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The Association Between Facets of Conscientiousness and Performance-based and Informant-Rated Cognition, Affect, and Activities in Older Adults

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Abstract

Objective: To identify facets of Conscientiousness associated with objective cognitive performance, informant-rated cognitive decline, and informant-rated affect and activities implicated in cognitive health.

Method: Health and Retirement Study participants (N=2,516) reported on their personality, completed a comprehensive cognitive assessment, and had knowledgeable informants report on their cognition, affect, and activities.

Results: Industriousness and responsibility were associated with better cognitive performance; order was associated with less informant-rated cognitive decline. The facets were also associated with more positive affect, less negative affect, greater engagement in cognitive activities and activities outside the house, and less engagement in passive activities, as rated by a knowledgeable informant. Informant-rated engagement in cognitive activities mediated the association between self-reported responsibility and objective cognitive performance.

Conclusions: Tendencies toward achievement and accountability were associated with healthier cognitive performance and daily profiles that support cognitive health, whereas organization was associated with cognition as reported by a knowledgeable informant. The differential pattern of correlates is informative for the theoretical processes that link distinct facets of Conscientiousness to healthier cognitive aging.

Keywords

Five factor model; Facets; Cognitive function; memory; attention; conscientiousness

Conscientiousness is a trait within the Five Factor Model (FFM) of personality that is defined as a general tendency to be organized, disciplined, and responsible (Costa & McCrae, 1992). It is the FFM trait that is associated most consistently with better health

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outcomes (Friedman, Kern, Hampson, & Duckworth, 2014), including maintaining cognitive function over time (Luchetti, Terracciano, Stephan, & Sutin, 2016) and protection against Alzheimer's disease (Kaup, Harmell, & Yaffe, 2019) and dementia (Terracciano, Stephan, Luchetti, Albanese, & Sutin, 2017). It has thus emerged as a critical psychological factor for healthier cognitive aging.

Under this broad trait are several lower-order characteristics, referred to as facets (Costa & McCrae, 1992; Green, O'Connor, Gartland, & Roberts, 2016). Theoretical conceptualizations of Conscientiousness usually include facets that capture qualities of industriousness/achievement striving (the tendency to work hard to achieve one's goals), order (the tendency to be organized in possessions and behavior), self-control/self-discipline (the tendency to have control over one's self), and responsibility/dutifulness (the tendency to be responsible and accountable to other people; Costa & McCrae, 1992; Roberts, Chernyshenko, Strark, & Goldberg, 2005; Watson, Nus, & Wu, 2017). Some theoretical conceptualizations also include the facets of traditionalism (the tendency to follow the rules) and virtue (the tendency to be honest) (Roberts et al., 2005).

Facet-level analyses can help to better understand how a broad trait is related to an important outcome, such as cognitive function. Research at the facet level can help identify specific patterns of behaviors and processes that may contribute to how the broad trait operates and help better inform theoretical accounts of Conscientiousness. For example, an association with order but not self-control would suggest that the processes related to organization are more relevant for cognitive health than those related to self-control. Further, facet-level associations sometimes go in opposite directions, which can obscure the association at the domain level (Moon, 2001). Such differences likewise indicate how the trait functions and how processes associated with the facet may contribute to the outcome. For example, one study showed that domain-level Conscientiousness was unrelated to verbal fluency but there were divergent associations at the facet level, with a positive association for achievement striving and a negative association for deliberation (Sutin et al., 2011). The facet of deliberation captures the tendency to think before acting. In the context of a verbal fluency task, where speed is critical for good performance, this tendency may lower how fast someone can perform on this task, whereas the time limit may be more motivating for individuals higher in achievement striving. As such, facet level associations provide a fine-grained picture of how the broad domain operates in predicting cognitive health.

Facet-level analyses of Conscientiousness and cognition have focused primarily on either risk of cognitive impairment in older adulthood (Sutin, Stephan, & Terracciano, 2018) or the association with intelligence in younger and middle adulthood (Rammstedt, Lechner, & Danner, 2018). This work has suggested that the self-control/discipline and responsibility/dutifulness facets are associated consistently with lower risk of Alzheimer's disease and dementia in older adulthood (Sutin et al., 2018; Terracciano et al., 2014). A somewhat different pattern emerges when intelligence is the outcome rather than impairment. In middle adulthood, order is associated with worse performance on measures of intelligence (Moutafi, Furnham, & Crump, 2006; Rammstedt et al., 2018), whereas there is some evidence that responsibility is associated better performance (Rammstedt et al., 2018). In undergraduate samples, industriousness tends to have positive associations with both fluid and crystalized

intelligence, whereas order is unrelated to these measures (Rikoon et al., 2016). Less work, however, has addressed the relation between facets of Conscientiousness and cognitive performance in older adulthood rather than global intelligence and cognitive impairment.

