Running Head: SOCIAL DESIRABILITY AND AGE DIFFERENCES IN PERSONALITY

This paper has been accepted for publication in the
Journal of Research in Personality on 18 May, 2022.

This paper is not the copy of record and may not exactly replicate
the authoritative version of the article published in the journal.

The final article will be available, upon publication, via its DOI:
<https://doi.org/10.1016/j.jrp.2022.104245>

Version 4: May 2022

Age Differences in Personality Traits and Social Desirability:

A Multi-Rater Multi-Sample Study

Liisi Ausmees^{1,*}, Christian Kandler², Anu Realo^{3,1}, Jüri Allik¹, Peter Borkenau⁴, Martina
Hřebíčková⁵, and René Mõttus^{6,1}

¹ Institute of Psychology, University of Tartu, Tartu, Estonia

² Department of Psychology, University of Bremen, Germany

³ Department of Psychology, University of Warwick, UK

⁴ Institute of Psychology, Martin-Luther-Universität Halle–Wittenberg, Halle, Germany

⁵ Institute of Psychology, Academy of Sciences of the Czech Republic, Brno, Czech Republic

⁶ Department of Psychology, University of Edinburgh, Edinburgh, UK

*** Corresponding author**

Institute of Psychology

University of Tartu

Näituse 2, Tartu 50409, Estonia

E-mail: liisi.ausmees@ut.ee

Abstract

Little research has examined age differences by using more than one source of information. We compared age differences in Five-Factor Model (FFM) facets and nuances in self-reports and ratings by knowledgeable informants using samples from three countries (Estonia, Germany, and the Czech Republic; $N=5,624$). We hypothesized that age differences would be larger in self- than informant-reports, because of greater social desirability in self-descriptions with advancing age. Indeed, we found that age differences were systematically smaller in informant-reports compared to self-reports; this trend was stronger for traits independently rated as socially desirable. As age differences may be best approximated by average trends of self- and informant-reports, we provide meta-analytic age trends for multi-rater composite scores of the FFM facets and nuances.

Keywords: social desirability; age differences; personality traits; facets; nuances

Social desirability and age differences in personality traits:

A multi-rater multi-sample study

Cross-sectional and longitudinal studies in various countries have shown moderately consistent age differences in personality trait scores across the life span (Costa et al., 2000; Costa & McCrae, 2002; Roberts et al., 2006; Srivastava et al., 2003), reflecting normative gains and/or losses in these traits (Roberts & Mroczek, 2008). Many mean-level age trends are nonlinear with steeper increases or decreases during the first three decades of life and even reverse trends in old age (Donnellan & Lucas, 2008; Kandler et al., 2015; Lucas & Donnellan, 2011; Möttus et al., 2012). For example, Openness appears to have a curvilinear developmental trend across the lifespan: it first increases during adolescence, remains relatively constant during young and middle adulthood and declines in older age (Costa & McCrae, 2002; Roberts et al., 2006). Generally, the broad Five Factor Model (FFM) domains of Neuroticism, Extraversion, and Openness to Experience tend to decline, whereas Agreeableness and Conscientiousness show an upward trend between adolescence and later adulthood (Caspi et al., 2005; Costa & McCrae, 2002; Wortman et al., 2012). Because most of these normative changes appear to be towards greater social and psychological adjustment, they have been collectively referred to as the “maturity principle” of personality development (Caspi et al., 2005; Hogan & Roberts, 2004). There are, naturally, individual differences in these patterns of change (e.g., Schwaba & Bleidorn, 2018), with some people changing more or less than others (Roberts & Mroczek, 2008).

There are two main explanations for such normative maturation. First, the Five-Factor Theory (FFT) of personality holds personality traits as biologically anchored basic tendencies. The FFT thus attributes age-trends in personality traits to biologically based increases in maturity and emotional functioning (Costa and McCrae, 2002; McCrae & Costa, 2008). That is, the intrinsic maturation refers to the natural progression of personality development that occurs without much regard to cultural and historic context or individuals’ particular circumstances (McCrae et al., 2000;

McCrae & Sutin, 2008). This view accounts for the finding that similar mean-level trends can be found in genetically related species, such as orangutans and chimpanzees (Weiss & King, 2015), for instance. However, an alternative explanation stems from the Social Investment Theory (SIT), which states that people become committed to age-graded social roles involving work, family and wider community, and these commitments create reward structures that promote becoming more emotionally stable, conscientious and agreeable, for example (Roberts et al., 2005). As most people go through the transitions into these social roles and associated commitments at roughly similar ages, this can account for the normative mean-level age-trends. In line with the SIT, it has been found that the culture-specific timing of normative transitions appears to be linked with earlier or later personality maturation (Bleidorn et al., 2013), although these findings were not replicated in a more recent study comparing participants from 23 cultures speaking 17 different languages (McCrae et al., 2021). The socioanalytic model of maturity (Hogan & Roberts, 2004) also emphasizes the importance of taking into account the relationship between the individual and his or her society, as maturation has both identity and reputational elements.

But How Well Do We Really Know Age Differences in Personality Traits?

Any theorizing on the causes of the mean-level changes in personality traits presumes having robustly established these changes in the first place. Most of the findings have been based on either self-reports or, less commonly, reports by knowledgeable informants (e.g., McCrae et al., 2005) but, individually, each of these data sources provides only a limited amount of valid information. For example, McCrae (2015, 2018) and McCrae and Mõttus (2019) have shown that in many personality scales there is about as much systematic method-specific variance (e.g., variance specific to the self-report method) as there is variance in the trait of interest (variance common to source methods). In principle, then, age-differences observed in any single source of personality information could largely result from method effects (e.g., evaluative biases) that vary with age. If so, how can we know whether and to what extent the observed age differences are really in the traits

per se as opposed to reflecting age-related method effects? To disentangle age-associated substantive and method variances, findings based on different methods should be compared.

Age Differences in Self- and Informant-Reports of Personality

For example, true developmental or age-related changes in personality ought to be consensually valid: different observers (including the self) should agree on the direction and size of changes (Costa et al., 2019). The use of multiple informants has become one of the most valuable tools in personality research (Allik et al., 2015; Kenny et al., 2006; Möttus et al., 2020; Vazire, 2006; McCrae & Möttus, 2019), supported by the finding that personality constructs have sufficient measurement invariance across the rating sources (Möttus et al., 2020).

But the few studies that have tried to replicate self-report-based age differences in informant ratings have yielded inconsistent results (McCrae, et al, 2004). For example, McCrae and colleagues (2005) asked over 11,000 students from 49 countries to complete a personality inventory about either a younger (aged 18-21) or an older person (over age 40) they knew well and found that although the overall pattern of age differences was similar to those in previous, self-report-based studies (e.g., Costa & McCrae, 2002), the effect sizes were notably smaller for Neuroticism and Agreeableness, with the latter not even being significant in most country-samples. Rohrer and colleagues (2018) used a data set of over 10,000 self- and informant-ratings of personality traits, with more than 200 observations per each year of age spanning from 14 to 29 years. They showed that age trends in informant-reports were consistent with the respective trends in self-reports for Extraversion and Openness, and that there were no self- or informant-reported increases in Agreeableness. Self- and informant-reported Conscientiousness were both positively correlated with age, but the increase in informant-reports seemed to “lag behind” the increase in self-reports. And whereas relatively older individuals reported increasingly higher levels of emotional stability, informant-reports of emotional stability remained mostly stable, meaning that informant-reports did not confirm the expected maturation between the ages of 14 and 29. In contrast, in a 17-year

longitudinal study of German adolescents, parents reported a decline in adolescents' Neuroticism that was not seen in self-reports, and increases in parent-reported Openness and Conscientiousness were significantly larger than as judged by children themselves (Luan et al., 2017). In addition, the few studies that have compared self- and other-rated personality development over time (Oltmanns et al., 2020; Lenhausen et al., 2020; and Watson & Humrichouse, 2006) have found that informant-rated personality trait trajectories indicate less maturation (e.g., decreases in Agreeableness) than self-rated trajectories.

These findings are consistent with the possibility that oft-observed age differences in personality scores may be to some, perhaps even substantial, extent be mixed with (single source) methodological artefacts. But what could possibly bias either self-reports, informant-ratings, or both?

Social Desirability as an Explanation for Discrepant Findings

Advancing age is associated with a stronger tendency to present oneself in a positive light, meaning that older people tend to respond to questionnaire items in more socially desirable ways (Dijkstra et al, 2001; Paulhus, 2002; Soubelet & Salthouse, 2011). Socially desirable responding is a general tendency – sometimes also a temporary motivation – to give desirable answers on self-reports to appear positive (Paulhus, 2017). This has been shown for ratings of well-being (Fastame & Penna, 2012) and substance abuse (Welte & Russell, 1993), as well as affect and personality (Soubelet & Salthouse, 2011). Because a) the observed mean-level trends in personality are generally towards greater maturity, which is socially desirable (e.g., Caspi et al., 2005), and b) the mean-level trends in personality appear stronger in self-reports than in informant-ratings (McCrae et al., 2005; Rohrer et al., 2018), it seems plausible that the findings about mean-level trends in personality are confounded with age-variant socially desirable responding. That is, socially desirable response biases might distort the true age trends in personality traits, leading to an overestimation of age differences in some (i.e., more socially desirable) personality traits. Earlier

research combining a self-report personality inventory with a social desirability scale has indeed suggested that some of the age-related differences in self-reported affect and personality traits could be attributed to age-related increases in socially desirable responding (Soubelet & Salthouse, 2011).

How can we find out whether age-trends in personality traits are confounded with socially desirable responding and whether this can account for differences in the age trends between self-ratings and informant-reports? As was done by Soubelet and Salthouse (2011) we could residualize trait scores for an individual-level measure of socially desirable responding and re-estimate the associations of these residualized scores with age. If age-differences in personality traits reflect socially desirable responding, the relationships between personality traits and age should be weaker when adjusted for socially desirable responding. However, it is difficult to separate variance due to socially desirable responding from valid trait variance based on one source of information alone; what looks like “style” may in fact be “substance” (McCrae & Costa, 1983).

For this reason, it may be more useful to identify any *systematic* differences across different rating perspectives. Specifically, we can compare age trends across traits and rating methods and see whether the differences between rater perspectives (i.e., self- *versus* informant-ratings of personality traits) track with the traits’ social desirability levels. If age trends in self-reports are biased due to social desirability, then a) more socially desirable traits should show commensurately larger age differences, b) the trend of larger age differences in more socially desirable traits should be stronger in self-reports compared to informant-reports, and c) differences between self-reports and informant-ratings in the age trends should be proportional to traits’ social desirability (i.e., the more desirable the trait, the stronger the age trends in self-reports in comparison to informant-ratings).

But these hypotheses, based on comparing traits in their numeric properties such as social desirability and age differences, are hard to test with a sample of just a few traits such as the domains of the FFM.

Age Trends in Personality Facets and Nuances

Fortunately, there is more to personality traits than the Big Five. For example, Soto and John (2012) argued that understanding age trends in personality requires consideration of narrower traits such as lower-level personality facets because the broad domains do not capture all the meaningful information about how personality traits develop across adulthood. The existing facet-level studies have indeed revealed that these specific traits show distinctive patterns of age differences.

