Original Research Article

Conscientiousness Predicts Performance on the Stroop Task but Not Other Attentional Control Tasks in Older and Younger Adults

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Abstract

The current study examined the relationships between attentional control (AC) and the Big Five personality traits. Older and younger adults (M_{age} = 38.62 years; *Range* = 18–90) completed a battery of behavioral attention tasks consisting of Stroop color naming, anti-saccade, and operation span, which were designed to assess inhibition, goal maintenance, and working memory processes as a comprehensive assessment of AC. Participants then completed a set of personality scales including the NEO-FFI short form. Regression analyses revealed that Big Five personality scores were not related to the AC composite, but individual task relationships were found. Specifically, participants reporting greater Conscientiousness showed improved Stroop performance, but a Conscientiousness benefit did not extend to the other AC measures. No relationships emerged between other Big Five traits and AC. This work suggests potential cognitive benefits for Conscientiousness in older and younger adults and highlights a fruitful integration of personality and basic cognitive processes.

Keywords

attentional control, working memory, Stroop, Big Five personality, Conscientiousness

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The Five-Factor Model of personality proposes that five distinct, yet related, dimensions form the foundation of adult personality (for review, see McCrae & Costa, 2008). These basic traits are: (1) Neuroticism (N), negative emotionality and diminished self-restraint, (2) Extraversion (E), sociability and positive emotionality, (3) Openness (O), creativity and the pursuit of novelty, (4) Agreeableness (A), tendency towards trust and cooperation, and (5) Conscientiousness (C), self-regulation and organization. This model has received extensive attention in part because of its associations with important practical outcomes. For example, more extraverted (and less neurotic) individuals tend to be happier (DeNeve & Cooper, 1998). Strong correlations have also been demonstrated between the Big Five dimensions and psychopathology, with O, C, E, and A predicting lower (and N predicting higher) rates of depression, anxiety, and behavioral disorders (Kotov et al., 2010). Conscientiousness is associated with the development of problem-related strategies as means to address adversity (Watson & Hubbard, 1996) and facilitates memory capabilities for older adults as cognitive abilities decline (Luchetti et al., 2016). The Five-Factor model has received decades of support, including evidence of cross-cultural consistency and neurological substrates for each dimension (Allen & DeYoung, 2017).

Despite many studies showing psychological and lifestyle factors associated with the Big Five, few have compared these relationships to behavioral cognitive processes, particularly those employing tasks of attentional control (AC), which refers to one's ability to selectively attend to relevant environmental aspects while ignoring salient but irrelevant information (Heitz et al., 2005). This is surprising given basic cognitive functions such as attention and memory are trait-like, operating relatively consistently across circumstances and stimuli. When considering the Big Five, C would presumably be the strongest correlate with AC given high C individuals show high self-discipline and deliberation which would require an adept cognitive system to focus on specific tasks in the face of distraction. Indeed, of the available studies, C appears to be the most frequently associated factor; however, relationships are inconsistent. Pearman (2009) reported that C is negatively associated with short-term memory using the forward and backward digit span tasks from the Weschler Adult Intelligence Scale (Wechsler, 1997) and a counting-backwards task. Soubelet (2011) reported a similar negative relationship between C and working memory on the letter-number sequencing task and fluid ability on the matrix reasoning and block design tasks (Wechsler). In contrast, Jackson and Balota (2012) reported that high C was related to fewer errors and off-task thoughts in a mind wandering paradigm—a cognitive benefit of C that is consistent with the facet of self-discipline.

Research on neural correlates of personality traits further suggests that C may be uniquely valuable in predicting performance in attentional control tasks. Initial work suggests that C is associated with volumetric measures of the lateral prefrontal cortex, a brain region critical for self-regulation and executive control (DeYoung et al., 2010). One study (Rueter et al., 2018) noted that C was associated with enhanced connectivity between multiple brain regions associated with detecting and responding to salient information (what the authors term a goal priority network), suggesting that C may be related to task processes that require detecting and reacting to specific features in the environment.

