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The Relationship of the NEO Personality to the
Primary Mental Abilities in the Seattle Longitudinal Study

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Abstract

The association between the NEO personality factors and the six PMA abilities was examined in 1502 subjects (age range: 22-96 yrs) in the Seattle Longitudinal Study. Two-step hierarchical regression analyses examined the association between the five NEO factors (neuroticism, extraversion, openness, agreeableness, conscientiousness) and demographics (age/cohort, education) for each PMA cognitive ability. The analyses were run on the total sample, by age/cohort group and by gender. Results indicated that Openness to experience had the most consistent association with the 6 PMA abilities. Spatial orientation was the ability with the least consistent relationship with the NEO factors. The NEO factors accounted for more variance in reasoning ability and verbal ability than in the other PMA abilities. The personality factors Neuroticism, Extraversion, and Openness accounted for more variance in the PMA abilities with increasing age, particularly for older males. However, Neuroticism and Extraversion were negatively associated with cognitive ability performance in older adults. Overall, while the NEO factors were consistently found to be associated with the 6 PMA abilities, only 20 to 30 percent of the total variance accounted for was associated with NEO factors.

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The primary purpose of the current study was to determine the magnitude of the relationship between personality and cognitive ability. The amount of research conducted on the relationship between personality as measured by the NEO personality factors and cognitive ability has been limited. Prior research addressing the relationship between personality and cognitive ability generally suggests that only one factor of personality, openness to experience, is consistently related to cognitive ability (Costa et al., 1976; McCrae, 1987; Ackerman & Rolfhus, 1999, McCrae, 1987).

The demographic variables of age, education and gender were included since they have been found to be related to both cognition and personality. Costa et al. (1976) suggested that openness to experience was likely correlated with education, and that more years of education led to more tolerance for novel experiences, contributing to the further development of cognitive abilities. Other studies have also demonstrated that there is a relationship between openness to experience and education (Costa et al., 1976; McCrae, 1987; Ackerman & Rolfhus, 1999; McCrae, 1987). Since prior research demonstrated the relationship between openness to experience and education and the relationship between openness to experience and cognitive ability, education was included in the model to determine whether education accounted for additional variance after consideration of personality factors.

The current study is cross-sectional. However, both longitudinal and cross-sectional studies have found that after age thirty, there is considerable stability in personality throughout adulthood (Costa et al., 1976; McCrae & Costa, 1982; Costa et al., 1986; Costa & McCrae, 1988; McCrae, 1993; Costa, Metter, & McCrae, 1994). Since a young adult cohort is included in the

SLS, age/cohort differences in the relationship of personality and cognition were examined. Also, gender differences in personality factors may differentially impact cognitive ability. Although some researchers found slight differences between males and females on all personality factors, except conscientiousness, they also claimed that differences in personality factors are often more apparent within rather than between gender (McCrae & Costa, 1982; Costa et al., 1986; Costa, Terracciano, & McCrae, 2001).

The current investigation explored the relationship between the 5 NEO personality factors and the 6 PMA abilities in the total Seattle Longitudinal Study (SLS) sample, and then by age/cohort and gender. Hence, two research questions were considered for the total sample. What is the magnitude of the relationship between the 5 NEO personality factors and the 6 cognitive abilities? What is the magnitude of the relationship between the personality and cognitive factors when controlling for age/cohort and education? To explore individual differences, two additional research questions were considered for age/cohort and gender. Does the magnitude of the relationship between personality and cognitive ability differ by age/cohort? by gender? What is the relationship by age/cohort and gender when controlling for age and education? It was hypothesized that there would be a moderate relationship between personality and cognitive ability. Additionally, openness to experience was hypothesized to have the most consistent association with cognitive ability.