Even less is known about how the facets are associated with informant-ratings of cognition. Judgements of an individual's cognitive function by a knowledgeable informant are critical to the diagnosis of dementia (American Psychiatric Association, 2013; Mayo Clinic, 2019). Such ratings are helpful for clinicians to get a better understanding of whether symptoms are new or a long-standing characteristic of the person (e.g., did the individual just start having trouble remembering a shopping list or has the person always struggled with this type of memory?). In parallel with performance on objective measures of cognition in older adulthood, higher scores on domain-level Conscientiousness tend to be associated with better informant-rated cognition (Slavin et al., 2010). Whether this association holds across all facets of Conscientiousness or whether there is a specific pattern of associations is not yet known.

Informants can also provide other important information about the target beyond ratings of cognitive function. Informant ratings in other domains are often used to get another perspective about the individual's functioning. Informants, for example, can rate the target's emotional states and their usual activities. Although Conscientiousness is not typically considered an affective trait, it is associated with a consistent emotional profile. Higher Conscientiousness, for example, is associated with feeling more happiness and less negative emotions in general (Fayard, Roberts, Robins, & Watson, 2012) and with less negative affect after experiencing a stressor (Leger, Charles, Turiano, & Almeida, 2016). At the facet level, there is some evidence that the order and self-discipline facets are associated with less daily negative affect and less variation in negative affect (Penley & Tomaka, 2002). Less work has addressed the associations between the facets and daily affect, as rated by a knowledgeable informant.

Finally, there is growing interest in how individuals use their time and the psychological correlates of such time use (Rohrer & Lucas, 2018). Conscientiousness has been associated with a number of ways that individuals use their time. Individuals high in Conscientiousness, for example, are invested in their work (Lodi-Smith & Roberts, 2007) and also spend time volunteering (Mike, Jackson, & Oltmanns, 2014), cleaning and doing upkeep around the house (Jackson et al., 2010), and are physically active (Wilson & Dishman, 2015) and less likely to spend time in sedentary activities, such as watching TV (Sutin et al., 2016). Daily active engagement may be one mechanism that helps support cognitive health over time (Sutin et al., 2019). Similar to affect, this research has been primarily at the domain level and has relied primarily on self-reports. The present research seeks to identify facet-level associations and determine whether patterns previously observed with self-report are also apparent with informant ratings.

The present study addresses the relation between the facets of Conscientiousness and cognitive health and daily activities that support cognitive health. We test the association between six facets of Conscientiousness and objective cognitive performance. In addition, we examine and how these self-rated facets are associated with informant-rated (a) cognitive

decline, (b) daily affect, and (c) activities. In post-hoc analyses, we further test whether informant-rated affect and activities mediate the relation between the facets and the two cognitive outcomes.

Method

Participants and Procedure

Participants were drawn from the Harmonized Cognitive Assessment Protocol (HCAP) sub-study of the Health and Retirement Study (HRS). Participants were randomly selected from the overall HRS sample if they had completed the 2016 HRS assessment and were aged 65 years or older. A total of 3,496 participants of the 5,500 randomly selected HRS participants completed at least some part of the HCAP assessment. Most HRS participants in HCAP completed a measure of the facets of Conscientiousness as part of the Leave-Behind Questionnaire at a previous wave in either 2008 or 2010. Participants were selected into the analytic sample if they had completed this facet measure of Conscientiousness, completed at least part of the HCAP assessment, and had information available on their sociodemographic characteristics. In addition, as part of HCAP, target participants were asked to nominate one knowledgeable close other to complete a survey on the target's cognitive function and daily activities. A total 2,516 participants provided information on the facets and the cognitive or informant measures. The analytic samples ranged from 2,302 to 2,478 because of missing data on some of the variables.

Measures

Facets of Conscientiousness.—Six facets of Conscientiousness were assessed with a 24-item measure (Roberts et al., 2005). Four items measured each facet: self-control (e.g., "I rarely jump into something without first thinking about it." alpha=.52), order (e.g., "I hardly ever lose or misplace things." alpha=.46), industriousness (e.g., "I have high standards and work toward them." alpha=.63), traditionalism (e.g., "I support long-established rules and traditions." alpha=.44), virtue (e.g., "If the cashier forgot to charge me for an item, I would tell him/her." alpha=.50), and responsibility (e.g., "I carry out my obligations to the best of my ability." alpha=.53). Participants rated each item on a scale from 1 (strongly disagree) to 6 (strongly agree), items were reverse scored as necessary, and the mean taken across items.

