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Personality and Performance in Specific Neurocognitive Domains Among Older Persons

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Abstract

Objective—Certain Big 5 personality dimensions have been repeatedly linked to global measures of cognitive function and outcome categories. We examined whether the Big 5 or their specific components showed differential evidence of associations with specific neurocognitive domains.

Design—Cross-sectional.

Participants—179 older adults (70+) participating in a broader study on cognitive aging.

Measurements—The NEO-Five Factor Inventory (NEO-FFI) and a comprehensive battery of neuropsychological tests.

Results—Adjusted for age, gender, and years of education, p-values, Bayes Factors, and measures effect size from linear models suggested strong evidence for associations between better delayed recall memory and higher Conscientiousness (principally the facets of Goal-Striving and Dependability) and Openness (specifically the Intellectual Interest component). Better executive function and attention showed moderate to strong evidence of associations with lower Neuroticism (especially the Self-conscious Vulnerability facet), and higher Conscientiousness (mostly the Dependability facet). Better language functioning was linked to higher Openness (specifically, the Intellectual Interests facet). Worse visual-spatial function was strongly associated with higher Neuroticism.

Conclusions—Different tests of neurocognitive functioning show varying degrees of evidence for associations with different personality traits. Better understanding of the patterning of neurocognitive-personality linkages may facilitate grasp of underlying mechanisms, and/or refine

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understanding of co-occurring clinical presentation of personality traits and specific cognitive deficits.

Keywords

personality; cognitive function; neuropsychological tests

Meta-analytic results now show robust associations between higher Neuroticism and lower Conscientiousness and incident dementia[1] as well as decline on measures of global cognitive function[2] such as the Mini-Mental Status Exam (MMSE)[3] or Mattis Dementia Rating Scales (MDRS)[4]. Dementias, related endpoints such as mild-cognitive impairment (MCI), and general measures of cognitive function are heterogeneous endpoints characterized by several key cognitive domains. In addition to memory, language, executive function, visual-spatial abilities, attention, and their various subdivisions are all key aspects of neurocognitive function in later life and contribute uniquely to functional capacity, independence, and ultimately quality of life.

Conscientiousness, Neuroticism, Openness, and the two other so-called "Big 5" personality dimensions of Extraversion and Agreeableness are also themselves composites of many specific interrelated traits. The composite nature of these personality constructs makes it impossible to determine exactly which component(s) is (are) relevant to any given outcome[9], and obfuscates understanding of their etiologic role (if any) in health outcomes[10].

For example, a recent study reported that it was the vulnerability facet of Neuroticism, rather than several others, that was particularly predictive of decline in a neurocognitive composite among depressed older persons[11]. This greater level of specificity might help refine personality-based prediction of the likelihood of developing cognitive problems, or particular deficit profiles (e.g., amnestic vs. dysexecutive). Understanding the focal area(s) of personality involved in cognitive deficits may also suggest prevention intervention strategies[12]. For instance, behavioral prevention efforts might be chosen either to complement personality strengths (e.g. exercise for those high on the activity facet of Extraversion) or compensate for deficits (e.g., enhancing mental stimulation for those low in the intellectual interest component of Openness). If specific personality components also provide useful information about genotype, other biological, or behavioral risk mechanisms, they could inform targeted therapeutics as well[12]. Several such mechanisms have been proposed, for which various personality-cognitive function linkages would constitute differing degrees of support. There is thus compelling reason to begin isolating the particular facets of Big 5 domains showing the strongest evidence of linkage to different cognitive functions. The goal of this report was to assess the strength of evidence for the existence of associations between different components of personality and tests of varying neurocognitive domains.

Methods

Participants and Procedure

Participants were drawn from a larger naturalistic study on aging and cognition, described in detail elsewhere[13,14]. Briefly, community-dwelling older persons from the Rochester, NY area were recruited via print and media advertisements, senior organizations, and word of mouth. Inclusion criteria included age 70+, no known major psychiatric or neurological disorder at time of enrollment, and ability to speak and read English. Exclusion criteria included the use of anticonvulsants, antipsychotics, neuroleptics, highly active antiretroviral therapy, antiemetics, dementia diagnosis, and use of mematine or anticholinergics. Those meeting inclusion criteria were consented, completed baseline history questionnaires, and then followed yearly with an extensive neuropsychological battery administered by a neuropsychologist (MM) or closely supervised psychometrician. Subjects were tested in a geriatric outpatient clinic after brief interviews and health assessments ensuring that they were free from active symptoms or medication side effects that would affect cognitive test performance, and received meal vouchers to the local hospital cafeteria as well as feedback on cognitive status in exchange for participation. All procedures were approved by the University of Rochester Institutional Review Board.

