shown in Table 3. Similar to previous research on personality and cognition in HRS (Luchetti et al., 2016), higher Neuroticism and lower Openness and Conscientiousness measured in 2008/2010 were associated with lower cognitive function assessed in 2012. At the facet level, participants who were more self-controlled, industrious, and responsible performed better on the cognitive tasks than individuals who scored lower on these traits. Higher Openness, Conscientiousness and Industriousness were also associated with maintaining better cognition between the 2008/2010 and 2012 assessments. How individuals evaluated their day was associated with cognition assessed the next year. Specifically, participants who reported more active engagement and better subjective health had better cognitive function in 2012 and maintained their cognitive function between the two waves. More time spent alone was associated with steeper cognitive declines over the follow-up period.

We then tested whether personality had an indirect effect on cognition through active engagement, negative feelings, subjective health, and time spent alone (Table 4). There was a significant indirect effect of the traits on cognition through both active engagement and subjective health: Lower Neuroticism and higher Openness and Conscientiousness measured in 2008/2010 were associated with better cognitive functioning, in part, through more active engagement and better subjective health. Part of this pattern extended to change in cognition between baseline and follow-up for Openness and Conscientiousness (Table S2): More open and conscientious participants maintained their cognitive health in part through better subjective health (point estimate=.08, 99% CI=.03, .13 for Openness and point estimate=.14, 99% CI=.06, .23 for Conscientiousness). Finally, the effects were similar for the facets of Conscientiousness: There was an indirect effect of higher order, industriousness, and responsibility on better cognition through more active engagement and better subjective health (Table 5). Higher subjective health also mediated the relation between higher industriousness and change in cognition (point estimate=.05, 99% CI=.02, .09; Table S2).

Discussion

The present research integrated several related lines of research to identify mechanisms that contribute to the association between personality and cognitive function over time. Specifically, moving deeper than general reports of how individuals typically feel, we showed that personality was associated with specific evaluations of a single day (yesterday) and that these evaluations were associated with subsequent performance on cognitive tasks.

Formal mediation analysis indicated that active engagement and subjective health explained part of the association between personality traits and facets and cognitive function.

Previous research on personality and active engagement, negative feelings, subjective health, and time alone has suggested that both traits and facets are associated with these four evaluations. Individuals higher in Neuroticism and lower in Conscientiousness, for example, are more likely to experience negative emotions (Soto, 2013) and report lower subjective health (Löckenhoff et al., 2008). Missing from this literature, however, is a recent, specific time scale. That is, previous research in this area has typically focused on either the frequency of experience in general without a specific time scale (e.g., from never to frequently) or the frequency over a longer time frame (e.g., past 30 days). Measurement on a recent time scale is important to capture more granular associations and reduce memory biases involved in making evaluations over longer time periods. The present research indicates that the associations between personality and the four daily evaluations are broadly consistent with more general measures.

The specific evaluations of how individuals spent their previous day were also associated prospectively with better cognition functioning: Active engagement and better health were both associated with better cognitive function the next year and maintaining better cognitive health over the up to four-year follow-up. A rapidly growing literature indicates that individuals who engage in more cognitively stimulating activities maintain their cognitive function and have a lower risk of dementia (Scarmeas & Stern, 2003; Wang et al., 2017). Better self-rated health has likewise been found to predict better cognitive outcomes (Bendayan et al., 2017; Montlahuc et al., 2011). This research tends to focus on measurements at one point in time as predictors of long-term outcomes, such as dementia. The present research indicates that this process also plays out in a similar way across a shorter time span.

Perhaps most importantly, the results from this research are a step toward a mechanistic model of the role of personality in cognitive aging. Previous work has focused primarily on clinical and behavioral risk factors as mechanisms responsible for this relation. For example, clinical factors, such as diabetes and obesity, and behavioral risk factors, such as smoking, have been found to account for part, but not all, of the relation between personality and dementia risk (Terracciano et al., 2017). Physical activity has likewise been implicated as a partial mediator for both cognitive decline (Allen et al., 2017) and risk of dementia (Terracciano et al., 2017). The present research indicates that other mechanisms also contribute to this pathway.