Cognitive performance.—Five domains of cognitive function were measured in the HCAP assessment. Detailed information about the tasks, protocol, and scoring can be found in Weir and colleagues (2016). The five domains were: (1) *Episodic memory,* measured with the CERAD Word List Learning and Recall Task, the Brave Man, and the Wechsler Memory Scale Logical Memory I, (2) *Speed-attention*, measured with Backward Count, the Letter Cancellation Test, Trails A and B, and the Symbol-Digit Modalities Test, (3) *Visuospatial skills,* measured with CERAD Constructional Praxis and Raven's matrices, (4) *Language,* measured with an animal fluency task, and (5) *Numeric Reasoning*, measured with the HRS Number Series. All tasks were first scored and then standardized. For the three domains measured with multiple tasks the mean taken across the standardized scores. Trails A and B were multiplied by −1 before standardization so that the scoring would be in the same direction as the other measures in the speed-attention domain. The mean of the five domains

was then taken as a measure of total cognitive performance (alpha=.80). There was no evidence that this measure was skewed (skewness and kurtosis<1).

Informant-rated cognitive decline.—Knowledgeable informants reported on participants' current cognitive functioning and perceived decline over the last 10 years on four standard measures of informant-rated cognition. Specifically, informants (one informant per participant) completed the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) (Jorm, 1994), Part 1 of the Blessed Dementia Rating Scale (Morris et al., 1989), the 1066 (Prince et al., 2011), and the Community Screening Instrument for Dementia (CSID) (Hall et al., 2000). See Weir and colleagues (2016) for details about the scales and scoring. The scales were scored and standardized. The mean of the four scales was then taken as a measure of informant-rated cognitive decline (i.e., scores were in the direction of worse cognitive function and perceived decline over time). There was some evidence that this measure was skewed, which was also apparent in the individual measures. As such, the natural log was taken of the four measures prior to standardizing (alpha=.85). The composite of the transformed variables was not skewed (skewness and kurtosis<1).

Informant-rated affect and activities.—Informants were asked to rate the affect and activities of the target. Specifically, informants were asked, "Thinking about yesterday (or the most recent day you observed [him/her] most of the day), how much would you say [he/she] felt…" and rated four positive affect items (happy, engaged, alert, interested; alpha=.80) and two negative affect items (confused, withdrawn; alpha=.60). Ratings were made on a scale from 1 (*not at all*) to 5 (*very much*). Informants were also asked about the average amount of time doing a number of activities in a typical day: "Thinking first about things done around the house, in an average day how many hours does [he/she] spend…?" Informants rated watching TV, reading, chores/home maintenance, computer/internet, and napping on a scale from 0 (none) to 5 (7 hours or more). An exploratory factor analysis indicated that these items loaded on two factors: Passive activities (watching TV, napping, chores [reverse scored]; alpha=.47) and cognitive activities (reading, computer/internet; alpha=.42). Finally, informants were asked about the frequency of several activities outside the home, including frequency of working/volunteering, gong to the store, going for a walk, and playing sports/exercising. Ratings were made on a scale from 1 (daily) to 6 (never) and reversed scored in the direction of more frequent activity. An exploratory factor analysis indicated that these items loaded on one factor (alpha=.59). Negative affect had a slight skew; the natural log was taken to reduce the skew. With this transformation for negative affect, none of the informant ratings of affect or activities was skewed (skewness and kurtosis<1).

Covariates.—Target covariates included participant-reported age in years at the baseline personality assessment, sex (female=1, male=0), race (African American=1 [dummy variable 1] and other/unknown=1 [dummy variable 2], both compared to white=0), and education in years. Informant covariates were informant-reported age in years at the HCAP assessment, informant sex (female=1, male=0), informant education in years, length of time informant knew target participant in years, and relationship with target participant (spouse=1, other=0).