Associations with attentional task performance have been found with O and E. Booth et al. (2006) found positive relationships for both dimensions with verbal memory on the Hopkins Verbal Learning Test (Benedict et al., 1998), and general cognitive ability on the Modified Mini Mental Status Exam (Teng & Chui, 1987). Soubelet and Salthouse (2011) further reported a positive relationship between O and fluid intelligence—one's ability to creatively reason solutions to specific problems. Further, Pearman (2009) reported a positive association between processing speed on a letter comparison task and E. Thus, some relationships between personality and cognitive performance have been found, but these relationships have been tested with a broad selection of tasks, sometimes yielding inconsistent effects.

Although mostly indirect, there is some evidence that N and trait anxiety (a subfactor of N) may be related to AC. For example, scores on the State-Trait Anxiety Inventory predict some differences in performance on antisaccade tasks. Specifically, individuals high in trait anxiety showed delayed latencies, but equivalent error rates, compared to low anxiety individuals (Derakshan et al., 2009), suggesting that high trait anxiety individuals may be concerned about their performance and slow responses in an effort to enhance accuracy (see too Shi et al., 2019, for a meta-analysis supporting a relationship between AC and anxiety). Additionally, highly anxious individuals show substantial performance deficits when antisaccade tasks include negatively valenced images (e.g., angry faces; Reinholdt-Dunne et al., 2012). Other work using children reported that N was related to lower levels of self-reported attentional control (Muris et al., 2004). Collectively, these patterns are consistent with Attentional Control Theory (Eysenck & Derakshan, 2011) which posits that AC deficits can be triggered by high-anxiety contexts. High N individuals may therefore show breakdowns in AC as they work towards regulating general emotional concerns or concerns regarding task performance.

In the present study, we further examined how personality factors relate to cognitive performance. However, rather than only examining relationships to individual tasks testing potentially different cognitive abilities, we also examine associations to several tasks designed to provide a comprehensive composite of AC. AC is multifaceted and extends beyond basic information processing as individuals must sustain attention in the face of distraction while maintaining task goals and adapting to changing task demands (Draheim et al., 2022). Given these cognitive functions, researchers often measure AC across several tasks. In the present study, we adopted a variant of the AC battery utilized by Hutchison (2007). This battery consists of the Stroop color-naming task, a classic inhibition task in which individuals must suppress an automatic word-reading response, the antisaccade task, a visual-vigilance task, and the operation span task (OSPAN), a measure of working-memory capacity. Thus, we provide a comprehensive assessment of AC that offers greater information than examining each task in isolation.

In a recent review of the attentional control literature, Draheim et al. (2022) noted that AC is a better measure of overall cognitive capacity than measures of fluid intelligence and working memory capacity alone. Indeed, it has been shown that the direct relationship between working memory capacity and fluid intelligence that has been reported consistently (Engle et al., 1999; Kane et al., 2004), and is mediated by AC when measures of working memory, fluid intelligence, and AC are derived via structural equation modeling. Given that working memory capacity is correlated with several real-world behaviors such as language learning (Wen, 2015), long-term memory, emotional regulation (Schmeichel et al., 2008), and psychological states such as anxiety and depression (Moran, 2016; Nikolin et al., 2021; Shi et al., 2019), it is likely that AC may offer even greater predictive power for externally valid behaviors. Moreover, because many of these real-world behaviors correlate with personality traits, it is reasonable to expect that AC may share similar associations.

