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A celebration of Hermann Rorschach's seminal text with this completely new translation!



Translatices and Editorial Hermann Rorschach's psychodiagnostics Newly Translated and Annotated 100th Anniversary Edition hogrefe Philip J. Keddy/Rita Signer/Philip Erdberg/Arianna Schneider-Stocking (Translators and Editors)

Hermann Rorschach's Psychodiagnostics

Newly Translated and Annotated 100th Anniversary Edition

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This new English translation and 100th anniversary annotated edition of Psychodiagnostics, the only book published by Hermann Rorschach, showcases Rorschach's empiricism and the wide-ranging flexibility of his thinking - and thus helps us to understand why his iconic inkblot test has survived for a century and is still being used around the world, with the support of a strong evidence base. The expert translation team have collaborated closely to create an accessible rendition of Hermann Rorschach's presentation of the inkblot test that resulted from his empirical research experiments. Also included is the case study lecture that Rorschach gave to the Swiss

Psychoanalytic Society in 1922, just six weeks before his premature death. Both his book and the lecture are accompanied by annotations for the first time, looking backward to the sources of Rorschach's terminology and also forward to how the test is used today. Drawings and photographs from the Rorschach Archive as well as introductory chapters on the history of the translation and the creation of Psychodiagnostics bring the story of this important figure and his work to life. This volume is essential reading for both historians and contemporary users of the inkblot test and anyone interested in exploring personality testing.



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Original Article



Associations of Multiple Measures of Openness to Experience with a Brief Questionnaire of Positive, Negative, and Disorganized Schizotypy

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Abstract: The vulnerability for schizophrenia-spectrum disorders is expressed across a continuum of clinical and subclinical symptoms and impairment known as schizotypy. Schizotypy is a multidimensional construct with positive, negative, and disorganized dimensions. Openness to experience offers a useful personality domain for exploring multidimensional schizotypy. This study examined the factor structure of openness and its relation to schizotypy using the Multidimensional Schizotypy Scale-Brief (MSS-B) in a sample of 2,236 adults. Positive schizotypy was broadly associated with elevated openness and negative schizotypy was generally associated with diminished openness. Principal components analysis of 15 openness facets replicated the four-factor structure of openness including Fantasy/Feelings, Eccentricity, Nontraditionalism, and Ideas factors. All three schizotypy was inversely associated with Fantasy/Feelings. Results support the construct validity of the MSS-B, use of alternative openness measures in examining schizotypy, and the multidimensional structures of schizotypy and openness.

Keywords: schizophrenia-spectrum, schizotypy, personality, openness

Current models suggest that schizophrenia represents the most extreme manifestation of a continuum of subclinical and clinical symptoms and impairment known as schizotypy (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010). Schizotypy includes subclinical expressions, prodromal and at-risk mental states, schizophrenia-spectrum disorders, and full-blown psychotic disorders. Schizotypy offers a useful construct for evaluating the expression and etiology of schizophrenia-spectrum disorders. Schizotypy has a multidimensional structure consisting of positive (psychotic-like), negative (deficit), and disorganized dimensions (Kwapil & Barrantes-Vidal, 2015). Positive schizotypy involves odd beliefs, unusual perceptual experiences, and paranoid ideation. Negative schizotypy is characterized by functional deficits including affective flattening, avolition, anhedonia, alogia, and asociality. Disorganized schizotypy is characterized by disruptions in organizing and expressing thought, speech, and behavior. The Multidimensional Schizotypy Scale (MSS; Kwapil, Gross, Silvia, et al., 2018) and Multidimensional Schizotypy Scale-Brief (MSS-B; Gross, Kwapil, Raulin, et al., 2018) offer promising measures of positive, negative, and disorganized schizotypy. The MSS and MSS-B have good psychometric properties (e.g., Gross, Kwapil, Raulin, et al., 2018; Kemp, Gross, et al., 2020; Kwapil, Gross, Silvia, et al., 2018; Li et al., 2020), and the validity of the scales has been demonstrated in an interview (e.g., Kemp et al., 2021), questionnaire (e.g., Gross, Kwapil, Burgin, et al., 2018), and ambulatory assessment (e.g., Kwapil et al., 2020) studies.