Statistical Approach

Several models were used to examine the relation between the facets and the cognitive variables and informant ratings. Bivariate correlations were used to examine the association between the six facets and the seven outcomes (total cognition, informant-rated cognitive decline, informant-rated positive and negative affect, and informant-rated passive, cognitive, and outside activities). We tested for differences between the correlations using an *r*-to-*z* transformation and a standard test for differences among correlations with a common variable (Lee & Preacher, 2013; Steiger, 1980). Linear regression was used to examine the association between the facets of Conscientiousness and total cognition, controlling for participant covariates, and informant ratings (cognitive decline, affect, and activities), controlling for the informant and relationship covariates as well as the participant covariates (Model 2). Two additional regressions were run as follow-up analyses to identify which facets had independent associations with the outcomes: all six facets were included in the model simultaneously (Model 3) or when the composite of the facets was included as a covariate (Model 4; note: interpret these analyses with caution due to the large correlations between the facets and the overall composite), both controlling for Model 2 covariates. Finally, the associations between the facets and outcomes were tested in a bifactor model framework (Chen, Hayes, Carver, Laurenceau, & Zhang, 2012). A bifactor model hypothesizes that there is a general factor (i.e., conscientiousness) that accounts for the commonality shared by multiple specific factors (i.e., facets), and that each facet accounts for the unique influence of the specific component over and above the general factor. Parcels were created for the facets to form two manifest indicators following the item-to-construct balance technique (Little et al., 2002). The bifactor model was constructed following the approach of Chen and colleagues (Chen et al., 2012): Each parcel had a nonzero loading on both the general factor and the facet it was designed to measure, but no loadings on the other facets; the facets were uncorrelated with each other and with the general factor; and all error terms associated with the parcels were uncorrelated. In addition to setting one of the facet loadings in the general factor to 1, one of the parcel loadings in each of the facets was also set to 1. For each outcome, we ran a separate bifactor model in which all facets were entered simultaneously controlling for the covariates (Model 5). The bifactor models were estimated using the maximum likelihood estimator in Mplus 8 (Muthén, L.K. & Muthén, B.O., 1998). The overall bifactor model consisting of the general factor conscientiousness and the six facets fit the data well (RMSEA = .044, 90% CI [0.039, 0.049]; CFI = .953; TLI = .935; SRMR = .033). The standardized factor loadings of the bifactor model are in Supplemental Table S1. The variances of all facets were statistically significant ($p < .001$; Table S1), indicating that they are specific factors over and above the general factor. In evaluating the results, we focus on associations with similar effect sizes across the various analytic approaches. Finally, in post-hoc analyses, we tested whether informant-rated affect and activities mediated the relation between the facets and total cognition and informant-rated cognitive decline using PROCESS (Hayes, 2018).

Results

Descriptive statistics for all study variables are shown in Table 1. Bivariate correlations among all analytic variables are shown in Supplemental Table S2. Bivariate correlations

between the facets and the individual cognitive tasks and informant-ratings are shown in Supplemental Table S3. Of note, a fairly consistent pattern of associations with the facets was evident across the cognitive domains and across the measures of informant-rated cognitive decline. The associations between the facets and total cognition are shown in Table 2. All of the facets were associated with better cognitive performance (Model 1). The test of differences between correlations indicated that industriousness and responsibility had stronger associations with total cognition than the other four facets. A similar pattern emerged when controlling for the covariates (Model 2). These associations were reduced when all six facets were included in the model simultaneously (Model 3) and from when the composite was included in the model (Model 4). The effect sizes were similar in the bifactor model (Model 5). This model, however, should be interpreted with caution because it had marginal fit to the data (RMSEA = .052, 90% CI [0.049, 0.055]; CFI=.878).

Table 2 also shows the relation between the facets and informant-rated cognitive decline. The bivariate correlations indicated that self-control, order, industriousness, and responsibility were associated with informant-rated cognitive decline (Model 1). The relation with self-control and responsibility were not independent of the covariates (Model 2) and relation with industriousness was not independent of the other facets (Model 3) or the composite (Model 4). The associations between the facets and informant-rated cognitive decline were reduced by when all six facets were included in the model simultaneously (Model 3) and when the composite was included in the model (Model 4). Finally, the bifactor model (Model 5) also indicated that order was the only facet associated with informant-rated cognitive decline (RMSEA=.043, 90% CI [0.041, 0.046]; CFI=.848).

The facets of Conscientiousness were associated with informant-rated affect and daily activities (Table 3). Again, industriousness emerged as the most consistent independent correlate of affect and activities: Participants who had a general tendency toward working hard were perceived as experiencing more frequent positive affect and less frequent negative affect and spent less time in passive activities at home and engaged in more activities outside the home. In the bifactor model, industriousness was related to affect (PA: RMSEA = .043, 90% CI [0.041, 0.046]; CFI = .845; NA: RMSEA = .043, 90% CI [0.041, 0.046]; CFI = .843) and all types of activities (Passive: RMSEA = .043, 90% CI [0.041, 0.046]; CFI = .849; Cognitive: RMSEA = .042, 90% CI [0.038, 0.047]; CFI = .951; Outside: RMSEA = .044, 90% CI [0.041, 0.046]; CFI = .846). Responsibility generally followed a similar pattern, although in some models, responsibility was not independent of the other facets and/or composite measure. There were, however, associations between responsibility and less engagement in passive activities and more engagement in cognitive activities. In the bifactor model, responsibility was associated with greater positive affect and more engagement in cognitive activities.