Despite indirect associations between cognitive measures and personality, few studies have examined the direct relationships between the Big Five and tasks of AC, though generally, results have been mixed. In the Stroop task, Booth et al. (2006) reported a positive relationship between C and performance on the Stroop color-word task. However, their study sampled only older adult participants who tend to show age-related cognitive declines, which manifest in exaggerated Stroop errors and response latencies relative to younger adults (Spieler et al., 1996). Further, Booth et al. scored the Stroop task by counting the number of total trials correct in a 45 s time frame—a scoring procedure which precludes trial-by-trial analyses of response latencies and errors which are essential for precisely assessing incongruency effects (see MacLeod, 1991). In contrast, Fleming et al. (2016) assessed individual trials, but reported no correlations between any of the Big Five factors and Stroop. Their analyses only utilized response latencies and did not include accuracy rates on incongruent trials which are error prone. For the antisaccade task, Fleming et al. reported a small negative correlation between N and antisaccade accuracy, though Unsworth et al. (2009) reported no relationship between either antisaccade or OSPAN and any of the Big Five factors. Thus, the relationships reported have been inconsistent, which could reflect differences in scoring/analyses (e.g., the Stroop task).

We sought to clarify these issues in the present study and closely examine the relationships between the Big Five and AC using a large and diverse sample of individuals including younger and older adults. Our inclusion of both age groups was to bolster the representativeness of our sample, but also to evaluate potential interactions between AC and the Big Five given evidence that both cognitive and personality factors show age-related differences. As noted previously, Stroop performance is highly sensitive to age-related declines (e.g., Aschenbrenner & Balota, 2017; Bugg et al., 2007;

Spieler et al., 1996), and age-related breakdowns in AC have been detected on several tasks including antisaccade (Reuter-Lorenz et al., 1995), OSPAN (Rhodes & Kelley, 2005), and several others (Hasher et al., 1999; Salthouse, 1992, for reviews), supporting the notion that advancing age is negatively related to attentional ability. Similar age-related differences have been reported within the Big Five. There is broad agreement that E, O, and N are negatively associated with age, and A and C are positively associated with age (Costa et al., 1986; Helson et al., 2002; Mroczek et al., 2006), though there is some evidence that C may peak in middle age and either remain stable or decline slightly in older adulthood (Donnellan & Lucas, 2008). Inclusion of both age groups therefore allowed us to separate possible age-related effects while isolating the relationship between AC and the Big Five.

Given the mixed status of prior research on attention, cognition, and the Big Five, we had only a few hypotheses. First, we anticipated that we would replicate the observed positive association between C and Stroop performance observed in Booth and colleagues' (2006) study, but using trial-level data. Specifically, we predicted that high C would be associated with a reduction in errors on more challenging incongruent trials and a lower incongruency effect in latencies between incongruent and congruent trials. Because C is characterized by self-regulation and restraint, we anticipated that this effect would be robust. Similar relationships, however, might also be found in other attentional tasks. For example, the antisaccade task, which also requires inhibitory control, and span scores on the OSPAN task (consistent with Soubelet, 2011) might also show a positive association with C. The antisaccade task similarly requires highly sustained and vigilant visual attention, which may be disrupted due to diminished cognitive self-restraint. We therefore predicted a negative association between N and antisaccade accuracy. To the extent that working memory capacity also requires cognitive self-restraint, we similarly predicted a negative association between N and scores on the OSPAN task. Finally, although our inclusion of older adults was to account for age-related differences in AC and personality, we expected relationships between AC and the Big Five factors would be largely consistent with the literature. Specifically, we expected that age would be negatively related with AC, and the O, E, and N personality factors. In contrast, we expected age would be positively related to C and A.

Method

Participants

Data were collected from 230 individuals ($M_{age} = 38.82$, $SD_{age} = 26.17$), of which 152 were undergraduate students from The University of Southern Mississippi ($M_{age} = 20.47$, $SD_{age} = 4.08$), and 78 older adults (60 years of age or older) from the greater Hattiesburg, MS community ($M_{age} = 74.57$, $SD_{age} = 6.77$). We deliberately recruited older adults to improve the representativeness of our sample, however the sample was non-continuous (i.e., few middle-aged adults) and thus, age was analyzed as a discrete

Table 1. Demographic Information for Study Participants.