For example, some facets of Neuroticism, such as N5: Impulsiveness, are more strongly related to age, whereas others (e.g., N1: Anxiety) have weaker associations (Costa & McCrae, 2002; McCrae et al., 2004) with age. In a large sample with longitudinal data, Terracciano and colleagues (2005) showed that although the age-trajectories of the self-reported NEO PI-R facets generally corresponded to those of the factors they defined, the strengths of the association with age varied substantially across facets. Their research showed the largest age effects for three facets of Extraversion (i.e., E4: Activity, E5: Excitement Seeking, and E6: Positive Emotions) and two facets of Openness (i.e., O1: Fantasy and O3: Feelings), which all were smaller in older individuals. The largest age-related positive slopes were found for three facets of Agreeableness (i.e., A1: Trust, A2: Straightforwardness, and A4: Compliance; Terracciano et al., 2005). Soto and John (2012) demonstrated using the CPI-Big Five that the Industriousness facet of the Conscientiousness – but not the Orderliness facet – showed a significant positive age trend, the Adventurousness facet of Openness to Experience – but not the Idealism and Intellectualism facets – showed a significant negative trend, and the Rumination facet of Neuroticism – but not the Anxiety and Irritability facets – showed a significant negative trend (Soto & John, 2012). That facets of the same domains vary in age differences has also been reported in numerous other studies (e.g., Bleidorn et al., 2009; Jackson et al., 2009; Möttus et al., 2015; Roberts et al., 2006).

But even facets may not be the lowest level of the personality trait hierarchy as they may be split into hundreds of yet narrower characteristics, nuances (McCrae, 2015). The unique variance in

nuances, after controlling for the facets and FFM domains, tends to demonstrate the essential properties of traits such as stability over years, agreement across assessment methods and heritability (Möttus et al., 2017; Möttus et al., 2020). As far as our current ability to measure personality goes, nuances can be operationalized with individual personality test items (McCrae & Möttus, 2019) although they do not equate items (Condon et al., 2020). It is therefore not entirely surprising that items of the same facets tend to vary in age differences.

For example, Lucas and Donnellan (2009) conducted an item-level analysis using nationally representative Australian data and found that not all personality items (or more specifically, self-ratings of different adjectives) showed patterns similar to those exhibited by their respective domains or traits (Lucas & Donnellan, 2009). Möttus and colleagues (2015) also reported that different items of the same facets often showed different, sometimes even opposing, relations with age. Möttus and Rozgonjuk (2021) systematically compared the Big Five domains, facets, and 300 items used to measure them (capturing variance of nuances on top of facets and domains) in terms of how much age-relevant information each level contained. Controlling for model over-fitting by testing and validating models in separate samples, they found that nuances (i.e., items) contained over 40% more age-related variance than facets. Strikingly, residualizing the 300 items for all domains and facets had no impact on how much age-relevant variance the items collectively contained, suggesting that age-differences in the domains and facets could be mostly ascribed to nuances.

These findings suggest that our between-trait differences-based hypotheses that link age differences in self- and informant-ratings of traits with the social desirability levels of these traits should not be tested based on five broad domains alone. Instead, the hypotheses should also be tested at the level of facets. Moreover, harnessing the unique age-relevant information in items and capitalizing on their sheer number, our hypotheses can be tested at the level of nuances, or single

items. In fact, there is a long history of using item-level analyses to test hypotheses based on between-trait differences (e.g., Funder & Dobroth, 1987).

Present Study

The main aims of this study were to explore whether – and to what extent – age-differences in self-reports of personality traits are associated with, and possibly inflated by, socially desirable responding, and to report age differences in the FFM facets and items with reduced biases. Do people indeed become more pleasant, emotionally stable, and down to earth as they age or could such findings, at least partly, be explained by how older individuals choose to respond to certain personality questionnaire items? More specifically, we compared age-related mean differences in self- and informant-rated personality traits and explored the possible association of social desirability (as rated by panels of judges) with these differences. If the results showed larger age differences in self-rated personality traits than in informant-ratings, then some of the differences could be ascribed to measurement artefacts such as socially desirable responding. If age-related changes were found to be more pronounced for socially desirable traits but similar in self- and informant-rated personality traits, then this would reflect substantive age differences (e.g., due to social adaptation or maturation).

Our multi-rater research focused on different levels of the trait hierarchy, as distinctive developmental patterns have been found for traits below the broad personality domains such as the Big Five, facets (McCrae, et al., 2000; Terracciano et al, 2005), and even for micro-traits or nuances below facets (Mõttus et al., 2017; Rozgonjuk & Mõttus, 2021). Moreover, we aimed to cross-validate the findings and therefore used samples from three different countries: Estonia, Germany, and the Czech Republic. Finally, we meta-analyzed the findings across the samples. Although a few studies have previously published some parts of the present data concerning age differences in

personality traits¹, no previous study has carried out analyses on age differences in personality traits in these samples in connection with social desirability ratings of these traits. Moreover, to the best of our knowledge, age differences in personality traits have previously not been examined with a comparable level of comprehensiveness in any cross-sectional study, using both self- and informant-ratings at the level of facets as well as single items of the NEO Personality Inventories – Revised and 3 (NEO PI-R and NEO PI-3), and meta-analyzing the parameters based on samples from different countries across samples.

Method

Ethics Statement

The data used in this study have been previously published (in, e.g., Allik et al., 2010; Ausmees et al., 2021; McCrae et al., 2004; Möttus et al., 2016; Möttus et al. 2017, etc.). All the data were collected in a manner consistent with ethical standards for the treatment of human subjects.

Participants

Estonian sample. The Estonian sample was based on the Estonian Biobank cohort, a large volunteer sample of the Estonian resident adult population. The data were collected by the Estonian Genome Centre (Leitsalu et al., 2014). Both self- and informant-reports of the NEO PI-3 were available for 3,419 individuals aged 18 to 91 years ($M = 46.7$, $SD = 17.0$), 59.6% of whom were women. Informant ratings were given by individuals who knew the participants well. From the informants, 46.4% were spouses or partners, 25.5% were family members, 7.7% were other relatives, 15.4% were friends, 3.1% were acquaintances, and 1.9% others). Their mean age was 41.8

¹ For example, Möttus and colleagues have reported self-rated age differences in personality traits in the Estonian sample (Möttus et al., 2015, 2017). Mean-level changes in personality traits in one of the German twin samples (Bielefeld Longitudinal Study of Adult Twins, BiLSAT) have been published by Bleidorn and colleagues (2009) who examined self-rated age changes over the period of 10 years (Bleidorn et al., 2009). Self- and informant-ratings of personality traits in the Czech sample have previously been reported by McCrae and colleagues (2004) who conducted analyses also at the level of facets (McCrae et al., 2004). Social desirability of personality traits has also been compared with the difference between self- and observer-ratings – Allik and colleagues (2010) examined this in Estonian, German, and Czech samples – but not in connection to age trends in personality traits.

years ($SD = 15.8$), and 69.4% were women. Informants reported that they had known the targets for an average of about 23 years ($SD = 15.0$) and in general felt that they had a close relationship with the target ($M = 4.7$, $SD = 0.6$, rated on a scale from 1 to 5, where higher ratings indicated greater closeness).

German sample. Combined data from the third wave of the Bielefeld Longitudinal Study of Adult Twins (BiLSAT; Kandler et al., 2013) and from the Jena Twin Study of Social Attitudes (JeTSSA; Stöbel et al., 2006) were used. Only participants with self- and informant-reports were used in this study. Both self- and informant ratings were available for 1,491 people (1,152 women), whose age was between 17 and 82 years ($M = 36.0$; $SD = 13.4$). Participants were instructed to ask two acquaintances, who knew them well but preferably did not know their twin sibling, to provide the informant ratings; the ratings of the two informants were averaged (in 92.4% of cases). There were altogether 2,869 informant raters for 1,491 twins. Raters' age ranged from 13 to 88 years ($M = 36.3$, $SD = 13.4$). From the informants, 42.6% were friends, 32.5% were spouses/partners, 16.2% were colleagues, 7.6% were family members, and 1.1% others. Informants had known the target between 1 and 69 years ($M = 11.6$, $SD = 10.2$). In this study, we ran all the analyses separately for the Twin 1 (757 people, 79.0% females) and Twin 2 (734 people, 75.5% females) subsamples, for cross-validation and to avoid dependencies in the data.

Czech sample. There were 714 participants (58.3% females) with both self- and informant-ratings; the data had been previously collected in the course of Czech self-other agreement studies (see McCrae et al., 2004). Their ages ranged from 15 to 81 years ($M = 36.1$, $SD = 14.1$). From the informants, 40.0% were spouses/partners, 42.7% were friends, 7.8% were siblings, and 9.5% were other relatives (Hřebíčková, 2003). The formation of the Czech sample is described in more detail in McCrae and colleagues (2004).

Power analysis. According to a *post-hoc* power analysis, the minimal sample size needed to detect a small effect size (i.e., $r > .10$) with 80% power and significance level 0.05 is about $N = 700$.

Therefore, in all the samples in our study (i.e., the Estonian and Czech samples and two German twin subsamples) there was sufficient power to detect small and moderate effect sizes, even at smaller alpha levels to accommodate increased Type 1 error rate due to multiple testing. Moreover, our multi-sample replication study was specifically designed to reduce the likelihood of false positive findings since we focused on patterns that replicated across samples.

Measures

Personality Traits. In the Estonian Biobank data, personality ratings were obtained using the Estonian translation of the NEO PI-3 (McCrae & Costa, 2010), which is a slightly modified version of the NEO PI-R (Costa & McCrae, 1992; Kallasmaa et al., 2000). For the measurement of personality characteristics in the two German twin subsamples, the German version of the NEO PI-R was administered (Ostendorf & Angleitner, 2004). And in the Czech sample, the Czech version of the NEO PI-R (Hřebíčková, 2002) was used. The NEO PI-R/3 contains 240 items, grouped into 30 facet scales, which are hierarchically organized under the five domain scales of the FFM. Responses were made on a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. We focused on facets and individual items and ignored the domain scales.

Measures of Social Desirability. For the analysis of the Estonian data, we used social desirability ratings of the NEO PI-3 questionnaire items by two separate groups of judges: Panel 1 ($N = 9$; 2 men and 7 women²) and Panel 2 ($N = 214$; mean age 29.3, $SD = 11.8$; 73.0% were women), with slightly different instructions. The Panel 1 sample consisted of experts (previously described in Möttus et al., 2014) and was given the following instruction: *“The descriptive characteristics of people often contain an evaluative component. Some characteristics are considered very important for gaining social approval, whereas other characteristics are not approved at all. For each item, please indicate how helpful agreeing with it would be for gaining*

² Information about the Panel 1 respondents' ages was not available. The judges were mostly experts; their ages were not reported by Möttus et al. (2014).

others' approval.” The ratings were provided on a 7-point scale (1 – *not helpful at all* to 7 – *very helpful*), with 4 as neutral. The Estonian Panel 2 consisted of laypeople and their instruction was the same as for the German and Czech judges (see below).