Finally, in post-hoc analyses, we tested whether informant-rated affect and activities mediated the relation between the facets and cognitive function. The informant-rated affect and activities were all associated with objective cognitive performance: positive affect (β=.16), negative affect (β=−.19) and engagement in passive activities (β=−.16), cognitive activities (β=.26) and activities outside the home (β=.16) were associated with higher total cognition (all ps<.001). For the mediation analysis, we focused on industriousness and

responsibility because these were the two facets with associations with total cognitive function and had associations with informant-rated activities and affect. The association between industriousness and better cognitive function was due, in part, to less negative affect, less time spent in passive activities at home, and greater engagement in activities outside the home, whereas only greater engagement in cognitive activities mediated the association between responsibility and better cognitive performance (Table 4).

Discussion

The present research examined the association between six facets of Conscientiousness and objective and informant-rated cognitive decline and informant-rated affect and daily activities. Industriousness and responsibility emerged as consistent correlates of objective cognitive performance, whereas order was the only independent correlate of informant-rated cognitive decline. Industriousness was also associated with daily affect and engaging in cognitively and physically routine activities inside and outside the house and responsibility was associated with greater engagement in fewer passive activities and more cognitive activities, as reported by a knowledgeable informant. In post-hoc analyses, these ratings were found to mediate the relation between the industriousness and responsibility and cognitive performance.

When considered separately, all of the facets of Conscientiousness were associated with better cognition. This pattern suggests that Conscientiousness broadly contributes to better cognitive performance and is consistent with the literature on cognitive function in older adulthood that identifies trait Conscientiousness as a predictor of healthier cognitive function (Segerstrom, 2018). Although Conscientiousness has been associated with lower fluid intelligence earlier in the lifespan (Rammstedt et al., 2018), it seems to play a protective role against cognitive impairment in older adulthood (Terracciano et al., 2017), perhaps because of the healthier lifestyle associated with this trait (Bogg & Roberts, 2004) that accumulates over the lifespan.

One benefit of a facet-level analysis is to examine whether there are specific components of Conscientiousness that have independent associations (beyond the effect of the other facets and the higher-order Conscientiousness domain) with the outcomes of interest (Rammstedt et al., 2018). For objective cognition, a clear pattern emerged that higher industriousness and responsibility were both associated with higher overall cognitive functioning, regardless of modeling technique used to test the association. Individuals who score higher on industriousness tend to be focused and dedicated to achieving their goals through hard work and are competitive (Roberts et al., 2005). Such processes may motivate individuals high in industriousness to perform well, regardless of the domain or situation, including cognitive testing. Responsibility has been described as individuals who have a tendency to “like to be of service to others, frequently contribute their time and money to community projects, and tend to be cooperative and dependable” (p. 122; Roberts et al., 2005). Responsibility is an interpersonal component of Conscientiousness that is distinct from its agentic components (e.g., industriousness). The present research indicates that these two distinct components have independent associations with cognitive function. Industriousness may help promote healthier cognitive function through greater engagement in activities, whereas responsibility

may help promote healthier cognitive function through strong interpersonal and social commitments.

A different pattern emerged for informant-rated cognitive decline. Specifically, order had an independent association with these ratings. Individuals high in order are very organized in their possessions, thoughts, and behaviors (McCrae & Costa, 2010), and this organization (e.g., regular sleep schedule or exercise routines, adherence to treatment regimens for conditions such as diabetes or blood pressures) may help maintain better cognitive function. Given that order is a more visible facet, it is also possible that informants misattributed greater organization for healthier cognitive function. Another non-mutually exclusive possibility is that the greater organization of individuals higher in order may mask cognitive decline. If order is misperceived as cognitive ability, there may be a delay in diagnosis since informant-rated cognitive decline is an important part of the diagnosis of dementia.

An individual's daily affect and activities may be mechanisms that support healthier cognitive aging. Individuals who experience less negative affect (Korthauer et al., 2018) and those involved in more engaging activities (Sutin et al., 2019) tend to maintain their cognitive function in older adulthood. Previous research has shown that individuals high in Conscientiousness tend to experience more positive affect and less negative affect on average (Fayard et al., 2012). The present research indicates that close others likewise detect this emotional profile. These associations support the previous literature on affect and Conscientiousness that relied entirely on self-report. It also indicates, similar to objective cognitive function, that industriousness and responsibility are the two facets that are most consistently associated with this emotional profile.

The pattern of correlates between the facets and daily activities also provides information about how the components of Conscientiousness are related to activities typically associated with this trait. Individuals higher in Conscientiousness, for example, engage in less sedentary behavior than individuals lower on this trait (Sutin et al., 2016). The present research suggests that the industriousness facet was associated with both less sedentary behavior (e.g., fewer hours spent on passive activities at home) and greater engagement in activities outside the home, and that these behavioral patterns are detectable by close others. Individuals high in Conscientiousness likewise try keep busy. These associations are consistent with the larger literature on Conscientiousness that indicates it is associated with investment in work (Lodi-Smith & Roberts, 2007), spend time volunteering (Mike et al., 2014), and taking care of the house (Jackson et al., 2010).