Group/Demographic variable	Student group	Older adult group	Combined groups
N	152	78	230
Mean (*SD*) Age (yrs.)	20.47 (4.08)	74.58 (6.77)	38.82 (26.18)
Age Range (yrs.)	18–51	60–90	18–90
% Female	82.23%	67.95%	77.39%
Mean (*SD*) Education (yrs.)	13.43 (1.55)	15.55 (2.76)	14.16 (2.27)
Education range (yrs.)	12–19	7–21	7–21

variable.[1] Available demographic data which included reported gender and years of education for each sample are reported in Table 1.

Our sample size was selected based on related work by Jackson and Balota (2012) and Soubelet (2011) who similarly examined associations between personality and cognition while including older adults. Each study included 116 and 164 participants, respectively, and we chose to sample beyond those numbers to ensure sufficient power to detect interactions age-related interactions. Based on our sample, a sensitivity analysis using G*Power (Erdfelder et al., 1996) indicated that our sample yielded excellent (.95) power to detect small-to-moderate effects ($f^2 = .057$; $r = .232$) using a regression model with five predictors (two-tailed) and sufficient power (.80) to detect small effects ($f^2 = .034$; $r = .177$).

Materials

AC was assessed through Stroop color naming, antisaccade, and OSPAN, which were presented in this same fixed order. All tasks were run using E-prime software (Schneider et al., 2012). Our study also included gender and the Need for Cognition Scale (Cacioppo & Petty, 1982) in our regression models, but no significant effects were found. We therefore do not include this variable in our analyses below but have included it in our Supplemental Materials for completeness.

Stroop Color-Naming. Stroop stimuli were taken from Spieler et al. (1996) and included four color words (blue, green, red, and yellow) and four neutral words (bad, deep, legal, and poor). Participants were instructed to identify the color of each word, but not the word itself, by responding verbally into a microphone which measured the onset of the vocal response and correct and incorrect verbal responses were coded by the experimenter. A total of 130 trials were presented which consisted of 10 practice and 120 experimental trials. Practice trials consisted of 3 incongruent (word and color mismatch), 4 congruent (word and color match), and 3 neutral trials (word unrelated to color). Experimental trials consisted of 48 neutral trials (each neutral word displayed 12 times in each color), 36 congruent trials (each color word presented 9 times in each color), and 36 incongruent trials (each color word presented 9 times in the other incongruent color). Practice and experimental trials were presented in a fixed random order. Experimental trials were further parsed into 3 blocks of 40 trials with each block separated by a self-paced rest break.

Antisaccade. The antisaccade task was based on a version used by Hutchison (2007). Participants were instructed to look at a fixation point on the center of the computer screen; they were told that a large asterisk would be presented on the far left or right side of the screen at the same horizontal level from fixation. They were instructed to look away from the asterisk when detected, to search for a target letter (*O* or *Q*), presented on the opposite side of the screen. They were further informed that the target would be displayed very briefly and covered up by a mask (##) and that their task was to report the target letter by entering it into labeled keys on a keyboard, guessing if necessary. Trials presented a fixation (+) which was centered on the screen for 1000 or 2000 ms. After fixation, a large asterisk, presented in 20-pt. Courier New font appeared on the left or right sides of the screen for 300 ms. The fixation delay and location of the asterisk varied randomly across trials to limit anticipatory effects of when and where the asterisk would appear. The target immediately followed the asterisk and was displayed for 200 ms; the target was then covered up by the mask. The mask remained on the screen for 5000 ms, during which time participants were to enter in their target response. If no response was entered during this time, feedback of "No Response Detected" was displayed for 2000 ms. The next trial immediately followed an entered response or the "No Response Detected" feedback. Participants were given 16 practice trials followed by 48 test trials divided into 3 blocks with a self-paced rest break presented in between each block. Fixation durations and target letters were distributed equally across the practice and test trials.

