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A Systematic Review and Meta-Analysis of the Association between Personality and Cognitive Failures / Complaints

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Abstract

This systematic review examined the associations of personality traits with cognitive failures and cognitive complaints across the adult lifespan. We first present three conceptual models (cognitive abilities, mental processes, and reporting bias) that could explain why personality is related to such behaviors. We then conducted five separate meta-analyses with 10–17 cross-sectional samples (N = 7,642 – 10,564) that were identified through a systematic literature search following the MOOSE guidelines. Higher neuroticism (r = .39, 95% CI [0.32, 0.45]) and lower conscientiousness (r = −.36, 95% CI [−.42, −.29]) were related to more cognitive failures and complaints. Lower scores on the remaining traits were also associated with more cognitive failures and complaints, yet to a weaker extent (extraversion: r = −.14, 95% CI [−.20, −.08]; openness: r = −.07, 95% CI [−.11, −.03]; agreeableness: r = −.13, 95% CI [−.21, −.05]). With the current empirical evidence, it is not possible to tell which of the three conceptual models explains how much of the associations. For neuroticism, there is more support for the mental processes than the reporting bias model, but more research is needed to fully test mechanistic models. We provide several suggestions for future research to address existing limitations of the literature on personality and cognitive failures and complaints.

Introduction

Do people who tend to worry also report more lapses in memory and cognitive functioning? And if so, why? Is it because “the worriers” negatively bias self-judgements? Or is it because they are distracted by their own thoughts? The present work addresses these questions by reviewing the literature on personality traits and both cognitive failures and cognitive complaints. Recent years have seen an increasing number of studies concerned with examining personality traits as predictors of reporting minor errors in thinking during everyday life (Carrigan & Barkus, 2016; Sutin et al., 2020) or complaining about one’s functioning in various cognitive domains (Aschwanden et al., 2018; Buchanan, 2016, 2017; Hill et al., 2020; Kliegel & Zimprich, 2005; Snitz et al., 2015). For instance, individuals with

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higher neuroticism and lower conscientiousness are more likely to complain about their memory (Pearman & Storandt, 2004). Individuals with higher extraversion, in contrast, tend to view their memory more favorably (Steinberg et al., 2013). Likewise, individuals with higher openness tend to report fewer general cognitive complaints (Slavin et al., 2010) and individuals lower in agreeableness seem to report more lapses in memory, perception, and action (Sutin et al., 2020). The theoretical explanation for these associations has been an active area of debate. Furthermore, the methodological limitations of current literature also deserve attention. The present review is structured as follows: First, the key concepts of personality and cognitive failures/complaints are defined. Second, we present three conceptual models (cognitive abilities, mental processes, and reporting bias) that may explain why personality traits are associated with such behavior. Third, we conducted five separate meta-analyses with cross-sectional samples that were identified through a systematic literature search following the MOOSE guidelines. We further considered publication bias and explored potential sources of heterogeneity. Finally, we discuss common limitations of current studies and provide recommendations for future research to better understand the how and why of the relation between personality and cognitive failures/complaints.

Definitions

Personality traits.—Personality traits refer to individual differences in characteristic patterns of behaviors, thoughts, and feelings. These relatively stable individual differences are generally assessed with self-report questionnaires that ask for the degree of agreement to statements such as “I am someone who is anxious” (i.e., item to measure neuroticism). Since the 1980’s, there has been a broad consensus that personality traits can be organized in a conceptual framework that consists of five basic traits, the so-called Big Five (John & Srivastava, 1999) or Five-Factor Model (FFM) (McCrae & John, 1992). There is a general consensus that the FFM is largely representative of a broad range of adult individual differences (Costa & McCrae, 1992), and it has been well replicated across measurement methods (i.e., self-report vs. observer ratings), in samples of women and men, from adolescence to older adults, and cross-culturally (Costa & McCrae, 2003; McCrae et al., 2005). Within the FFM, personality traits are conceptualized as mostly independent from measures of intelligence and cognition, while others have suggested that intelligence could be integrated with larger models of personality (DeYoung, 2011). The five traits are known as neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Briefly, neuroticism, contrasts even-temperedness with the tendency to feel worry, anxiety, depression, and anger. Extraversion refers to the propensity to be sociable, active, assertive, and to experience positive affect. Openness to experience (hereafter openness) reflects the tendency to be open to new ideas, creative, original, and complex. Agreeableness refers to the propensity to be trusting, warm, modest, and altruistic. Conscientiousness reflects the tendency to be disciplined, organized, planful, task- and goal-directed, and rule-following. We base this review on studies that operationalized personality from the perspective of the FFM.

Cognitive failures and complaints.—There is no clear differentiation between cognitive failures and complaints; these two terms and others (e.g., subjective cognitive

impairment, subjective cognitive decline) tend to be used interchangeably in the literature. Cognitive failures are defined as momentary lapses in memory, perception, and/or action that result in mistakes (Broadbent et al., 1982). Cognitive complaints are defined as negative judgments about one's cognitive functioning (Mascherek et al., 2011). In the present review, we use "cognitive behaviors" as an umbrella term when we refer to both cognitive failures and complaints, and there is no need to differentiate between them. Strictly speaking, however, the *actual* cognitive behavior for both constructs is to *realize* and *report* a minor error or a deviation from the individually defined "normal" cognitive functioning. Since it is difficult to measure *actual* cognitive lapses, most studies rely on self-reports. These lapses are referred to as subjective cognitive failures or subjective cognitive complaints because it is the individual's perception of their cognitive functioning (Jessen et al., 2014). The most widely used instrument to assess cognitive failures is the Cognitive Failures Questionnaire (CFQ) (Broadbent et al., 1982). The English version of the CFQ consists of 25 items that measure cognitive failures in perception, memory, and motor function during the past 6 months. For example, individuals are asked "Do you read something and find you have not been thinking about it and must read it again?". Items are answered on a 5-point-Likert-type scale ranging from never to very often. To measure cognitive complaints, a variety of questionnaires or scales have been used in the literature, for example the Prospective and Retrospective Memory Questionnaire (PRMQ; 16 items) (Smith et al., 2000), the Subjective Memory Complaints Questionnaire (SMCQ; 14 items) (Youn et al., 2009) or the Subjective Cognitive Complaints Scale (SCCS; 24 items) (Snitz et al., 2012). The items of these questions are similar, an example from the PRMQ is "Do you forget to buy something you planned to buy, like a birthday card, even when you see the shop?", which is answered on a 5-point-Likert-type scale ranging from never to very often. However, sometimes cognitive complaints are measured with a single question only (e.g., "Do you have complaints about your memory?") (Comijs et al., 2002). Informants (i.e., a person who knows the participant well) are also sometimes asked to rate the participants' cognitive behavior (Slavin et al., 2010; Sutin et al., 2019). Cognitive failures are relatively common, and most people experience them from time to time, especially under stress, tiredness or bad mood (Lange & Süß, 2014; Mahoney et al., 1998). Although many adults report more memory and other cognitive difficulties as they grow older (Jonker et al., 2000; Ponds et al., 2000), cognitive failures happen to people of every age group and they should not be confounded with mild cognitive impairments (MCI), an early stage of clinical dementia (Clément et al., 2008). We focus on self-reported (vs. informant-reported) failures and complaints in several domains of cognitive function (e.g., general, memory, executive function, attention) in healthy individuals across the adult lifespan.

It is important to note that cognitive failures/complaints are not necessarily equivalent to cognitive function. Past studies have reported weak, negative or unrelated associations between cognitive failures/complaints and objective cognitive performance (Burmester et al., 2016; Könen & Karbach, 2018; Lange & Süß, 2014). As such, cognitive failures/complaints should not serve as proxies for cognitive function, but rather be considered an important marker of everyday cognition in their own right. For example, cognitive failures and complaints have some predictive value for cognitive decline (Mendonça et al., 2016) and are risk factors for cognitive impairment (Jessen et al., 2014). It is, however, beyond the scope

of this review to go into more detail in the clinical implications of the cognitive failures/complaints for older adults and the reader is referred to corresponding literature (Burmester et al., 2016; Carrigan & Barkus, 2016).