The post-hoc mediation analysis suggested that these patterns of affect and activities may be pathways that support healthier cognition. Specifically, industriousness contributes to better cognitive performance because of less frequent negative affect and less time spent in passive activities at home and also more time spent in activities outside the home. In contrast, responsibility is linked to better cognition through more time spent engaging in cognitive activities. This pattern is broadly similar to previous research that found that self-reported affect and daily active engagement are mechanisms between the facets and maintaining cognitive function in older adulthood (Sutin et al., 2019). It is important to note, however, that the cognitive tasks and the informant-rated affect and activities were

assessed at roughly the same time (the facets were assessed six-to-eight years earlier). As such, it was not possible to tease apart the temporal order. We hypothesize that the temporal order is that individuals higher in industriousness and responsibility have healthier emotional patterns and engage in a more active lifestyle, which, in turn, supports better cognitive function. It may be the case, however, that individuals who maintain their cognitive function have healthier emotional patterns and engage in more activities. Subsequent measures of cognition and affect/activities are needed to potentially tease apart these two possibilities.

There are also other mechanisms that may contribute to the association between both industriousness and responsibility and better cognitive function. First, industriousness and responsibility, as well as order, are associated with better self-rated health and a lower burden of disease (Chopik, 2016). Entering old age healthier and with fewer chronic diseases likely helps to support cognitive function. Second, and likewise, industriousness and responsibility, as well as order, are associated with healthier markers of objective health (e.g., adiposity, cholesterol, glucose; (Sutin, Stephan, & Terracciano, 2018). Thus, in addition to fewer chronic diseases, they also have healthier physiological profiles that may help support cognitive function. Third, industriousness and responsibility have strong associations with better performance markers of health, including lung function, grip strength, and walking speed (Sutin et al., 2018). Given the importance of physical activity for cognitive health (Prakash, Voss, Erickson, & Kramer, 2015), it may be that individuals with these traits have a physically active lifestyle that helps protect their cognition. Further, for order, it may be that better physical health may lead to impressions of better cognitive health.

It is important to put the modest associations found in the present research in the broader context of the literature on both personality and cognitive function. In contrast to much of the literature on the health correlates of conscientiousness (Bogg & Roberts, 2004), there was no method overlap in the associations since the facets were self-reported by the participants and all outcomes were either objective performance measures or ratings made by a knowledgeable informant. As such, the associations were not inflated due to shared method variance that can happen when all measures are self-reported. In addition, cognition in older adulthood is complex, and many factors are known to contribute to cognitive outcomes, from genetics (Savage et al., 2018) to the environment (Zhang & Chen, 2018). Given the complexity of this outcome, any individual factor, such as a facet of personality, is expected to have only a modest association. Still, the identification of such associations contributes to knowledge of how psychological factors contribute to cognitive function in older adulthood and the associations found in this sample are similar in magnitude to what is typically reported for personality and cognition (e.g., Allen, Laborde, & Walter, 2019; Sutin et al., 2011).

The present research had several strengths, including a relatively large sample of older adults, performance-based measures of cognition and informant-rated cognitive decline, affect, and usual activities. There are also some limitations to consider. First, the cognitive tasks and informant ratings were cross-sectional. As such, it was not possible to examine how the traits were associated with changes in these measures over time. Second, as mentioned above, the ordering of measurement did not allow for a rigorous test of the

proposed temporal mediational pathway. It would be worthwhile in future research to have multiple assessments of the facets, cognition, and informant-rated affect and activities to look both at change and reciprocal relations over time to more fully test the possible temporal pathways that contribute to these associations. Finally, the sample was all older adults over the age of 65. Although this age range is a strength of the current study, as cognitive function is critical in older adulthood, we could not test whether the associations hold in younger populations. That is, some evidence suggests that facets may have different patterns of correlates with cognition earlier in adulthood (Moutafi et al., 2006; Rammstedt et al., 2018). Future research could sample from across the lifespan to test for age differences in the association between the facets and cognitive performance, affect, and time use.

