



# Personality nuances and cognition: A multi-cohort and multi-method approach

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## ABSTRACT

There is substantial evidence for an association between the Five-Factor Model personality domains and cognition across adulthood. Examining the items that compose each of the five domains, known as nuances, can provide novel insight into the aspects of the traits most connected to cognitive outcomes. This study tested the association between personality nuances and cognition (memory performance, subjective memory, informant-rated cognition) in five community-based cohorts. Participants ( $N > 28,000$ , age range: 32–104 years) were administered the Midlife Development Inventory (MIDI) to assess personality nuances, immediate and recall tasks to assess memory performance, and a subjective memory measure. Ratings of cognitive functioning from a knowledgeable informant were available in two samples. There was a strong pattern of replicability between personality items and cognitive outcomes across samples and cognitive measures. Meta-analyses indicated that higher neuroticism nuances (particularly the nervous and worry items) were related to lower memory performance, worse subjective memory, and worse informant-rated cognition. Higher conscientiousness (particularly the organized and responsible items), extraversion (particularly the active item), and openness (particularly the intelligent item) nuances were consistently associated with better memory performance, better subjective memory, and better informant-rated cognition across samples. To a lesser extent, higher agreeableness nuances (helpful, warm, sympathetic) were associated with better memory and subjective memory. This research adds to the existing literature by providing novel evidence of replicable associations between personality nuances and cognition.

## 1. Introduction

There is substantial evidence for an association between the Five-Factor Model (FFM) personality traits (McCrae and John, 1992) and a broad range of cognitive functions across adulthood (Chapman et al., 2017; Graham et al., 2021; Hock et al., 2014; Luchetti et al., 2021; Sutin et al., 2019a, 2023b). Higher neuroticism (a measure of negative emotions and vulnerability to stress) has been consistently related to worse cognitive function, including lower memory, speed, attention, executive-function, fluency, visuospatial ability, and numeric reasoning (Sutin et al., 2019a). In contrast, higher conscientiousness (a measure of

self-discipline and responsibility) and openness (a measure of intellectual curiosity and creativity) have been associated with better cognitive performance, such as better memory, fluency, visuospatial ability, speed, attention, and executive function (Chapman et al., 2017; Graham et al., 2021; Luchetti et al., 2021; Sutin et al., 2019a, 2023b). These associations have also been found with subjective ratings of cognition (Aschwanden et al., 2020; Sutin et al., 2023c) and informant reports of cognitive function (Best et al., 2021; Sutin et al., 2019b). In addition, higher neuroticism and lower conscientiousness have been consistently related to a higher risk of dementia (Aschwanden et al., 2020; Duchek et al., 2020). To a lesser extent, extraversion (a measure of sociability,

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positive emotions, and activity) has been associated with better cognitive function, and better memory function in particular (Luchetti et al., 2021; Sutin et al., 2023b), whereas there is less consistent evidence for an association with agreeableness (a measure of cooperativeness, altruism, and trust) and cognition (Luchetti et al., 2016; Sutin et al., 2019a). There is evidence for multiple pathways through which personality traits are related to cognition, including behavioral, psychological, biological, and health-related factors. For example, higher emotional stability, extraversion, openness, and conscientiousness have been linked to better cognition through their association with engagement in physical and cognitive activities (Allen et al., 2019; Best et al., 2021; Jackson et al., 2020; Stephan et al., 2024a), lower inflammation (Stephan et al., 2024b), and higher physical and sensory functions (Stephan et al., 2023, 2024c).

Personality is organized as a hierarchy of traits of increasing specificity (McCrae, 2015; McCrae and Costa, 1999; Möttus et al., 2017). Therefore, broad traits are composed of lower-order, narrower traits referred to as facets (Costa and McCrae, 1992), which are thought to provide a more detailed understanding of the link between personality and crucial outcomes. There is some evidence linking personality facets to cognition (Aiken-Morgan et al., 2012; Graham and Lachman, 2014; Marcolini et al., 2023; Sutin et al., 2023c; Terracciano et al., 2022). For example, the depression and anxiety facets of neuroticism have been related to poor cognitive function, whereas the dutifulness, self-discipline, organization, and responsibility facets of conscientiousness have been associated with better cognitive function (Graham and Lachman, 2014; Sutin et al., 2023c; Terracciano et al., 2022). Other research found that curiosity and openness to ideas facets of openness to experience, the sociability-related facets of extraversion, and the tendermindedness, compassion and respectfulness facets of agreeableness are related to better cognitive performance (Sutin et al., 2023c; Terracciano et al., 2022).

Existing research on the association between personality traits and cognition has mostly focused on personality domains, with a few studies on facets. However, the personality hierarchy extends below facets to narrower personality characteristics called nuances (McCrae, 2015; Möttus et al., 2017). Nuances represent the lowest level of the traits hierarchy and the most specific units of personality assessment, which correspond, operationally, to individual personality questionnaire items (Möttus et al., 2017, 2019). A growing body of research indicates that the link between personality traits and a range of outcomes, including health-related outcomes, is at least partly driven by personality nuances (Möttus et al., 2017; Seeboth and Möttus, 2018; Stewart et al., 2022, 2024). One recent study found that the assessment of nuances contributes to a more refined understanding of personality and dementia (Stephan et al., 2024d). Based upon the Health and Retirement Study (HRS) and the English Longitudinal Study on Ageing (ELSA) and using the Midlife Development Inventory (MIDI, Zimprich et al., 2012), Stephan et al. (2024d) found replicable and stronger associations between higher scores on the neuroticism items nervous and worry and higher risk of incident dementia, whereas higher scores on the conscientiousness items responsible and organized and the extraversion item active were associated with a lower risk of incident dementia (Stephan et al., 2024d). Furthermore, a poly-nuance score, which aggregates the effect of personality items, was slightly more strongly associated with a higher risk of dementia than the personality domains (Stephan et al., 2024d). The previous study (Stephan et al., 2024d) only examined the association between nuances and dementia and not with cognitive performance more generally. In addition to the connection with dementia, memory and other cognitive functions broadly impact the productivity, relationships, and ability to live independently of older adults (Raimo et al., 2024). However, the associations between cognitive functioning and personality nuances remain to be tested.