Schizotypy and Openness to Experience

Psychopathology can be conceptualized in terms of maladaptive variants of normal personality (e.g., Widiger & Samuel, 2005). Models of psychopathology such as the Hierarchical Taxonomy of Psychopathology (HiTOP) and the DSM-5 Section III dimensional trait model are purportedly aligned with the domains of the Five-Factor Model (FFM) of general personality (Kotov et al., 2017). Therefore, normal models of personality should enhance our understanding of positive, negative, and disorganized schizotypy. Previous studies demonstrated that the schizotypy dimensions are differentially associated with FFM (Costa & McCrae, 1992) personality dimensions and facets (e.g., Gross et al., 2014; Ross et al., 2002). Openness to experience, broadly defined as the inclination to consider and engage with unfamiliar or unconventional activities, feelings, and ideas (McCrae & Costa, 1985), appears particularly relevant for understanding multidimensional schizotypy.

Much of the work evaluating openness in schizotypy has focused on positive and negative schizotypy, such that positive schizotypy is typically associated with elevated openness, whereas negative schizotypy is associated with diminished openness (Chmielewski & Watson, 2008; Gross et al., 2014; Kwapil, Gross, Burgin, et al., 2018; Ross et al., 2002). However, these studies have typically been limited by failing to include disorganized schizotypy. Reliance on measures that seemingly do not capture the full range of openness (e.g., McCrae & Costa's [2010] NEO measures of openness) has likely further limited this line of research. For example, HiTOP and the DSM-5 dimensional trait model reportedly align with the FFM; however, their respective "Thought Disorder" and "Psychoticism" factors, which overlap with conceptualizations of multidimensional schizotypy (e.g., Kotov et al., 2020), demonstrate less consistency with openness to experience than expected. It has been argued that this poor alignment may be due to there being no normal variant of these Thought Disorder/Psychoticism factors (e.g., Widiger & Crego, 2019). Furthermore, as noted by Crego and Widiger (2017) and Gore and Widiger (2013), McCrae & Costa's conceptualization and measurement of openness largely focus on adaptive expressions of the construct. Thus, measures such as the widely used NEO may not adequately capture the maladaptively high openness that characterizes magical and referential thinking and predilection for fantasy in schizotypy, or in Psychoticism or Thought Disorder. However, other measures appear to better capture maladaptive expressions of the construct and appear useful for examining schizotypy. For example, the HEXACO Personality Inventory (Lee & Ashton, 2004) and the Inventory of Personal Characteristics (IPC; Tellegen & Waller, 1987) include "unconventionality" as part of their measure of openness. Likewise, the Experiential Permeability Inventory (EPI; Piedmont et al., 2009) measures maladaptive variants of both high and low openness.

Kemp, Burgin, et al. (2020) examined the association of MSS positive, negative, and disorganized schizotypy with NEO-Personality Inventory-3 (NEO-PI-3; McCrae & Costa, 2010) openness to experience, HEXACO openness to experience, IPC unconventionality, and the EPI. Additionally, they reported that four factors underlie the various facets of openness (Fantasy/Feelings, Ideas, Eccentricity, Nontraditionalism). Consistent with the odd ideas that characterize positive schizotypy, MSS positive schizotypy was broadly associated with increased openness (especially eccentricity). Negative schizotypy was generally inversely associated with openness, especially aspects involving fantasy, aesthetics, actions, and feelings, but was modestly associated with the eccentricity aspects of openness. Disorganized schizotypy was generally unassociated with openness, although it was modestly associated with eccentricity. These findings highlight the importance of including maladaptive expressions of openness in conceptualization and measurement of the construct, especially when relating it to psychopathology.