The study ran 2007–2014, with the bulk of data collection from the 2008–2013 period and a battery of psychosocial measures (including a personality inventory) administered in 2012–2013. During an initial pilot period of the psychosocial battery, 61 participants were randomly selected to complete the personality measure at their scheduled assessment, with another 124 of the remaining 192 active cohort members completing surveys by mail (overall personality completion rate of 185 / 253 = 73%). A multivariate logistic regression revealed no age, gender, race, or baseline MMSE differences between those who completed the personality measure and those who did not, but completers were somewhat more educated ($z = 2.61$, $p = .009$; Mean (M) 16.3, vs. 15.1 years of education). Twenty-five additional participants also completed the personality measure by mail after doing so during the earlier pilot phase, and their most recent scores were used subject to being within 1 year of most recent cognitive testing. Six persons were excluded because they did not have cognitive data within the prior year, resulting in an analysis sample of 179. Table 1 shows sample characteristics, with hypertension (52%), cancer (31%, including prostate cancer) and cardiovascular disease (29%) being the most common chronic conditions, and an MMSE mean (M) / standard deviation (SD) of 28.5 / 1.8.

Cognitive Measures

The cognitive battery was designed to assess attention, executive, language, memory, and visuoperception (see Table 1).

Trail Making Test (TMT)—The TMT is a well-validated test of attention, processing speed, and executive function, including two parts [15]. Part A involves connecting numbered circles in ascending sequence as quickly as possible, primarily assessing attention, including visual scanning and motor function. Part B involves connecting both numbered and lettered circles sequentially in alternating fashion, and tests the executive function dimensions of planning, set shifting, and flexibility. Scores for each part are measured in seconds of completion time.

Wechsler Memory Scales Third Edition (WMS-3) Digit Span—WMS-3 digit span includes separate tests of the number digits that can be immediately recalled a) in the order in which they are presented (Forward Digit Span), then b) in the reverse order in which they are presented (Backward Digit Span)[16]. Two trials are given for digit sequences lengths from 1–9 forward and 1–8 backward, with the test stopping when both trials at a span length are failed. Thus WMS-3 forward digit span scores can range from 0–9, with backward scores ranging from 0–8. Both procedures test attention and working memory, with backward digit span additionally requiring the executive function skill of reversing order once the information has been encoded.

Rey Auditory Verbal Learning Test (RAVLT)—The RAVLT[17] consists of an initial 15 word list presented over five trials, after which participants repeat back those they recall. This produces a learning over trials score, consisting of the total number of words recalled. A different "interference" word list is then provided to the participant. Free recall of the interference list is assessed, and then free recall of the original list is assessed again. After a 20-minute delay, the participant is asked to recall items from the original list, for a delayed recall memory score (0–15). Subsequently they are shown a longer list of words from which they must identify those on the original list, resulting in a recognition memory score (0–15).

Boston Naming Test (BNT)—The BNT asks participants to name the objects depicted in line drawings, with 60 items of increasing difficulty[18]. A 20 second time limit is given for response, and scores consist of the total number of correct trials, ranging from 0–60. The test assesses language function, based on visual recognition of objects.

Category Fluency (CF)—This test asks individuals to name as many examples of a given category as possible within 60 seconds[19]. Animals were used in this study. Scores are the total number of different animals named. The CF test assesses language functioning based on spontaneous word generation.

Hooper Visual Organization Test (HVOT)—The HVOT presents participants with line-drawings of common objects that have been separated into disjointed pieces, and asks them to determine what the object is[20]. The test contains 30 items, with scores ranging from 0–30, and tests visual spatial integration ability. It also requires naming.