Conceptual Models

Previous research on personality and cognitive failures/complaints has focused primarily on neuroticism. From this literature, there is consistent evidence that higher neuroticism is associated with greater frequency of cognitive failures and complaints (Aschwanden et al., 2018; Hill et al., 2020; Kliegel & Zimprich, 2005; Könen & Karbach, 2018; Lange & Süß, 2014; Mecacci et al., 2004; Slavin et al., 2010; Snitz et al., 2015; Sutin et al., 2020; Wilhelm et al., 2010). In contrast to neuroticism, fewer studies have addressed the relation between extraversion and cognitive failures/complaints. There is, however, preliminary evidence of a negative relation (Hill et al., 2019; Steinberg et al., 2013; Wallace, 2004; Williams et al., 2017). As for extraversion, there is some preliminary evidence of a negative relation between openness and failures/complaints (Hill et al., 2020; Slavin et al., 2010; Wallace, 2004; Williams et al., 2017). Few studies have tested the association between agreeableness and cognitive failures/complaints. With some exceptions (Sutin et al., 2020; Wallace, 2004), the available evidence indicates that agreeableness is not reliably associated with cognitive failures/complaints. There is relatively consistent evidence that higher conscientiousness is associated with fewer cognitive failures/complaints (Buchanan, 2016, 2017; Hill et al., 2019; Könen & Karbach, 2018; Lane & Zelinski, 2003; Pearman & Storandt, 2004; Slavin et al., 2010; Steinberg et al., 2013; Sutin et al., 2020; Wallace, 2004; Williams et al., 2017).

Until now, it remains largely unanswered why personality correlates with cognitive failures and complaints. In this section, we summarize common hypotheses discussed in the literature by placing them in three conceptual models (see Figure 1). Briefly, the “cognitive abilities” model postulates that the association between personality and cognitive behavior is dependent on the individuals’ level of cognitive functioning. The “mental processes” model suggests that personality influences cognitive behavior through mental processes that are characteristic to the traits. The “reporting bias” model specifies that personality influences the judgment of cognitive capacities, which could lead to biases in self-reported behavior. It is likely that all three models explain part of the associations between personality and cognitive failures and complaints, but some models might explain more variance than others in specific trait-behavior associations. The models are not mutually exclusive and other mechanisms may also play an important role.

Cognitive abilities

The “cognitive abilities” model postulates that the relation between personality and cognitive failures/complaints is dependent on cognitive abilities. For example, individuals who are excitement-seekers, assertive, and cheerful (i.e., high in extraversion) are more likely to engage in complex social situations that keep them involved in cognitively rich activities (Stephan et al., 2014), thereby supporting their cognitive functioning and buffer against failures and complaints (Curtis et al., 2015). Moreover, individuals higher on openness are more likely to engage in intellectually demanding activities (Stephan et al.,

2014) that in turn enhance their cognitive functioning reserve (Chapman et al., 2012; Curtis et al., 2015; Soubelet & Salthouse, 2010) and may prevent failures and complaints. Likewise, personality may shape cognitive behavior through a cascade of effects on proximal health behaviors and cognitive health (Payne & Lohani, 2020). Such a model assumes that cognitive failures/complaints are the reflection of cognitive abilities and are significantly related to these abilities (but evidence for this association is mixed as previously stated). To our knowledge, no study has directly addressed this model. While studies have examined the link between personality and cognitive abilities (Curtis et al., 2015; Luchetti et al., 2016; Sutin et al., 2019) as well as the link between cognitive abilities and cognitive failures/complaints (Burmester et al., 2016), an empirical integration of these links in a time-ordered manner with cognitive failures/complaints as outcome is lacking.

While we focus in this review on cognitive failures/complaints as an outcome, cognitive failures/complaints can be hypothesized as potential mechanisms between personality and cognitive functioning. This scenario has been investigated in a longitudinal mediation model, in which cognitive complaints were identified as unidirectional mechanism: Whereas cognitive complaints mediated the effect of cognitive performance on neuroticism over 12 years, they did not mediate the effect of neuroticism on cognitive performance (Aschwanden et al., 2018).

Mental processes

In the “mental processes” model, personality traits are defined by characteristic mental processes that explain why individuals are more vulnerable or resilient to cognitive failures/complaints. For instance, individuals with high neuroticism tend to be more prone to rumination (i.e., repetitively thinking about the same issue), which may distract them from their ongoing behavior and action (Munoz et al., 2013). Behavioral factors linked to the traits may also influence these mental processes: High neuroticism, for example, has been associated with poor sleep (Duggan et al., 2014), which could contribute to daytime sleepiness and thereby impair mental processes, leading to more cognitive failures. Moreover, individuals who are high on conscientiousness tend to be organized, achievement oriented, persistent, and self-disciplined not only in self-reports, but also in their actual behavior in real life (Fleeson & Gallagher, 2009; Jackson et al., 2010). This organization may extend to their mental processes and such a structured mindset may help them to focus on what is going on around them and thus reduce cognitive failures and complaints (Könen & Karbach, 2018; Sutin et al., 2020). Further, being less forgiving and more aggressive (i.e., lower agreeableness) may interfere with the ability to follow through on cognitive actions, leading to more cognitive failures (Sutin et al., 2020). To date, such a mental processes model has not yet been tested, and research on personality and characteristic mental processes is rare. Previous research suggested that neuroticism is defined by greater mental noise (Flehmig et al., 2007; Robinson & Tamir, 2005) but studies for the remaining traits are lacking. Further work is needed on identifying characteristic mental processes. It would be important to simultaneously assess cognitive behavior and ongoing mental processes using multi-method approaches that include, for example, ambulatory assessments, electroencephalogram (EEG), and eye-tracking.

Reporting bias

The “reporting bias” model specifies that people view and judge themselves based on their personality traits, which could lead to biases in self-reported behavior. For example, individuals high in neuroticism tend to be overly critical of themselves and their cognitive functioning (Colvin et al., 2018; Mascherek et al., 2011), which in turn might make them more likely to report more cognitive failures. In contrast, individuals high in extraversion tend to have greater global self-efficacy and make more positive evaluations of their lives (Soto, 2015) and their health (Sutin & Terracciano, 2016), which may contribute to their confidence about their cognition and thus positively color their self-reports, resulting in less frequently reported failures and complaints (Hill et al., 2019; Sutin et al., 2020). Likewise, people with high openness tend to have a stronger belief in their intellectual capacities and creativity (Goldberg, 1999; John & Srivastava, 1999), which may lead to fewer perceived cognitive problems and result in less frequently reported failures and complaints. In such a model, self-reported behavior may reflect, in part, inappropriate general worry or objectively unjustified complaints (for neuroticism) and overestimated self-evaluations (for extraversion and openness), regardless of frequency of actual cognitive failures (Wilhelm et al., 2010). This tendency means that individuals refer to their typical self-view when they rate their cognitive behavior and thus may under- or overestimate them. With self-reports, it is not possible to differentiate between negatively or positively perceived self-judgments and actual cognitive behavior. Ambulatory assessment studies could potentially mitigate such biases as they reduce memory bias and heuristic processing (Conner & Mehl, 2015) and allow measurement of behavior when it occurs. Such studies are scarce in research on personality and cognitive behaviors, but those that exist indicate substantial relations for neuroticism and openness. Higher neuroticism, for example, has been associated with more real-time cognitive failures (Lange & Süß, 2014) and greater variability in cognitive complaints (Hill et al., 2020), whereas higher openness tends to be related to fewer daily cognitive complaints (Hill et al., 2020). These findings suggest that the association between neuroticism and openness and cognitive failures/complaints may not be due entirely to reporting bias, however, these studies still require the individual to recognize the behavior and make an attribution for it. Moreover, studies that include informant data may also help to reduce bias as these reports are independent from the participant’s personality. The few existing studies that have done so suggest significant associations of cognitive behavior with neuroticism and conscientiousness (Slavin et al., 2010; Sutin et al., 2019) as well as openness (Slavin et al., 2010). Further (ambulatory) research that also includes informant ratings and more objective indicators of cognitive behavior will help to disentangle potential reporting bias and actual behavior.

Literature search

Having introduced the conceptual models, the next section focuses on the present state of the existing empirical evidence. There are currently two published reviews on personality and cognitive failures/complaints. In 2016, Carrigan and Barkus reviewed the association between cognitive failures and broad psychological factors. Of the FFM personality traits, their review included neuroticism only, which was related to more cognitive failures (Carrigan & Barkus, 2016). A more recent review examined the relationships between all

FFM personality traits and subjective cognitive impairment in older adults without dementia (Koller et al., 2019), which supported the association of higher neuroticism and lower conscientiousness with greater self-reports of cognitive problems. No consistent relationships for openness, extraversion or agreeableness were identified. Koller and colleagues conclude that the complexity of the relationship between personality and reporting cognitive problems is not yet fully understood.