Kemp, Burgin, et al. (2020) demonstrated that MSSassessed positive, negative, and disorganized schizotypy have differential patterns of associations with openness. However, these associations have not been evaluated using the MSS-B. The MSS-B was designed to maintain the same content coverage of positive, negative, and disorganized schizotypy as the MSS, and the analogous MSS and MSS-B subscales show high concordance (Kemp, Gross, et al., 2020). Thus, the MSS-B appears to offer a promising brief alternative that largely maintains the full-length version's strong psychometric properties. Furthermore, studies that have directly compared the validity of the MSS and MSS-B support the use of the short-scale (e.g., Gross, Kwapil, Burgin, et al., 2018). However, Smith et al. (2000) noted that evidence for the validity of the original measure does not automatically confer to brief forms and that reduction in items may endanger content coverage even if the original and short forms correlate highly. Therefore, it is necessary to demonstrate the validity of short-forms relative to original measures.

Goals and Hypotheses

The goal of the present study was to examine the expression of adaptive and maladaptive variants of openness to experience in positive, negative, and disorganized schizotypy using the MSS-B. Specifically, we aimed to replicate Kemp, Burgin, et al.'s (2020) findings using the full-length MSS regarding (a) the differential associations of positive, negative, and disorganized schizotypy with measures of openness to experience; (b) the factor structure of openness to experience; and (c) the associations of multidimensional schizotypy with openness factors (provided an identifiable factor structure emerges). We expected positive schizotypy to be broadly associated with elevated openness, and that it would be most strongly associated with maladaptive aspects of openness (e.g., eccentricity), as well as openness to fantasy, aesthetics, and ideas. Consistent with the characterization of negative schizotypy involving diminished affect, thoughts, and interest in the world, we expected negative schizotypy to be broadly associated with low openness (although directly associated with an eccentricity factor of openness). Finally, disorganized schizotypy was hypothesized to be generally unassociated with openness, although modestly associated with eccentricity. Replication of the associations between schizotypy and openness will provide further support for the use of the MSS-B as a short-form of the MSS, and for the inclusion of alternative measures of openness in evaluating schizotypy. Finally, replication of the factor structure of openness will provide support for considering the multidimensional structure of openness.

Method

Participants

Participants were recruited through Amazon Mechanical Turk (MTurk) and the participant pools at three universities. A total of 2,775 participants completed the study, although 539 (19.4%) were omitted due to invalid or incomplete responding. The final sample included 1,281 participants enrolled from Kemp, Burgin, et al.'s (2020) study and 955 newly enrolled participants. Due to a programming error, demographic information is missing for 589 participants (26.3%). Demographic characteristics for the remaining 1,647 participants were: $M_{age} = 22.0$ years, SD = 8.4; 61.3% female; 6.8% Black, 7.2% Asian/Pacific Islander, 74.3% Caucasian, 7.8% Hispanic/Latino, .9% Native American, and 3.2% other. The sample size provided power of at least .80 to detect small effect sizes in regression analyses with three predictors at α of .001.

Measures

The Multidimensional Schizotypy Scale (MSS; Kwapil, Gross, Silvia, et al., 2018) and Multidimensional Schizotypy Scale-Brief (MSS-B; Gross, Kwapil, Raulin, et al., 2018) con-

tain true-false items that examine positive, negative, and disorganized schizotypy. The scales were developed using large and diverse samples following best practices specified by DeVellis (2012) and item selection was based on content coverage, and classical test theory, item response theory, and differential item functioning metrics (see source articles for each scale for complete details and items). Both scales have good to excellent internal consistency and test-retest reliability, and the subscales show strong concordance across the original and brief measures (Gross, Kwapil, Raulin, et al., 2018; Kemp, Gross et al., 2020; Kwapil, Gross, Silvia, et al., 2018). The MSS-B positive, negative, and disorganized schizotypy subscale scores were computed for all participants. MSS-B scores were derived from the 77-item MSS for participants from Kemp, Burgin, et al. (2020). The remaining participants completed the 38-item MSS-B. Thirteen infrequent responding items were intermixed with the MSS and MSS-B to identify invalid responders (Chapman & Chapman, 1983). Following the authors' recommendations, participants who endorsed more than two of the infrequency items were identified as invalid responders and thus omitted from analyses.