The German NEO PI-R items were rated by 20 judges (11 women), ages ranging from 20 to 29 ($M = 23.8$, $SD = 2.9$). The Czech NEO PI-R ratings were provided by 100 judges (43 men and 57 women), with mean age of 40.5 years ($SD = 15.1$). The German and Czech judges were laypeople. The judges of Estonia: Panel 2, as well as German and Czech panels received the following instruction: “*Descriptions of people often contain evaluative information. Some personality characteristics are considered more desirable receiving approval from other people, whereas others are undesirable. If someone agrees strongly with this item – does this present that person in favorable or unfavorable light or is agreeing with this item neutral as regards to others' approval?*”. Ratings were again provided using a 7-point scale, ranging from -3 (extremely undesirable) to +3 (extremely desirable) with zero as a neutral point. All desirability ratings were subsequently standardized within each sample (the facet-level standardized scores are shown in Table A1 in online supplementary material, which can be accessed [here](#)). The four sets of item ratings were in good agreement: Spearman's ρ s (ρ s) ranged from .71 (between Estonian Panel 1 and Panel 2 ratings) to .89 (between German and Czech ratings) at the level of facets, and from .70 (between Estonian Panel 1 and Panel 2 ratings) to .86 (between German and Czech ratings) at the level of items (see Table A2 and Figure A1 in supplementary materials).

Analysis

At the level of both 30 facets and 240 items, the analysis of the associations between personality traits, age and social desirability consisted of three main parts: (1) calculating the correlations (Spearman's ρ) of target's age (Age) with self- and informant-reported personality traits to find out whether the magnitudes of age correlations differ between self- and informant-reported personality traits; (2) correlating the resulting two correlation profiles (consisting of 270 correlation

coefficients in case of the associations between self-rated personality and Age, and 270 correlation coefficients in case of the associations between informant-rated personality and Age) with the average social desirability ratings of these altogether 270 facets/items to examine whether there are differences between self- and informant-reports in how traits associate with social desirability ratings, and finally (3) subtracting the informant-rated personality—Age correlation profile from the self-rated-personality—Age correlation profile and correlating (using Spearman's ρ) these correlation-differences with corresponding social desirability ratings, which informs us on the extent to which the potential discrepancy in the age correlations of self- and informant-rated personality traits tracks with social desirability of these traits. These analyses were conducted in four datasets: Estonian sample, Germany Twin 1 and Twin 2 subsamples, and the Czech sample; in addition, the analyses for the Estonian personality dataset were conducted separately with two different sets of previously collected social desirability ratings, resulting in samples named “Estonia: Panel 1” and “Estonia: Panel 2”.³

In the Estonian sample, we carried out a robustness analysis by re-examining the associations of 30 facets and 240 items with age and social desirability ratings using linear mixed effects models. In these models, the facet/item scores were first standardized and then predicted by age, ratings' source (i.e., self- versus informant-ratings), the interaction between age and ratings' source, and random intercept of the target; these analyses were separately carried out for each of the 270 traits. The facet-level parameters (age betas and the interaction between age and ratings' source) are shown in supplementary material, Table A4. The correlations (Spearman's ρ s) of these estimates with social desirability ratings, at the level of facets and items, can be found in Table A5.

³ The two Estonian social desirability rating panels were analyzed separately instead of combining them into a single set of ratings due to slightly different instructions during data collection, and because the agreement was the weakest between the two Estonian panels (see Table A2 and Figure A1 in supplementary material). A closer look at the average social desirability ratings of the Estonian Panel 1 and Panel 2 revealed some potentially relevant differences – Panel 2 had rated A4: Compliance as relatively undesirable ($z = -0.65$), whereas in other samples this facet was perceived as desirable (z s ranging from 0.13 in Estonia: Panel 1 to 0.46 in the Czech panel). Discrepancies were also observed in case of O1: Fantasy where the ratings of Estonian Panel 2 were considerably higher ($z = 0.59$) than in other samples (z s ranging from -0.43 in the German panel and -0.30 in the Czech panel).

As an additional exploration, we examined in the Estonian NEO PI-3 dataset, whether the age of raters could be associated with the self/informant differences in age correlations. More specifically, we asked whether older people provide more lenient/generous ratings compared to younger raters, after matching their ages to target age. Again, the differences were examined at the level of 30 facets and 240 items. Details of these analyses are described in supplementary material (results can be found in Table A8). Using the Estonian dataset, we also conducted multiple-indicators multiple-causes (MIMIC; Jöreskog & Goldberger, 1975) models separately for each of the 30 personality facets in order to analyze informant-ratings of personality traits in the context of informant's age, target's age, and informant's relationship with the target (as a dichotomous variable of being the spouse/partner of the target or not). In MIMIC models, several background variables can be examined simultaneously and this type of modelling also allows testing measurement invariance of continuous covariates, such as age in our study (for more details and results, see supplementary material, Table A9). As an additional exploration using the Estonian NEO PI-3 dataset, MIMIC models were also run to examine age-related measurement invariance in the self-ratings of personality traits, separately for each of the 30 personality facets. In these models, target's age was analyzed as a continuous covariate (for details, see supplementary material, Table A6).

In order to explore the robustness of using the means of self- and informant-ratings (self-informant composite scores), we constructed bifactor models (Holzinger & Swineford, 1937), separately for each personality facet. Each bifactor model incorporated a general factor, onto which all 16 items measuring one facet loaded, and two orthogonal (uncorrelated) method factors respectively for self-ratings and informant-ratings, each loading on a subset of 8 items⁴. Thereafter we extracted the factor scores of the general (g) factors in case of each facet, constituting the common variance of self- and informant-ratings. These general factor scores were then correlated

⁴ In the MIMIC and bifactor models, correlated residuals (error covariances) within self- and informant-factors were allowed, when it was necessary for fitting the baseline self- and informant-confirmatory factor analysis models (conducted separately). Correlated residuals were added to the models one-by-one, based on the highest modification indices until good model fit was achieved (i.e., Comparative Fit Index (CFI) $\geq .95$).

with the self-informant composite scores of the respective facets (for more details and results, see supplementary Table A11).

And finally, we conducted a meta-analysis of the obtained correlation coefficients combining all samples, separately at the level of 30 facets and 240 items, and calculated meta-analytic means (i.e., weighted by sample size) of self- and informant-rated personality facet scores for different age groups.

The analyses were conducted in Microsoft R Open 4.0.0 (R Core Team, 2020). Packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2021) were used for confirmatory factor analysis, MIMIC models, and bifactor models, and package *pwr* (Champely, 2020) for power calculations for correlation tests. Package *lmerTest* (Kuznetsova et al., 2017) was used for linear effects models, and *ggplot2* (Wickham, 2016) to visualize the age trajectories of self- and informant-ratings. Package *meta* (version 4.9-5; functions *metacor* and *metamean*; Balduzzi et al., 2019) was used for meta-analysis with correlations and weighted means.

Results

Associations between Personality Traits and Age

The visualized age trajectories of self- and informant-reports (as local regression fit lines) for 30 facets in four samples (i.e., Estonia, Czech, Germany Twin 1, and Germany Twin 2) can be found in supplementary material B, in Open Science Framework (see [here](#)). At the level of facets, the highest Spearman correlations (ρ) between age and personality facets in three samples (i.e., Estonia, Germany Twin 1 and Twin 2) were for E5: Excitement-Seeking, in case of both self- and informant-reports). In each of the three samples, these correlations were greater in magnitude for self-reported E5: Excitement-Seeking compared to the informant-reports of the trait (for Estonia: ρ s $-.52$ and $-.40$; for Germany Twin 1: ρ s $-.38$ and $-.29$; and for Twin 2: ρ s $-.41$ and $-.34$, for self- and informant-reports, respectively; $ps < .001$). In the Czech sample, the highest correlation in self-ratings was found between target's age and O1: Fantasy (ρ s $-.41$ and $-.35$, $p < .001$), whereas in case

of informant-ratings, the highest correlation was found between target's age and E6: Positive Emotions ($\rho = -.36$), although this correlation was lower in self-reports ($\rho = -.27$, $ps < .001$). All facet-level personality—age correlations of both self- and informant-ratings can be found in the supplementary material (Table A3).

Insert Table 1 about here

In all samples, the median absolute correlations (Spearman's ρ s) between age and personality traits were smaller in informant-reports than in self-ratings (see Table 1). This tendency was found both for NEO PI-R/3 facets as well as items. For instance, in the largest sample – the Estonian NEO PI-3 dataset – the median absolute age-correlations for self- and informant-ratings were $\rho = .18$ vs $.08$ at the level of facets and $\rho = .11$ vs $.07$ at the level of items, respectively. The difference was, however, somewhat smaller in the German Twin 2 subsample – at the level of items, the median absolute age-correlations for self- and informant-ratings were $\rho = .08$ vs $.07$, respectively.

But despite the average effect sizes being smaller in informant-reports, the age—facets correlation *profiles* of self- and informant-reports were in good agreement between the samples (see Table 2): Spearman's ρ s were between $.87$ (Germany Twin 2) and $.89$ (Estonia, Czech, and Germany Twin 1 samples). Similar results were obtained for the age—items correlation profiles where the Spearman's ρ s ranged from $.83$ (Germany Twin 2) to $.90$ (Estonia). This suggests that self- and informant-reports capture similar age differences in personality traits and that the observed trends themselves are therefore likely valid, but something either inflated the effects in self-reports, deflated them in informant-reports, or both.⁵

⁵ We re-examined the associations of age with personality facets and items also using linear mixed effects models, because correlations and regression slopes are not always exchangeable (Rohrer & Arslan, 2021). We analyzed the age slope and the interaction between age and source of rating (self- versus informant-report) separately for each of the 30 facets and 240 items, using the Estonian sample ($N = 3,419$). These estimates are shown in supplementary material,

Insert Table 2 about here

Associations with Social Desirability Ratings

In most samples (except the analysis involving the Estonian social desirability ratings by panel 2), the self-rated-personality—Age correlations were more strongly associated with mean social desirability ratings than the informant-rated-personality—Age correlations (Figure 1). Similar tendency was also evident at the item-level analyses (see Table 2). Associations were the strongest in the Czech sample where the difference between self—Age and informant—Age correlations was highly correlated with social desirability ratings at both the facet-level ($\rho = .82$) as well as item-level ($\rho = .55$, $ps < .001$) of analysis. The respective findings were somewhat more modest in magnitude (but nevertheless significant) in the samples of Estonia: Panel 1 ($ps .45$, $p < .05$, at the level of facets, and $.31$, $p < .001$, at the level of items), Germany: Twin 1 ($ps .52$, $p < .01$, at the level of facets, and $.26$, $p < .001$, at the level of items), and Germany: Twin 2 ($ps .60$, at the level of facets, and $.23$, $ps < .001$, at the level of items). The only sample where these results did not replicate was with the Estonian second set of social desirability ratings (Estonia: Panel 2; see Figure A2 in supplementary material), where the ratings were provided by 214 judges⁶.

Table A4. The interactions between age and source of rating (from linear mixed effects models) were almost perfectly correlated with the simple difference between self—Age and informant—Age correlations (in the Estonian NEO PI-3 data), suggesting that our primary analytic approach for estimating the rater perspective differences in age trajectories were robust to the method of analysis.