With a multi-cohort and multi-method approach, the present study examined the association between personality nuances and cognition among middle-aged and older adults. In line with existing evidence

(Möttus et al., 2017, 2019), nuances were represented by individual items from the personality questionnaire. The present study was based on five samples of adults who completed the MIDI (Zimprich et al., 2012). Using the same MIDI items made it possible to test the replicability of the association across cohorts. As cognition encompasses a wide range of mental abilities that can be assessed through various methods and raters, this study examined three cognition measures commonly included in population-based cohorts: Memory performance, subjective memory, and informant-rated cognition. Memory is the ability to encode and recall information. Performance on immediate and delayed recall tests is related to critical functions in activities of daily living and is implicated in various outcomes, including frailty (Gale et al., 2017) and dementia (Josefsson et al., 2023). Subjective memory refers to perceived memory ability and is a precursor of dementia (Möllers et al., 2022; Tsutsumimoto et al., 2017). Finally, the assessment of informant-rated cognitive functioning is a part of clinical evaluation of cognitive impairment (Milanovic et al., 2023) and predictive of the risk of incident dementia (Gruters et al., 2019; Sutin et al., 2023a).

Based upon existing research on the broad FFM personality domains and the cognitive outcomes [objective memory performance (Sutin et al., 2023b), subjective memory (Sutin et al., 2023c), and informant-rated cognition (Sutin et al., 2019b)], it was predicted that lower scores on neuroticism items and higher scores on extraversion, openness, and conscientiousness items would be associated with better cognitive outcomes. However, it was expected that the associations' strength varies across items of the same domains. Consistent with the dementia study (Stephan et al., 2024d), stronger associations were expected for the neuroticism items nervous and worry, the conscientiousness items responsible and organized, and the extraversion item active. Using the same data as previous research (Stephan et al., 2023; Sutin et al., 2019b, 2023b), complementary analyses were conducted to examine the association between neuroticism, extraversion, openness, agreeableness, and conscientiousness and the cognitive outcomes. These domain-level analyses were performed to compare with the nuance-level analyses and to evaluate the extent to which nuances may have a stronger predictive power than domains.

## 2. Methods

### 2.1. Participants

The present study included five samples: HRS, ELSA, the Midlife in the United States Study (MIDUS), the National Social Life, Health, and Aging Project (NSHAP) and the National Health and Aging Trends Study (NHATS). HRS was approved by the University of Michigan Institutional Review Board (IRB). ELSA was approved by the National Research Ethics Service. The Education and Social/Behavioral Sciences and the Health Sciences IRB at the University of Wisconsin-Madison approved the MIDUS Study. NSHAP was approved by the Social and Behavioral Sciences IRB at the University of Chicago and the NORC IRB. Finally, the Johns Hopkins Bloomberg School of Public Health IRB approved NHATS. In each sample, all participants provided written informed consent. No IRB approval was required for the analyses presented in this work because de-identified publicly available data were used. These five samples were selected because they used similar personality assessments (the MIDI), included objective memory performance, subjective assessment of memory, or informant-rated cognition, and were freely available. This study was not pre-registered. Table 1 includes descriptive statistics for the five samples.

HRS is a longitudinal panel survey of a representative sample of Americans aged 50 years and older and their spouses. Data on personality, demographic factors and objective and subjective memory were obtained in 2006/2008 from a total of 12386 participants aged from 50 to 104 years. Data on informant-rated cognition were obtained in 2016 as part of the Harmonized Cognitive Assessment Protocol (HCAP) from a selected subsample of HRS participants aged 65 years and older (N =

**Table 1**  
Descriptive statistics of the samples

Variables	HRS M/%	SD	ELSA M/%	SD	MIDUS M/%	SD	NSHAP M/%	SD	NHATS M/%	SD
Age	68.51	9.87	66.09	8.69	56.03	12.16	72.34	7.06	79.07	7.32
Sex (%female)	59%	–	55%	–	55%	–	53%	–	58%	–
Education	12.83	2.94	4.17	2.23	7.36	2.53	2.80	1.00	5.28	2.25
Ethnicity (% Hispanic)	7%	–	–	–	–	–	7%	–	4%	–
Race (%African American)	11% <sup>a</sup>	–	2% <sup>b</sup>	–	3% <sup>a</sup>	–	10% <sup>a</sup>	–	20% <sup>a</sup>	–
Memory Performance	9.91	3.34	10.79	3.48	11.38	4.60	7.25	2.05	8.32	3.51
Subjective Memory <sup>c</sup>	3.02	0.93	2.80	0.90	3.53	0.89	–	–	–	–
Informant-rated cognition <sup>d</sup>	–0.00	0.89	–0.00	0.87	–	–	–	–	–	–
Neuroticism	2.04	0.61	2.10	0.59	2.05	0.62	1.15	0.59	2.21	0.85
Extraversion	3.20	0.55	3.15	0.56	3.10	0.57	2.20	0.56	3.16	0.74
Openness	2.95	0.54	2.88	0.55	2.91	0.53	1.91	0.65	2.85	0.82
Agreeableness	3.53	0.47	3.51	0.48	3.45	0.50	2.46	0.51	3.59	0.53
Conscientiousness	3.36	0.48	3.30	0.49	3.40	0.45	2.35	0.55	3.25	0.70