OSPAN. The OSPAN task was taken directly from Foster et al. (2015). In this task, participants viewed and read aloud mathematical strings (e.g., $(5 \times 3) - 2 = ?$) and were to compute the answer silently. Once a solution was computed, participants were then to click the mouse which would direct them to another screen with a solution (e.g., 11); they would need to select "yes" if the solution was correct or "no" if the solution was incorrect. Once a response to the solution was made, a single letter was displayed for 1000 ms (e.g., J) followed by another mathematical string. This procedure repeated for 2–7 math strings/letters (i.e., spans) and was then followed by a serial recall test in which letters were to be recalled in the order in which they appeared by clicking letter-labeled boxes on the computer screen. This procedure repeated for one block of 7 trials, with each span length tested once. Span lengths were presented randomly across participants, but all lengths were tested. Participants were instructed to place equal emphasis on the math and memorization portions of the experiment and were encouraged to maintain an 85% accuracy rate on the math portion. Accuracy feedback on math problems was provided at the end of each trial.

NEO-FFI Short Form. The NEO-FFI Personality Inventory (McCrae & Costa, 2004) is an established measure that examines participants' Big Five traits and includes 60 total items, 12 that correspond to each dimension. Participants rated their agreement (1 = *strongly disagree*; 5 = *strongly agree*) with the extent to which each item described them.

Procedure

After consenting to the study, participants were asked to complete the three AC tasks in the order listed above followed by the NEO-FFI. Participants were assessed individually with an experimenter present to ensure tasks were completed reliably. The experiment took slightly less than one hour to complete including a full debriefing.

Results

Attentional Control Tasks

Stroop analyses computed reaction times (RTs) and percent errors for the three trial types (congruent, neutral, and incongruent). RT analyses only contained trials with correct responses. responses less than 200 ms and greater than 3000 ms, and those above or below 3 *SD*s of each participant's mean across trial types were trimmed as outliers (removing 1.0% of trials). From remaining RTs, Stroop incongruency effects were computed (i.e., difference between incongruent and congruent trials in mean RTs and z-transformed RTs[2]). For analyses, a standardized Stroop composite score was created which consisted of the Stroop incongruency effect and error rates on incongruent trials using a principal components analysis. Incongruent errors were included as these were the more challenging trials with higher variability in errors rates. For the antisaccade task, accuracy was computed (correct divided by total trials) which ranged from 38–100% across participants with chance performance at 50%. OSPAN was computed as the number of letters correctly recalled in serial order for each of the 2–7 span trials (i.e., partial span) resulting in a maximum span score of 27 (*Range* = 0–25). Due to a computer error, data were unavailable for eight participants in the antisaccade, three in the OSPAN, and two in the Stroop task. No participant had data missing from more than one task.

Principal Component Analysis

Following Hutchison (2007; Hutchison et al., 2014), tasks within the AC battery were submitted to a principal components analysis to examine intercorrelations between tasks. We anticipated that each task would have some independent variability due to task-specific processes (e.g., reading ability in Stroop, visual acuity in antisaccade, and mathematic ability in OSPAN), but importantly, would contain shared variance due to contributions of AC processes. Table 2 reports task loadings for the AC

Table 2. Loadings and Uniqueness of Attentional Tasks on the Attentional Control Composite.

Task	Attentional Control Loading	Uniqueness
Antisaccade	.805	.336
Operation Span	.776	.390
Stroop Composite	−.743	.448

Note. The extraction method used was a principal components analysis using a promax rotation. Proportion of variability accounted = .609.

tasks. In rare cases where participants had missing tasks, these cells were imputed using mean performance across participants. A promax rotation was used and a single component was identified which accounted for 60.90% of variance across task types which we attribute to AC. The antisaccade and OSPAN tasks loaded positively as higher scores were indicative of greater AC (i.e., greater accuracy and greater span scores) whereas Stroop loaded negatively as more errors on incongruent trials and greater (i.e., slower) reaction times were indicative of lower AC. Consistent with these loadings, correlations for the AC measures showed a positive correlation between the OSPAN and antisaccade tasks and each correlated negatively with the Stroop composite (Table 3).