Active engagement and subjective health emerged as the most important of the four experiential factors in the pathway between Neuroticism, Openness, and Conscientiousness and cognition. It was somewhat surprising that the same mechanisms for cognition were apparent for all the trait-cognition relations. That is, it might have been expected that different underlying tendencies associated with the traits would have led to differential mechanisms. Openness, for example, is defined in part by creativity and interest in a wide range of cognitively-engaging activities (Stephan et al., 2013). In the present study Openness was indeed associated with greater active engagement the previous day, but the indirect

effect of active engagement on cognition was similar for Neuroticism and Conscientiousness. It may be the case that there is a threshold for active engagement to be protective for cognition that beyond which it does not provide additional benefit. Of note, the direct effect of Openness on cognition remained significant after accounting for the four factors but the direct effect of the other traits did not.

Contrary to expectations, negative feelings and time spent alone had only weak associations with cognition and neither factor was a mediator of the association between personality and cognition. We had hypothesized that negative feelings would mediate the relation between Neuroticism and cognition because the frequent experience of negative emotions is one of the core tendencies of individuals high in Neuroticism (Costa & McCrae, 1992) and negative affectivity has been implicated in dementia risk (Korthauer et al., 2018; Sutin, Stephan, & Terracciano, 2018). There was a relatively strong association between Neuroticism and negative feelings, but the latter was only weakly associated with cognition. Negative feelings may have greater implications for severe cognitive decline rather than for maintenance of normal cognitive function. Further, negative feelings and subjective health have a relatively strong correlation, and, when both are in the model, subjective health may have more unique variance and thus was an independent predictor.

In addition to the broad domains, the present research addressed six more specific facets of Conscientiousness. The six facets generally shared similar associations with the four evaluations as the associations at the domain level. The facet-level analyses, however, did reveal which aspects of Conscientiousness were most strongly and weakly associated with the evaluations. Specifically, the facets of order and industriousness were generally the most strongly associated with the evaluations, whereas virtue and self-control generally had the weakest associations. Fewer of the facets emerged as significant predictors of cognition. Similar to previous research in the HRS on dementia risk (Sutin et al., in press), self-control, industriousness, and responsibility were associated with better cognitive function at the follow-up, although only industriousness was associated with change in cognition. Similar to domain-level Conscientiousness, active engagement and subjective health partially mediated the association between these facets and cognition. These pathways explained the largest portion of the association between industriousness and cognition.

The amount of time spent alone was associated only weakly with change in cognition. Social integration has emerged as a critically important factor in dementia risk (Kuiper et al., 2015). Social integration includes both an objective component (e.g., amount of contact with others) and a subjective component (e.g., feelings of loneliness; Cacioppo & Patrick, 2008). There is growing evidence that the experience of loneliness is a stronger predictor of cognitive impairment than how much contact an individual has with other people (Sutin, Stephan, Luchetti, et al., 2018). This distinction is likely also true for normal cognitive function. Unfortunately, we only had time spent alone, and not subjective feelings of loneliness and thus could not address daily loneliness as a mechanism of this relation. The present research does suggest that just the number of hours spent alone does not have a strong relation with cognition. It is possible, for example, that some people are doing cognitively engaging activities while alone (e.g., reading) that may help preserve cognition.

The primary aim of this research was to test a mechanistic model that specifies daily evaluations as one pathway that helps explains the well-replicated association between personality and global cognition. As such, it contributes to models of personality and cognition by identifying mechanisms of this relation. This approach is consistent with NIH's emphasis on the need to identify mechanisms to design more effective interventions (Nielsen et al., 2018). Although traits are relatively stable across adulthood (Terracciano, McCrae, & Costa, 2010), there is evidence that interventions are effective at changing maladaptive aspects of personality (Roberts et al., 2017), including those related to cognition. As such, there is the potential for interventions to modify traits, such as Neuroticism, that may lead to downstream improvements in cognition, perhaps through more positive evaluations of daily experiences. Further, personality may modulate the efficacy of interventions (Rouch et al., 2018), and there is growing evidence for the efficacy of interventions tailored to the individual's personality (Conrod et al., 2013; Kolanowski, Litaker, Buettner, Moeller, & Costa, 2011). Such an approach may also be helpful to help individuals maintain their cognitive function with age.