Note. HRS: N = 12386, ELSA: N = 8097, MIDUS: N = 3218, NSHAP: N = 2060, NHATS: N = 2578; <sup>a</sup> % African American; <sup>b</sup> % not white; <sup>c</sup> HRS: N = 12386, ELSA: N = 6410, MIDUS: N = 3621, NHATS: N = 2568; <sup>d</sup> HRS: N = 2342, ELSA: N = 835; See method section for differences in measures across the two samples.

2342). HRS data can be accessed at <https://hrs.isr.umich.edu/data-products>.

ELSA is a panel study of a representative sample of people over 50 years living in England. Personality, demographic, and memory performance data were obtained at Wave 5 (2010/2011) from 8097 participants aged from 50 to 89 years, and 6410 participants also had data on subjective memory. Informants-rated cognition was obtained from the HCAP in 2018 from a selected subset of ELSA participants aged 65 years and older (N = 835). ELSA data can be accessed at <https://www.ukdataservice.ac.uk/>.

MIDUS is a longitudinal cohort study of non-institutionalized US adults. Data were obtained from MIDUS 2 (2004–2006). Complete data on personality, demographic factors and objective memory were obtained from 3218 participants (age range: 32–84 years). A total of 3621 participants provided complete data on personality, demographic and subjective memory. No informant-rated cognition data were available in MIDUS. MIDUS data can be accessed at <http://midus.wisc.edu/index.php>.

NSHAP is a population-based study of older Americans. The present study used data from Wave 2 (2010–2011). A total of 2060 participants (age range: 62–90 years) had complete data on personality traits, demographic factors, and memory performance. Subjective memory and informant-rated cognition were not available in NSHAP. NSHAP data can be accessed at <http://www.ssc.wisc.edu/wlsresearch/data/>.

NHATS is a nationally representative longitudinal panel study of Medicare enrollees aged 65 and older. Complete data on personality, demographic factors, and objective memory performance were obtained in 2013/2014 from 2578 participants aged from 67 to 103 years. A total of 2568 individuals also had complete information on personality, demographics, and subjective memory. NHATS do not include informant-rated cognition. NHATS data can be accessed at <http://www.nhats.org>.

## 2.2. Personality

The MIDI (Zimprich et al., 2012) was used in the five samples to assess personality traits. Participants were given a list of adjectives assessing each trait of the FFM and asked to rate themselves on each adjective using a scale from 1 (*not at all*) to 4 (*a lot*) in HRS, ELSA, MIDUS, and NHATS, and from 0 (*not at all*) to 3 (*a lot*) in NSHAP. Neuroticism (4 items), extraversion (5 items), openness (7 items), agreeableness (5 items) and conscientiousness (5 items) were measured using a 26-item version in HRS, ELSA and MIDUS. NSHAP used a 21-item version with 4 items for neuroticism, 5 items for extraversion, 4 items for openness, 4 items for agreeableness and 4 items for conscientiousness. A 10-item version was used in NHATS, including two items per trait. Items relevant for the study were similar across instruments. Supplementary material includes the complete list of items with

descriptive statistics for the five samples (Table S1).

## 2.3. Memory performance

In the five samples, memory was assessed by asking participants to read a list of words they had to recall immediately and again after a brief delay. A list of 10 words was given to participants in HRS, ELSA, and NHATS, a list of 15 words was given to participants in MIDUS, and a list of 5 words was given to participants in NSHAP. An overall score was computed by summing the number of words recalled correctly across the immediate and delayed recall tasks.

## 2.4. Subjective memory

In HRS, ELSA, and NHATS, subjective memory was assessed with the item, “How would you rate your memory at the present time?” Answers were given on a scale ranging from 1 (*poor*) to 5 (*excellent*). In MIDUS, subjective memory was assessed with the item: “Compared to other people your age, how would you rate your memory?” using a scale ranging from 1 (*poor*) to 5 (*excellent*).

## 2.5. Informant cognition

Informant-rated cognition was available in HRS and ELSA. Four informant measures of cognition were used: The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) (Jorm, 1994), the Blessed Dementia Rating Scale-Part 1 (Morris et al., 1989), the Community Screening Instrument for Dementia (CSID) (Hall et al., 2000) and the 1066 (Prince et al., 2011). In the IQCODE, informants were asked to rate participants’ current functioning compared to their functioning 10 years earlier using 16 items. Answers were given on a scale ranging from 1 (*much improved*) to 5 (*much worse*), and averaged. Higher scores on IQCODE indicated informant’s greater perceived decline of respondents over 10 years. The Blessed Dementia Rating Scale Part 1 asked informants to indicate whether the participant had experienced a loss in the ability to do everyday activities using eight items. Answers were coded as 1 (*some loss or severe loss*) or 0 (*no loss*), and the sum was taken with higher scores indicating greater loss in function. In the CSID, informants were asked to indicate whether participants experienced changes in their ability to remember things and engage in cognitively demanding activities using 14 items, coded as 1 (*yes and sometimes*) or 0 (*no*). The sum was taken across items with higher scores indicating worse function. In the 1066, five items asked informants about their perception of the participant’s ability to do daily activities. Answers were given using a yes/no format, and summed with higher scores representing worse ability. Descriptive statistics for the four scores are presented in supplementary material (Table S2). The four scores were

standardized to z-scores. An overall informant-rated cognition score was computed by averaging the four scores. The overall score was reversed so that a higher score indicated better informant-rated cognition.