⁶ When we excluded the ratings of the youngest judges (aged < 30 years) from the Estonia: Panel 2 and conducted additional analysis with the ratings of the remaining 72 raters, results showed a similar pattern that had appeared in other samples. Namely, the associations of desirability ratings were higher in case of self-rated-personality—Age correlations (Spearman $ps .16$ and $.15$, for facet- and item-level analysis, respectively) than for informant-rated-personality—Age correlations ($ps .09$ and $.08$, for facet- and item-level, respectively). At the level of facets, these associations were not statistically significant ($ps > .10$). But at the level of items, the positive relationship between desirability ratings and the difference between self—Age and informant—Age correlations was clearly replicated ($\rho = .20$, $p = .002$). Thus, the ratings from younger judges in the Estonia: Panel 2 sample deviated from the general trend. We emphasize that these were strictly exploratory analyses.

Insert Figure 1 about here

Meta-Analysis Combining All Samples. We combined the correlation coefficients (social desirability ratings' associations with the difference between self-reported-personality—Age and informant-reported-personality—Age correlations) from four samples into meta-analytic estimates. As there were two sets of Estonian social desirability ratings (Panel 1 and Panel 2), two sets of meta-analytic correlations (for self- and informant-rated traits) were calculated (personality ratings in other samples were, of course, correlated with the respective desirability ratings of these samples); the only difference between these two sets of meta-analyses was using either Panel 1 or Panel 2 desirability ratings for the Estonian correlations. All samples had equal weights (à 25%) in the model, as the correlations were based on the same N in every sample ($N = 30$ in case of the facet-level analysis and $N = 240$ in case of analysis with items). The meta-analytic results (at the level of facets as well as items) had high heterogeneity (I^2 was between 80 and 93 per cent in both facet- and item-level analyses). Thus, a random-effects model was applied, in order to take into account both within- and between-samples variability.

Combining the results from the four samples, a significant correlation coefficient was found between social desirability and rater perspective differences in age-correlations both at the level of 30 facets and 240 items. In case of facets, the meta-analytic correlations were $r = .63$ (95% CI [.40, .78]), $p < .001$ (when desirability ratings from the Estonian Panel 1 were included in the analysis), and $.55$ (95% CI [.14, .80]), $p < .05$ (when desirability ratings from the Estonian Panel 2 were included). In case of items, the meta-analytic correlations were $.35$ (95% CI [.18, .50]), $p < .001$ (when desirability ratings from the Estonian Panel 1 were included), and $.30$ (95% CI [.08, .50]), p

< .01 (when desirability ratings from the Estonian Panel 2 were included). Figure 2 illustrates the associations of meta-analytic age trends in self-rated personality and in informant-rated personality with meta-analytic desirability ratings.⁷

Insert Figure 2 about here

Additional Exploration: Age-Related Invariance in Self-Ratings. In order to further explore the possibility that older individuals might respond to personality questionnaire items in a more positive or favourable way compared to younger individuals, we analyzed age-related measurement invariance in self-ratings using the Estonian NEO PI-3 data ($N = 3,419$). Detailed results from the MIMIC models (Jöreskog & Goldberger, 1975) are described in supplementary material (in Table A6). In sum, less than adequate model fit (i.e., $CFI < .90$ and $RMSEA > .08$) was detected for seven facets – E5: Excitement-seeking, O5: Intellect, A3: Altruism, A5: Modesty, C2: Order, C4: Achievement-striving, and C5: Self-discipline. Thus, it is possible that people in different ages respond to at least some items belonging to these facets differently. Although A3: Altruism and C5: Self-discipline are among the most socially desired traits, there seems to be no systematic tendency of more evaluative facets showing more noninvariance.

Additional Exploration: Associations with the Age of the Informant. We again used the Estonian NEO PI-3 dataset ($N = 3,419$) to explore whether the age of the informant could be associated with social desirability bias. Details of these analyses are described in supplementary material (results can be found in Table A8). Out of 30 facets, there were statistically significant ($p <$

⁷ Figures 1 and 2 show that the social desirability ratings of the facets of Neuroticism differ considerably from those of other facets as highly undesirable (especially in case of Estonia Panel 1). Therefore, we explored the associations between self- and informant-rated age trends and social desirability across samples also without the facets/items of Neuroticism. As a result, in the Estonian data, the associations of self- and informant-rated age trends with social desirability became more similar. However, in case of the Czech sample, the Self–Age correlation was more strongly associated to social desirability ratings than the Informant–Age correlation at the level of both facets and items even after removing the facets/items of Neuroticism, and this difference was statistically significant. Results from these additional analyses can be found in supplementary material (Table A7).

.05) differences between older and younger raters (matched for targets' ages) for seven facets. Older group of raters gave more favorable/desirable ratings (i.e., higher ratings of Extraversion, Openness to Experience, Agreeableness, and Conscientiousness items, and lower ratings of Neuroticism items) in case of four facets and younger group of raters gave more favorable ratings in case of three facets. At the level of 240 NEO PI-3 items, there were statistically significant ($p < .001$ — because of the large number of comparisons) differences between older and younger raters for 33 items. Twenty-one of these effects pointed to more favorable/desirable ratings by the older group of raters. Thus, the hypothesis that the ratings of older informants are more generous was not clearly supported. However, we found that the correlations of targets' ages with informant-rated personality traits were considerably more strongly associated with social desirability ratings (by Panel 1) in the older group compared to the younger group of raters — this was observed at the level of facets as well as items. Therefore, older raters seemed to give more socially desirable ratings to older targets, compared to younger targets.

These findings were largely confirmed by further analysis in the Estonian NEO PI-3 sample, where we used facet-level MIMIC models of informant-ratings, enabling us to also take into account the type of rater (whether the rater was the spouse of the target or not). As can be seen in Table A9 in supplementary materials, older informants gave significantly ($p < .001$) more positive ratings of targets in case of six facets (four of these were in line with the findings from the previous analysis), and more negative ratings in case of one facet, compared to younger informants (when target's age and informant type was taken into account). As for measurement invariance, less than adequate model fit (i.e., $CFI < .90$ and/or $RMSEA > .08$) was detected for five facets — E5: Excitement-seeking, O3: Openness to feelings, O5: Intellect, O6: Openness to values, and C4: Achievement striving (for details, see Table A9 in supplementary material).⁸

⁸ As a limitation, MIMIC models explicitly test only intercept/threshold invariance (invariance of factor loadings is assumed). However, when sample size is large ($> 2,000$) and the degree of noninvariance is large, factor loading invariance can also be detected (Kim et al., 2012).

Age Differences in Self-Informant Composite Scores of Personality Traits

According to our multi-sample multi-rater study, age differences in self-rated personality scales could be influenced (generally inflated) by social desirability. If so, how to best represent age differences in personality? It is often argued that the combination (consensus) of multiple raters provides the most valid information about individual differences, as source method specific effects tend to at least somewhat cancel out (Kolar et al., 1996; McCrae & Mõttus, 2019). Indeed, if people becoming less talkative or more dutiful with age is a real phenomenon rather than merely self-perceptions changing with age, it should be observed by both the self and external observers. Therefore, we argue that the pattern of correlations with self-informant *composite scores* can represent age-related changes in personality more validly than age-correlations in self- or informant-ratings individually.

To demonstrate these age trends in the facets, we first calculated means of self- and informant-ratings for each of the 30 facets separately in 12 age groups (generally in 5-year steps), separately in each of the four samples, and then computed meta-analytic (i.e., weighted) means across the four samples, using random effects models. These weighted self-informant facet-level composite scores (grouped according to the Big Five dimensions) are depicted by age groups on Figures 3 to 7 (the T-scores on these five figures were obtained by first standardizing the facet scores within samples and two rater types; next, we calculated self-informant average scores for every participant and thereafter means of these composite scores for 12 age groups within each sample; finally, the age group means of self-informant composite scores of four samples were combined into meta-analytic age group means). Largest age-related decreases in the self-informant composite scores were found in E5: Excitement-seeking (see Figure 4) and in O1: Openness to fantasy (Figure 5). Largest age-related increases in composite scores were found for C3: Dutifulness (Figure 7). Mean-level decreases in Neuroticism facets were relatively small, except for N5: Impulsiveness (see Figure 3). Notably, there were age trend differences between facets of the same

Big Five dimensions. For example, despite dramatic decreases in the E5: Excitement-seeking facet of Extraversion, E1: Warmth and E3: Assertiveness facet scores remained almost unchanged from young adulthood to the old age. And the age trend of C4: Achievement striving differed from the age trends of other facets of Conscientiousness because of its U-shaped curve. Facet-level correlations between age and NEO PI-R/3 self-informant composite scores separately for the four samples can be found in supplementary material, Table A10.

As combining the self- and informant-reports may pose a risk of also combining the error in both sets of ratings, we carried out an additional analysis. More specifically, we used again the Estonian NEO PI-3 data to run bifactor models in case of each facet to estimate a general factor reflecting the shared variance among the self- and informant-reports. We extracted factor scores of the general factors from each of the facet models and examined the associations of these general factor scores reflecting common variance of self- and informant-ratings with the self-informant composite scores described above. We found that the two types of self-informant scores (i.e., the composite scores and general factor scores) correlated highly for most facets, from .64 (in case of C4: Achievement Striving) to .95 (in case of E4: Activity; $p < .001$), with median of .91. The correlation was below .80 only for three facets. The age trends of these two sets of self-informant scores across 30 personality facets were highly correlated ($\rho = .94$, $p < .001$), suggesting that facets most strongly correlated with age did so regardless of whether sum scores or bifactor scores were used. All correlation coefficients and bifactor models' fit indices are reported in supplementary Materials (Table A11).

Given the findings presented so far, it is not surprising that the meta-analytic age trends in self-reported facets alone tended to be stronger for 17 facets (out of 30) than the meta-analytic age trends in the composite scores of self- and informant-reports; note that if rater perspective had no effect on age differences in trait scores, then the age differences should be larger in the self-informant composite scores than in either self-ratings or informant-ratings alone, due to their higher

reliability. For instance, the negative age-correlation of N1: Anxiety facet dropped from $-.11$ ($p < .01$) to $-.06$ ($p = .177$) and the positive association between age and two facets of Agreeableness also decreased: for A2: Straightforwardness, the meta-analytic correlation changed from $.14$ ($p < .01$) to $.09$ ($p < .05$) and for A5: Modesty it declined from $.24$ to $.19$ ($ps < .01$). However, several associations between age and personality traits were almost unchanged; for example, for N5: Impulsiveness (from $-.26$ to $-.24$, $ps < .001$) and E5: Excitement-seeking (from $-.41$ to $-.42$, $ps < .001$). In 13 facets, the age trends remained the same or became slightly stronger in the composites of self- and informant-reports, compared to self-reports alone (correlations increased in, for example, A6: Tender-mindedness and C2: Order). Nevertheless, the mean change in age correlations was in these cases much smaller than in the 17 facets mentioned above. It is not straightforward to formally estimate the degree of the significance of these changes, but it seems safe to assume that they are too small to be significant. The item-level meta-analytic correlations between composite scores and age can be found in supplementary material (Table A12).