Method

Participants

Participants consisted of community dwelling older adults from the Seattle, Washington area recruited through their membership in the Group Health Cooperative of Puget Sound, a health maintenance organization. The sub-sample used for the current analyses

included participants in the seventh wave (1998) of the Seattle Longitudinal Study that completed demographic information, the PMA ability measures, and the Revised NEO Personality Inventory (Costa & McCrae, 1992). The total sample included 1502 participants, 658 males and 844 females. The mean age of the sample was 60.4 years (N= 1502; range = 22 - 96 years). The total sample was divided into four predetermined age groups: young adults (N= 234; range = 22 - 42 years), middle-age adults (N= 525; range = 43 - 62 years), young-old adults (N=336; range 63-72 years), and old-old adults (N= 407; range = 73 - 96 years). Mean education level for the total sample was 15.4 years (range = 6 - 20; SD = 2.62). Demographics for the total sample by gender and age/cohort group are reported in Table 1.

Measures

The measures employed in the current analyses were drawn from the larger testing battery of the Seattle Longitudinal Study.

Dependent Variables

Six cognitive ability factors were constructed based on prior confirmatory factor analyses (Schaie, Dutta & Willis, 1991). Inductive reasoning, spatial orientation, number skills, verbal ability, perceptual speed, and verbal memory comprise the abilities.

Verbal Memory. The ability of verbal memory consists of memorizing and recalling meaningful language units. This ability was assessed by three measures: Immediate Recall (Zelinski, Gilewski, & Schaie, 1993), Delayed Recall (Zelinski, Gilewski, & Schaie, 1993), and PMA Word Fluency (Thurstone, 1948).

Number Skill. Number skill involves speed, accuracy, and the ability to work with figures, understand numerical relationships, and solve quantitative problems. This ability was assessed using four measures: Primary Mental Abilities Number (Thurstone, 1948), Addition

(Ekstrom et al., 1976), Subtraction and Multiplication (Ekstrom et al., 1976), and Number Comparison (Ekstrom et al., 1976).

Inductive Reasoning. Inductive reasoning ability involves identifying patterns or rules and applying them to solve a problem. The cognitive factor score for inductive reasoning is derived from the following measures: Primary Mental Abilities Reasoning (Thurstone, 1948), ADEPT Letter Series (Blieszner, Willis, & Baltes, 1981), Word Series (Schaie, 1985), and Number Series (Thurstone, 1962).

Spatial Orientation. Spatial orientation requires the ability to mentally rotate two and three-dimensional objects. Four measures were used to assess this ability: Primary Mental Abilities Space (Thurstone, 1948), Object Rotation (Schaie, 1985), Alphanumeric Rotation (Schaie, 1985), and Cube Comparisons (Ekstrom et al., 1976).

Verbal Comprehension. Verbal comprehension measures the range of passive vocabulary used in activities of reading or listening, and the ability to understand ideas expressed in words. The cognitive factor of verbal ability consists of four measures: Primary Mental Abilities Verbal Meaning (Thurstone, 1948), ETS Vocabulary V-2 (Ekstrom et al., 1976), ETS Vocabulary V-4 (Ekstrom et al., 1976), and PMA Word Fluency (Thurstone, 1948).

Perceptual Speed. Perceptual speed involves using visual perception to find figures and make comparisons as quickly and as accurately as possible. Four measures assessed the ability of perceptual speed: Identical Pictures (Ekstrom et al., 1976), Finding A's (Ekstrom et al., 1976), Number Comparison (Ekstrom et al., 1976), and PMA Word Fluency (Thurstone, 1948).

Independent Variables

Personality. *The Revised NEO Personality Inventory* (NEO-PI-R; Costa & McCrae, 1992). This measure involves responding to a 240-item questionnaire assessing the five

personality factors, neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness, as well as six facets under each of the five factors. Items involve a 5-point likert-type scale ranging from strongly disagreeing with the statement to strongly agreeing with the statement. With the permission of the publisher, Schaie (2000) reformatted the NEO-PI-R so that the statements were responded to by circling the desired response instead of recording the answer on a separate sheet of paper.

Five Factor scores were calculated for each participant based on their responses on the questionnaire. Neuroticism, Extraversion, Openness to experience, Agreeableness, and Conscientiousness are the five factors that used as independent variables for this sample.

Neuroticism. The NEO factor, Neuroticism, measures emotional stability, maladjustment, and the ability to cope with emotional stress. Examples include anxiety, depression, and self-consciousness.