## 2.6. Covariates

Demographic covariates included age (in years), sex (coded as 1 for female and 0 for male), education, and race. Education was assessed in years in HRS, on a scale from 1 (no qualification) to 7 (NVQ4/NVQ5/Degree or equivalent) in ELSA, from 1 (no grade school) to 12 (doctoral level degree) in MIDUS, from 1 (less than high school) to 4 (bachelors or more) in the NSHAP, and from 1 (no schooling completed) to 9 (Master's, professional or doctoral degree) in NHATS. Race was coded as 1 (African American/Black) and 0 (not African American/Black) in the HRS, MIDUS, NSHAP, and NHATS, and as 1 for not white and 0 for white in ELSA. Ethnicity (coded as 1 = Hispanic or Latinx and 0 = non-Hispanic/Latinx) was controlled in the HRS, NHATS, and NSHAP. Additional covariates were included for analyses predicting informant-rated cognition such as informant age, sex, education (in years), length of time informant knew participant (in years), relationship with the participant (coded as 1 for spouse and 0 for other). Given that informant-rated cognition was assessed in 2016 in HRS, the wave of personality assessment was also controlled (coded as 1 for 2006 and 0 for 2008) to account for potential time-related effects on informant-rated cognition.

## 2.7. Data analysis

The same analytic approach was used across the samples and the results were combined with random-effects meta-analysis. Linear regression tested the association between personality and memory performance, subjective memory and informant-rated cognition. Each personality item was standardized to z-score and examined in separate analyses, controlling for demographic factors. Informant demographic information (and wave of personality assessment for HRS) was also controlled in the analysis of informant-rated cognition. The association between personality items and objective memory was examined in all five samples, while subjective memory was addressed in HRS, ELSA, MIDUS, and NHATS, and informant-rated cognition was tested in HRS and ELSA. Additional analysis also examined the association between personality domains and memory performance, subjective memory and informant-rated cognition. For the prediction of both objective and subjective memory, a total of 26 analyses (one per item) were conducted in HRS, ELSA, and MIDUS, and 10 were performed in NHATS. A total of 21 analyses were conducted for the prediction of objective memory performance in NSHAP. For the prediction of informant-rated cognition, 26 analyses were conducted in both HRS and ELSA. A random-effect meta-analysis that combined the estimates from the different samples was conducted using JAMOMI 2.3.18.

For each outcome, double-entry correlations between the coefficients obtained across the MIDI items in each sample were computed to evaluate replicability of the associations across samples. The same analyses were conducted to test whether the pattern of correlation replicated across the three cognitive measures.

Poly-nuance scores were computed in each sample and for each cognitive outcome (memory, subjective memory, informant-rated cognition). For this, each item was weighted by its empirical association (standardized regression estimate) with a given outcome and then summed into a poly-nuance score for each person. These scores were standardized to z-scores. Linear regression was used to examine the association between the poly-item score and memory performance, subjective memory or informant-rated cognition (as available in each study). Estimates from each sample were combined using a random-effect meta-analysis. Additional analyses included the five domains as covariates.

## 3. Results

### 3.1. Association between personality items and memory performance

In line with expectations, all items assessing neuroticism were related to worse performance whereas items assessing extraversion (with the exception of the item talkative), openness and conscientiousness were related to better memory (Table 2). Furthermore, all agreeableness-related items apart from the item softhearted were associated with better memory performance (Table 2). Fig. 1 shows a forest plot with the meta-analytical estimates of the link between each nuance and objective memory performance. The strongest associations were found with the items nervous (for neuroticism), active (for extraversion), intelligent (for openness), helpful and sympathetic (for agreeableness), and responsible (for conscientiousness) (Table 2). The pattern of association between personality items and memory performance was similar across the samples, as indicated by the correlations  $>.80$  between the coefficients of each sample (Table S3). Consistent with past studies that have used the same data (Sutin et al., 2023b), additional domain-level analyses revealed that higher neuroticism was associated with lower memory, whereas higher extraversion, openness, agreeableness and conscientiousness were related to better memory (Table 2). There was also a significant association between the poly-nuance scores and memory performance (meta-analytically, .11) that was slightly stronger than the association between personality domains and memory (meta-analytically, .03 to .08; Table 2). This association persisted when the five domains were included as additional covariates, suggesting the items' unique variance was linked with memory.