Personality Measurement

The NEO-Five Factor Inventory [21] is a 60 item measures, assessing the Big 5 composite domains of Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness, each assessed with 12 items. Each item involves a Likert response scale ranging from 0–4, yielding raw score ranges for each domain from 0–48. The NEO-FFI is one of the most commonly used measures of the Big 5, including in older adults, with well-established validity and reliability. In the present sample, internal consistency reliability estimated by Cronbach's α / Bentler's ρ[22] were: Neuroticism .89 / .90; Extraversion .77 /.

80 ; Openness .70 / .72; Agreeableness .74 / .76; Conscientiousness .84 / .86. Each of the 5 domains contains 2–3 subscales tapping specific facets of a particular Big 5 dimension, ranging from 3 to 7 items each[23]. Each of the 5 domains contains 2–3 subscales tapping specific facets of a particular Big 5 dimension, ranging from 3 to 7 items each[23]. The factor structure of these subscales has been cross-validated in independent samples[24], including older adults[25]. These "subcomponent" or "facet" scales provide a means of identifying the specific element(s) of a broad Big Five scale most potently associated with an outcome[9]. The subscales include, by domain, Neuroticism: Anxiety, Depression, Self-conscious Vulnerability (also sometimes called the "self-reproach" scale, assessing self-consciousness and vulnerability to stress); Extraversion: Sociability, Positive Affect, and Activity; Openness: Intellectual Interests, Aesthetic Interests, and Unconventionality; Agreeableness: Prosociality and Non-antagonism; Conscientiousness: Orderliness, Dependability, Goal-Striving. These subscales had mean α / ρ reliability coefficients of .69 / .77, respectively. Bentler's ρ has been suggested as a better reliability estimate for short scales because it is not dependent on the number of scale items[22]. Unconventionality was unreliable (α = .36, ρ = .49) and excluded from analysis.

Statistical Analysis

Linear models with robust standard errors were fit for each cognitive test score, including a personality scale as the focal predictor and adjusting for age and education (Z-scores), and gender. Our question involved estimating the size and precision of a large number of associations in order to distinguish between the large majority with no statistical evidence, and smaller subsets with a) a relatively large amount of evidence, b) those with moderate but still noteworthy evidence, and c) those with a small amount of suggestive evidence. We implemented recent guidelines from the American Statistical Association which suggest that the traditional reliance on p-values for simple rejection of the null hypothesis be complemented by other statistical measures, including those lending themselves to a gradation or continuum of evidence for an association [26]. Specifically, four measures of evidence were examined: 1) P-values from two-tailed t-tests on regression coefficients were considered at both conventional significance thresholds ($p < .05$), as well as the rejection threshold based on the False Discovery Rate (FDR)[27]. 2) Bayes Factors for each association, which have the following interpretation attributable to Jeffreys[28] / Kass and Rafferty[29], respectively, as: 1–3, "anecdotal" / "worth only a bare mention"; 3–10, "substantial" / "positive"; 10–20, "strong" / "positive"; 20–30, "strong" / "strong"; 30–100, "very strong" / "strong"; 100–150, "decisive" / "strong"; > 150, "decisive" / "very strong". [29]. 3) regression coefficients, reflecting the SD change in the test score associated with a 1 SD change in the predictor; and 4) *Unique* variance of the test score attributable to a trait was then determined by Shapley decomposition of model R^2's[30] (denoted $R^2{}_s$). The first two measures are based on the probability that a non-zero association is present, whereas the latter two are effect size measures quantifying the magnitude or size of an association. We classified evidence *for the existence of associations* as "strong" if they had p-values below the FDR threshold and Bayes Factors of ≥ 20; as "moderate" if they showed p-values below the FDR threshold and Bayes-Factors in the 3–20 range; and as "mildly suggestive" if they had significant p-values and Bayes Factors in 1–3 range. To further facilitate interpretation, we computed 95% confidence intervals (CIs) around the effect size measures. Associations with effect sizes falling outside of another's 95% CI are statistically significantly different at $p < .05$. To gain a sense of practical significance, effect sizes were compared to demographic benchmarks of age and education.