Extraversion. Extraversion is a measure of sociability. This includes assertiveness, preference for time spent with others, ease of speaking with others and the tendency to experience positive emotions.

Openness to Experience. Openness to experience measures the degree to which people are conservative in various domains of life. For example, openness is comprised of a general willingness to actively explore novel ideas, entertain various unconventional values and appreciation for aesthetics.

Agreeableness. The NEO factor, agreeableness, measures interpersonal characteristics such as trust, altruism, compliance, modesty and tender-mindedness.

Conscientiousness. Conscientiousness measures self-control, the ability to control impulses. Self-discipline, competence, deliberation and achievement striving are examples of more specific aspects of conscientiousness.

Life Complexity Inventory (LCI; Gribbin, Schaie, & Parham, 1980). The LCI collects demographic, lifestyle, activity, work, educational, and living characteristics from the study participants. Demographic variables used in this study include age/cohort, gender and education.

Results

Hierarchical regression analyses were employed to determine the significant relationships for each cognitive ability: 5 NEO personality factors (step 1), and age/cohort, gender and education (step 2). Results of the two-step hierarchical regression analyses with the specific β for each predictor are presented in Tables 2-10. Total R^2 and ΔR^2 are shown. The findings include the total sample, age/cohort and gender groups.

Total Sample

Personality factors and demographics were significantly associated with the cognitive ability factors. Openness to experience was significantly associated with all the cognitive abilities except spatial orientation. Additionally, reasoning ability and verbal ability were predicted by all NEO factors except agreeableness. All of the associations of cognitive ability and age were negative with the exception of verbal ability, which had a positive association with age. Results are in Table 2.

Verbal Memory. Openness and Agreeableness, age/cohort and education accounted for a significant amount of the variance in verbal memory ($R^2 = .32$). However, 20% of this variance was attributed solely to age/cohort and education.

Number Skills. Significant associations for number skills included Conscientiousness and a negative relationship with Openness, age/cohort and education ($R^2 = .06$). Age/cohort and education accounted for 4% of this variance.

Inductive Reasoning. Reasoning ability was negatively associated with Neuroticism and Extraversion, age/cohort and education ($R^2 = .44$). Of the variance accounted for in reasoning ability, 33% was attributable to age/cohort and education.

Spatial Orientation. In addition to age/cohort and education, the NEO factors Neuroticism, Extraversion, and Agreeableness were negatively associated with spatial orientation ($R^2 = .34$). Age/cohort and education accounted for 27% of the variance in spatial ability.

Verbal Comprehension. Significant associations with verbal comprehension were found for Neuroticism, Extraversion, Openness, Conscientiousness, age/cohort and education ($R^2 = .30$). Only 11% of this variance was attributable to age/cohort and education, leaving 19% of the variance accounted for by the NEO factors.

Perceptual Speed. Finally, perceptual speed was significantly associated with Openness and Agreeableness, age/cohort and education ($R^2 = .47$). Age/cohort and education accounted for 35% of the variance in perceptual speed.

Age/cohort and Gender Groups

Young Adults. For the young adult sample, the NEO factors, age/cohort and education accounted for between 5 to 33 percent of the variance in PMA ability. Results are in Tables 3 and 4.

Verbal Memory. Verbal memory in young females was found to be significantly associated with openness, age/cohort and education ($R^2 = .24$). Education and age/cohort with verbal memory in young females accounted for 9% of the total variance.

Inductive Reasoning. In young males, reasoning ability was found to be negatively associated with age/cohort and positively associated with education ($R^2 = .09$). Reasoning ability in young females was related to education ($R^2 = .11$).

Verbal Comprehension. For both males and females, Openness and education were found to be significantly associated with verbal comprehension (Males: $R^2 = .27$; Females: $R^2 = .33$). In addition, in females there was a significant relationship between age/cohort and verbal comprehension. For males and females, age/cohort and/or education accounted for 15% of the variance in verbal comprehension.

Perceptual Speed. Perceptual speed was related to education in young males ($R^2 = .12$). For females, Openness and age/cohort accounted for a significant proportion of the variance in perceptual speed ($R^2 = .12$). Age/cohort attributed for 6% of the total variance.