### 3.2. Association between personality items and subjective memory

The meta-analysis indicated that all neuroticism-related items were associated with worse subjective memory, whereas all items assessing extraversion, openness and conscientiousness were associated with better subjective memory (Table 3, Fig. 1). Except for the item softhearted, all agreeableness items were also associated with better subjective memory (Table 3). The items calm (for neuroticism), active (for extraversion), intelligent (for openness), helpful (for agreeableness) and organized (for conscientiousness) had the strongest association with subjective memory. Additional analysis revealed correlations  $>.80$  between the coefficients for the items across samples (Table S4), indicating high replicability of the overall pattern of association. However, there was lower replicability of effects size when comparing the association between items and objective and subjective memory (Table S6). Domain-level analyses indicated that higher neuroticism was related to lower subjective memory, whereas higher extraversion, openness, agreeableness and conscientiousness were associated with higher subjective memory (Table 3). The poly-nuance scores were significantly related to subjective memory with a stronger association (.29) than the five domains (.09–.21; Table 3). Additional analyses indicated that the significant association between the poly-nuance score and subjective memory persisted even when the five domains were controlled, again in line with the items being linked with memory above and beyond domains.

### 3.3. Association between personality items and informant-rated cognition

All neuroticism and conscientiousness items were associated with informant-rated cognition (Table 4, Fig. 1). The strongest associations were found with the items worrying and nervous (for neuroticism) and the items organized, responsible and hardworking (for conscientiousness). Higher scores on the extraversion items friendly, lively and active, and on the openness item intelligent were also related to better informant-rated cognition (Table 4). The association between items and informant-rated cognition was similar across the HRS and ELSA, as indicated by the correlation  $>.76$  (Table S5). Furthermore, the pattern of



**Table 2**  
Summary of regression analysis predicting memory performance from personality domains and items.

	HRS <sup>a</sup>	ELSA <sup>b</sup>	MIDUS <sup>b</sup>	NSHAP <sup>a</sup>	NHATS <sup>a</sup>	Random Effect	Heterogeneity I <sup>2</sup>
Personality domain							
Neuroticism	−.09***	−.06***	−.07***	−.05**	−.05**	−0.07***	46.88
Extraversion	.05***	.05***	.07***	.05*	.02	0.05***	1.76
Openness	.09***	.07***	.07***	.05*	.04*	0.07***	48.26
Agreeableness	.05***	.01	.04*	.02	.02	0.03**	51.89
Conscientiousness	.10***	.07***	.07***	.07***	.08***	0.08***	38.57
Personality items							
Moody	−.05***	−.05***	−.04**	−.03	—	−0.05***	0
Worrying	−.07***	−.03**	−.05**	−.05*	−.03	−0.05***	53.22
Nervous	−.09***	−.06***	−.07***	−.05*	−.06**	−0.07***	42.63
Calm	.04***	.03***	.04**	.02	—	0.04***	0
Outgoing	.04***	.03***	.04**	.05*	.03*	0.04***	0
Friendly	.03**	.02*	.03*	.03	—	0.03***	0
Lively	.04***	.05***	.04**	.02	—	0.04***	0
Active	.07***	.07***	.09***	.06**	—	0.07***	0
Talkative	.01	−.01	.03*	.01	.003	0.006	15.5
Creative	.05***	.04***	.03	.04*	.03	0.04***	0
Imaginative	.06***	.05***	.04**	.06**	.04**	0.05***	0
Intelligent	.08***	.10***	.07***	—	—	0.09***	30.72
Curious	.05***	.07***	.05***	.02	—	0.05***	31.68
Broad-minded	.07***	.02*	.05***	—	—	0.05**	80.43
Sophisticated	.03***	.005	.04*	—	—	0.02*	51.94
Adventurous	.05***	.03**	.04**	.02	—	0.04***	15.81
Helpful	.05***	.02*	.06***	—	—	0.04***	65.13
Warm	.03**	.02	.03	.002	.02	0.02***	0
Caring	.03**	.01	.03*	.02	.01	0.02***	4.5
Softhearted	.02*	−.01	−.004	.01	—	0.005	42.87
Sympathetic	.07***	.02	.02	.03	—	0.04***	75.16
Organized	.06***	.06***	.06***	.06**	.06***	0.06***	0
Responsible	.09***	.06***	.04*	.06**	—	0.07***	64.45
Hardworking	.05***	.03***	.03	.04*	—	0.04***	14.4
Careless	−.04***	−.02	−.04*	—	—	−0.03***	19.33
Thorough	.07***	.04***	.05**	.05*	.08***	0.06***	37.89
Poly-nuance score	.12***	.11***	.11***	.09***	.10***	0.11***	0

Note. HRS: N = 12386, ELSA: N = 8097, MIDUS: N = 3218, NSHAP: N = 2060, NHATS: N = 2578; <sup>a</sup>Adjusted for age, sex, education, race, and ethnicity; <sup>b</sup> Adjusted for age, sex, education, and race.  
\**p* < .05, \*\**p* < .01, \*\*\**p* < .001.

association between items and informant-rated cognition was consistent with the associations observed for objective and subjective memory (Table S6). Consistent with past research using part of the data (Stephan et al., 2023; Sutin et al., 2019b), higher neuroticism, lower extraversion, openness and conscientiousness were related to worse informant-rated cognition. The poly-nuance score was related to informant-rated cognition (Table 4); its association was slightly stronger (.16) than the association between neuroticism, extraversion, openness and conscientiousness and informant-rated cognition (.05–.13). However, this association persisted when the five domains were included as covariates.