Insert Figure 3 about here

Insert Figure 4 about here

Insert Figure 5 about here

Insert Figure 6 about here

Insert Figure 7 about here

Associations of Age Differences in Self-Informant Composite Scores with Social

Desirability Ratings. To estimate the extent to which age trends in self-informant composite scores are associated with social desirability ratings, we calculated the associations (Spearman ρ s) between age trends in self-informant composite scores and social desirability in each sample and combined the correlation coefficients from four samples into meta-analytic estimates. As there were two sets of Estonian social desirability ratings (i.e., Panel 1 and Panel 2), also two sets of meta-analytic correlations were calculated. Meta-analytic estimates combining all samples at the level of facets were as follows: .42 (95% CI [.26, .57]), $p < .001$ (when social desirability ratings of the Estonian Panel 1 were included) and .34 (95% CI [.09, .54]), $p < .01$ (when desirability ratings from the Estonia Panel 2 were included). At the level of items, the meta-analytic correlations were .25 (95% CI [.18, .33]), $p < .001$ (when social desirability ratings of the Estonian Panel 1 were included) and .21 (95% CI [.07, .35]), $p < .01$ (when ratings from the Estonian Panel 2 were included).

These findings show that the pattern of age-related changes in self-informant composite scores do overlap with social desirability ratings, but to a smaller degree than for age-related changes in self-reports. Of course, we did not expect the correlations to vanish altogether because the composite scores were based on self-ratings and informant ratings, and age differences in these individually had tracked with social desirability.

Discussion

Age differences in personality, informing us on the magnitude and qualities of personality development and thereby psychological development more generally, are one of the most important questions of personality science. It may therefore seem surprising how little research has examined them and their robustness by relying on more than one source of information. Psychologists have

known for a long time that any one assessment method is subject to potential artefacts but combining them can yield more trustworthy results (e.g., Eid & Diener, 2006). Therefore, we examined age-differences in personality in both self- and informant-ratings. Because age differences in personality characteristics do not tend to be well aligned with how the characteristics are combined into broad traits such as the FFM domains, we investigated age differences in narrower traits such as facets and nuances. We also examined the potentially confounding role of socially desirable responding in age differences in personality. Finally, we cross-validated and combined findings across samples from multiple countries.

Indeed, leveraging the multi-rater, multi-trait, and multi-sample data proved useful. Age differences in personality look consistently somewhat smaller when measured from informants' perspective, compared to the targets' own perspective. Previous studies have yielded somewhat conflicting results (e.g., Luan et al., 2017; McCrae et al., 2005), but we showed that this tendency manifests in multiple samples from different countries; as a pattern across multiple traits and across different specificity levels of the personality trait hierarchy such as facets and nuances (McCrae, 2015). Examining the possible contributions of socially desirable responding to age differences, it appeared plausible that age differences in self-reported personality traits in particular may in part be driven by age-related increases in socially desired responding. This is because a) trait–age correlations tracked with these traits' levels of social desirability, b) this trend pertained to self-reports in particular, and c) traits' correlations with age were larger in self-reports than in informant ratings commensurately the traits' levels of social desirability. These patterns of associations were relatively consistent across samples and languages. This is in line with earlier empirical evidence that social desirability ratings seem to share a core common across languages and cultures (Allik et al., 2010).

Alternatively, it is also possible that age differences indeed strongly track with social desirability, meaning that personality traits that are most valued by society are also the traits that are most likely to change over time (e.g., Roberts and Wood, 2006). When this is true, informants'

ratings should systematically underestimate these developmental patterns. Although the judgment of another person's personality characteristics may be a relatively simple task (Allik et al., 2016), some aspects of personality are known better to the self than to others, and vice versa (Vazire, 2010). According to the self-other knowledge asymmetry (SOKA) model, the self should be more accurate than others for traits low in observability (e.g., Neuroticism), whereas others should be more accurate than the self for traits high in evaluativeness (e.g., Agreeableness) (Vazire, 2010). But it is exactly the *most* desirable, and hence evaluative, traits for which age differences were systematically weaker in informant-ratings as opposed to self-ratings – that is, for traits which the informants may be in a better position to accurately assess.

Moreover, if informants are not able to assess less observable traits as accurately as the targets themselves are, we should expect trait–age correlations to be higher (or at least not as much lower) in self-reports than in informant-reports for more observable traits (because correlations in informant-ratings are lowered by poor validity for these traits). For a corollary analysis to this effect, we used the average (across nine raters) observability ratings for the 240 NEO PI-3 items from Möttus and colleagues (2014) and correlated these to self- and informant-reported items' correlations with age in the current Estonian data. Both Spearman's correlations were non-significant ($\rho = .05$ and $.11$, $ps > .10$, respectively), as was the correlation between items' observability and differences in age-correlations between self- and informant-reports ($\rho = -.03$, $p = .63$). Therefore, although we cannot definitely rule out age-differences in self-reports being systematically more accurate than those in informant ratings, we do not have evidence for it.

It is also plausible that age trends are not influenced by social desirability in the same way for every trait. For instance, we found that the average age-trait correlations in self-reports and informant-ratings were notably different for Neuroticism and Agreeableness. Similar correlation-differences were also seen for Extraversion, Openness to Experience, and Conscientiousness, but in smaller magnitude. Thus, it is possible that the self/informant discrepancy in age trends is driven largely by Neuroticism and Agreeableness – the former being highly undesirable and the latter

highly desirable. It is curious, however, that although Conscientiousness was rated highly socially desirable as well (almost identically to Agreeableness), age-related increases in Conscientiousness were also observed by informants in addition to targets themselves. Earlier research (e.g., McCrae et al., 2005) has also shown that age increases in informant-rated Conscientiousness are comparable to those in self-reports. This leads us to ask that if social desirability is partly behind the self/informant differences in age correlations, why are traits in the Conscientiousness domain not affected by it? Or are self-ratings of Conscientiousness traits affected by socially desirable responding, but so are informant-reports? With this study we were not able to exclude all the possible mechanisms leading to self-informant discrepancies in age-related differences. There may be other factors at play besides social desirability, for example age stereotypes. A typical older individual is cross-culturally perceived more conscientious than a young person (Chan et al., 2012), so it is possible that informant-ratings are influenced by this common age stereotype, while self-ratings are influenced by social desirability bias. However, if informants would rely on age stereotypes instead of personal experience with the target, this should also be seen for other traits. But in the study of Chan et al. (2012), the “typical” old person was thought to be considerably more agreeable than the “typical” adolescent or adult, so the age trends in informant-ratings of Agreeableness (which diverge from age trends in self-ratings) cannot be attributed to age stereotypes.

Another possibility is that raters’ age influences their personality descriptions. Becoming more agreeable with age could also result in more generous ratings of others. We explored this possibility by using several different approaches, for instance, by dividing informants into younger and older half after matching their ages to target age and by running MIMIC models to simultaneously take into account the effects of the informants’ and target’s age, as well as the type of informants. The hypothesis that the ratings of older informants are more generous in their ratings was not clearly supported, but older raters did seem to give more socially desirable ratings to older targets, compared to younger targets. We can conclude that informants’ age is associated with

personality age trends from raters' perspective, but only to a relatively small degree and in unsystematic ways.

Methodological Implications

How should studies into age differences in personality be carried out – based on self-reports, informant ratings or a combination of these? The current evidence suggests that using self-reports alone may be the poorest option, plausibly entailing inflated estimates. Using informant-ratings alone may in principle lead to underestimation of age differences, although we do not have any compelling evidence for this. If one would have to choose between the two sources of information, we would recommend informant-ratings. Biases associated with self-reports (e.g., self-presentation) can pose serious problems for research on personality development, because age differences in these confounding variables could undermine the validity of measuring the development of personality traits (Rohrer et al., 2018). But that is not to say that informant-reports are completely free from bias. For instance, Leising et al. (2010) have described the letter of recommendation effect, which states that informants who are recruited by the targets themselves tend to like the targets and thus describe them more positively. Thus, ideally other accuracy criteria that exist independently of self- and informant-reports should be included to validate informant-reports or compare the validity of self- and informant-reports (Funder, 1995; Kenny, 1994).

While such criteria are hard to find for every trait (not to mention for hundreds of nuances), we suggest that the least assumption-laden and perhaps most valid way to describe age-related changes in personality may be to employ the *means* of self- and informant-reports. We believe that this approach enables to extenuate the disadvantages associated with either of these methods; biases may cancel out. Alternatively, this could also lead to combining the errors from self- and informant-ratings in addition to trait-relevant variance, but we demonstrated using bifactor models that for most personality facets, the means of self- and informant-reports are in good agreement with the factor scores reflecting the shared variance among the self- and informant-ratings. When we

combined the self-informant composite scores from four samples, the largest age-related changes were in E5: Excitement-seeking and O1: Openness to fantasy, which decreased considerably with advancing age. Although there are notable age-related increases in more socially desirable traits such as C3: Dutifulness, these changes were smaller compared to the downward trends in the less socially desirable facets of Extraversion and Openness. According to meta-analytic estimates (in both facets and items), age trends in self-informant composite personality traits did overlap with social desirability ratings, but these associations were somewhat smaller compared to the estimates concerning the age trends in self-reported personality traits alone.

Theoretical Implications

The more desirable a personality trait, the more it tends to increase with age. This tendency was clear for self-ratings, pointing to potential methodological artefacts (Dijkstra et al., 2001; Soubelet & Salthouse, 2011), but to a smaller extent it also pertained to informant-ratings (especially in case of relatively older informants) and the composites of self- and informant-ratings. Such a pattern may be consistent with the maturation hypothesis (Costa and McCrae, 2002; Caspi et al., 2005); normatively, people tend to become socially more adjusted either because of biological maturation (McCrae & Costa, 2008; Weiss & King, 2015) or due to commitments and social pressures (Bleidorn et al., 2013; Roberts et al., 2005), or both.

However, as these effects have typically been documented based on self-report data and may thus in part be inflated by self-report biases, the evidence for the maturation hypothesis may have been over-estimated. Based on self-reports alone, high scores on socially desirable traits/scales may or may not indicate departure from reality; evidence from different sources must be obtained to be convinced that there is more than biased responding in these heightened scores (Paulhus, 2002). And if this is done (as in this study), a tendency for overall (social) maturation may account for less of personality development than previously thought. However, in order to fully understand and accurately measure psychological maturation and maturity-relevant traits it is necessary to clearly

define the meaning of maturity, especially in terms of personality traits below the level of broad domains. There has been little research into facet-level personality maturation (e.g., Schwaba et al., 2022), not to mention the scarcity of studies going below the level of facets. Without a specific and non-circular conceptualization of psychological maturity with maturation defined independently of aging to start with (so that people at the same age could also differ in their maturity), it is also difficult to evaluate its overlap with related concepts (e.g., healthy personality; Bleidorn et al., 2020).

Limitations

This study had a cross-sectional design, which means that effects of aging are confounded with cohort differences. Using longitudinal multi-rater data, it would be possible to estimate the stability of true scores of personality traits controlling for both random error (retest unreliability) and method bias (Costa et al., 2019; Kandler et al., 2010). However, when Terracciano and colleagues (2005) compared longitudinal and cross-sectional results over a time span of 15 years, they found that in the same sample, with the same instrument, cross-sectional and longitudinal designs closely agreed. Clearly, a time span of 15 years is relatively short – the possible impact of cultural change in the form of cohort and time period should not be ignored (Twenge et al., 2018). Thus, ideally, combining the cross-sectional and longitudinal methods using different birth cohorts (i.e., conducting a cross-sequential study) over a longer period of time would be especially beneficial. Another aspect that would need attention in future studies is increasing the cultural diversity of samples. We analyzed data from three different European countries with distinct languages and historical background, but the findings may not be generalizable to other cultural backgrounds. Thus, it would be useful to check for the universality of present findings beyond Europe. All in all, replications using different sources of data are encouraged – not only in terms of cultural diversity of the samples, but also by including different types of raters.