Correlations

Bivariate correlations were computed to examine the relationships between variables (Table 3). Some relationships were found between personality traits and performance: High C individuals showed decreased Stroop composite scores ($r = -.13$), while N correlated with better performance on the antisaccade ($r = .25$) and OSPAN ($r = .19$) tasks. Composite AC ability was most strongly related to N ($r = .22$) and inversely related with A ($r = -.14$). However, these associations may be spurious due to age differences in both personality and performance. The older adult sample demonstrated weaker AC on both the composite and on each task (rs > .44). The older adult group reported substantially lower N ($r = -.38$), lower E ($r = -.11$), and higher A ($r = .25$).

Predicting Attentional Control via Regression Models

To understand the unique contributions of each Big Five traits in statistically predicting AC, we regressed AC scores for each task and the AC composite onto the full profile of Big 5 scores, age, and years of education (Table 4). As in past research (e.g., Musek, 2007), we observed relatively strong relationships between the Big Five dimensions, indicating that multiple regression is more informative regarding the unique role of each personality trait by controlling for shared variance.

Table 3. Descriptives and Bivariate Correlations Between Observed Variables.

	Age Group	Education	N	E	O	A	C	Antisaccade	OSPAN	Stroop Comp.	Att. Control Comp.
Age Group	-	.426***	−.383***	−.110^	.075	.251***	.057	−.614***	−.551***	.444***	−.681***
Education		-	−.219***	.035	.258***	.251***	.069	−.334***	−.263***	.092	−.292***
N			-	.017	−.004	−.384**	−.359**	−.082	.249**	.187**	.224**
E				-	−.100	.055	.276**	−.107	.085	.112^	.128^
O					-	.226**	−.024	−.043	−.056	−.017	−.015
A						-	.387**	.043	−.152*	−.130*	−.140*
C							-	−.133*	−.083	−.010	.014
Antisaccade								-	.469**	−.414**	.814**
OSPAN									-	−.355**	.782**
Stroop Comp.										-	−.744**
Att. Control Comp.											-
N	230	226	230	230	230	230	230	222	227	228	230
M (*SD*)	.34 (.47)	14.09 (2.45)	2.75 (.74)	3.24 (.42)	3.23 (.54)	3.53 (.44)	3.87 (.55)	.64 (.18)	13.44 (6.66)	—	—

Notes. ^ = $p < .10$; * = $p < .05$; ** = $p < .01$. *M* and *SD* were 0.00 and 1.00 for the Stroop and Attentional Control composites as these scores were standardized. Age Group scored: 0 = Student Sample; 1 = Older Adult Sample.

Table 4. Models Predicting Attentional Control Based on Age Group, Education, and Big Five Scores.

Model/Statistic	b (*SE*)	β	*t*	*p*
Antisaccade				
Age Group	−0.22 (.02)	−.57	8.95	<.001
Education	−0.006 (.005)	−.04	1.25	.211
N	0.005 (.02)	.02	0.34	.732
E	0.03 (.03)	.07	1.20	.234
O	0.007 (.02)	.02	0.36	.721
A	0.01 (.03)	.02	0.37	.713
C	−0.02 (.02)	−.06	0.89	.375
Intercept	0.70 (.15)	.00	4.70	<.001
Adj. $R^2 = .376$, $F(7, 210) = 19.67$, $p < .001$				
OSPAN				
Age Group	−7.69 (.94)	−.55	8.18	<.001
Education	−0.12 (.18)	−.04	0.69	.494
N	−0.29 (.60)	−.03	0.48	.631
E	1.09 (.95)	.07	1.15	.253
O	0.48 (.73)	.04	0.66	.509
A	−0.36 (1.02)	−.02	0.35	.726
C	−0.17 (.80)	−.01	0.21	.834
Intercept	15.38 (5.64)	.00	2.73	.007
Adj. $R^2 = .302$, $F(7, 216) = 14.78$, $p < .001$				
Stroop Composite				
Age Group	1.06 (.15)	.50	7.05	<.001
Education	−0.04 (.03)	−.09	1.30	.196
N	0.08 (.10)	.06	0.80	.426
E	−0.01 (.15)	−.01	0.09	.926
O	−0.13 (.12)	−.07	1.08	.282
A	0.06 (.16)	.03	0.36	.721
C	−0.27 (.13)	−.15	2.09	.037
Intercept	1.23 (.90)	.00	1.37	.174
Adj. $R^2 = .209$, $F(7, 216) = 9.43$, $p < .001$				
Attentional Control Composite				
Age Group	−1.44 (.02)	−.68	11.61	<.001
Education	−0.009 (.02)	−.02	0.40	.687
N	−0.04 (.08)	−.03	0.46	.643
E	0.14 (.13)	.06	1.11	.270
O	0.09 (.10)	.05	0.91	.362
A	−0.01 (.14)	−.006	0.10	.922
C	0.06 (.11)	.03	0.55	.580
Intercept	−0.19 (.75)	.00	0.25	.801
Adj. $R^2 = .461$, $F(7, 217) = 25.02$, $p < .001$				