Despite these limitations, the current study adds to the literature on personality and cognitive function. It shows that there is a divergence between objective cognitive measurements and informant-rated cognitive decline, such that higher industriousness and responsibility are associated with better performance across the cognitive tasks whereas higher order is associated with less informant-rated cognitive decline. It also shows which facets of Conscientiousness are related to affect and activities, as rated by a knowledgeable informant. These patterns provide information on the relation between Conscientiousness and cognition in older adulthood and suggest pathways through which specific components of this trait promote healthier cognitive aging.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive Statistics for All Study Variables

Variable	Mean (SD) or % (n)
Participant characteristics	
Age (years)	69.27 (7.33)
Sex (female)	60% (1509)
Race (African American)	12.5% (314)
Race (Other)	4.0% (100)
Race (white)	83.5% (2102)
Hispanic (yes)	7.9% (199)
Education (years)	12.97 (2.90)
Informant characteristics	
Age (years)	65.36 (12.85)
Sex (female)	67.2% (1609)
Education (years)	13.63 (2.54)
Relationship characteristics	
Spouse (year)	45.4 (1087)
Years known	30.29 (21.51)
Conscientiousness Facets	
Self-control	4.72 (.92)
Order	4.33 (.94)
Industriousness	4.74 (.96)
Traditionalism	4.36 (.90)
Virtue	5.04 (.92)
Responsibility	5.27 (.77)
Total cognition	−.036 (.71)[a]
Informant-rated cognitive decline	−.13 (.74)[a]
Informant-rated affect	
Positive affect	3.88 (.78)
Negative affect	1.43 (.69)
Informant-rated activities	
Passive	2.48 (.86)
Cognitive	2.04 (1.10)
Outside	3.34 (1.15)

Note. *N*s range from 2,302 to 2,516 due to missing data.

[a]Score is a composite of multiple tasks that were standardized before aggregating.

Table 2

Association Between Facets of Conscientiousness and Total Cognition and Informant-rated Cognitive Decline

Facet	Model 1		Model 2		Model 3		Model 4		Model 5	
	r	*p*	β	*p*	β	*p*	β	*p*	β	*p*
					Total Cognition					
Self-Control	$.11_{a}$	.000	.068	.000	.030	.072	−.001	.963	.016	.576
Order	$.08_{a}$	.000	.048	.002	.009	.582	−.024	.192	.001	.982
Industriousness	$.24_{b}$	.000	.089	.000	.057	.001	.034	.084	.056	.025
Traditionalism	$.06_{a}$	.002	.058	.000	.022	.175	−.011	.573	.032	.285
Virtue	$.09_{a}$	.000	.056	.000	.015	.371	−.017	.371	.002	.978
Responsibility	$.23_{b}$	.000	.087	.000	.047	.008	.027	.175	.060	.164
					Informant-rated Cognitive Decline					
Self-Control	$-.04_{a}$	.044	−.036	.073	−.006	.787	.010	.714	−.016	.672
Order	$-.09_{b}$	.000	−.093	.000	−.085	.000	−.083	.001	−.177	.001
Industriousness	$-.10_{b}$	.000	−.059	.004	−.036	.110	−.028	.277	−.036	.273
Traditionalism	$.00_{a}$	.824	.000	.984	.026	.239	.061	.016	.042	.289
Virtue	$.00_{a}$	.897	−.011	.588	.006	.773	.046	.073	.095	.273
Responsibility	$-.05_{ab}$	.015	−.038	.070	−.015	.508	.006	.811	−.019	.719

Note. Coefficients are standardized beta coefficients from linear regression. Model 1 is the bivariate correlation. Subscripts that are different are different at $p<.05$. Model 2 controls for age, sex, race, and education for Total Cognition and age, sex, race, Latinx ethnicity, education, informant age in years, informant sex, informant education in years, length of time informant knew target participant in years, and relationship with target participant for informant-rated cognitive decline. Model 3 is all facets entered simultaneously controlling for the covariates. Model 4 controls for composite Conscientiousness and the covariates (interpret with caution due to the large correlations between the facets and the overall composite). Model 5 is estimates from bifactor model controlling for the covariates.

Table 3

Association Between Facets of Conscientiousness and Informant-rated Affect and Activities