The only sample where the main results did not replicate was with the Estonian Panel 2 social desirability ratings, which differed from the ratings provided by other panels in respect of several

facets (e.g., perceiving A4: Compliance as an undesirable trait). Interestingly, when we exploratorily excluded younger raters (below 30 years of age), the similar pattern of results was seen as was evident in all other samples. Thus, the degree to which traits are considered socially desirable or undesirable may also vary with age – the potential age-related disparities in social desirability ratings may need more careful consideration in future studies. However, raters' age cannot be the only explanation for not obtaining the expected results in this particular sample, as the mean age of judges was even lower for the German sample. We are therefore unsure as to the reasons for why this sample did not conform to the general pattern.

Conclusion

In summary, the present multi-sample, multi-rater multi-trait study found that age-related differences in self-reported personality tend to be more strongly tied to social desirability ratings compared to age differences in informant-reports. These findings converged across most samples and were replicated at the level of facets as well as questionnaire items representing nuances. We suggest that age differences in personality traits are studied by comparing results based on multiple sources of personality ratings. The differences may be best described by the patterns in self-informant composite scores of these traits, and we depict them by combining findings from three different datasets from three different countries.

Data Availability Statement

Due to copyright reasons, we cannot share the personality questionnaires used in the present study (NEO PI-R/3). We do not have permission to share the data openly, because of data access restrictions. Supplementary materials (A and B) and analysis scripts can be accessed via our OSF project at <https://osf.io/jkxqv/>. The present study was not pre-registered.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authorship Contribution Statement

The corresponding author was involved in study conceptualization, conducted the majority of the data analysis with the advice from the last author, and drafted the manuscript together with the last author. All other authors assisted in writing and editing the manuscript and had also been involved in data collection (this study used previously collected data). The last author came up with idea of the study and wrote substantial sections of the introduction and discussion section.

Acknowledgments

Preparation of this manuscript was supported by the University of Tartu (SP1GVARENG), institutional research funding (IUT2-13) from the Estonian Ministry of Education and Sciences, and the Estonian Research Council grant PRG1151. The assistance of Andres Metspalu, Tõnu Esko, and Deivi Tupits in collecting the Estonian data is gratefully acknowledged. Authors are grateful to Rainer Riemann, Alois Angleitner, Wiebke Bleidorn, Wolfgang Thiel, Katharina Stöbel, Nicole Kämpfe-Hargrave, and Frank Spinath for their contribution to collecting the German twin-data. The Czech part of research was supported by a grant 13-25656S of the Czech Science Foundation and by RVO: 68081740 of the Institute of Psychology, Academy of Sciences of the Czech Republic. Authors are sincerely thankful to Robert R. McCrae for his valuable suggestions and comments.

Correspondence concerning this article should be addressed to Liisi Ausmees, Institute of Psychology, University of Tartu, Näituse 2, Tartu 50409, Estonia. E-mail: liisi.ausmees@ut.ee

References

- Allik, J., Borkenau, P., Hřebíčková, M., Kuppens, P., & Realo, A. (2015). How are personality trait and profile agreement related? *Frontiers in Psychology*, 6, 785.
<https://doi.org/10.3389/fpsyg.2015.00785>
- Allik, J., de Vries, R. E., & Realo, A. (2016). Why are moderators of self-other agreement difficult to establish? *Journal of Research in Personality*, 63, 72-83.
<https://doi.org/10.1016/j.jrp.2016.05.013>
- Allik, J., Realo, A., Mõttus, R., Borkenau, P., Kuppens, P., & Hřebíčková, M. (2010). How people see others is different from how people see themselves: A replicable pattern across cultures. *Journal of Personality and Social Psychology*, 99, 870-882.
<https://doi.org/10.1037/a0020963>
- Ausmees, L., Talts, M., Allik, J., Vainik, U., Sikka, T.-T., Nikopensius, T., Esko, T., & Realo, A. (2021). Taking risks to feel excitement: Detailed personality profile and genetic associations. *European Journal of Personality*. <https://doi.org/10.1177/08902070211019242>
- Balduzzi, S., Rücker, G., & Schwarzer, G. (2019). How to perform a meta-analysis with R: A practical tutorial. *Evidence-Based Mental Health*, 22, 153-160.
<https://doi.org/10.1136/ebmental-2019-300117>
- Bleidorn, W., Hopwood, C. J., Ackerman, R. A., Witt, E. A., Kandler, C., Riemann, R., Samuel, D. B., & Donnellan, M. B. (2020). The healthy personality from a basic trait perspective. *Journal of Personality and Social Psychology*, 118(6), 1207-1225.
<https://doi.org/10.1037/pspp0000231>
- Bleidorn, W., Kandler, C., Riemann, R., Spinath, F. M., & Angleitner, A. (2009). Patterns and sources of adult personality development: Growth curve analyses of the NEO PI-R scales in a longitudinal twin study. *Journal of Personality and Social Psychology*, 97(1), 142-155.
<https://doi.org/10.1037/a0015434>
- Bleidorn, W., Klimstra, T. A., Denissen, J. J. A., Rentfrow, P. J., Potter, J., Gosling, S. D. (2013). Personality maturation around the world: a cross-cultural examination of social-investment theory. *Psychological Science*, 24, 2530-2540.
<http://dx.doi.org/10.1177/0956797613498396>
- Caspi, A., Roberts, B. W., & Shiner, R. L. (2005). Personality Development: Stability and Change. *Annual Review of Psychology*, 56, 453-484.
<https://doi.org/10.1146/annurev.psych.55.090902.141913>

- Champely, S. (2020). *Pwr: Basic Functions for Power Analysis*. <https://CRAN.R-project.org/package=pwr>
- Chan, W., McCrae, R. R., De Fruyt, F., Jussim, L., Löckenhoff, C. E., De Bolle, M., Costa, P. T., Sutin, A. R., Realo, A., Allik, J., Nakazato, K., Shimonaka, Y., Hřebíčková, M., Graf, S., Yik, M., Brunner-Sciara, M., De Figuerola, N. L., Schmidt, V., Ahn, C. K., Ahn, H. N., ... Terracciano, A. (2012). Stereotypes of age differences in personality traits: universal and accurate? *Journal of Personality and Social Psychology*, 103(6), 1050–1066. <https://doi.org/10.1037/a0029712>
- Condon, D. M., Wood, D., Möttus, R., Booth, T., Costantini, G., Greiff, S., Johnson, W., Lukaszewski, A., Murray, A., Revelle, W., Wright, A. G. C., Ziegler, M., & Zimmermann, J. (2020). Bottom up construction of a personality taxonomy. *European Journal of Psychological Assessment*, 36(6), 923-934. <http://dx.doi.org/10.1027/1015-5759/a000626>
- Costa, P. T., & McCrae, R. R. (1992). Normal personality assessment in clinical practice: The NEO Personality Inventory. *Psychological Assessment*, 4(1), 5–13. <https://doi.org/10.1037/1040-3590.4.1.5>
- Costa, P. T., Jr., & McCrae, R. R. (2002). Looking backward: Changes in the mean levels of personality traits from 80 to 12. In D. Cervone, & W. Mischel (Eds.), *Advances in personality science* (pp. 219–237). Guilford.
- Costa, P. T., Jr., McCrae, R. R., & Löckenhoff, C. E. (2019). Personality across the life span. *Annual Review of Psychology*, 70, 21.1-21.26. <https://doi.org/10.1146/annurev-psych-010418-103244>
- Costa, P. T., Jr., McCrae, R. R., Martin, T. A., Oryol, V. E., Senin, I. G., Rukavishnikov, A. A., Shimonaka, Y., Nakazato, K., Gondo, Y., Takayama, M., Allik, J., Kallasmaa, T., & Realo, A. (2000). Personality development from adolescence through adulthood: Further cross-cultural comparisons of age differences. In V. J. Molfese & D. Molfese (Eds.), *Temperament and personality development across the life span* (pp. 235-252). Lawrence Erlbaum Associates.
- Dijkstra, W., Smit, J. J., & Comijs, H. C. (2001). Using social desirability scales in research among the elderly. *Quality and Quantity*, 35(1), 107-115. <https://doi.org/10.1023/A:1004816210439>
- Donnellan, M. B. & Lucas, R. E. (2008). Age differences in the Big Five across the life span: Evidence from two national samples. *Psychology and Aging*, 23(3), 558-566. <https://doi.org/10.1037/a0012897>

- Eid, M. & Diener, E. (2006). *Handbook of Multimethod Measurement in Psychology*. American Psychological Association.
- Fastame, M. C. & Penna, M. P. (2012). Does social desirability confound the assessment of self-reported measures of well-being and metacognitive efficiency in young and older adults? *Clinical Gerontologist*, 35(3), 239-256. <https://doi.org/10.11144/Javeriana.upsy16-2.sds>
- Funder, D. C. (1995). On the accuracy of personality judgment: A realistic approach. *Psychological Review*, 102, 652-670. <https://doi.org/10.1037/0033-295x.102.4.652>
- Funder, D. C., & Dobroth, K. M. (1987). Differences between traits: Properties associated with interjudge agreement. *Journal of Personality and Social Psychology*, 52, 409–418. <https://doi.org/10.1037//0022-3514.52.2.409>
- Hogan, R., & Roberts, B. W. (2004). A socioanalytic model of maturity. *Journal of Career Assessment*, 12(2), 207–217. <https://doi.org/10.1177/1069072703255882>
- Holzinger, K. J. & Swineford, F. (1937). The bi-factor method. *Psychometrika*, 2(1), 41-54. <https://doi.org/10.1007/BF02287965>
- Hřebíčková, M. (2002). Internal consistency of the Czech version of the NEO Personality inventory (NEO-PI-R). *Československá Psychologie*, 46, 521–535.
- Hřebíčková, M. (2003). Metodologické souvislosti výzkumu Shody Mezi Sebeposouzením a Posouzením Druhými [Methodological issues of research in agreement self-other]. *Československá Psychologie*, 47, 533–547.
- Jackson, J. J., Walton, K. E., Harms, P. D., Bogg, T., Wood, D., Lodi-Smith, J., ... Roberts, B. W. (2009). Not all Conscientiousness scales change alike: A multimethod, multisample study of age differences in the facets of Conscientiousness. *Journal of Personality and Social Psychology*, 96(2), 446–459. <https://doi.org/10.1037/a0014156>
- Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., & Rosseel, Y. (2021). semTools: Useful tools for structural equation modeling. R package version 0.5-5. Retrieved from <https://CRAN.R-project.org/package=semTools>
- Jöreskog, K. G. & Goldberger, A. S. (1975). Estimation of a model with multiple indicators and multiple causes of a single latent variable. *Journal of the American Statistical Association*, 70, 631-639. <https://doi.org/10.2307/2285946>
- Kallasmaa, T., Allik, J., Realo, A., & McCrae, R. R. (2000). The Estonian version of the NEO-PI-R: An examination of universal and culture-specific aspects of the five-factor

model. *European Journal of Personality*, 14(3), 265–278. [https://doi.org/10.1002/1099-0984\(200005/06\)14:3<265::AID-PER376>3.0.CO;2-B](https://doi.org/10.1002/1099-0984(200005/06)14:3<265::AID-PER376>3.0.CO;2-B)

Kandler, C., Bleidorn, W., Riemann, R., Spinath, F. M., Thiel, W., & Angleitner, A. (2010).