The present research had several strengths, including a longitudinal design that spaced the three components of the mediation model out in time, a relatively large sample, and proximal assessments of the potential mediators. There are, however, some limitations to consider when evaluating this research. First, we did not have multiple assessments of the mediators. The day reconstruction method offers a more specific assessment of the potential mediators, but the assessment in this study still only occurred at one point in time. Fluctuations in the mediators may be as important or more important than single assessments. Future research could take an experience sampling approach or measurement burst design to the mediators to test this issue. Second, we only had the facets of Conscientiousness and not the facets of any of the other traits. This omission is due to the data availability in the HRS (the facets of the other four traits are not measured). Future research could also include the facets of the other traits. Finally, the evaluation of the previous day was also limited. For example, participants reported how much time they spent alone but not whether they felt lonely. Future research could include more in-depth assessments.

Despite these limitations, the present study identifies aspects of day-to-day psychological functioning that link personality to cognitive function over time. Previous research has indicated that personality traits, particularly higher Neuroticism and lower Conscientiousness, are associated with an increased risk of cognitive impairment and dementia (Terracciano et al., 2017). The mechanisms through which traits lead to this long-term outcome are less understood. This research is a step toward a mechanistic model that identifies the pathways through which personality contributes to cognitive aging and risk of impairment.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgement:

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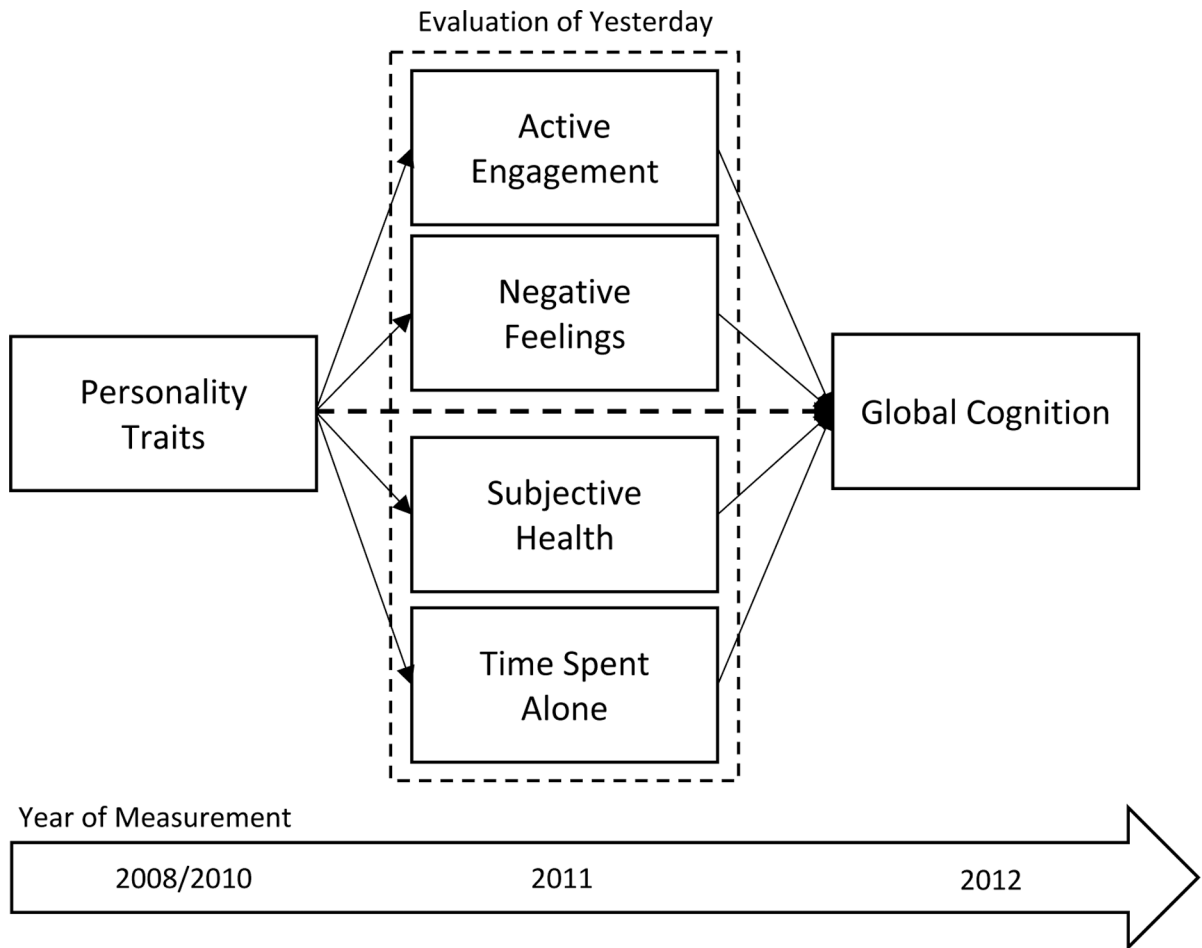
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Figure 1.
Mediational figure showing the mechanistic pathway between personality and global cognition through daily evaluations.