Note. Variation in DF due to random absences of individual outcomes.

Predicting Stroop Composite. The first model regressing the Stroop composite onto our predictors yielded two significant effects (Table 4). The older adult group had significantly poorer Stroop performance ($\beta = .51$, $p < .001$). Interestingly, there was also a unique effect of C indicating that more conscientious individuals performed better on this task ($\beta = -.14$, $p = .04$), after controlling for the age difference.

Predicting Antisaccade. A full linear regression model with all predictors (Table 4) indicated only a significant difference in antisaccade performance between age groups with poorer performance in the older adult group ($\beta = -.61$, $p < .001$).

Predicting OSPAN. The OSPAN analysis reflected the same pattern as antisaccade. Again, only age predicted unique variance in working memory ($\beta = -.58$, $p < .001$).

Predicting Attentional Control Composite. The final models replicated the same basic pattern. In a full model, only age group uniquely predicted AC scores and its effect was extremely large ($\beta = -.71$, $p < .001$).

Trait × Age Moderation. Finally, we tested whether age group effects may have been moderated by specific levels of the Big 5 traits. This analysis yielded no significant trait × age interactions. There was a marginal ($p = .08$) interaction indicating that the negative effect of age group on Stroop performance was diminished among highly conscientious individuals, but because this interaction was unreliable we did not probe it further. Other interactions were unreliable (ps > .17). For antisaccade, all age group × trait interactions were non-significant (ps > .335). On OSPAN, a marginal interaction ($p = .09$) indicated that age differences were more pronounced among highly neurotic participants but no other age group by trait interactions were observed for OSPAN (ps > .345). Finally, no interactions were found on the full AC composite (ps > .16).

Discussion

The present study examined the relationships between the Big Five personality factors and behavioral performance on tasks of AC. Our regression analyses revealed noteworthy factors that contribute to AC, specifically the influence of C and age. First, we found that C was predicted better performance on the Stroop task (i.e., fewer errors and diminished incongruency effects). Importantly, this finding held after controlling for age and education, indicating that the specific benefits of C associated with Stroop may extend across the lifespan. Of note, age predicted poorer performance across the other AC tasks, and for the AC composite in general. As such, our findings suggest that C may promote certain attentional processes even as cognitive capacities decline.

Our findings provide important additions to the literature as few studies have examined the relationships between the Big Five and cognitive performance. As reviewed above, the main personality factors associated with cognitive performance have been C, E, and O. Our study found such a relationship with C, although this relationship was limited to Stroop performance. The Stroop pattern is consistent with Booth et al. (2006) who found that C was related to better Stroop performance using a relatively coarse performance measure that did not assess trial-level errors or response latencies. In contrast to our predictions however, our results did not show that C was related to AC in general, working memory (OSPAN), or inhibition (antisaccade), which are relationships that have been reported elsewhere using different tasks (e.g., Jackson & Balota, 2012; Soubelet, 2011). However, as noted in our Introduction, the relationships reported between C and cognitive performance are variable, with relationships occurring in both positive and negative directions. These patterns are perhaps not surprising given researchers often employ different tasks that tap into different cognitive functions when assessing personality. Clearly, more research is needed to accurately determine relationships between C and cognitive ability, but our study adds to the accumulating evidence that personality factors assessed via questionnaire-based responses may be related to cognitively demanding behavioral measures, at least via the Stroop task.