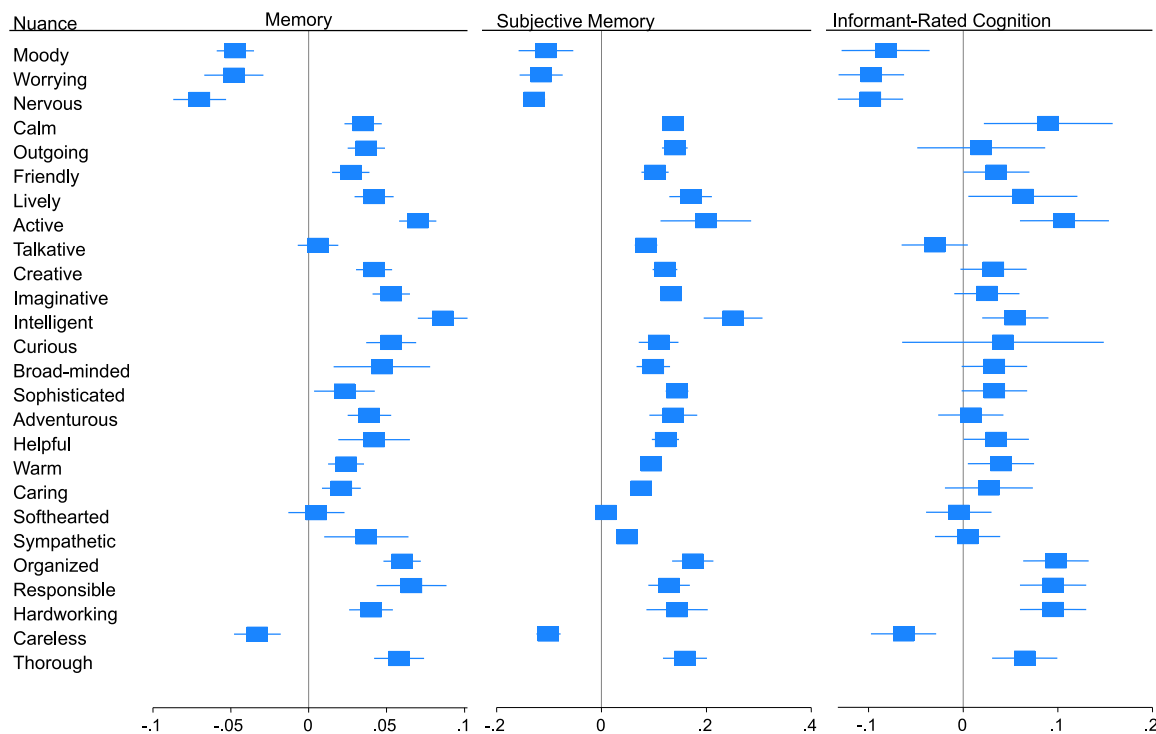
4. Discussion

The present study examined the association between personality nuances, which are the lowest level of the personality hierarchy, and cognition assessed with multiple methods in up to five samples. The specific nuances associated with cognition, as well as their effect sizes, tended to replicate across multiple samples and different cognitive outcomes, including objective and subjective memory and informant-rated cognition. This study adds to research on domains and facets of personality by providing novel evidence that personality nuances have robust associations with cognition.

The association between personality nuances and cognition is consistent with and extends recent research on the nuances related to dementia risk (Stephan et al., 2024d). Similar to the prediction of dementia (Stephan et al., 2024d), all neuroticism and conscientiousness items were related to memory, subjective memory, and informant-rated cognition. In addition, with a few exceptions, all extraversion, openness, and agreeableness items were associated with objective and subjective memory, which is also in line with recent dementia findings (Stephan

et al., 2024d). Therefore, this study indicates that memory, subjective memory, and informant-rated cognition are polynuanced; that is, a large range of specific personality characteristics predict these cognitive outcomes. Yet, Stephan et al. (2024d) found a stronger association of the MIDI items nervous, worry, responsible, organized, and active with dementia risk, compared to other items (Stephan et al., 2024d), and the present study mirrors this pattern by showing that these items, along with the item intelligent, were the strongest and most consistent item-level correlates of cognition across different measures and samples. The present study, combined with past research (Stephan et al., 2024d), suggests that a relatively similar set of narrow personality nuances are related to different cognitive outcomes, including memory performance, subjective memory, informant-rated cognition, and dementia risk. Furthermore, additional analyses indicated that the size of the associations between nuances and cognitive outcomes was relatively similar particularly between informant-rated cognition and both objective memory (*r* > .70) and subjective memory (*r* > .80).

These nuances-level findings are broadly in line with research on the personality facets associated with cognition (Sutin et al., 2023c; Terracciano et al., 2022). For example, the items nervous and worry are nuances of the anxiety facet (Costa and McCrae, 1992), which has been associated with lower cognitive performance (Terracciano et al., 2022) and poorer subjective memory (Sutin et al., 2023c). The link between the responsibility and organization nuances and better cognition across measures is broadly consistent with findings of an association between the responsibility and organization facets of conscientiousness and better objective and subjective cognitive performance (Sutin et al., 2022, 2023c). In addition, being organized is a nuance of the order facet (Costa and McCrae, 1992), which has been associated with higher cognitive performance and higher informant-rated cognition (Sutin



**Fig. 1.** Forest plot of the meta-analytical estimates for the association between personality nuances and cognitive measures.