However, there has been no systematic attempt to quantitatively synthesize the evidence linking personality and cognitive behavior across the range of studies and methodologies that have addressed this association. We aimed to fill this gap by conducting a meta-analysis for each trait. Based on the previous literature (Carrigan & Barkus, 2016; Koller et al., 2019; Könen & Karbach, 2018; Sutin et al., 2020), we expected higher neuroticism and lower conscientiousness to be associated with more cognitive failures and complaints. The meta-analyses were prepared in accordance with the MOOSE recommendations for meta-analyses of observational studies (Stroup et al., 2000). The MOOSE checklist can be found in Table 1. The research question was formed using the PICO framework (Schardt et al., 2007) with P (participants) = *adults*; I (Intervention) = *no intervention / exposure, observational (cohort study)*; C (Comparison) = *level of personality traits (individual differences)*, and O (Outcome) = *cognitive failures or cognitive complaints*. A systematic literature search of five electronic databases covering all years up to 2020 was conducted during January-March 2020. The databases searched were MEDLINE provided by PubMed, Science Direct, Web of Science as well as psycINFO and psycARTICLES provided by APA PsycNet. The search terms used were *personality OR personality traits OR neuroticism OR conscientiousness OR extraversion OR openness OR openness to experience OR agreeableness OR five factor OR big five AND cognitive behaviors OR cognitive complaints OR memory complaints OR complaints OR cognitive failures*. Further, the reference lists of previous work were screened for additional studies. Studies on the relation between personality and cognitive failures or complaints were considered for this review if the following criteria were met: (1) *Study design*: Studies were cross-sectional, longitudinal, or had an ambulatory assessment design. (2) *Publication status*: Studies were published in an English language, peer-reviewed journal. (3) *Measure of outcome*: Studies reported how cognitive failures or cognitive complaints were measured. (4) *Measure of personality*: Studies reported how personality was measured and assessed at least one of the following traits: neuroticism, extraversion, openness, agreeableness, and/or conscientiousness.

We identified a total of 25 articles, which included 29 samples across all personality traits and study designs. The key characteristics of the studies that form the basis of this review are outlined in Table 2. In Table 3, we summarize the effect sizes as reported in the corresponding samples. Meta-analyses were conducted for cross-sectional studies that reported a correlation coefficient. The number of included samples varied across traits: neuroticism $k = 17$ (N = 10,564); extraversion $k = 12$ (N = 8,254); openness $k = 11$ (N = 8,514); agreeableness $k = 10$ (N = 7,642); conscientiousness $k = 13$ (9,404). Although we included at least 10 or more effect sizes, caution should be applied when interpreting the results. The meta-analytic findings should be considered as a snapshot of the current literature rather than as a definitive summary of whether personality affects cognitive behavior. Mean age ranged from 19.8 years (Wallace, 2004) to 81.2 years (Snitz et al.,

2015). Sample sizes ranged from 78 (Williams et al., 2017) to 5,133 participants (Sutin et al., 2020). In a sensitivity analysis, we included an additional sample of Buchanan (2016) with more than 49,000 participants. We did not include this sample in the primary analyses as it might skew the total sample size and potentially drive or mask the associations between effect size or significance and sample size. The findings of three longitudinal and four ambulatory assessment studies are qualitatively summarized as it was not possible to estimate pooled effect sizes with such small numbers of studies.

Statistical analysis.—For cross-sectional studies that reported a correlation coefficient, we calculated the pooled mean effect size using random-effect model meta-analyses. When studies examined several outcomes, these data points were averaged (Buchanan, 2017; Wilhelm et al., 2010). In four studies (Lane & Zelinski, 2003; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Williams et al., 2017), we flipped the reverse-coded effects to facilitate the interpretation. Between-study heterogeneity was quantified using tau^2, Hedges *Q*, and I^2 statistics (Higgins et al., 2003). I^2 ranges between 0% and 100%; values >50% were considered to represent large heterogeneity (Bellou et al., 2017).

We evaluated evidence of publication bias in our meta-analyses using three strategies. First, we examined the distribution of obtained effect sizes in a funnel plot and used the Egger's test for funnel plot asymmetry (Egger et al., 1997) to evaluate whether the distribution was significantly asymmetrical, which would be the case when publication bias is present. Second, a trim and fill procedure was applied to obtain a bias-corrected estimate of the overall effect (Duval & Tweedie, 2000). Third, we used the precision-effect test and precision-effect estimate with standard errors (PET-PEESE; Stanley and Doucouliagos, 2014) to estimate the effect size that would be expected in a study in which the standard error is zero. PET is a meta-regression approach to adjust for small-study effects (i.e., the tendency of studies with smaller samples to produce larger effect sizes) and assesses if there is a true effect beyond publication bias. If so (i.e., PET is significant), the additional PEESE provides a better estimate because it corrects for non-linear relationships between the reported effect size and standard errors (Stanley and Doucouliagos, 2014).

In a sensitivity analysis, we included a sample of Buchanan (2016), which had a size of N = 49,398. We further ran a series of meta-regressions to explore potential sources of heterogeneity. First, we tested whether the results differed between studies that assessed cognitive failures and studies that measured cognitive complaints. Second, we examined whether year of publication moderated the strength of the associations. To further test the generalizability of our findings, the following moderators were examined: country (USA vs. other), mean age of the sample (<65 vs. >65 years), proportion of gender (<60% vs. >60% female), proportion of minority (<20% vs. >20%), and personality measure. The latter was grouped by NEO Five-Factor Inventory (NEO-FFI) vs. not NEO-FFI. All moderators were dichotomized to facilitate meta-regressions, except for year of publication (continuous variable).

Finally, leave-one-out analyses were conducted to examine whether the degree of heterogeneity was driven by one specific study. The meta-analyses and meta-regressions were completed using the "metafor" package (Viechtbauer, 2010) in R software.

Neuroticism

By pooling the results from 17 cross-sectional studies, we found an overall $r = .39$, 95% CI [0.32, 0.45], $p < .001$ (forest plot in Figure 2), suggesting that higher neuroticism is linked to more cognitive failures/complaints. There was also significant heterogeneity (Q = 284.63, df = 16, $p < .001$; $I^2 = 91.88\%$). Some evidence for publication bias was indicated by the Egger's test (t = −2.74, $p = .015$), suggesting that small-study effects exist (i.e., small studies are predominately in direction of larger effect sizes). However, the bias-corrected (trim and fill) estimate of effect size was identical to that obtained in the primary model ($r = .39$, 95% CI [0.32, 0.45]). Referring to PET, there was a true effect beyond publication bias ($b_0 = 0.64$, $p < .001$). PEESE was thus considered ($b_0 = 0.61$, $p < .001$), indicating that even when controlling for small-study effects, there seems to be a significant association between neuroticism and cognitive failures/complaints in an idealized study in which the standard error (i.e., parameter estimation error due to sampling error variance) is simulated to be zero.

The sensitivity analysis that included the large sample (N = 49,398) of Buchanan (2016) showed that the association was unchanged ($r = .39$, 95% CI [0.32, 0.45]), but heterogeneity was larger (Q = 386.29, df = 17, $p < .001$; $I^2 = 95.93\%$). The leave-one-out analyses indicated that heterogeneity was mainly due to the study of Sutin et al. (2020) and heterogeneity was slightly reduced with its exclusion (Q = 99.01, df = 16, $p < .001$; $I^2 = 86.77\%$). The meta-regressions did not identify factors that moderated the meta-analytic results for neuroticism.

Three studies investigated the relationship between neuroticism and cognitive failures/complaints longitudinally. In all studies, higher neuroticism was related to a greater likelihood of reporting memory problems (Comijs et al., 2002) and complaining more often about memory (Lane & Zelinski, 2003) or general cognition (Aschwanden et al., 2018) over time. Furthermore, four studies examined the association in daily life (n = 3 ambulatory assessment; n = 1 daily diary). Thereof, three studies reported that higher trait neuroticism predicted greater variability in reports of memory failures (Neupert et al., 2006) and cognitive complaints (Hill et al., 2020). Further, higher trait neuroticism was related to more real-time cognitive failures (Lange & Süß, 2014). Of note, the relation with real-time cognitive failures was even stronger ($rs = .31$, $p = .003$) than with general cognitive failures ($r = .22$, $p = .039$) (Lange & Süß, 2014).

Extraversion

When the 12 cross-sectional studies were pooled, a significant association between higher extraversion and fewer cognitive failures/complaints was found ($r = -.14$, 95% CI [−.20, −.08], $p < .001$; see Figure 3). Both the Q and I^2 values indicated heterogeneity (Q = 60.83, df = 11, $p < .001$; $I^2 = 78.26\%$). The Egger's test was statistically significant (t = 2.52, $p = .031$), although the trim-fill bias-corrected effect size was identical to that obtained in the primary model ($r = -.14$, 95% CI [−.20, −.08]). PET was significant ($b_0 = -.26$, $p < .001$) and PEESE indicated a significant effect for extraversion on cognitive behavior when controlling for small-study effects ($b_0 = -.25$, $p < .001$).