Results

Big 5 Domains and Cognitive Tests

A small number of noteworthy linkages appeared between Big 5 domains and cognitive tests, and are summarized in Table 2 according to degree of evidence. Relatively strong evidence was apparent for associations between Neuroticism and both TMT-A and TMT-B scores (attention and executive function), as well as HVOT scores (visual-spatial function). Higher Conscientiousness scores were also positively associated with delayed recall memory scores on the RAVLT. Standardized regression coefficients and unique R^2s also tended to be relatively large for associations with strong evidence. However, 95% CIs included the effect size values noted for associations for which less evidence was present in Table 2, and thus none of the effect sizes as statistically significantly different at $p < .05$. As a benchmark of practical significance, in demographics-only models, one SD of age (4.4 years) showed an average neurocognitive test standardized regression coefficient (β) of .134 in absolute value, and average unique R^2 (R^2_s) of .026, while one SD of education (2.4 years) showed an average $\beta = .102$ and $R^2_s = .015$. Maximal effect sizes unadjusted for personality were, for 1 SD age and TMT-A (attention), $\beta = .277$ and $R^2_s = .074$; and for 1 SD education, BNT (language), $\beta = .224$ and $R^2_s = .053$. For traits with strong evidence of association, values ranged from $\beta = .25$ and $R^2_s = .06$ to $\beta = |.30|$ and $R^2_s = .09$.

Moderate evidence (p-values beyond FDR rejection threshold and substantial / strong Bayes Factors of 3–20) indicated positive associations between Openness and BNT, RAVLT-Recall, and Category Fluency scores, as well as between Conscientiousness and better TMT-A scores. A few additional associations showed p-values significant by conventional or FDR rejection thresholds, and positive but “anecdotal / barely mentionable” Bayes Factors, tentatively suggesting links between higher Extraversion and RAVLT delayed recall scores, and between better Category Fluency scores and lower Neuroticism and higher Conscientiousness. Effect sizes were on par with the average, but generally less than the maximum of those for age and education.

Facet Level Associations

A broadly similar pattern of associations emerged when considering personality at the facet level. Results are summarized in Table 3. The strongest level of evidence for associations pinpoint the Goal-Striving and Dependability facets of Conscientiousness as powerful correlates of RAVLT delayed recall scores. The Depression and Anxiety facets were the prominent elements of Neuroticism associated with worse visual organization scores. Self-Reproach showed a moderate level of evidence for association with visual organization. The Openness relationship to RAVLT delayed recall scores appeared to be most attributable to the Intellectual Interests facet. The following additional specific associations also showed moderate degrees of evidence: Higher Self-Conscious Vulnerability with higher completion time on both TMT-A and B; lower Dependability with worse TMT-B scores; lower

Depression and greater Intellectual Interests with better word production on the Category Fluency test; Activity and RAVLT recall scores; and Positive Affect and the BNT. Several additional facet associations either met conventional, but not FDR (.004 for facet analyses) rejection thresholds, or showed weaker Bayes Factors. In most cases, these tended to pinpoint specific components of the domain associations noted in Table 2 (e.g., Dependability and Orderliness driving the Conscientiousness association with Category Fluency). The pattern of effect sizes tended to mirror those for the domains, non-significant differences across differing levels of evidence, and magnitudes comparable to average, and in some cases maximal effect sizes for age and education.

Discussion

We assessed the degree of evidence for a large number of specific personality-cognition associations. The general profile that emerged was

1. better memory function accompanied by higher Conscientiousness and Openness; better attention and executive function by higher Conscientiousness and lower Neuroticism;
2. better language function associated higher Openness, with suggestions of higher Conscientiousness and lower Neuroticism; and
3. worse visual-spatial function in the presence of high Neuroticism.

The specific facets driving the link between Conscientiousness and delayed recall memory were Dependability (diligence and attention to duty), and Goal-Striving (the tendency to pursue objectives). Both of these dispositions involve a motivational component that may enhance cognitive engagement with tasks, thus facilitating later recall. These associations are consistent with the growing evidence for links between lower Conscientiousness and AD[1], the cardinal symptom of which is memory impairment. Low Openness has also been implicated in dementia[1], and the particular facet of Intellectual Interests showed very strong associations with delayed recall. Prior reports of 1-year decline in the composite MDRS have also implicated deficits in the Intellectual Interests aspect of Openness[31].

The association between Neuroticism and delayed recall memory performance was equivocal, failing to meet our threshold for even mildly suggestive evidence (e.g., $p = .092$). Such weak evidence was noted in a prior study in a largely non-demented sample[33]. Given that the sample was high-risk, but as yet free from profound impairment, persons higher in Neuroticism may manifest worse attention, executive function, and visual spatial performance prior to the appearance of major memory problem.