Note. The forest plot displays the overall synthesized effects, not those from the individual samples. Meta-analytical estimates for the association between personality nuances and memory are based on five datasets; Meta-analytical estimates for the association between personality nuances and subjective memory are based on four datasets; Meta-analytical estimates for the association between personality nuances and informant-rated cognition are based on two datasets.

et al., 2022). Activity is a nuance of the energy level facet of extraversion (Soto and John, 2017) which has been related to better self-rated memory (Sutin et al., 2023c). However, the association between higher scores on the activity item and better memory contrasts with the lack of relationship between the activity facet (Costa and McCrae, 1992) and cognitive performances (Graham and Lachman, 2014; Terracciano et al., 2022) or dementia risk (Terracciano et al., 2014). The association between higher scores on the item intelligent and better cognition across measures is broadly consistent with the link between the openness to ideas facet and higher objective and subjective memory performance (Sutin et al., 2023c; Terracciano et al., 2022). Finally, being helpful and warm are nuances of the agreeableness facet of compassion (Soto and John, 2017) which have been found to relate to higher objective cognitive performance and subjective memory (Sutin et al., 2023c). Furthermore, being sympathetic is a nuance of the tendermindedness facet (Costa and McCrae, 1992), which has been linked to better cognition (Terracciano et al., 2022).

There were some differences between the effect sizes of nuances within a given trait. For example, the more energetic item of extraversion, like the item active, had a stronger association with cognitive outcomes than the outgoing and friendly items, which are more measures of sociability. In addition, the openness item referring to intellectual interest like the item intelligent, was more strongly associated with cognition than items that emphasize a preference for variety, like the adventurous item. Therefore, being active and intelligent may lead to higher involvement in activities, such as physical and cognitive activities resulting in better cognitive functioning (Su et al., 2022).

Consistent with existing knowledge (Seeboth and Möttus, 2017; Stewart et al., 2022, 2024), the present study revealed that narrow personality nuances were likely to drive the association between some personality domains and cognitive measures. For example, the association between extraversion and memory performance, subjective memory, and informant-rated cognition was mostly driven by the activity

nuance, whereas the link between openness and these cognitive measures was mostly driven by the intelligence nuance. Furthermore, both nuances were more strongly related to cognitive outcomes than their respective domains. In addition, a poly-nuance score, which aggregates the contribution of each nuance with cognitive outcomes, was slightly more strongly related to cognitive measures than personality domains. Despite these exceptions, however, there was no clear evidence of a stronger predictive value of nuances compared to personality domains, which is consistent with recent research for cognitive outcomes (Stephan et al., 2024d). For example, the size of the link between neuroticism and conscientiousness domains and most cognitive outcomes was stronger than their respective constitutive nuances. This finding is consistent with the hypothesis that broad personality domains are more strongly associated with broad life outcomes that are influenced by a wide range of behaviors, feelings, and thoughts (Seeboth and Möttus, 2018; Stewart et al., 2022), such as cognition. Alternatively, this reflects these outcomes' high degree of polynuedness: with almost all items linked with them at least to some degree, it does not matter much how the items are aggregated as long as all protective items are keyed in the same direction.

The association between personality traits and cognition may be explained by a range of biological, functional, behavioral, and psychological pathways (Allen et al., 2019; Jackson et al., 2020; Stephan et al., 2023, 2024a; Sutin et al., 2020). For example, higher neuroticism has been related to worse cognition in part through its link with white matter hyperintensities (Terracciano et al., 2023), poor health (Sutin et al., 2020), engagement in fewer activities (Allen et al., 2019; Stephan et al., 2024a), and higher depressive symptoms (Stephan et al., 2024b). Higher extraversion, openness and conscientiousness have been related to better cognition through their association with lower inflammation (Stephan et al., 2024b), better health (Sutin et al., 2020), higher involvement in activities (Allen et al., 2019; Jackson et al., 2020; Stephan et al., 2024a), and lower depressive symptoms (Stephan et al.,

**Table 3**  
Summary of regression analysis predicting subjective memory from personality domains and items.

	HRS <sup>a</sup>	ELSA <sup>b</sup>	MIDUS <sup>b</sup>	NHATS <sup>a</sup>	Random Effect	Heterogeneity I <sup>2</sup>
Personality domain						
Neuroticism	-.15***	-.14***	-.22***	-.14***	-0.16***	87.54
Extraversion	.18***	.15***	.25***	.14***	0.18***	92.72
Openness	.20***	.18***	.26***	.14***	0.20***	92.67
Agreeableness	.10***	.07***	.11***	.09***	0.09***	43.4
Conscientiousness	.20***	.17***	.29***	.18***	0.21***	94.36
Personality items						
Moody	-.08***	-.08***	-.16***		-0.11***	92.66
Worrying	-.11***	-.07***	-.17***	-.11***	-0.11***	89.27
Nervous	-.12***	-.11***	-.16***	-.13***	-0.13***	56.71
Calm	.13***	.13***	.16***		0.14***	0
Outgoing	.14***	.11***	.17***	.14***	0.14***	69.25
Friendly	.10***	.08***	.13***		0.10***	70.61
Lively	.16***	.14***	.21***		0.17***	87.84
Active	.17***	.14***	.28***		0.20***	97.4
Talkative	.08***	.06***	.11***	.10***	0.08***	59.67
Creative	.12***	.09***	.14***	.14***	0.12***	65.97
Imaginative	.14***	.12***	.15***	.11***	0.13***	24.73
Intelligent	.21***	.23***	.30***		0.25***	93.84
Curious	.09***	.09***	.15***		0.11***	86.28
Broad-minded	.10***	.07***	.13***		0.10***	81.19
Sophisticated	.13***	.14***	.17***		0.14***	58.78
Adventurous	.13***	.10***	.18***		0.14***	90.34
Helpful	.12***	.10***	.15***		0.12***	70.95
Warm	.11***	.08***	.11***	.07***	0.10***	52.94
Caring	.08***	.06***	.09***	.08***	0.08***	0
Softhearted	.02*	-.003	.00		0.009	32.25
Sympathetic	.05***	.04**	.06***		0.05***	0
Organized	.16***	.14***	.23***	.16***	0.17***	88.51
Responsible	.12***	.10***	.17***		0.13***	87.49
Hardworking	.13***	.10***	.20***		0.14***	94.22
Careless	-.09***	-.09***	-.13***		-0.10***	63.12
Thorough	.15***	.13***	.22***	.13***	0.16***	89.89
Poly-nuance score	.26***	.23***	.37***	.25***	0.29***	96.13