Sources of cumulative continuity in personality: A longitudinal multiple-rater twin study.

Journal of Personality and Social Psychology, 98, 995–1008.

<https://doi.org/10.1037/a0019558>

Kandler, C., Kornadt, A. E., Hagemeyer, B., & Neyer, F. J. (2015). Patterns and sources of

personality development in old age. *Journal of Personality and Social Psychology*, 109,

175-191. <https://doi.org/10.1037/pspp0000028>

Kandler, C., Riemann, R., Spinath, F. M., Bleidorn, W., Thiel, W., & Angleitner, A. (2013). The

Bielefeld Longitudinal Study of Adult Twins. *Twin Research and Human Genetics*, 16, 167-

172. <https://doi.org/10.1017/thg.2012.67>

Kenny, D. A. (1994). *Interpersonal perception*. Guilford Press.

Kenny, D. A., West, T. V., Malloy, T. E., & Albright, L. (2006). Componential analysis of

interpersonal perception data. *Personality and Social Psychology Review*, 10(4), 282-294.

https://doi.org/10.1207/s15327957pspr1004_1

Kim, E. S., Yoon, M., & Lee, T. (2012). Testing Measurement Invariance Using MIMIC: Likelihood

ratio test with a critical value adjustment. *Educational and Psychological Measurement*,

72(3), 469-492. <https://doi.org/10.1177/0013164411427395>

Kolar, D. W., Funder, D. C., & Colvin, C. R. (1996). Comparing the accuracy of personality

judgments by the self and knowledgeable others. *Journal of Personality*, 64(2), 311–337.

<https://doi.org/10.1111/j.1467-6494.1996.tb00513.x>

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in

Linear Mixed Effects Models. *Journal of Statistical Software*, 82(13), 1–26.

<https://doi.org/10.18637/jss.v082.i13>

Leising, D., Erbs, J., & Fritz, U. (2010). The letter of recommendation effect in informant ratings of

personality. *Journal of Personality and Social Psychology*, 98(4), 668–

682. <https://doi.org/10.1037/a0018771>

Leitsalu, L., Haller, T., Esko, T., Tammesoo, M.-L., Alavere, H., Snieder, H., Perola, M., Ng, P. C.,

Mägi, R., Milani, L., Fischer, K., & Metspalu, A. (2014). Cohort Profile: Estonian Biobank

of the Estonian Genome Center, University of Tartu. *International Journal of Epidemiology*, 44(4), 1137–1147. <https://doi.org/10.1093/ije/dyt268>

- Lenhausen, M. R., van Scheppingen, M. A., & Bleidorn, W. (2021). Self–other agreement in personality development in romantic couples. *European Journal of Personality*, 35(6), 797–813. <https://doi.org/10.1177/0890207020969011>
- Luan, Z., Hutteman, R., Denissen, J. J. A., Asendorpf, J. B., & van Aken, M. A. G. (2017). Do you see my growth? Two longitudinal studies on personality development from childhood to young adulthood from multiple perspectives. *Journal of Research in Personality*, 67, 44–60. <https://doi.org/10.1016/j.jrp.2016.03.004>
- Lucas, R. E., & Donnellan, M. B. (2009). Age differences in personality: Evidence from a nationally representative Australian sample. *Developmental Psychology*, 45, 1353–1363. <https://doi.org/10.1037/a0013914>
- Lucas, R. E., & Donnellan, M. B. (2011). Personality development across the life span: Longitudinal analyses with a national sample from Germany. *Journal of Personality and Social Psychology*, 101, 847–861. <https://doi.org/10.1037/a0024298>
- McCrae, R. R. (2015). A more nuanced view of reliability: Specificity in the trait hierarchy. *Personality and Social Psychology Review*, 19, 97–112. <https://doi.org/10.1177/1088868314541857>
- McCrae, R. R. (2018). Method biases in single-source personality assessments. *Psychological Assessment*, 30(9), 1160–1173. <https://doi.org/10.1037/pas0000566>
- McCrae, R. R., & Costa, P. T. (1983). Social desirability scales: More substance than style. *Journal of Consulting and Clinical Psychology*, 51(6), 882–888. <https://doi.org/10.1037/0022-006X.51.6.882>
- McCrae, R. R., & Costa, P. T. (2008). The Five-Factor Theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed.). (pp. 159–181). Guilford Press.
- McCrae, R. R., & Costa, P. T. (2010). *NEO Inventories Professional Manual*. Psychological Assessment Resources.
- McCrae, R. R., Costa, P. T., Hřebíčková, M., Urbánek, T., Oryol, V. E., Rukavishnikov, A. A., & Senin, I. G. (2004). Age differences in personality traits across cultures: Self-report and observer perspectives. *European Journal of Personality*, 18, 143–157. <https://doi.org/10.1002/per.510>

- McCrae, R. R., Costa, P. T., Martin, T. A., Oryol, V. E., Rukavishnikov, A. A., Senin, I. G., Hřebíčková, M., Urbánek, T. (2004). Consensual validation of personality traits across cultures. *Journal of Research in Personality*, 38, 179-201. [https://doi.org/10.1016/S0092-6566\(03\)00056-4](https://doi.org/10.1016/S0092-6566(03)00056-4)
- McCrae, R. R., Costa, P. T., Ostendorf, F., Angleitner, A., Hřebíčková, M., Avia, M. D., Sanz, J., Sanchez-Bernardos, M. L., Kusdil, M. E., Woodfield, R., Saunders, P. R., & Smith, P. B. (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology*, 78(1), 173-186. <https://doi.org/10.1037//0022-3514.78.1.173>
- McCrae, R. R., De Bolle, M., Löckenhoff, C. E., & Terracciano, A. (2021). Lifespan trait development: Towards an adequate theory of personality (Chapter 23, pp. 621-641). In J. F. Rauthmann (Ed.), *The Handbook of Personality Dynamics and Processes*. Academic Press. <https://doi.org/10.1016/B978-0-12-813995-0.00023-6>
- McCrae, R. R., & Möttus, R. (2019). What personality scales measure: A new psychometrics and its implications for theory and assessment. *Current Directions in Psychological Science*, 28(4), 415–420. <https://doi.org/10.1177/0963721419849559>
- McCrae, R. R., & Sutin, A. R. (2018). A Five-Factor Theory perspective on causal analysis. *European Journal of Personality*, 32(3), 151–166. <https://doi.org/10.1002/per.2134>
- McCrae, R. R., Terracciano, A., Personality Profiles of Cultures Project (2005). Universal features of personality traits from the observer's perspective: data from 50 cultures. *Journal of Personality and Social Psychology*, 88, 547–61. <https://doi.org/10.1037/0022-3514.88.3.547>
- Möttus, R., Allik, J., Hřebíčková, M., Kööts-Ausmees, L., & Realo, A. (2016). Age differences in the variance of personality characteristics. *European Journal of Personality*, 30, 4–11. <https://doi.org/10.1002/per.2036>
- Möttus, R., Allik, J., & Realo, A. (2020). Do self-reports and informant-ratings measure the same personality constructs? *European Journal of Psychological Assessment*, 36(2), 289–295. <https://doi.org/10.1027/1015-5759/a000516>
- Möttus, R., Johnson, W., & Deary, I. J. (2012). Personality traits in old age: Measurement and rank-order stability and some mean-level change. *Psychology and Aging*, 27, 243–249. <http://dx.doi.org/10.1037/a0023690>
- Möttus, R., Kandler, C., Bleidorn, M., Riemann, R., & McCrae, R. R. (2017). Personality traits below facets: the consensual validity, longitudinal stability, heritability, and utility of

personality nuances. *Journal of Personality and Social Psychology*, 112(3), 474–490.

<https://doi.org/10.1037/pspp0000100>

Mõttus, R., McCrae, R. R., Allik, J., & Realo, A. (2014). Cross-rater agreement on common and specific variance of personality scales and items. *Journal of Research in Personality*, 52, 47–54. <https://doi.org/10.1016/j.jrp.2014.07.005>

Mõttus, R., Realo, A., Allik, J., Esko, T., Metspalu, A., & Johnson, W. (2015). Within-trait heterogeneity in age group differences in personality domains and facets: Implications for the development and coherence of personality traits. *PLoS ONE*, 10(3), e0119667.

<https://doi.org/10.1371/journal.pone.0119667>

Mõttus, R., Realo, A., Vainik, U., Allik, J., & Esko, T. (2017). Educational attainment and personality are genetically intertwined. *Psychological Science*, 28(11), 1631–1639. <https://doi.org/10.1177/0956797617719083>

Mõttus, R., & Rozgonjuk, D. (2021). Development is in the details: Age differences in the Big Five domains, facets, and nuances. *Journal of Personality and Social Psychology*, 120(4), 1035–1048. <https://doi.org/10.1037/pspp0000276>

Mõttus, R., Sinick, J., Terracciano, A., Hřebíčková, M., Kandler, C., Ando, J., Mortensen, E. L., Colodro-Conde, L., & Jang, K. L. (2019). Personality characteristics below facets: A replication and meta-analysis of cross-rater agreement, rank-order stability, heritability and utility of personality nuances. *Journal of Personality and Social Psychology*, 117(4). <https://doi.org/10.1037/pspp0000202>

Mõttus, R., Wood, D., Condon, D. M., Back, M. D., Baumert, A., Costantini, G., Epskamp, S., Greiff, S., Johnson, W., Lukaszewski, A., Murray, A., Revelle, W., Wright, A. G. C., Yarkoni, T., Ziegler, M., & Zimmermann, J. (2020). Descriptive, predictive and explanatory personality research: Different goals, different approaches, but a shared need to move beyond the Big Few traits. *European Journal of Personality*, 34(6), 1175–1201. <https://doi.org/10.1002/per.2311>

Oltmanns, J. R., Jackson, J. J., & Oltmanns, T. F. (2020). Personality change: Longitudinal self-other agreement and convergence with retrospective-reports. *Journal of Personality and Social Psychology*, 118(5), 1065–1079. <https://doi.org/10.1037/pspp0000238>

Ostendorf, F. & Angleitner, A. (2004). *NEO-Persönlichkeitsinventar nach Costa und McCrae, Revidierte Fassung*. Hogrefe.