A small relationship was also found between N and both the antisaccade and OSPAN tasks, which likely contributed to the positive association to the overall AC composite. While these patterns were consistent with our predictions, we carefully note that these patterns did not hold in our regression analyses. We found that age predicted unique variance in both antisaccade and the OSPAN tasks, which was likely responsible for the initial correlations. Indeed, we found a negative correlation between age and N—a pattern that has been documented previously (Roberts et al., 2006)—which suggests that age is an important factor to account for when examining relationships between personality factors and AC.

Our study did not however show relationships with either E or O. We run into similar interpretative issues with these factors given other studies used different tasks assessing different cognitive processes. We do note that a non-significant positive relationship was found between E and AC ($p = .13$), which is directionally consistent with other research showing a positive association with measures of processing speed (Pearman, 2009) and general cognition (Teng & Chui, 1987). We refrain from interpreting null effects but suggest that the relationship with E may simply be small which would require a larger sample to detect.

Our inclusion of older and younger adult samples allowed for control of age-related differences that occur on AC and the Big Five factors. We acknowledge that our group-sampling approach of separate university students, who were predominantly younger adults, and older adults, resulted in a bimodal distribution of age for our analyses. Accordingly, we were careful to analyze age discretely which may have biased age effects in the models relative to a more mesokurtic distribution. Despite this possibility, we were still able to achieve some degree of statistical control for age-related variance which did not affect the primary data pattern we reported between AC and C. Thus, while our distribution of age might have resulted in some relationships with other individual variables that would benefit from replication with a more representative sample (e.g., the correlation between age and AC, which was quite strong), these effects were sufficiently controlled for in our primary analyses between AC and the Big Five personality factors.

Additionally, our use of the NEO-FFI short form precludes evaluation of subfacets of the Big Five (e.g., DeYoung et al., 2007). Some of these facets may be particularly informative when examining the relationship between AC more broadly and specific tasks. For instance, self-discipline and restraint, two facets in C, may be related to performance on the Stroop task given the requirement to inhibit the automatic reading response in favor of color naming and to continue to maintain the task goal over several minutes of completing the task. Examining subfactors associated with each of the Big Five would provide a nuanced framework for understanding the links between personality and AC. Our relatively limited trait measurement may also explain disparities between the current data and previous work, suggesting a need for further study.

Conclusion

In sum, our study provides new evidence for the relationships between the Big Five personality factors and AC. Specifically, our analyses showed an association between C and better Stroop performance, showing that an individual AC task shows trait-specific associations. To our knowledge, the relationships between traits and the AC as assessed by a variety of highly valid attentional tasks has not yet been examined. A strength of our study is that we recruited a large sample of diverse individuals taken from a wide age range (18–90 years) to ensure variability in both cognitive performance and personality characteristics. These data suggest considerable value in further expanding the scope of both cognitive and personality dimensions to uncover personality's pervasive effects on basic cognitive processes.

Author Contributions

Conceptualization of the research idea was completed by MJH and MRG. Data collection, analyses, and interpretation were conducted by all three authors. Primary writing and analyses were completed by MJH and LAK.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Standards

The study reported was approved by the Institutional Review Board at The University of Southern Mississippi and was performed in accordance with the ethical standards as set forth in the 1964 Declaration of Helsinki and its later amendments. All participants provided informed consent.

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Supplemental Material

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Notes

1. For all regression models reported, we also conducted separate analyses in which age was analyzed continuously. When age was analyzed continuously or discretely, the pattern of significant results was the same. Given that sample ages were clustered into discrete younger and older adult groups, we chose to report regression models with age as a discrete variable which better represents the bimodal distribution in this sample.
2. Stroop difference scores in response latencies were similarly computed between incongruent and neutral trial RTs. This difference score was equivalent to the difference score computed with congruent trials and had no effect on subsequent analyses.

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