Facet	Model 1		Model 2		Model 3		Model 4		Model 5	
	r	*p*	β	*p*	β	*p*	β	*p*	β	*p*
					Positive Affect					
Self-Control	$.08_{a}$	.000	.048	.022	.011	.615	−.010	.716	.039	.311
Order	$.07_{ab}$	.001	.057	.006	.027	.225	.012	.628	.081	.123
Industriousness	$.16_{c}$	.000	.119	.000	.102	.000	.107	.000	.134	.000
Traditionalism	$.02_{bd}$	.412	.008	.688	−.021	.346	−.064	.014	−.043	.291
Virtue	$.01_{d}$	.489	.001	.960	−.031	.174	−.079	.003	−.176	.056
Responsibility	$.11_{c}$	.000	.077	.000	.051	.035	.034	.160	.117	.032
					Negative Affect					
Self-Control	$-.06_{a}$	.002	−.045	.032	−.019	.416	−.002	.932	−.038	.324
Order	$-.05_{ab}$	.019	−.044	.038	−.020	.372	−.006	.825	−.027	.608
Industriousness	$-.12_{c}$	.000	−.079	.000	−.065	.006	−.059	.029	−.076	.024
Traditionalism	$.00_{b}$	.975	−.009	.678	.019	.411	.049	.061	.021	.620
Virtue	$-.02_{b}$	.359	−.024	.267	−.004	.866	.029	.282	.031	.723
Responsibility	$-.07_{a}$	.001	−.051	.020	−.023	.335	−.012	.670	−.027	.611
					Passive Activities					
Self-Control	$-.05_{a}$	.023	−.055	.007	.000	.998	.036	.169	.016	.667
Order	$-.07_{a}$	.000	−.066	.001	−.023	.283	.006	.797	−.034	.508
Industriousness	$-.19_{b}$	.000	−.154	.000	−.135	.000	−.127	.000	−.158	.000
Traditionalism	$-.05_{a}$	.021	−.021	.323	.030	.182	.079	.002	.068	.090
Virtue	$-.07_{a}$	.001	−.051	.014	−.019	.392	.035	.174	−.015	.857
Responsibility	$-.13_{c}$	.000	−.098	.000	−.051	.032	−.035	.197	−.060	.248
					Cognitive Activities					
Self-Control	$.05_{a}$	.009	.011	.578	.003	.892	.002	.948	−.004	.914
Order	$.03_{ab}$	.159	−.002	.935	−.010	.631	−.016	.501	−.024	.677
Industriousness	$.12_{c}$	.000	.020	.312	.012	.590	.017	.508	.108	.001
Traditionalism	$-.02_{b}$	.387	−.023	.243	−.039	.071	−.050	.043	−.112	.007
Virtue	$.03_{ab}$	.099	.008	.680	.002	.919	−.002	.933	−.072	.488
Responsibility	$.14_{c}$	.000	.050	.013	.056	.013	.065	.012	.241	.000
					Outside Activities					
Self-Control	$.04_{a}$	.086	.011	.594	−.031	.162	−.062	.019	−.053	.156
Order	$.06_{ab}$	.007	.038	.056	.014	.505	−.007	.786	.044	.384
Industriousness	$.16_{c}$	.000	.103	.000	.094	.000	.091	.001	.106	.001
Traditionalism	$.02_{a}$	.271	.030	.148	.003	.887	−.023	.357	−.013	.744
Virtue	$.02_{a}$	.245	.026	.202	.007	.742	−.025	.338	−.023	.787
Responsibility	$.11_{b}$	.000	.065	.002	.037	.110	.029	.278	.057	.271

Note. Model 1 is the bivariate correlation. Subscripts that are different are different at $p<.05$. Model 2 controls for age, sex, race, Latinx ethnicity and education for Total Cognition and age, sex, race, education, informant age in years, informant sex, informant education in years, length of time informant knew target participant in years, and relationship with target participant for informant-rated cognitive decline. Model 3 is all facets entered simultaneously controlling for the covariates. Model 4 controls for composite Conscientiousness and the covariates (interpret with caution due to the large correlations between the facets and the overall composite). Model 5 is estimates from bifactor model controlling for the covariates (except Model 5 for Cognitive Activities, which did not converge when controlling for covariates and we thus ran the model without covariates.

Table 4

Indirect Effects of Industriousness and Responsibility on Cognition Through Informant-Rated Affect and Activities

Facet	Mediation Parameter									
	Facet to Mediator (path a)	***p***	***Mediator to Cognition (path b)***	***p***	***Indirect Effect (axb)***	***p***	***Total Effect (path c)***	***p***	***Direct Effect (path c')***	***p***
Industriousness							.04 (.01)	.008	.01 (.01)	.260
Positive affect	.08 (.02)	.000	.00 (.02)	.878	.00 (.00)	.882				
Negative affect	−.02 (.01)	.004	−.29 (.04)	.000	.01 (.00)	.007				
Passive activities	−.13 (.02)	.000	−.06 (.01)	.000	.01 (.00)	.000				
Cognitive activities	.01 (.02)	.747	.15 (.01)	.000	.00 (.00)	.747				
Outside activities	.12 (.03)	.000	.05 (.01)	.000	.01 (.00)	.002				
Responsibility							.04 (.02)	.009	.03 (.02)	.083
Negative affect	.05 (.02)	.024	.00 (.02)	.878	.00 (.00)	.889				
Positive affect	−.01 (.01)	.451	−.29 (.04)	.000	.00 (.00)	.457				
Passive activities	−.04 (.03)	.090	−.06 (.01)	.000	.00 (.00)	.120				
Cognitive activities	.07 (.03)	.035	.15 (.01)	.000	.01 (.00)	.038				
Outside activities	.05 (.04)	.138	.05 (.01)	.000	.00 (.00)	.169				

Note. Coefficients are unstandardized coefficients and p-values from the mediation analysis controlling for the covariates.