Subscales of several widely used personality inventories were administered in order to assess both adaptive and maladaptive openness. The NEO-Personality Inventory-3 (NEO-PI-3; McCrae & Costa, 2010) is a measure of FFM personality domains, and the NEO-PI-3 48-item Openness to Experience subscale contains six facets, each containing eight items: Fantasy, Aesthetics, Feelings, Actions, Ideas, and Values. The HEXACO-PI (Lee & Ashton, 2004) is an alternative measure for evaluating the FFM; its 16-item Openness to Experience subscale has strong psychometric properties and assesses Aesthetic Appreciation, Inquisitiveness, Creativity, and Unconventionality. Two subscales from the Experiential Permeability Inventory (EPI; Piedmont et al., 2009) were included in order to assess maladaptive levels of openness to experience: the 16-item Odd and Eccentric subscale and the 11-item Unrestricted Self subscale. According to the scale creators, these subscales have acceptable psychometric properties. All four of these openness measures are rated on a Likert scale from 1 = strongly disagree to 5 = strongly agree. Finally, the Inventory of Personal Characteristics' (IPC; Tellegen & Waller, 1987) was developed to measure Tellegen's seven-factor model of personality, and its 24-item Unconventionality scale was included as an alternative measure for openness. This scale contains three subscales that are rated from 1 = definitely false to 4 = definitely true: Imagination, Odd, and Traditionalism. Following our procedures in Kemp, Burgin, et al. (2020), we refer to the last subscale as (Un)Traditionalism for consistency with other subscale conceptualizations.

Procedure

Data Collection

Data collection was completed online using Qualtrics survey software. The study was approved by the university IRBs and all participants provided informed consent. Participants completed demographic questions followed by the MSS/MSS-B and infrequency items, which were intermixed and presented in five randomized blocks. Participants next completed the NEO-PI-3, HEXACO, and EPI in random order. Participants always completed the IPC last because it used a 4-point Likert scale rather than the 5-point scale in the other personality measures. MTurk participants received \$2, and undergraduates received course credit.

Analytic Plan

In order to investigate our hypotheses regarding the associations between multidimensional schizotypy and openness to experience, we completed a series of linear regression analyses in which the scores on the MSS-B positive, negative, and disorganized schizotypy subscales were entered simultaneously as predictors of each openness measure score, which included openness total scores (when applicable) and subscale scores. For example, MSS-B positive, negative, and disorganized schizotypy were entered as simultaneous predictors (i.e., at the same step) of the NEO-PI-3 Openness total score. This procedure provides information regarding the unique prediction of each MSS-B subscale on openness measures, over and above the other two MSS-B subscale scores. The standardized regression coefficient (β), change in \mathbb{R}^2 , effect size (f^2), and bivariate correlation (r) are reported for each predictor. Following Cohen (1992), f^2 values of .02, .15, and .35 are considered small, medium, and large effect sizes, respectively. Bivariate correlation values of .10, .30, and .50 are considered small, medium, and large effects, respectively. Note that change in R^2 and f^2 were computed for each predictor by rerunning the analyses with the specific MSS-B predictor entered at the second step, over and above the other two MSS-B subscales (entered at step 1).