TMT-B (tapping in part executive function) and A (attention; both involve visual-spatial, motor, and processing speed components) were both strongly related to Neuroticism. A strong TMT-neuroticism association was noted previously in a similar sample[34]. The proneness to stress, distress, and anxiety that are emblematic of Neuroticism may inhibit cognitive performance in part by interfering with the efficiency of rapid information processing[35]. The Self-consciousness Vulnerability facet showed moderate, and Anxiety and Depression facets mildly suggestive evidence of links with TMT associations. This facet-level pattern of associations is broadly consistent with a recent report of longitudinal decline in TMT-B performance in a depressed sample[11]. There was also moderate evidence that people scoring higher in Conscientiousness (specifically its Dependability component) achieved better TMT-B completion times. We recently observed a similar association in an AD sample as well[36], suggesting some generality across sub-clinical and clinical populations in this pattern.

A body of neurobiological findings exists regarding Neuroticism, Conscientiousness, and brain regions implicated in executive functions, attention, and processing speed. Older persons higher in Conscientiousness show greater orbitofrontal cortex volume (the inverse being true for those high in Neuroticism)[8], a key area in executive function tasks, and lesions in the dorsolateral prefrontal cortex were associated with both higher Neuroticism and lower Conscientiousness[37]. White matter preservation in aging has been reportedly associated with lower Neuroticism and higher Conscientiousness[8].

Language, whether in response to pictorial stimuli (the BNT) or spontaneous generation (Category Fluency) showed moderate evidence of Openness associations, attributable specifically to the Openness facet of Intellectual Interests, which has previously been linked to better verbal fluency[38]. Such associations are often observed over and above the influence of education[39], and that was the case here. Intellectual curiosity may thus be useful as a second key marker of cognitive reserve, in addition to years of schooling.

Finally, an unusually strong association between visual-spatial ability (the HVOT) and Neuroticism was observed, attributable primarily to the depression and anxiety facets. Isolated reports have noted similar but weaker[40,41] or task-dependent[42] Neuroticism effects in visual-spatial integration, or the organization of disjoint components into a meaningful picture. One recent study in college students theorized that this link may be dependent on cognitive map abilities localized in the hippocampus, which also shows functional associations with Neuroticism [4344], although this is speculative. However, performance on both sections of the TMT, to which Neuroticism was also strongly linked here, also involves some degree of visual-spatial ability. Thus, persons scoring higher in Neuroticism perform strikingly worse on multiple tests dependent on visual spatial skill.

In summary, study findings indicate:

1. previously reported personality links to composite cognitive outcomes may reflect a specially patterned set of connections between the Big 5 and distinct cognitive domains;
2. these connections appear to some extent localized to particular elements of Big 5 dimensions; and
3. in older sub-clinical samples, memory deficits are most likely to be accompanied by lower Conscientiousness and Openness, worse executive function and attention by lower Conscientiousness and Neuroticism, poorer language function by lower Openness, and visual-spatial deficits by higher Neuroticism.

As the study was cross-sectional, the direction of causation is unclear and it is likely that bi-directionality over time exists[45]. Results of this study should also not be assumed to transfer to populations with advanced dementing disorders, differing ages, or lower education. Although the tests employed here represent common measures of underlying cognitive constructs, there is also wide variability in tests used to assess any particular neurocognitive domain, and this should be kept in mind. We did not test specific neurophysiological mechanisms for the observed associations, but tried instead to contextualize the observed pattern of findings within existing neurophysiological findings. It should also be noted that differences in measures of statistical evidence are influenced by reliability differences in scales as well as the underlying phenomenon in question. Study strengths included a well-validated personality measure enabling the analysis of both the broad Big 5 and their subcomponents, and the examination of grades of evidence for observed linkages, based on both p-values and Bayes Factors. Future investigation might pursue neurobiological mechanisms responsible for the trait-neurocognitive linkages, and/or consider common genetic polymorphisms. The construction of formal prediction models for different patterns of cognitive decline, based in part on premorbid personality, would also be a natural next step in probing how personality phenotype can be integrated into clinical care. In future work it will likely be useful to take a nuanced approach based on specific sub-components of the Big 5 as well as specific domains of overall cognitive function.