Middle-aged Adults. In middle-aged adults, NEO personality factors, age/cohort and education accounted for between 2 to 35 percent of the variance in PMA ability. For middle-aged females education was significantly associated with all of the PMA abilities except for spatial orientation. Results are in Tables 5 and 6.

Verbal Memory. For middle-aged males, Openness and education accounted for a significant amount of the variance in verbal memory ($R^2 = .13$). Education accounted for 7% of the total variance. Neuroticism, Openness, age/cohort and education were significantly related to verbal memory ($R^2 = .15$) in middle-aged females. Of the total variance, age/cohort and education accounted for 7% of the variance in verbal memory.

Number Skills. Number skills in males were found to be significantly associated with extraversion and education ($\underline{R}^2 = .06$). Of the total variance, 3% was attributable to education. Only education was related to number skills ($\underline{R}^2 = .05$) for females.

Inductive Reasoning. For males, reasoning ability was only associated with age/cohort and education ($\underline{R}^2 = .10$). In middle-aged females, in addition to education, reasoning ability was negatively associated with Conscientiousness ($\underline{R}^2 = .13$) with education accounting for 6% of the total variance.

Spatial Orientation. For females, spatial orientation was only predicted by conscientiousness ($p < .05$; $\underline{R}^2 = .03$).

Verbal Comprehension. Education, Extraversion and Openness to experience were associated with verbal comprehension ($\underline{R}^2 = .35$) in middle-aged males. Education accounted for 16% of the total variance in verbal comprehension. In addition to education, the NEO personality factors Neuroticism, Extraversion, Openness and Conscientiousness accounted for a significant proportion of the variance in verbal comprehension ($\underline{R}^2 = .35$) for females. Only 9% of the total variance was attributable to education, leaving 24% attributable to the NEO factors.

Perceptual Speed. For males, perceptual speed was significantly associated with Openness, age/cohort and education ($\underline{R}^2 = .14$), with 9% of the total variance attributable to the association of speed with education and age/cohort. Perceptual speed was associated with age/cohort and education ($\underline{R}^2 = .17$) in middle-aged females.

Young-old Adults. The NEO factors, age/cohort and education accounted for up to 33 percent of the variance in PMA abilities for the young-old adults. Results are in Tables 7 and 8.

Verbal Memory. For males, Openness accounted for a significant proportion of the variance in verbal memory ($\underline{R}^2 = .09$). For young-old females, memory had positive associations

with education and negative associations with age/cohort. Age/cohort and education accounted for 20% of the total variance in verbal memory.

Number Skills. In young-old males, the relationship between Openness and number skills was negative ($\underline{R}^2 = .07$). Numeric ability was associated with Conscientiousness ($\underline{R}^2 = .08$) in females.

Inductive Reasoning. Extraversion, Agreeableness and age/cohort were negatively associated with reasoning ability ($\underline{R}^2 = .15$) in males. Age/cohort accounted for 5% of the total variance. For females, only education accounted for a significant proportion of the variance in reasoning ability ($\underline{R}^2 = .21$).

Spatial Orientation. Spatial orientation was not associated with any of the personality or demographic variables in young-old males or females.

Verbal Comprehension. Verbal ability was negatively associated with Extraversion, and positively associated with Openness and education ($\underline{R}^2 = .31$) in males. Education accounted for 9% of the total variance in verbal comprehension. In young-old females, openness and education were found to account for a significant proportion of the variance in verbal comprehension ($\underline{R}^2 = .33$), with 14% of the total variance accounted for by education.

Perceptual Speed. Extraversion and age/cohort were negatively associated with perceptual speed, along with the positive association of perceptual speed with openness and education ($\underline{R}^2 = .24$) in males. Age/cohort and education accounted for 8% of the total variance in perceptual speed. For young-old females, perceptual speed had positive associations with education and negative associations with age/cohort ($\underline{R}^2 = .14$).

Old-old Adults. In old-old adults, NEO personality factors, age/cohort and education accounted for between 6 to 47 percent of the variance in PMA abilities. Results are in Tables 9 and 10.