The inclusion of Buchanan's large sample (2016; N = 49,398) did not change the association (r = −.14, 95% CI [−.19, −.09]) but it increased heterogeneity (Q = 124.93, df = 12, p <.001; I^2 = 89.55%). The leave-one-out analyses indicated that heterogeneity was mainly due to the study of Sutin et al. (2020) and heterogeneity was slightly reduced with its exclusion (Q = 27.26, df = 11, p = .002; I^2 = 64.50%). Proportion of gender moderated the association between higher extraversion and fewer failures/complaints (Z = 3.10, p = .002), such that the association was stronger in samples with <60% women (r = −.24, 95% CI [−.27, −.21]) than in those with >60% women (r = −.10, 95% CI [−.17, −.03]).

Only one study (Hill et al., 2020) had a design other than cross-sectional, reporting no significant relation between extraversion and cognitive failures/complaints in daily life.

Openness

The findings from 11 cross-sectional studies were pooled and a significant association between higher openness and fewer cognitive failures/complaints was found (r = −.07, 95% CI [−.11, −.03], p <.001; Figure 4). Heterogeneity was non-significant according to the Q-value and less than moderate referring to the I^2-value (Q = 17.27, df = 10, p = .069; I^2 = 46.09%). The Egger's test was non-significant (t = 0.63, p = .542). The bias-corrected effect sizes were similar to that obtained in the primary model (trim-fill: r = −.08, 95% CI [−.12, −.04]; PET-PEESE: adjusted estimate = −.08, p <.001).

The inclusion of Buchanan's large sample (2016; N = 49,398) slightly weakened the association (r = −.06, 95% CI [−.10, −.01]) and increased heterogeneity to a large extent (Q = 85.19, df = 11, p <.001; I^2 = 82.59%). The leave-one-out analyses indicated that heterogeneity was mainly due to the study of Williams et al. (2017; study 1): With its exclusion, heterogeneity was reduced in I^2-statistics (I^2 = 18.36%) and remained statistically non-significant in Q-statistics (Q = 12.13, df = 10, p = .206). The meta-regressions did not identify factors that moderated the meta-analytic results for openness.

As for extraversion, only one study was not cross-sectional: Higher openness was related to fewer daily cognitive complaints (Hill et al., 2020).

Agreeableness

The meta-analysis of 10 studies showed a significant association of higher agreeableness with fewer cognitive failures/complaints (r = −.13, 95% CI [−.21, −.05], p <.001; Figure 5). There was heterogeneity around the mean effect size in the observed studies (Q = 122.47, df = 9, p <.001; I^2 = 85.06%). The Egger's test was significant (t = 3.77, p = .006). Of note, however, if any bias exists, it seems to *reduce* rather than increase the effect size. The effect for agreeableness in the largest sample (Sutin et al., 2020) was the largest of all studies (r = −.33) and smaller studies with effects larger than this effect are missing. The bias-corrected effect sizes were thus larger than the effect obtained in the primary model (trim-fill: r = −.18, 95% CI [−.26, −.11]; PET-PEESE: adjusted estimate = −.34, p <.001).

The inclusion of Buchanan's large sample (2016; N = 49,398) did not change the association (r = −.14, 95% CI [−.21, −.07]) but heterogeneity was increased (Q = 144.86, df = 10, p <.001; I^2 = 95.05%). The leave-one-out analyses indicated that heterogeneity was mainly

due to the study of Sutin et al. (2020) and heterogeneity was reduced with its exclusion (Q = 17.10, df = 9, p = .029; I^2 = 54.12%). The meta-regressions identified two factors that moderated the association between agreeableness and failures/complaints. First, measure of cognitive behavior was a significant moderator (Z = 3.02, p = .003), such that the association was stronger in studies that assessed cognitive failures (r = −.22, 95% CI [−.33, −.11]) than in those measuring cognitive complaints (r = −.05, 95% CI [−.10, −.01]). Proportion of minority (Z = −2.12, p = .034) was the second moderator: The association between higher agreeableness and fewer failures/complaints was stronger in samples with >20% minority (r = −.22, 95% CI [−.35, −.08]) than those with <20% minority (r = −.07, 95% CI [−.14, −.01]).

No study has examined this association longitudinally and the one identified ambulatory assessment study (Hill et al., 2020) reported no significant relation between agreeableness and cognitive complaints in daily life.

Conscientiousness

The meta-analysis of 13 studies suggested that higher conscientiousness was associated with fewer cognitive failures/complaints (r = −.36, 95% CI [−.42, −.29], p <.001; Figure 6). Heterogeneity around the mean effect size was found (Q = 113.70, df = 12, p <.001; I^2 = 88.52%). No evidence for publication bias was found; the Egger's test was non-significant (t = 0.91, p = .384) and the bias-corrected estimates showed robust effects for conscientiousness (trim-fill: r = −.33, 95% CI [−.40, −.26]; PET-PEESE: adjusted estimate = −.45, p <.001).

The effect was slightly stronger (r = −.38, 95% CI [−.45, −.31], p <.001) when including Buchanan's large sample (2016; N = 49,398), but heterogeneity increased (Q = 660.12, df = 13, p <.001; I^2 = 96.39%). The leave-one-out analyses indicated that heterogeneity was mainly due to the study of Slavin et al. (2010) and heterogeneity was slightly reduced with its exclusion (Q = 68.58, df = 12, p <.001; I^2 = 84.86%). The meta-regressions did not identify factors that moderated the meta-analytic findings. Of note, age did not moderate the meta-analytic association, although a previous study that tested age as a moderator suggested that the correlation between higher conscientiousness and fewer cognitive failures is stronger in younger than older adulthood (Sutin et al., 2020). Future studies need to test whether age moderates the association between conscientiousness and cognitive behavior.

The association has rarely been investigated longitudinally or in daily life. Conscientiousness was related negatively to memory complaints over three years (Lane & Zelinski, 2003) and was unrelated to cognitive complaints in daily life (Hill et al., 2020).

Summary

The meta-analytic results showed that higher neuroticism and lower conscientiousness were related to more cognitive failures and complaints with moderate effect sizes. Lower scores on extraversion, openness, and agreeableness were also associated with more cognitive failures and complaints, yet to a weaker extent. We found some evidence for publication bias: For neuroticism and extraversion, small-study effects may exist, but the bias-corrected effects were of similar size than those obtained in the primary models; while for

agreeableness, publication bias may reduce rather than increase the actual effect size. The associations of neuroticism, openness, and conscientiousness did not vary by the tested moderators. The association of extraversion was stronger in samples with <60% women, while the association of agreeableness was stronger in studies that assessed cognitive failures (vs. complaints) and in samples with >20% minority.

Limitations and Future Directions

In this section, we discuss the limitations in the literature on personality and cognitive failures and complaints, which can be addressed by future research. With the current empirical evidence, it is not possible to tell which of the three conceptual models explains how much of the associations or whether some trait associations are more likely than others to be accounted by the suggested models. These models need to be tested and compared with appropriate study designs that also identify potential mechanisms. For neuroticism, the mental processes model may explain more variance than the others, given that mental noise has been suggested as a characteristic process (Flehmig et al., 2007; Robinson & Tamir, 2005) and previous research indirectly weakens the models of cognitive abilities (Aschwanden et al., 2018) and reporting bias (Hill et al., 2020; Lange & Süß, 2014; Slavin et al., 2010; Sutin et al., 2019). For the remaining traits, it is difficult to suggest a specific model without speculating too much beyond the available data.

Current literature is limited by a predominant use of cross-sectional data, which potentially threatens the internal validity (the extent to which the estimated association in the study corresponds to a causal effect from exposure to outcome). We identified only three longitudinal studies (Aschwanden et al., 2018; Comijs et al., 2002; Lane & Zelinski, 2003) but none included extraversion, openness, or agreeableness. There is a need for longitudinal studies that examine how the variables of interest change over time and provide insights into the direction of these relationships. This is particularly relevant for testing the model of cognitive abilities, which requires a temporal order where cognitive behavior represents the outcome.

The literature is further dominated by self-reported data. Compared to self-reports, informants may be able to more accurately rate cognitive behavior – at least independent of the participant's personality. It should be noted, however, that the informants' personality may influence their cognitive rating: It has been shown that informants with higher neuroticism provided higher estimates of memory difficulties in the person they were rating (Buchanan & Loveday, 2018). Nevertheless, the few existing studies on personality and informant-rated cognitive behavior suggest that the associations found with self-reports are robust when using other raters. In a cross-sectional study that included three of the five personality traits, higher neuroticism and both lower openness and conscientiousness were associated with more informant-reported memory complaints (Slavin et al., 2010). In a longitudinal study that assessed all five traits, participants who reported themselves as higher in neuroticism and lower in conscientiousness at baseline were rated by informants as having more cognitive difficulties 10 years later (Sutin et al., 2019). These studies suggest that the association of neuroticism, openness, and conscientiousness with cognitive behavior are not due to reporting bias and weaken the reporting bias model. Future studies that incorporate

informant data and/or objective indicators of cognitive behavior may help to reduce potential biases, replicate previous findings, and further allow testing the reporting bias model.