Note. HRS: N = 12386, ELSA: N = 6410, MIDUS: N = 3621, NHATS: N = 2568; <sup>a</sup>Adjusted for age, sex, education, race, and ethnicity; <sup>b</sup>Adjusted for age, sex, education, and race.  
\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

2024b). Although these pathways have been identified for the broad personality domains, it is likely that they may also explain the association between personality nuances and cognitive function. There are also alternative explanations for the association between nuances and informant-rated cognition. Indeed, being responsible, organized, intelligent, and active are observable nuances that may be interpreted as reflecting better cognitive function by knowledgeable informants.

The present study has several strengths, including the first examination of the association between personality nuances and multiple measures of cognition using coordinated analyses inclusive of up to 5 samples. However, there was some evidence of heterogeneity across samples, which may be attributable to cultural differences (between ELSA and the US samples), and age differences across samples. There are also limitations to consider. This study examined the cross-sectional associations between personality nuances and memory performance and subjective memory which limits causal interpretations. Reciprocal relationships may exist between nuances and both objective and subjective memory. The MIDI included only a limited set of items which may underestimate the contribution of nuances on cognitive measures. Future research may examine the association between personality nuances and cognition using other inventories such as the 240-item NEO-PIR (Costa and McCrae, 1992). The present study focused on the prediction of memory. NSHAP used a 5-words list, whereas a 10–15 words list was used in the remaining samples. However, the overall replicable pattern of association between personality and objective memory across the samples suggested that the differences in the number of words had no substantial effect on the findings. Future research may test whether the nuances associated with memory are also related to other cognitive functions, such as verbal fluency. Finally, more research is needed to test whether the overall pattern of association between nuances and

cognition replicates in low and middle-income countries.

Despite these limitations, the present study provides novel evidence about the personality nuances associated with cognition in middle and old age. Being less nervous, worried, more active, more intelligent, more organized, and more responsible was associated with better objective and subjective memory and higher informant-rated cognition.

**CRedit authorship contribution statement**

**Yannick Stephan:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Formal analysis, Conceptualization. **Angelina R. Sutin:** Writing – review & editing, Visualization, Methodology, Conceptualization. **René Möttus:** Writing – review & editing, Methodology, Conceptualization. **Martina Luchetti:** Writing – review & editing, Visualization, Methodology. **Damaris Aschwanden:** Writing – review & editing, Visualization. **Antonio Terracciano:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Formal analysis, Conceptualization.

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Table 4

Summary of regression analysis predicting informant-rated cognition from personality domains and items.

	HRS	ELSA	Random Effect	Heterogeneity I <sup>2</sup>
Personality domain				
Neuroticism	-.12***	-.14***	-0.13***	0
Extraversion	.03	.08*	0.05*	35.24
Openness	.04*	.06	0.05*	0
Agreeableness	.02	.03	0.02	0
Conscientiousness	.11***	.17***	0.13***	56.52
Personality items				
Moody	-.10***	-.05	-0.08***	35.58
Worrying	-.10***	-.09**	-0.10***	0
Nervous	-.09***	-.12***	-0.10***	0
Calm	.06**	.13***	0.09**	67.37
Outgoing	-.01	.06	0.02	66.81
Friendly	.03	.05	0.04*	0
Lively	.04*	.10**	0.06*	55.21
Active	.09***	.14***	0.11***	36.56
Talkative	-.03	-.03	-0.03	0
Creative	.04*	.01	0.03	0
Imaginative	.03	.01	0.02	0
Intelligent	.05*	.07*	0.06**	0
Curious	-.009	.10***	0.04	86.37
Broad-minded	.03	.04	0.03	0
Sophisticated	.03	.04	0.03	0
Adventurous	.01	.004	0.008	0
Helpful	.04*	.02	0.03	0
Warm	.04	.04	0.04*	0
Caring	.01	.06*	0.03	35.01
Softhearted	.0009	-.02	-0.005	0
Sympathetic	-.01	.01	0.005	0
Organized	.09***	.12***	0.10***	0
Responsible	.06**	.17***	0.10***	0
Hardworking	.09***	.11***	0.10***	0
Careless	-.06**	-.07*	-0.06***	0
Thorough	.06**	.08*	0.07***	0
Poly-nuance score	.14***	.20***	0.16***	57.34

Note. HRS: N = 2342, ELSA: N = 835; Adjusted for respondents and informants' demographic characteristics. Wave of personality assessment was controlled in the HRS.

\*p < .05, \*\*p < .01, \*\*\*p < .001.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2025.01.060>.

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