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Table 1

Participant Characteristics

Variable	M	SD
Age	82.09	4.37
Female percent	53%	–
Education	16.36	2.39
MMSE	28.52	1.83
Trails A	38.17	18.02
Trails B	102.89	60.45
WMS Forward Digit Span	6.41	1.13
WMS Backward Digit Span	4.66	1.13
RAVLT Learning Over Trials	13.21	6.37
RAVLT Recall	8.53	3.87
RAVLT Recognition	13.53	2.26
Boston Naming Test	55.87	5.70
Category Fluency	24.85	7.11
Hooper Visual Organization Test	23.62	3.27
Neuroticism	14.88	7.50
Extraversion	27.52	5.76
Openness	26.17	5.68
Agreeableness	35.92	4.67
Conscientiousness	34.04	5.74

Notes: Means (M) and standard deviations (SD), and percentage female. Test scores are raw scores. N = 179 for all except 178 for Trails A and Category Fluency, 177 for Trails B.

Table 2

Grades of Evidence For Associations Between Big 5 Domains and Neurocognitive Test Scores

Big 5 Domain	Neurocognitive Test / Function	p	BF	β [95% CI]	R^2_s [95% CI]
Strong Evidence					
Neuroticism	HVOT / Visual Organization	<.0001	642.50	−.30 [−.46, −.15]	.09 [.02 .19]
Conscientiousness	RAVLT / Recall Memory	.0026	31.19	.25 [.09, .42]	.06 [.01, .14]
Neuroticism	TMT-A / Attention	.009	24.32	.25 [.06, .44]	.05 [.01, .15]
Neuroticism	TMT-B / Executive Function	.0026	22.94	.25 [.09, .41]	.06 [.01, .15]
Moderate Evidence					
Openness	BNT / Language	.0045	17.19	.25 [.08, .42]	.07 [.02, .14]
Openness	RAVLT / Recall Memory	.0032	7.22	.23 [.08, .38]	.05 [.01, .12]
Conscientiousness	TMT-B / Executive Function	.0015	6.55	−.22 [−.35, −.09]	.05 [.01, .12]
Openness	Category Fluency / Language	.0037	4.75	.22 [.07, .37]	.06 [.01, .13]
Conscientiousness	TMT-A / Attention	.0035	3.54	−.20 [−.34, −.07]	.04 [.01, .11]
Mildly Suggestive Evidence					
Extraversion	RAVLT / Recall Memory	.0058	2.74	.19 [.06, .33]	.03 [.00, .10]
Neuroticism	Category Fluency / Language	.0076	1.82	−.19 [−.33, −.05]	.03 [.00, .09]
Conscientiousness	Category Fluency / Language	.0253	1.73	.19 [.02, .35]	.03 [.00, .08]

Notes: Linear models adjusted for age, gender, and education. TMT = Trail Making Test; RAVLT = Rey Auditory Verbal Learning Test. Higher scores on all test indicate better performance except for TMT A and B, for which higher scores equal worse performance. BF = Bayes Factor; β = standardized regression coefficient; R^2_S = unique variance accounted for via Shapley decomposition of R^2. 95% CI = 95% Confidence Interval, based on robust standard errors for β and bootstrap percentiles for R^2_S. P-values from t-test with 178 degrees of freedom for all outcomes, except for Trails A and Category Fluency (177) and Trails B (176). Strong evidence for association based on p-values exceeding rejection threshold of FDR (.011) and Bayes Factors > 20; Moderate evidence for association based on p-values exceeding FDR threshold and Bayes Factors 3–20; Mildly suggestive evidence for association p-values exceeding conventional or FDR threshold, positive but anecdotal Bayes Factors.