Future research may also address two further issues related to measurement. First, the construct validity (the extent to which measured variables capture the concepts intended to assess with those measures) of the associations may be threatened when the measurements of the predictor and the outcome are similar. For example, the item “Do you forget to buy something you planned to buy, like a birthday card, even when you see the shop?” is used to assess memory failures, however, it may remind the reader of items that capture conscientiousness. While some studies have used scales with limited overlap (Aschwanden et al., 2018; Buchanan, 2016; Kliegel & Zimprich, 2005; Williams et al., 2017), this issue could be further addressed with future studies that conduct sensitivity analyses by excluding potentially overlapping items or innovatively develop and test new measurements (Lange & Süß, 2014). Second, it might be of interest to consider facets within the personality traits. For instance, conscientiousness is comprised of the following facets: competence, order, dutifulness, achievement striving, self-discipline, and deliberation (Costa & McCrae, 1992). Some facets can have more predictive power than the overarching trait (Paunonen et al., 2003) or go in opposite directions, obscuring the association at the trait level (Sutin et al., 2011). Few studies have examined the association of facets with cognitive failures or complaints (Sutin et al., 2020), and more research is needed at the facets, or even at the item level, to gain a more nuanced understanding of the mechanisms underlying the associations (McCrae, 2016; Mõttus et al., 2019).

Moreover, publication bias may be present for three of the five traits. However, the number of studies was relatively small and there was little consistency across the various methods to evaluate publication biases. Still, the effects for neuroticism and extraversion may be overestimated in current literature, while the effect of agreeableness may be underestimated. There exist multiple ideas on how to reduce publication bias such as mandatory publication, negative results journals/articles, open reviewing, peer-review training and accreditation, post-publication review, pre-study publication of methodology, published rejection lists, research registration, and two-stage review (Carroll et al., 2017). Whilst some of them are difficult to tackle as a researcher (e.g., mandatory publication), others can be addressed with less difficulty. For instance, the avoidance of questionable research practices (e.g., optional removal of outliers, optional selection between two dependent variables, optional use of moderators, and optional stopping) and the willingness to carefully design and conduct pre-registered replications as well as to run sensitivity analyses (Carter et al., 2019) may make small, but feasible and appropriate changes in order to reduce publication bias as a single researcher.

Finally, the meta-analyses indicated heterogeneity across studies for all personality traits and we identified some of the sources for these variations. It should be noted, however, that we did not formulate specific hypotheses for the moderator variables; we rather explored them to form some basis for future research. Our results may inspire future studies to conduct preregistered replication efforts, which remains essential to establish these associations. For example, the association of agreeableness was stronger in studies that assessed cognitive failures than those measuring complaints; thus, future work is needed to clarify whether the

association varies across failures and complaints. Further, we identified proportion of gender as source of heterogeneity for extraversion and proportion of minority as source of heterogeneity for agreeableness. Future work may test whether these associations vary by gender and minority. For the remaining traits, sources for heterogeneity still need to be identified since none of the moderators we tested was significant.

Conclusion

Strengths of this work include the presentation of three conceptual models, the literature review that covered nearly the entire adult lifespan from 18 to 91 years and included findings from ambulatory assessment and longitudinal studies, and five separate meta-analyses that considered publication bias and potential moderator variables. Nonetheless, meta-analyses have limitations and should thus be used to understand broad trends in a particular research field and not to establish the indisputable truth of predictor-outcome relations (Carter et al., 2019). The following limitations should be considered when interpreting our findings. The meta-analyses were based on cross-sectional studies as we identified only three longitudinal studies (Aschwanden et al., 2018; Comijs et al., 2002; Lane & Zelinski, 2003), thereof none addressing extraversion, openness, or agreeableness. We can thus not disentangle temporal order and causal pathways. It could be that the associations are reciprocal, such that cognitive behavior influences personality traits. Furthermore, some of the studies included in the present review are based on the same data sets. For example, data from the Interdisciplinary Longitudinal Study of Adult Development (ILSE) was used by three research groups (Aschwanden et al., 2018; Kliegel et al., 2005; Kliegel & Zimprich, 2005) and data from the RHYTHM (Realizing Healthy Years Through Health Maintenance) study was used by two research groups (Aschwanden et al., 2019; Hill et al., 2020). The re-use of data sets may bias the present review and inflate confidence in specific associations; however, it should be noted that different temporal aspects (cross-sectional vs. longitudinal in ILSE) or variables (trait personality vs. personality-related behavior in RHYTHM) were considered within the same data sets.

To conclude, the FFM personality traits were associated with cognitive behavior, with stronger associations for neuroticism and conscientiousness. We presented the conceptual models “cognitive abilities”, “mental processes”, and “reporting bias”, which might be tested by future studies. We further identified common limitations of this literature and we made suggestions for future research that may contribute to ongoing efforts to better understand the associations between personality and cognitive failures and complaints.

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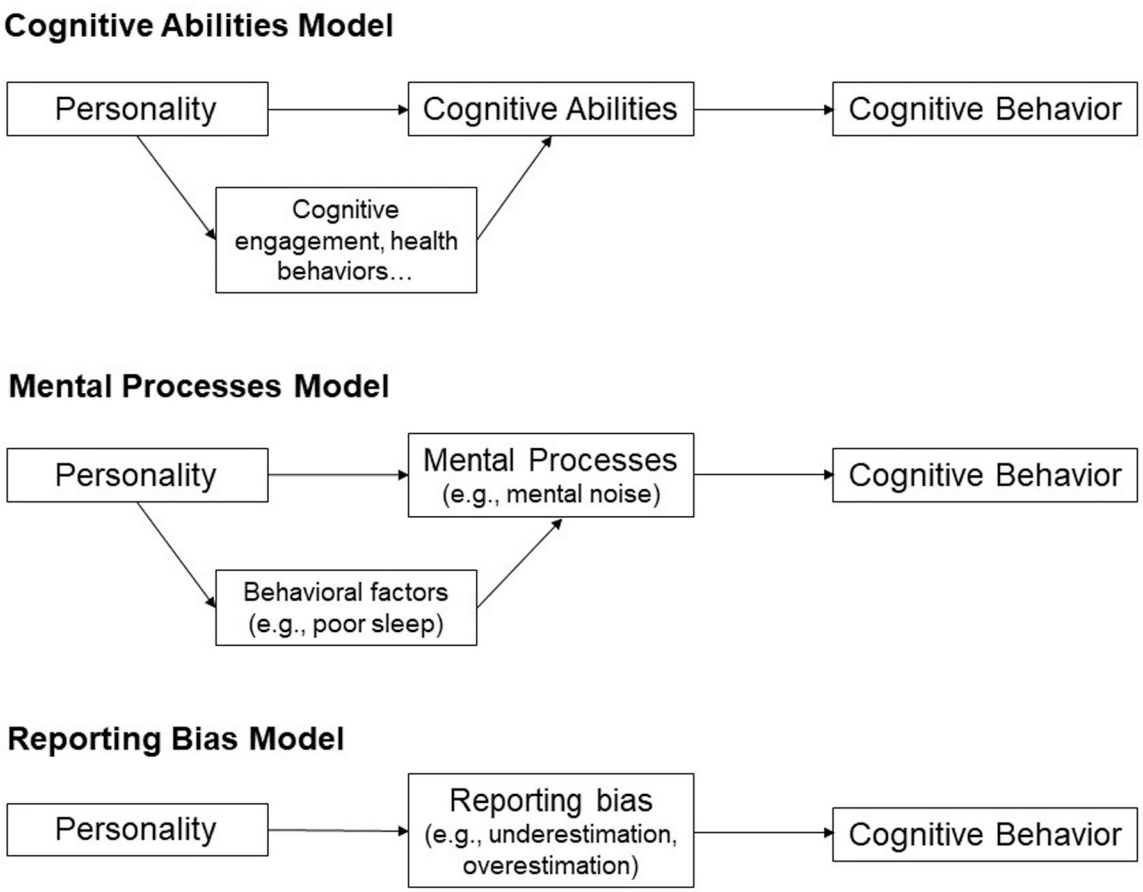

Figure 1.

Simplified illustration of the three conceptual models. The “cognitive abilities” model postulates that the association between personality and cognitive behavior is dependent on the individuals’ level of cognitive functioning. The “mental processes” model suggests that personality influences cognitive behavior through mental processes that are characteristic to the traits. The “reporting bias” model specifies that personality influences the judgment of cognitive capacities, which could lead to biases in self-reported behavior. It is likely that all three models explain part of the associations between personality and cognitive behavior, but some models might explain more variance than others in specific trait-behavior associations. The models are not mutually exclusive and other mechanisms may also play an important role.