- Paulhus, D. L. (2002). Socially desirable responding: The evolution of a construct. In H. I. Braun, D. N Jackson, & D. E. Wiley (Eds.), *The role of constructs in psychological and educational measurement* (pp. 49-69). Erlbaum.
- Paulhus, D. L. (2017). Socially Desirable Responding on Self-Reports. In Zeigler-Hill, V. & Shackelford, T. (eds), *Encyclopedia of Personality and Individual Differences*. Springer, Cham. https://doi.org/10.1007/978-3-319-28099-8_1349-1
- R Core Team (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>
- Roberts, B. W., & Mroczek, D. (2008). Personality Trait Change in Adulthood. *Current Directions in Psychological Science*, 17(1), 31-35. <https://doi.org/10.1111/j.1467-8721.2008.00543.x>
- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*, 132(1), 1-25. <https://doi.org/10.1037/0033-2909.132.1.1>
- Roberts, B. W., & Wood, D. (2006). Personality development in the context of the Neo-Socioanalytic Model of personality. In D. Mroczek & T. Little (Eds.), *Handbook of Personality Development* (Chapter 2, pp. 11–39). Lawrence Erlbaum Associates.
- Roberts, B. W., Wood, D., & Smith, J. L. (2005). Evaluating Five Factor Theory and social investment perspectives on personality trait development. *Journal of Research in Personality*, 39(1), 166–184. <https://doi.org/10.1016/j.jrp.2004.08.002>
- Rohrer, J. M., & Arslan, R. C. (2021). Precise answers to vague questions: Issues with interactions. *Advances in Methods and Practices in Psychological Science*, 4(2). <https://doi.org/10.1177/25152459211007368>
- Rohrer, J. M., Egloff, B., Kosinski, M., Stillwell, D., & Schmukle, S. C. (2018). In your eyes only? Discrepancies and agreement between self- and other-reports of personality from age 14 to 29. *Journal of Personality and Social Psychology*, 115, 304-320. <https://doi.org/10.1037/pspp0000142>
- Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, 48, 1-36. <http://www.jstatsoft.org/v48/i02/>
- Schwaba, T. & Bleidorn, W. (2018). Individual differences in personality change across the adult lifespan. *Journal of Personality*, 86(3), 450-464. <https://doi.org/10.1111/jopy.12327>
- Schwaba, T., Bleidorn, W., Hopwood, C. J., Manuck, S. B., & Wright, A. G. C. (2022). Refining the maturity principle of personality development by examining facets, close others, and

comaturation. *Journal of Personality and Social Psychology*. Advance online publication.

<https://doi.org/10.1037/pspp0000400>

- Soto, C. J., & John, O. P. (2012). Development of Big-Five domains and facets in adulthood: Mean-level age trends and broadly versus narrowly acting mechanisms. *Journal of Personality*, 80, 881–914. <https://doi.org/10.1111/j.1467-6494.2011.00752.x>
- Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2011). Age differences in personality traits from 10 to 65: Big five domains and facets in a large cross-sectional sample. *Journal of Personality and Social Psychology*, 100(2), 330-348. <https://doi.org/10.1037/a0021717>
- Soubelet, A., & Salthouse, T. A. (2011). Influence of social desirability on age differences in self-reports of mood on personality. *Journal of Personality*, 79(4), 741-762. <https://doi.org/10.1111/j.1467-6494.2011.00700.x>
- Srivastava, S., John, O. P., Gosling, S. D., & Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change? *Journal of Personality and Social Psychology*, 84(5), 1041-1053. <https://doi.org/10.1037/0022-3514.84.5.1041>
- Stöbel, K., Kämpfe, N., & Riemann, R. (2006). The Jena Twin Registry and the Jena Twin Study of Social Attitudes (JeTSSA). *Twin Research and Human Genetics*, 9, 783-786. <https://doi.org/10.1375/twin.9.6.783>
- Terracciano, A., McCrae, R. R., Brant, L. J., & Costa, Jr P. T. (2005). Hierarchical linear modeling analyses of NEO-PI-R scales in the Baltimore Longitudinal Study of Aging. *Psychology and Aging*, 20(3), 493-506. <https://doi.org/10.1037/0882-7974.20.3.493>
- Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2018). Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time. *Clinical Psychological Science*, 6(1), 3–17. <https://doi.org/10.1177/2167702617723376>
- Vazire, S. (2006). Informant reports: A cheap, fast, and easy method for personality assessment. *Journal of Research in Personality*, 40(5), 472–481. <https://doi.org/10.1016/j.jrp.2005.03.003>
- Vazire, S. (2010). Who knows what about a person? The self-other knowledge asymmetry (SOKA) model. *Journal of Personality and Social Psychology*, 98(2), 281-300. <https://doi.org/10.1037/a0017908>

- Watson, D., & Humrichouse, J. (2006). Personality development in emerging adulthood: Integrating evidence from self-ratings and spouse ratings. *Journal of Personality and Social Psychology*, 91(5), 959–974. <https://doi.org/10.1037/0022-3514.91.5.959>
- Weiss, A., & King, J. E. (2015). Great ape origins of personality maturation and sex differences: A study of orangutans and chimpanzees. *Journal of Personality and Social Psychology*, 108(4), 648–664. <https://doi.org/10.1037/pspp0000022>
- Welte, J. W. & Russell, M. (1993). Influence of socially desirable responding in a study of stress and substance abuse. *Alcoholism: Clinical and Experimental Research*, 17(4), 758-61. <https://doi.org/10.1111/j.1530-0277.1993.tb00836.x>
- Wickham, H. (2016). *Ggplot2: Elegant graphics for data analysis* (2nd ed.). Springer International Publishing. Retrieved from <https://ggplot2.tidyverse.org>
- Wortman, J., Lucas, R. E., & Donnellan, M. B. (2012). Stability and change in the Big Five personality domains: Evidence from a longitudinal study of Australians. *Psychology and Aging*, 27, 867–874. <http://dx.doi.org/10.1037/a0029322>

Table 1.

Medians of Absolute Correlations (Spearman's ρ) between Age and Personality Traits: At the Level of Facets and Items

	NEO PI-R/3 facets	
	Median of absolute correlations* between age and self-reports	Median of absolute correlations between age and informant-reports
Estonia	.18	.08
Germany Twin 1	.15	.09
Germany Twin 2	.12	.08
Czech	.14	.10
	NEO PI-R/3 items	
	Median of absolute correlations* between age and self-reports	Median of absolute correlations between age and informant-reports
Estonia	.11	.07
Germany Twin 1	.10	.08
Germany Twin 2	.08	.07
Czech	.11	.09

Note. NEO PI-R/3 = NEO Personality Inventory-R was used in the German and Czech samples, NEO Personality Inventory-3 was used in the Estonian sample. * Median of absolute correlations (Spearman's ρ) between age and self- or informant-reported facets/items, i.e., $Md | (\rho) |$.

Table 2.*Associations between Personality Characteristics, Age, and Social Desirability Ratings*

<i>Facet-level correlations (Spearman's ρs)</i>	Estonia		Germany Twin 1	Germany Twin 2	Czech	Meta-Analysis
	<i>Panel 1</i>	<i>Panel 2</i>				
Self—Age x Informant—Age	.89***	.89***	.89***	.87***	.89***	.89***/.89***
Desirability x Self—Age	.37*	-.03	.50**	.49**	.44*	.45***/.36**
Desirability x Informant—Age	.29	-.08	.40*	.31	.13	.29**/.20
Desirability x (Self—Age minus Informant—Age)	.45*	.00	.52**	.60***	.82***	.63***/.55*
<i>Item-level correlations (Spearman's ρs)</i>						
Self—Age x Informant—Age	.90***	.90***	.86***	.83***	.86***	.86***/.86***
Desirability x Self—Age	.21**	.02	.37***	.27***	.37***	.31***/.26***
Desirability x Informant—Age	.08	-.03	.28***	.14*	.12	.16***/.13*
Desirability x (Self—Age minus Informant—Age)	.31***	.09	.26***	.23***	.55***	.35***/.30**

Note. *** $p < .001$, ** $p < .01$, * $p < .05$; Self—Age = associations (Spearman's ρ s) of participants' age with self-reported personality at the level of facets or items; Informant—Age = associations (Spearman's ρ s) of targets' age with informant-reported personality at the level of facets or items; Desirability = Social desirability ratings at the level of facets or items, as rated by panel of judges (in Estonia, Panel 1, $N = 9$, and Panel 2, $N = 214$; in Germany, $N = 20$; in Czech Republic, $N = 100$). For meta-analytic estimates, they either include social desirability ratings from Estonian Panel 1 or Panel 2.

Figure Captions

Figure 1. Associations of Social Desirability Ratings with the Difference between Self-Ratings Correlated with Age and Informant-Ratings Correlated with Age. Social desirability ratings were provided by panels of judges and standardized separately within each sample. Sample sizes were $n = 3,419$ for Estonia, $n = 757$ for Germany Twin 1, $n = 733$ for Germany Twin 2, and $n = 700$ for the Czech sample. “Estonia: Panel 1” refers to using social desirability ratings given by the first panel of judges ($n = 9$); the associations with social desirability ratings from Panel 2 ($n = 214$) are presented in supplementary Figure A2.

Figure 2. Associations of Meta-Analytic Social Desirability Ratings to the Meta-Analytic Correlations between Personality Facets and Age. For the meta-analytic age correlations parameters from four samples (Estonia, Germany Twin 1 and Twin 2, and the Czech sample) were combined; for the meta-analytic social desirability estimates parameters from four panels (Estonia: Panel 1, Estonia: Panel 2, German, and Czech panels) were combined and standardized.

Figure 3. Age Differences in the Facets of Neuroticism: Weighted Self-Informant Composite Scores Combining Four Samples. Weighted (meta-analytic) means were calculated using random effects models. To obtain T-scores, self- and informant-ratings were separately standardized within each sample before combining into composite scores. N1, Anxiety; N2, Hostility; N3, Depression; N4, Self-consciousness; N5, Impulsiveness; N6, Vulnerability to stress.

Figure 4. Age Differences in the Facets of Extraversion: Weighted Self-Informant Composite Scores Combining Four Samples. Weighted (meta-analytic) means were calculated using random effects models. To obtain T-scores, self- and informant-ratings were separately standardized within each sample before combining into composite scores. E1, Warmth; E2, Gregariousness; E3, Assertiveness; E4, Activity; E5, Excitement-seeking; E6, Positive emotion.

Figure 5. Age Differences in the Facets of Openness to Experience: Weighted Self-Informant Composite Scores Combining Four Samples. Weighted (meta-analytic) means were calculated using random effects models. To obtain T-scores, self- and informant-ratings were separately standardized within each sample before combining into composite scores. O1, Openness to fantasy; O2, Openness to aesthetics; O3, Openness to feelings; O4, Openness to actions; O5, Openness to ideas; O6, Openness to values.

Figure 6. Age Differences in the Facets of Agreeableness: Weighted Self-Informant Composite Scores Combining Four Samples. Weighted (meta-analytic) means were calculated using random effects models. To obtain T-scores, self- and informant-ratings were separately standardized within each sample before combining into composite scores. A1, Trust; A2, Straightforwardness; A3, Altruism; A4, Compliance; A5, Modesty; A6, Tender-mindedness.

Figure 7. Age Differences in the Facets of Conscientiousness: Weighted Self-Informant Composite Scores Combining Four Samples. Weighted (meta-analytic) means were calculated using random effects models. To obtain T-scores, self- and informant-ratings were separately standardized within each sample before combining into composite scores. C1, Competence; C2, Order; C3, Dutifulness; C4, Achievement striving; C5, Self-discipline; C6, Deliberation.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7