Table 3

Grades of Evidence For Associations Between Big 5 Facets and Neurocognitive Test Scores

Facet (Big 5 Domain)	Neurocognitive Test / Function	p	BF	β [95% CI]	R^2_s [95% CI]
Strong Evidence					
Goal Striving (C)	RAVLT / Recall Memory	<.0001	235.29	.29 [.15, .42]	.08 [.02, .16]
Dependability (C)	RAVLT / Recall Memory	.0002	32.10	.30 [.15, .44]	.09 [.02, .19]
Anxiety (N)	HVOT / Visual Organization	.0014	329.25	−.28 [−.46, −.11]	.08 [.01, .18]
Depression (N)	HVOT / Visual Organization	.0014	141.35	−.27 [−.44, −.11]	.08 [.01, .18]
Intellectual Interests (O)	RAVLT / Recall Memory	.0007	42.46	.27 [.12, .42]	.06 [.01, .14]
Moderate Evidence					
Self Reproach (N)	HVOT / Visual Organization	.0014	19.08	−.24 [−.39, −.09]	.06 [.01, .14]
Self Reproach (N)	TMT-B / Executive Function	.0039	9.75	−23 [.08, .39]	.06 [.01, .14]
Activity (E)	RAVLT / Recall Memory	.0041	1.47	.23 [.07, .38]	.05 [.01, .13]
Dependability (C)	TMT-B / Executive Function	.0072	11.17	−.23 [−.40, −.06]	.05 [.00, .15]
Self Reproach (N)	TMT-A / Attention	.0082	9.96	.23 [.06, .41]	.05 [.01, .13]
Depression (N)	Category Fluency / Language	.0013	6.01	−.22 [−.35, −.09]	.04 [.00, .10]
Positive Affect (E)	BNT / Language	.0029	5.52	.21 [.07, .34]	.04 [.01, .11]
Intellectual Interests (O)	Category Fluency / Language	.0022	3.59	.22 [.08, .35]	.05 [.01, .12]
Mildly Suggestive Evidence					
Dependability (C)	Category Fluency / Language	.0072	4.04	.21 [.06, .36]	.04 [.00, .12]
Nonantagonism (A)	TMT-B / Executive Function	.0078	1.73	−.18 [−.31, −.04]	.03 [.00, .09]
Orderliness (C)	TMT-B / Executive Function	.0097	1.07	−.17 [−.30, −.04]	.03 [.00, .09]
Dependability (C)	TMT-A / Attention	.0111	2.19	−.19 [−.34, −.04]	.04 [.01, .10]
Intellectual Interests (O)	BNT / Language	.0130	3.58	.21 [.05, .38]	.05 [.01, .13]
Orderliness (C)	RAVLT / Recall Memory	.0152	1.33	.18 [.04, .32]	.03 [.00, .08]
Orderliness (C)	Category Fluency / Language	.0165	1.38	.18 [.03, .33]	.03 [.00, .09]
Anxiety (N)	TMT-B / Executive Function	.0190	2.26	.19 [.03, .35]	.03 [.00, .12]
Depression (N)	TMT-A / Attention	.02	8.64	.22 [.04, .42]	.05 [.00, .14]
Activity (E)	RAVLT / Recognition	.0216	1.34	.18 [.03, .33]	.03 [.00, .10]

Facet (Big 5 Domain)	Neurocognitive Test / Function	p	BF	β [95% CI]	R^2_s [95% CI]
Nonantagonism (A)	TMT-A / Attention	.0285	1.31	−.17 [−.33, −.01]	.03 [.00, .10]
Depression (N)	TMT-B / Executive Function	.0341	2.10	.19 [.01, .36]	.04 [.00, .13]
Positive Affect (E)	TMT-A / Attention	.0354	3.38	−.20 [−.38, −.014]	.04 [.00, .13]

Notes: Linear models adjusted for age, gender, and education. TMT = Trail Making Test; RAVLT = Rey Auditory Verbal Learning Test. Higher scores on all test indicate better performance except for TMT A and B, for which higher scores equal worse performance. BF = Bayes Factor; β = standardized regression coefficient; R^2_S = unique variance accounted for via Shapley decomposition of R^2. 95% CI = 95% Confidence Interval, based on robust standard errors for β and bootstrap percentiles for R^2_S. P-values from t-test with 178 degrees of freedom for all outcomes, except for Trails A and Category Fluency (177) and Trails B (176). Strong evidence for association based on p-values exceeding rejection threshold of FDR (.011) and Bayes Factors > 20; Moderate evidence for association based on p-values exceeding FDR threshold and Bayes Factors 3–20; Mildly suggestive evidence for association p-values exceeding conventional or FDR threshold, positive but anecdotal Bayes Factors.