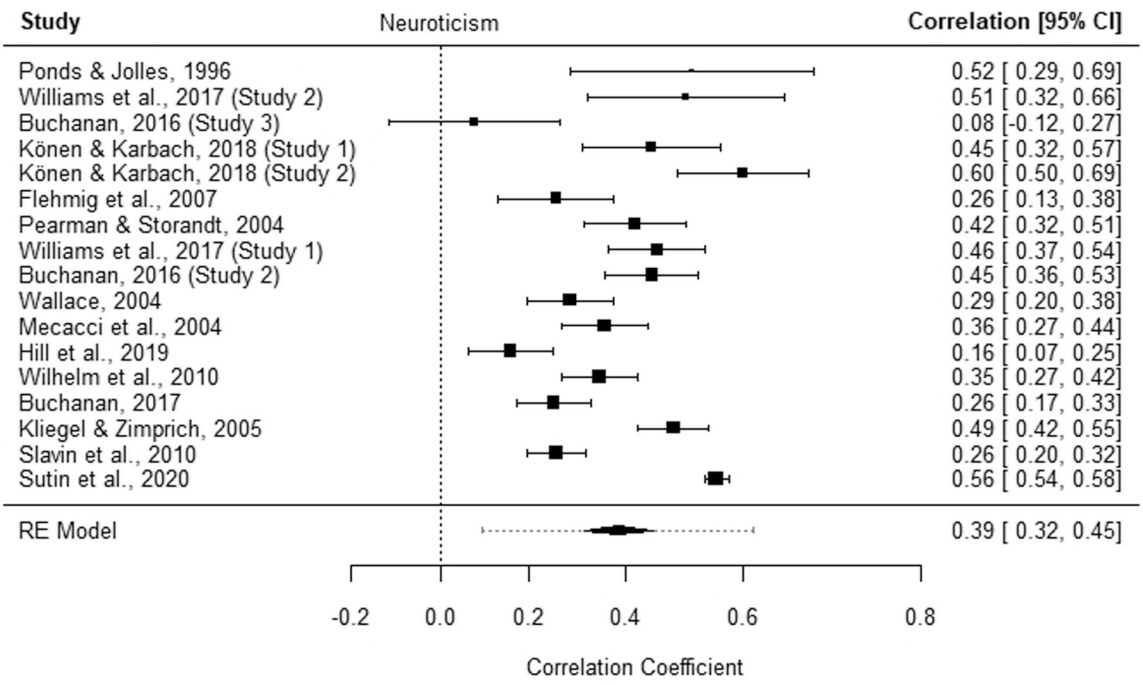

Figure 2.

Forest plot for neuroticism. The plot summarizes the individual study estimates and the average effect of the random-effects (RE) model. Effect sizes are displayed in correlation coefficients with corresponding 95% confidence intervals (95% CI). The x-axis ranges from $r = -.20$ to $r = .80$. Studies are listed in order of their sample size (i.e., smallest to largest).

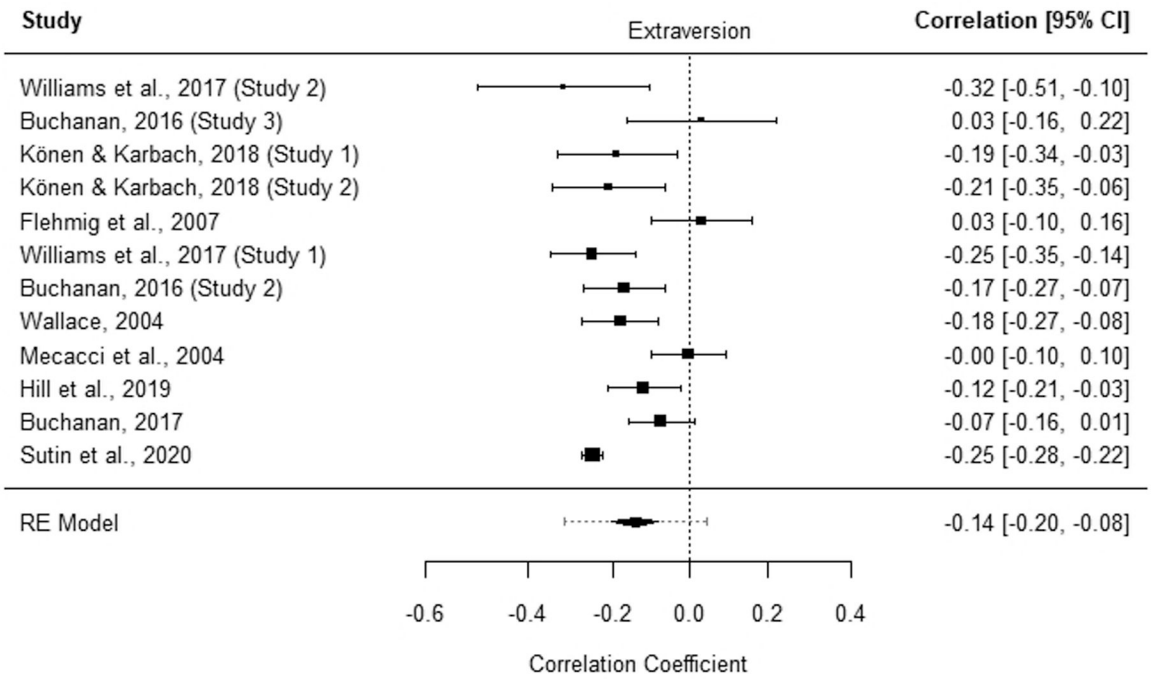

Figure 3.

Forest plot for extraversion. The plot summarizes the individual study estimates and the average effect of the random-effects (RE) model. Effect sizes are displayed in correlation coefficients with corresponding 95% confidence intervals (95% CI). The x-axis ranges from $r = -.60$ to $r = .40$. Studies are listed in order of their sample size (i.e., smallest to largest).

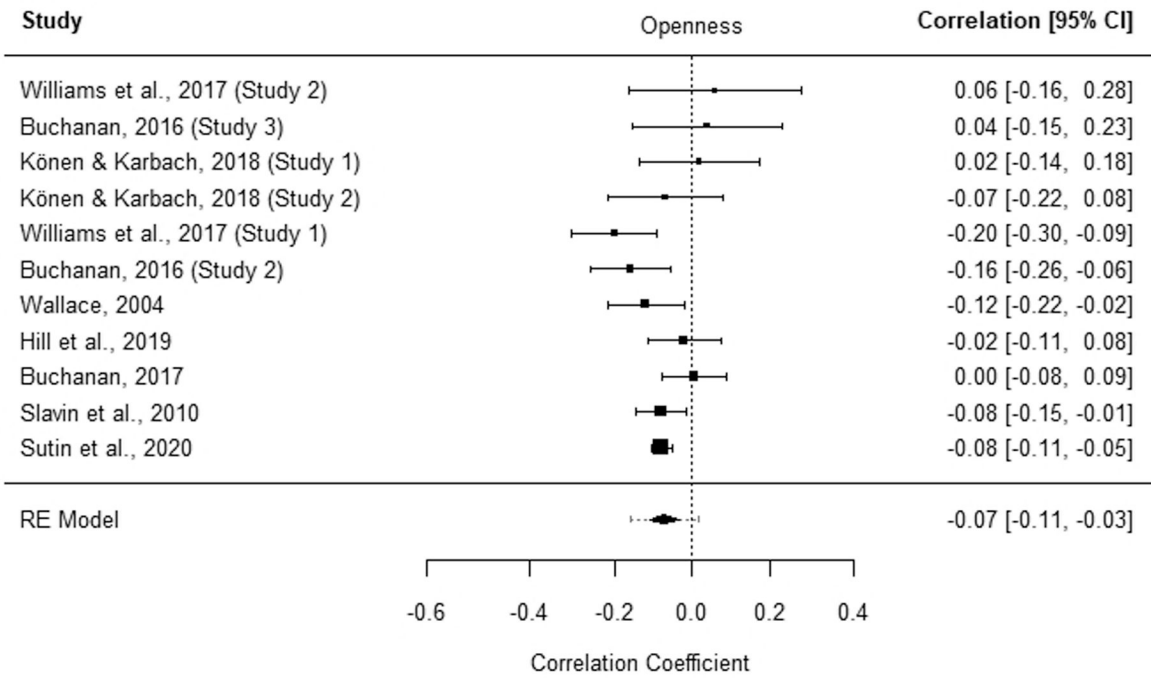

Figure 4.

Forest plot for openness. The plot summarizes the individual study estimates and the average effect of the random-effects (RE) model. Effect sizes are displayed in correlation coefficients with corresponding 95% confidence intervals (95% CI). The x-axis ranges from $r = -.60$ to $r = .40$. Studies are listed in order of their sample size (i.e., smallest to largest).