Verbal Memory. Neuroticism and age/cohort were negatively associated with verbal memory ($R^2 = .14$), with 5% of the variance attributed to age/cohort in males. Openness and age/cohort were significantly associated with verbal memory in females ($R^2 = .09$), with 4% of the total variance accounted for by age/cohort.

Number Skills. For old-old males, only age/cohort was significantly related to numeric ability, accounting for 12% of variance. In older females, numeric ability was found to be associated with Conscientiousness and education ($R^2 = .06$), with 3% of the total variance accounted for by education.

Inductive Reasoning. In males, reasoning ability was found to be negatively related to Neuroticism, Conscientiousness, age/cohort and education ($R^2 = .29$). Age/cohort and education accounted for 12% of the total variance. Reasoning ability was negatively associated with Extraversion, age/cohort and education ($R^2 = .18$) in females. Of the total variance in reasoning ability, age/cohort and education accounted for 12%.

Spatial Orientation. For old-old males, only age/cohort was significantly related to spatial orientation, accounting for 17% of variance. Spatial orientation was negatively associated with Extraversion and age/cohort ($R^2 = .11$) in females. Age/cohort accounted for 5% of the total variance in spatial orientation.

Verbal Comprehension. Verbal comprehension was negatively associated with Neuroticism and Extraversion, and positively associated with Openness and education ($R^2 = .40$) in males. Of the total variance, education accounted for 12%. In females, verbal ability was

negatively associated with Extraversion and Conscientiousness, and positively associated with Openness and education ($R^2 = .26$). Only 7% of the variance in verbal comprehension was attributed to education, leaving 19% attributable to the NEO factors.

Perceptual Speed. In males, perceptual speed was only associated with age/cohort and education ($R^2 = .31$). Similar to the older males, in older females, perceptual speed only significantly related to age/cohort and education ($R^2 = .14$).

Discussion

In general, the results from this study demonstrated that the NEO personality factors as well as age/cohort and education are associated with the PMA abilities regardless of age group and gender. As supported by prior research, the relationship between personality and cognitive ability was moderate, between 20 to 30 percent of the total variance accounted for could be attributed to the NEO personality factors (Costa et al., 1976; McCrae & Costa, 1982; Costa et al., 1986; Costa & McCrae, 1988; McCrae, 1993; Costa, Metter, & McCrae, 1994).

As hypothesized, openness to experience was the personality factor that was most consistently associated with cognitive abilities. This relationship was positive and constant across abilities, age/cohort and gender. Only in the young adult group was this association less prevalent. Openness to experience was significantly associated with at least one cognitive ability in each age/cohort and gender group. As previous research showed, openness to experience was related to education. In addition, the ability that openness to experience was most highly associated with was verbal ability, which is associated with education. Hence, it is possible that the relationship between openness to experience and cognitive ability is mediated by education

level. Further investigation of openness to experience at the facet level showed that two facets, ideas and values, were most highly associated with cognitive ability.

Extraversion was significantly related to verbal comprehension and reasoning ability, interestingly, the association was negative. Hence, lower scores on extraversion were consistently associated with higher ability performance. Investigating extraversion at the facet level revealed that two facets, warmth and gregariousness, had the highest negative association with cognitive ability. Warmth and gregariousness were also negatively associated with education however, this relationship was small and non-significant.

In middle-aged adults, neuroticism and extraversion showed negative associations with cognitive ability. Generally, these associations continued into old age, particularly for verbal comprehension, verbal memory and reasoning ability. Since neuroticism was negatively associated with cognitive ability, lower scores on neuroticism were consistently associated with higher ability scores.

Conscientiousness was associated with number skills, reasoning ability, and verbal comprehension. The association between conscientiousness and reasoning and verbal comprehension was negative. The relationship between conscientiousness and cognitive ability emerged in middle-aged females, and remained present into old age. The only group of males that demonstrated an association between conscientiousness and cognitive ability was the old-old males. This gender difference was not previously observed in the literature.