In order to evaluate the factor structure of openness to experience, we followed the procedures outlined in Kemp, Burgin, et al. (2020) and computed a principal components analysis with promax rotation of the 15 facet scores of the NEO-PI-3, HEXACO-PI, IPC, and EPI for the entire sample. Parallel analysis and Kaiser's stopping rule were used to determine the ideal number of factors to derive from the data. Next, assuming an identifiable factor structure emerged, we planned to examine whether the openness factor structure identified in Kemp, Burgin, et al.'s sample (n = 1,281) was similar to that identified in the newly enrolled sample (n = 955). Specifically, we computed

Tucker's congruence coefficient (Lorenzo-Seva & ten Berge, 2006), which provides an index of factor similarity. According to Lorenzo-Seva and ten Berge, a congruence coefficient above .95 indicates that two factors can reasonably be considered equal.

Following evaluation of an identifiable factor structure, we examined the MSS-B schizotypy subscales' unique prediction of each openness factor. For these analyses, we followed the same procedures described previously (i.e., linear regression analyses with MSS-B subscales as simultaneous predictors) for evaluating the association between the schizotypy subscales and individual measures of openness to experience. Finally, we evaluated whether the associations between the MSS-B subscales and openness measures and factors differed between samples (i.e., between participants who had MSS-B subscale scores derived from the full-length MSS versus those who completed the MSS-B). Specifically, we recomputed the aforementioned linear regression analyses, with sample entered at Step 2 and Schizotypy \times Sample interaction terms entered at Step 3.

Results

Descriptive statistics for the questionnaires are in Table 1. Participants scored across the full range on the MSS-B positive (0–13), negative (0–13), and disorganized (0–12) schizotypy subscales. Due to the large sample and number of analyses, alpha was set to .001 to minimize Type I error and avoid interpreting minuscule effects as statistically significant. Consistent with previous findings (e.g., Gross, Kwapil, Raulin, et al., 2018), the correlations among the MSS-B subscales were positive-negative, r = .23; positive-disorganized, r = .51, negative-disorganized, r = .32.

Results from the linear regression analyses are reported in Table 2, and each row in the table represents a separate regression analysis in which the scores on the three MSS-B subscales were entered simultaneously as predictors of openness measures. Note that variance inflation values were all below 1.5, indicating that multicollinearity did not appreciably impact the regression analyses.

Consistent with Kemp, Burgin, et al. (2020), MSS-B positive schizotypy was associated with the majority of the measures of openness to experience and was most strongly associated with measures tapping maladaptive variants of openness. MSS-B negative schizotypy was generally inversely associated with openness (especially feelings and aesthetics), although it was positively associated with measures of eccentricity. MSS-B disorganized schizotypy was broadly unassociated with openness but was associated with measures capturing eccentricity.

Table 1. Descriptive statistics for the Multidimensional Schizotypy Scale-Brief and measures of openness (n = 2,236)

Criterion	Mean	SD	Range	Coefficient α
Multidimensional Schizotypy Scale-Brief				
Positive Schizotypy	2.53	2.59	0-13	.77
Negative Schizotypy	1.54	2.14	0-13	.77
Disorganized Schizotypy	2.18	3.02	0-12	.88
NEO Openness Total	164.04	19.76	77-230	.89
NEO Openness to Fantasy	26.56	4.95	8-40	.74
NEO Openness to Aesthetics	26.42	5.85	8-40	.81
NEO Openness to Feelings	29.96	4.54	9-40	.73
NEO Openness to Actions	23.90	3.62	11-40	.55
NEO Openness to Ideas	27.86	5.28	8-40	.80
NEO Openness to Values	29.34	4.59	12-40	.74
HEXACO-PI Openness Total	50.88	9.32	17-80	.81
HEXACO-PI Aesthetic Appreciation	12.74	3.44	4-20	.67
HEXACO-PI Inquisitiveness	11.44	3.40	4-20	.67
HEXACO-PI Creativity	13.44	3.35	4-20	.73
HEXACO-PI Unconventionality	13.26	2.42	5-20	.48
IPC Unconventionality Total	59.33	8.83	28-87	.83
IPC (Un)Traditionalism	21.56	4.34	9-34	.75
IPC Imagination	15.16	2.66	5-20	.74
IPC Odd	14.41	3.88	6-24	.87
EPI Odd and Eccentric	38.08	10.31	16-78	.87
EPI Unrestricted Self	37.68	5.35	20-54	.70