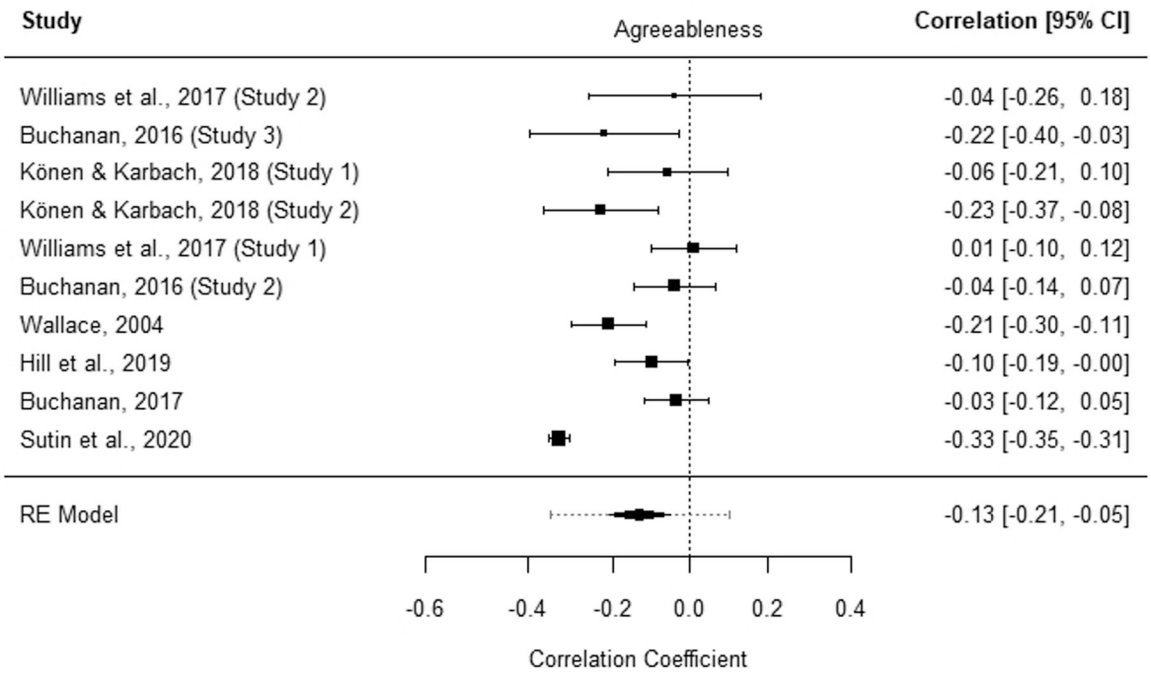

Figure 5.

Forest plot for agreeableness. The plot summarizes the individual study estimates and the average effect of the random-effects (RE) model. Effect sizes are displayed in correlation coefficients with corresponding 95% confidence intervals (95% CI). The x-axis ranges from $r = -.60$ to $r = .40$. Studies are listed in order of their sample size (i.e., smallest to largest).

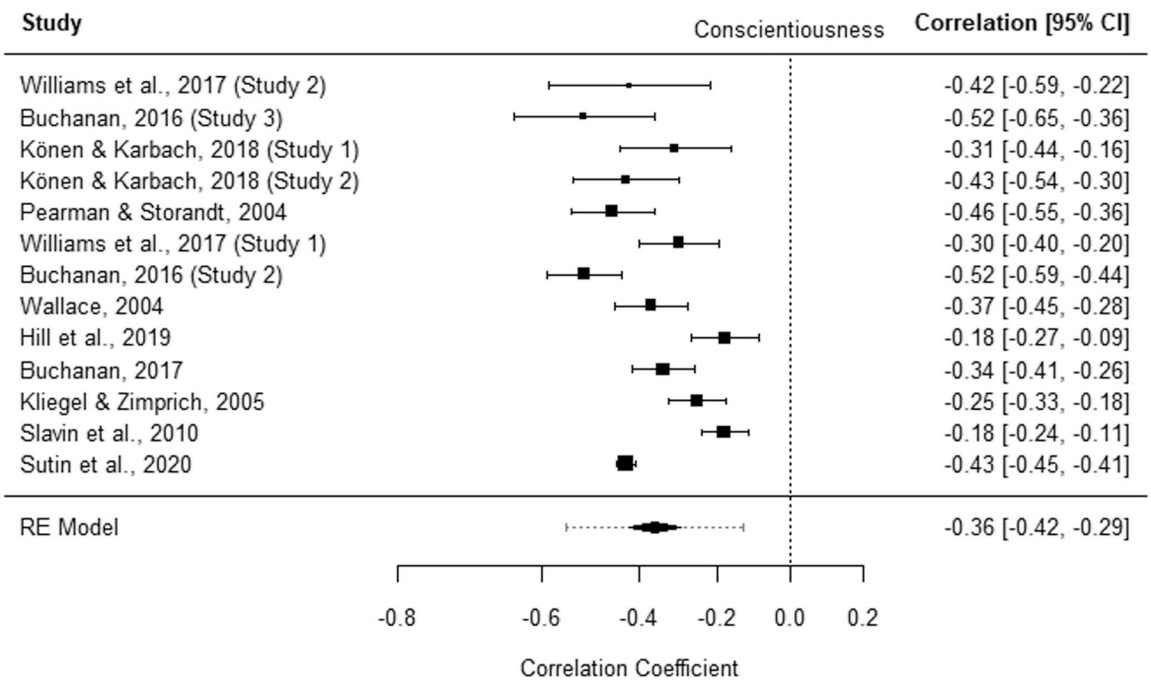

Figure 6.

Forest plot for conscientiousness. The plot summarizes the individual study estimates and the average effect of the random-effects (RE) model. Effect sizes are displayed in correlation coefficients with corresponding 95% confidence intervals (95% CI). The x-axis ranges from $r = -.80$ to $r = .20$. Studies are listed in order of their sample size (i.e., smallest to largest).

Table 1:

MOOSE Checklist for Meta-Analyses of Observational Studies

Item No	Recommendation	Reported on Page No
Reporting of background should include		
1	Problem definition	7
2	Hypothesis statement	7
3	Description of study outcome(s)	4, 8
4	Type of exposure or intervention used	8
5	Type of study designs used	8
6	Study population	4
Reporting of search strategy should include		
7	Qualifications of searchers (e.g., librarians and investigators)	Title page
8	Search strategy, including time period included in the synthesis and key words	8
9	Effort to include all available studies, including contact with authors	8
10	Databases and registries searched	8
11	Search software used, name and version, including special features used	-
12	Use of hand searching (e.g., reference lists of obtained articles)	8
13	List of citations	Table 2
14	Method of addressing articles published in languages other than English	-
15	Method of handling abstracts and unpublished studies	-
16	Description of any contact with authors	-
Reporting of methods should include		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	8
18	Rationale for the selection and coding of data	8
19	Documentation of how data were classified and coded	8–9
20	Assessment of confounding	8
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	-
22	Assessment of heterogeneity	8
23	Description of statistical methods	8–9
24	Provision of appropriate tables and graphics	Tables 1-3, Figs 2–6
Reporting of results should include		
25	Graphic summarizing individual study estimates and overall estimate	Figs 2–6
26	Table giving descriptive information for each study included	Table 2
27	Results of sensitivity testing	9–12
28	Indication of statistical uncertainty of findings	9–12, 14

Table 2

Characteristics of the studies included in the review.