Limitations and Future Directions

One obvious limitation of this study is the cross-sectional design. If relationships between personality and cognitive ability are to be used to contribute to explanations of cognitive decline with age and have possible implications for how to prevent, stall or remedy cognitive

decline, then longitudinal data would be more appropriate. Additionally, since researchers have claimed personality to be relatively stable after the age of thirty, the portion of the young adult sample under age thirty should be evaluated separately. In future research, the relationship between personality and cognitive ability could be investigated in five age groups. Also, further investigation of these relationships at the facet level will likely contribute to the explanation of these associations. These relationships will be evaluated longitudinally, hence providing the information needed to explain personality contributions to changes in cognitive performance.

References

- Ackerman, P.L., & Rolfhus, E.L. (1999). The locus of adult intelligence: Knowledge, abilities, and nonability traits. *Psychology and Aging, 14*(2), 314-330.
- Blieszner, R., Willis, S. L., & Baltes, P. B. (1981). Training research in aging on the fluid ability of inductive reasoning. *Journal of Applied Developmental Psychology, 2*, 247-265.
- Costa, P.T., Jr, Fozard, J.L., McCrae, R.R., & Bosse, R. (1976). Relations of age and personality dimensions to cognitive ability factors. *Journal of Gerontology, 31*(6), 663-669.
- Costa, P.T., Jr., & McCrae, R.R. (1988). Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. *Journal of Personality and Social Psychology, 54*(5), 853-863.
- Costa, P. T., Jr., & McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources, Inc.
- Costa, P. T., McCrae, R. R., Zonderman, A. B., Barbano, H. E., Lebowitz, B. & Larson, D. M. (1986). Cross-sectional studies of personality in a national sample: II. Stability in neuroticism, extraversion, and openness. *Psychology and Aging, 1*, 144-149.
- Costa, P.T., Jr., Metter, E.J., & McCrae, R.R. (1994). Personality stability and its contribution to successful aging. *Journal of Geriatric Psychiatry, 27*(1), 41-59.
- Costa, P.T., Jr., Terracciano, A., & McCrae, R.R. (2001). Gender differences in personality traits across cultures: Robust and surprising findings. *Journal of Personality and Social Psychology, 81*(2), 322-331.
- Ekstrom, R. B. French, J. W., Harman, H., & Derman, D. (1976). *Kit of factor-referenced cognitive tests (rev. ed.)*. Princeton, NJ: Educational Testing Service.
- Gribbin, K., Schaie, K. W., & Parham, I. A. (1980). Complexity of lifestyle and maintenance of intellectual abilities. *Journal of Social Issues, 36*, 47-61.
- McCrae, R.R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology, 52*(6), 1258-1265.
- McCrae, R.R. (1993). Moderated analyses of longitudinal personality stability. *Journal of Personality and Social Psychology, 65*(3), 577-585.

- McCrae, R.R. & Costa, P.T., Jr. (1982). Self-concept and the stability of personality: Cross-sectional comparisons of self-reports and ratings. *Journal of Personality and Social Psychology, 43*(6), 1282-1292.
- McCrae, R.R., Costa, P.T., Jr., de-Lima, M.P., Simoes, A., Ostendorf, F., Angleitner, A., Marusic, I., Bratko, D., Caprara, G.V., Barbaranelli, C., Chae, J.H., & Piedmont, R.L. (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology, 35*(2), 466-477.
- Schaie, K. W. (1985). *Manual for the Schaie-Thurstone Adult Mental Abilities Test (STAMAT)*. Palo Alto, CA: Consulting Psychological Press.
- Schaie, K. W., Dutta, R., & Willis, S. L. (1991). The relationship between rigidity-flexibility and cognitive abilities in adulthood. *Psychology and Aging, 6*, 371-386.
- Thurstone, L. L. (1948). *Primary Mental Abilities*. Chicago: University of Chicago Press.
- Willis, S. L. & Schaie, K. W. (1983). *Alphanumeric space test*. Unpublished manuscript, Pennsylvania State University, University Park.
- Zelinski, E. M., Gilewski, M. L., & Schaie, K. W. (1979). *Age differences for fact vs. inferences*. Paper presented at the 87th Annual Convention of the American Psychological Association, August 1979, New York.