Table 2. Linear regressions examining prediction by the Multidimensional Schizotypy Scale-Brief subscales (n = 2,236)

									MS	SS-B Diso	rganize	d	
	MSS-	B Positive	Schizo	otypy	MSS-B Negative Schizotypy			Schizotypy					
Criteria	r	β	ΔR^2	f ²	r	β	ΔR^2	f ²	r	β	ΔR^2	f ²	Total R ²
NEO Openness Total	.18*	.197*	.029	.031	13*	189*	.032	.034	.08*	.045	.001	.002	.063
NEO Openness to Fantasy	.27*	.223*	.036	.041	.00	095*	.008	.009	.21*	.127	.011	.012	.086
NEO Openness to Aesthetics	.23*	.241*	.043	.047	08*	151*	.020	.023	.13*	.057	.002	.003	.076
NEO Openness to Feelings	.08*	.151*	.017	.020	35*	400*	.142	.167	01	.046	.002	.002	.152
NEO Openness to Actions	.00	.042	.001	.001	13*	129*	.015	.015	05	032	.001	.001	.018
NEO Openness to Ideas	.10*	.129*	.012	.012	.00	013	.000	.000	.01	056	.002	.002	.012
NEO Openness to Values	02	029	.001	.001	.00	006	.000	.000	.01	.027	.000	.001	.001
HEXACO-PI Openness Total	.14*	.157*	.018	.018	.01	041	.001	.001	.05	016	.000	.000	.021
HEXACO-PI Aesthetic Appreciation	.15*	.147*	.016	.016	.00	044	.002	.002	.08*	.025	.000	.000	.024
HEXACO-PI Inquisitiveness	02	.000	.000	.000	.07	.096*	.008	.008	05	082	.005	.005	.011
HEXACO-PI Creativity	.15*	.179*	.024	.024	11*	154*	.021	.022	.04	.004	.000	.000	.043
HEXACO-PI Unconventionality	.15*	.147*	.016	.016	.02	015	.000	.000	.08*	.013	.000	.000	.023
IPC Unconventionality Total	.24*	.140*	.014	.015	.13*	.044	.002	.002	.25*	.170*	.020	.022	.082
IPC (Un)Traditionalism	01	074	.004	.004	.04	.016	.000	.000	.09*	.125*	.011	.011	.013
IPC Imagination	.24*	.264*	.051	.056	07	130*	.015	.016	.10*	.006	.000	.000	.072
IPC Odd	.33*	.203*	.030	.035	.20*	.091*	.007	.008	.33*	.201*	.028	.033	.151
EPI Odd and Eccentric	.61*	.544*	.218	.350	.19*	.024	.001	.000	.40*	.112*	.009	.014	.378
EPI Unrestricted Self	.31*	.258*	.049	.055	.13*	.040	.001	.002	.22*	.078	.004	.006	.102

Note. Medium effect sizes (f^2) in bold; large effect sizes in bold and italics. *p < .001.

	MSS	S-B Positive	Schizot	уру	MSS	MSS-B Negative Schizotypy				MSS-B Disorganized Schizotypy			
Openness factors	r	β	ΔR^2	f ²	r	β	ΔR^2	f ²	r	β	ΔR^2	f ²	Total R ²
Fantasy/Feelings	.25*	.282*	.058	.067	17*	250*	.055	.063	.11*	.046	.001	.002	.117
Eccentricity	.51*	.409*	.123	.175	.23*	.087*	.007	.010	.40*	.160*	.018	.025	.293
Nontraditionalism	04	057	.002	.003	05	053	.003	.003	.01	.059	.002	.003	.006
Ideas	.07	.080	.005	.005	.08*	.084*	.006	.006	.00	067	.003	.003	.012

Table 3. Linear regressions examining prediction of openness factors by Multidimensional Schizotypy Scale-Brief subscales (n = 2,236)

Note. Medium effect sizes (f^2) in bold; large effect sizes in bold and italics. *p < .001.