Year	Authors	Design	N	Age	Personality	Cognitive behavior
2019	Bell, Hill, & Stavrinos	CS	50	M=71.76	N, E, O, A, C (BFI)	Subjective executive function (Behavioral Rating Inventory of Executive Function-Adult)
1996	Ponds & Jolles	CS	52	M=63	N (Dutch neuroticism questionnaire)	Memory complaints (Metamemory in Adulthood Questionnaire; Memory Assessment Clinics Self-Rating Scale)
2015	Snitz et al.	CS	92	M=81.2	N, E, O, A, C (NEO-FFI)	Cognitive complaints (Memory Functioning; Questionnaire; Cognitive Failures Questionnaire; Subjective Cognitive Complaints Scale)
2013	Steinberg et al.	CS	125	M=77.00; range: 65–95	N, E, O, A, C (NEO-FFI)	Memory Complaints (Prospective Retrospective Memory Questionnaire)
2018	Könen & Karbach	CS	176	M=24.8; range: 19–39	N, E, O, A, C (BFI)	Cognitive failures (Cognitive Failures Questionnaire)
2007	Flehmig, Steinborn, Langner, & Westhoff	CS	222	M=31.4	N, E (EPI-Q revised)	Cognitive failures (Cognitive Failures Questionnaire)
2004	Pearman & Storandt	CS	283	M=70.6; range: 45–89	N, C (NEO-FFI)	Subjective memory (Memory Assessment Clinics Self-Rating Scale)
2005	Kliegel, Zimprich, & Eschen	CS	291	M=66.87	N, C (NEO-FFI)	Cognitive complaints (Nuremberg Self-Assessment List)
2017	Williams et al.	CS	study 1: 315; study 2: 78	study 1: M=20.8; study 2: M=27.0	N, E, O, A, C (NEO-PI-R)	Attentional control problems (Attentional Control Scale)
2004	Wallace	CS	386	M=19.8	N, E, O, A, C (Saucier's Mini-Markers)	Cognitive failures (Cognitive Failures Questionnaire)
2004	Mecacci, Righi, & Rocchetti	CS	390	range: 19–26 y	N, E (EPI-Q)	Cognitive failures (Cognitive Failures Questionnaire)
2019	Hill et al.	CS	425	M=76.68	N, E, O, A, C (IPIP)	Memory problems ("In the past year, how often did you have trouble remembering things?")
2010	Wilhelm, Witthöft, & Schipolowski	CS	496	M=25.00	N (Tupes and Christal battery)	Cognitive failures (Cognitive Failures Questionnaire)
2017	Buchanan	CS	523	range: 16–75	N, E, O, A, C (IPIP)	Memory problems (Prospective and Retrospective Memory Questionnaire)
2005	Kliegel & Zimprich	CS	607	M=62.9; range: 59–65	N, C (NEO-FFI)	Cognitive complaints (Nuremberg Self-Assessment List)
2010	Slavin et al.	CS	872	M=78.55; range: 70–90	N, O, C (NEO-FFI)	Cognitive complaints (Memory Complaint Questionnaire)
2020	Sutin, Aschwanden, Stephan, & Terracciano	CS	5133	M=44.63; range: 18–91	N, E, O, A, C (BFI)	Cognitive failures (Cognitive Failures Questionnaire)
2016	Buchanan	CS	49398	range: 16–85	N, E, O, A, C (IPIP)	Executive function problems (Webexec)
2003	Lane & Zelinski	L (3 y)	97	M=58.3; range: 30–81	N, C (NEO-PI-R)	Subjective memory (Memory Functioning Questionnaire)
2018	Aschwanden, Kliegel, & Allemand	L (12 y)	500	M=62.97; range: 60–64	N (NEO-FFI)	Cognitive complaints (Nuremberg Self-Assessment List)

Year	Authors	Design	N	Age	Personality	Cognitive behavior
2002	Comijs et al.	L (6 y)	2032	M=68.3	N (Dutch Personality Inventory)	Memory complaints (“Do you have complaints about your memory?”)
2008	Neupert, Mroczek, Spiro	DD	333	M=73.37; range: 44–89	N (EPI-Q)	Everyday memory failures (Questionnaire on Speech, Reading and Writing, Faces and Places, Actions, and Learning New Things + one item on medication adherence)
2014	Lange & Süss	AA	91	range: 60–76 years	N (BFI)	Cognitive failures (Questionnaire for Cognitive Failures in Everyday Life)
2019	Aschwanden, Luchetti, & Allemand	AA	136	M=70.45; range: 60–91	N, O (DBC)	Cognitive Complaints (adapted items from Nuremberg Self-Assessment List)
2020	Hill, Aschwanden, Payne, & Allemand	AA	136	M=70.45; range: 60–91	N, E, O, A, C (BFI)	Cognitive Complaints (adapted items from Nuremberg Self-Assessment List)

Note. CS = cross-sectional; L = longitudinal (years); DD = daily diary; AA = ambulatory assessment; N = neuroticism; E = extraversion; O = openness; A = agreeableness; C = conscientiousness; NEO-PI-R = NEO-Personality Inventory revised; NEO-FFI = NEO-Five Factor Inventory; EPI-Q = Eysenck Personality Questionnaire; BFI = Big Five Inventory; IPIP = International Personality Item Pool; DBC = Daily Behavior Checklist. Studies are listed in order of their sample size (i.e., smallest to largest) in each category (cross-sectional, longitudinal, ambulatory assessment). The meta-analyses included only cross-sectional studies that reported a correlation coefficient.

Table 3

Association between Personality and Cognitive Failures/Complaints in Each Study

Cross-sectional studies (r)	Sample size	Effect	N	E	O	A	C
Ponds & Jolles, 1996	52	r	**.52**	n.a.	n.a.	n.a.	n.a.
Williams et al. (sample 2), 2017	78	r	**.51**	**−.32**	**.06**	−.04	**−.42**
Buchanan (sample 3), 2016	103	r	.08	.03	.04	**−.22**	**−.52**
Könen & Karbach, 2018 (sample 1)	158	r	**.45**	**−.19**	.02	−.06	**−.31**
Könen & Karbach, 2018 (sample 2)	176	r	**.60**	**−.21**	−.07	**−.23**	**−.43**
Flehmig et al., 2007	222	r	**.26**	.03	n.a.	n.a.	n.a.
Pearman & Storandt, 2004	283	r	**.42**	n.a.	n.a.	n.a.	**−.46**
Williams et al. (sample 1), 2017	315	r	**.46**	**−.25**	**−.20**	.01	**−.30**
Buchanan (sample 2), 2016	345	r	**.45**	**−.17**	**−.16**	−.04	**−.52**
Wallace, 2004	386	r	**.29**	**−.18**	**−.12**	**−.21**	**−.37**
Mecacci et al., 2004	390	r	**.36**	.00	n.a.	n.a.	n.a.
Hill et al., 2019	425	r	**.16**	**−.12**	−.02	**−.10**	**−.18**
Wilhelm et al., 2010	496	r	**.35**	n.a.	n.a.	n.a.	n.a.
Buchanan, 2017	523	r	**.26**	−.08	.01	−.04	**−.34**
Kliegel & Zimprich, 2005	607	r	**.49**	n.a.	n.a.	n.a.	**−.25**
Slavin et al., 2010	872	rp	**.26**	n.a.	**−.08**	n.a.	**−.18**
Sutin et al., 2020	5,133	r	**.56**	**−.25**	**−.08**	**−.33**	**−.43**
Buchanan, 2016 (sample 1)	49,398	r	**.37**	**−.11**	**.02**	**−.20**	**−.58**
Further cross-sectional studies							
Bell et al., 2019	50	b	.33	−.14	−.03	−.15	−.24
Snitz et al., 2015	92	F	**4.77**	n.a.	n.a.	n.a.	n.a.
Steinberg et al., 2013	125	b	**.51**	**−.47**	.01	.01	**−.45**
Kliegel et al., 2005	291	b	**.15**	n.a.	n.a.	n.a.	**−.05**
Other study designs							
Lane & Zelinski, 2003 (L; 3y)	97	r	**.36**	n.a.	n.a.	n.a.	−.34
Aschwanden et al., 2018 (L; 12y)	500	r	**.46**	n.a.	n.a.	n.a.	n.a.
Comijs et al., 2002 (L; 6y)	2,032	OR	**1.48**	n.a.	n.a.	n.a.	n.a.
Neupert et al., 2008 (DD)	333	B	**.02**	n.a.	n.a.	n.a.	n.a.
Lange & Süss, 2014 (AA)	91	r	**.31**	n.a.	n.a.	n.a.	n.a.
Aschwanden et al., 2019 (AA)	136	μβ	.03	n.a.	n.a.	n.a.	n.a.
Hill et al., 2020 (AA)	136	b	**.24**	.01	**−.21**	.06	−.13

Note. N = neuroticism; E = extraversion; O = openness; A = agreeableness; C = conscientiousness; r = correlation coefficient; rp= partial correlation coefficient (Slavin et al., 2010, controlled for age, sex, and education); OR = odds ratio; b = standardized regression coefficient; B = unstandardized regression coefficient; F = F statistics from ANOVA; μβ = standardized Bayesian estimate; n.a. = not available (i.e., trait was not included in this study); L = longitudinal (years); DD = daily diary; AA = ambulatory assessment. In four studies (Lane & Zelinski, 2003; Pearman & Storandt, 2004; Ponds & Jolles, 1996; Pearman & Storandt, 2004; Williams et al., 2017), the original effect is reported in reverse based on the direction of scoring. We flipped it here to facilitate the interpretation. Bolded values are statistically significant α = .05. For correlation and regression coefficients, values of .10 represent small associations, values of .30 represent moderate associations, and values of .50 or larger represent strong associations (Cohen, 1988). Studies are listed in order of their sample size (i.e., smallest to largest) in each category (cross-sectional, longitudinal, ambulatory assessment). The meta-analyses included only cross-sectional studies that reported a correlation coefficient.