Table 1

Descriptive Statistics for All Study Variables

	Mean (*SD*; range) or %
Baseline Demographic Characteristics	
Age (years)	64.85 (8.84; 34–94)
Gender (female)	60%
Race (African American)	6%
Race (Other/unknown)	2%
Race (white)	92%
Hispanic ethnicity (yes)	4%
Education (years)	14.27 (2.19; 0–17)
Baseline Personality Domains	
Neuroticism	1.94 (.60; 1.00–4.00)
Extraversion	3.21 (.56; 1.20–4.00)
Openness	3.06 (.51; 1.14–4.00)
Agreeableness	3.54 (.46; 1.20–4.00)
Conscientiousness	3.47 (.44; 1.20–4.00)
Baseline Personality Facets	
Self-control	4.81 (.92; 1.00–6.00)
Order	4.37 (.96; 1.00–6.00)
Industriousness	4.94 (.91; 1.00–6.00)
Traditionalism	4.34 (.95; 1.00–6.00)
Virtue	5.04 (.91; 1.00–6.00)
Responsibility	5.39 (.71; 1.00–6.00)
Global Cognition[1]	
Baseline (2008/2010)	17.78 (2.93; 12.00–27.00)
Follow-up (2012)	17.08 (3.46; 3.00–27.00)

Note. N=3,454.

[1]Global cognition was measured with the modified Telephone Interview for Cognitive Status.

Table 2

Association Between Personality Domains and Facets and Experiences Yesterday

	Active Engagement	Negative Feelings	Subjective Health	Time Spent Alone
Neuroticism	−.28*	.31*	−.24*	.05*
Extraversion	.26*	−.14*	.23*	−.11*
Openness	.20*	−.06*	.14*	.01
Agreeableness	.17*	−.04	.09*	−.07*
Conscientiousness	.15*	−.15*	.22*	−.07*
Self-control	.07*	−.08*	.11*	−.01
Order	.12*a	−.13*a	.21*a	−.04
Industriousness	.15*a	−.10*	.18*a	−.10*a
Traditionalism	.09*	−.11*a	.09*	−.06*
Virtue	.11*	−.07*	.07*	−.05*
Responsibility	.14*a	−.09*	.16*a	−.04

Note. *N*=3,454. Coefficients are standardized beta coefficients from linear regression controlling for age, sex, education, race, ethnicity, and year of personality assessment.

*
p<.01.

[a]Significant when all facets are entered simultaneously.

Table 3

Association between Personality and Yesterday Evaluation and Cognition

Predictors	Cognition 2012	Change in cognition 2008/2010 to 2012
Age	−.23**	−.14**
Sex	.14**	.08**
Race (African American)	−.09**	−.05**
Race (Other/Unknown)	−.02	.00
Ethnicity (Hispanic)	−.05**	−.03
Education	.21**	.11**
Year	.03	.05**
Baseline cognition	--	.41**
Neuroticism	−.06*	−.04
Extraversion	.03	.03
Openness	.07*	.05*
Agreeableness	.03	.03
Conscientiousness	.06*	.04*
Self-control	.05*	.02
Order	.04	.02
Industriousness	.06*	.04*
Traditionalism	.01	.01
Virtue	.04	.03
Responsibility	.07*	.03
Yesterday Evaluation		
Active Engagement	.09*	.07*
Negative Affect	−.04	−.04
Subjective Health	.13*	.10*
Time Spent Alone	−.03	−.04*

Note. N=3,454. Coefficients are standardized beta coefficients from linear regression controlling for age, sex, education, race, ethnicity, and year of personality assessment (for the personality regressions because of the two-year difference in assessment of personality; year was not included in the yesterday evaluation regressions because all participants completed this measure during the 2011 Internet Survey). Change in cognition includes the 2008/2010 cognitive assessment as an additional covariate.

*
p<.01.

Table 4

Indirect Effects of Personality Traits on Cognition Through the Four Evaluations of Yesterday

Trait	IV to Mediator (path a)	Mediator to DV (path b)	Indirect Effect (axb)	Total Effect (path c)	Direct Effect (path c')
Neuroticism				−.33 (.09) *	−.14 (.10)
Active Engagement	−.59 (.03) *	.16 (.05) *	−.09 (−.18, −.01) *		
Negative Feelings	.97 (.05) *	.07 (.04)	.07 (−.02, .16)		
Subjective Health	−.39 (.03) *	.50 (.06) *	−.16 (−.23, −.09) *		
Time Alone	.46 (.15) *	−.01 (.01)	.00 (−.02, .01)		
Openness				.48 (.11) *	.32 (.11) *
Active Engagement	.48 (.04) *	.14 (.05) *	.07 (.01, .14) *		
Negative Feelings	−.22 (.06) *	.05 (.03)	−.01 (−.04, .01)		
Subjective Health	.27 (.03) *	.40 (.06) *	.11 (.06, .17) *		
Time Alone	.12 (.17)	−.01 (.01)	.00 (−.01, .01)		
Conscientiousness				.50 (.13) *	.27 (.13)
Active Engagement	.42 (.05) *	.16 (.05) *	.07 (.01, .14) *		
Negative Feelings	−.63 (.07) *	.06 (.03)	−.04 (−.10, .01)		
Subjective Health	.49 (.04) *	.39 (.06) *	.19 (.10, .29) *		
Time Alone	−.76 (.20) *	−.01 (.01)	.01 (−.02, .03)		

Note. N=3,454. Coefficients are unstandardized coefficients from the mediation analysis controlling for age, sex, education, race, ethnicity, and year of personality assessment. Numbers in parentheses are standard errors or 99% confidence intervals. IV=independent variable. DV=dependent variable.

*
p<.01.

Table 5

Indirect Effects of the Facets of Conscientiousness on Cognition Through the Four Evaluations of Yesterday

Facet	IV to Mediator (path a)	Mediator to DV (path b)	Indirect Effect (axb)	Total Effect (path c)	Direct Effect (path c')
		Mediation Parameter			
Self-Control				.19 (.06)*	.14 (.06)
Active Engagement	.10 (.02)*	.17 (.05)*	.02 (.00, .04)*		
Negative Feelings	−.18 (.03)*	.06 (.03)	−.01 (−.03, .01)		
Subjective Health	−.05 (.09)	.40 (.06)*	.05 (.02, .08)*		
Time Alone	.14 (.06)	−.01 (.01)	.00 (−.01, .01)		
Industriousness				.23 (.06)*	.13 (.06)
Active Engagement	.21 (.02)*	.16 (.05)*	.03 (.01, .07)*		
Negative Feelings	−.20 (.03)*	.06 (.03)	−.01 (−.03, .01)		
Subjective Health	.19 (.02)*	.40 (.06)*	.07 (.04, .12)*		
Time Alone	−.57 (.10)*	−.01 (.01)	.00 (−.01, .02)		
Responsibility				.31 (.08)*	.20 (.08)
Active Engagement	.24 (.03)*	.16 (.05)*	.04 (.01, .08)*		
Negative Feelings	−.25 (.04)*	.06 (.03)	−.02 (−.04, .01)		
Subjective Health	.21 (.02)*	.40 (.06)*	.09 (.04, .13)*		
Time Alone	−.28 (.12)	−.01 (.01)	.00 (−.01, .01)		

Note. $N=3,454$. Coefficients are unstandardized coefficients from the mediation analysis controlling for age, sex, education, race, ethnicity, and year of personality assessment. Numbers in parentheses are standard errors or 99% confidence intervals. IV=independent variable. DV=dependent variable.

*
$p<.01$.