Factor Structure of Openness

Following computation of a principal components analysis with promax rotation of the 15 facet scores of openness measures (Electronic Supplementary Material, ESM 1, Table E1), both parallel analysis and Kaiser's stopping rule supported the interpretation of four factors accounting for 64% of the total variance. The loadings suggest that the four factors are best characterized as Fantasy/Feelings, Eccentricity, Nontraditionalism, and Ideas. Note that these are comparable to the factors identified in Kemp, Burgin, et al. (2020), although the ordering of the factors differed. Furthermore, Tucker's congruence coefficients "Fantasy/Feelings," "Eccentricity," "Nontraditionalism," and "Ideas," were .981, .969, .980, and .983, respectively. Thus, we successfully replicated the factor structure in Kemp, Burgin, et al. (2020).

Next, we examined the MSS-B schizotypy subscales' unique prediction of each openness factor (see Table 3). Consistent with Kemp, Burgin, et al. (2020), MSS-B positive schizotypy was significantly associated with the Eccentricity (medium effect size) and Fantasy/Feelings (small effect size) factors, but was unassociated with the Nontraditionalism and Ideas factors. MSS-B negative schizotypy was inversely associated with Fantasy/Feelings and directly associated with Eccentricity and, surprisingly, Ideas (all small effects). MSS-B disorganized schizotypy was only associated with Eccentricity (small effect).

Finally, Tables E2 and E3 in ESM 1 present the regression analyses listed above with the three MSS-B Schizotypy Subscales \times Sample interaction terms. Note that only 2 of the 96 interaction terms were statistically significant, indicating that the associations of the MSS-B with the openness measures were consistent across the two samples and the two methods of deriving MSS-B scores.

Discussion

Schizotypy provides a useful framework for investigating a continuum of subclinical and clinical expressions of schizophrenia-spectrum psychopathology. Authors dating back to Meehl (1962) have stressed the need for valid and easily administered measures of schizotypy. Although there are several widely used measures that have contributed greatly to our understanding of schizotypy, these measures have limitations, including inconsistent factor structures. Furthermore, many schizotypy questionnaires are prohibitively long, thereby reducing their practical utility. Therefore, there is a clear need for psychometrically sound, brief measures of schizotypy. The MSS was developed to address many of the psychometric and conceptual limitations of prior measures, and the MSS-B offers a useful alternative to the full-length version. Prior studies evaluating the MSS-B indicated that it has good psychometric properties and concordance with the full-length MSS. However, Smith et al. (2000) warn that evidence of validity in a fulllength scale does not automatically extend to its brief form. Therefore, a series of the questionnaire (e.g., Kwapil, Gross, Burgin, et al., 2018), interview (Kemp, Bathery, et al., 2020), and laboratory (e.g., Sahakyan et al., 2020) studies have demonstrated comparable construct validity for the MSS-B as in the full-length MSS.

The present study extended these validation efforts by examining the association of MSS-B positive, negative, and disorganized schizotypy with multiple measures of openness. We compared these findings with those from Kemp, Burgin, et al. (2020), which measured schizotypy using the full-length MSS. The present study followed a method consistent with prior studies examining the construct validity of the MSS-B (e.g., Gross, Kwapil, Burgin, et al., 2018). Specifically, we examined the performance of the MSS-B using two samples: one sample in which the MSS-B scores were derived from the full-length MSS, and an independent sample in which participants completed the MSS-B. The MSS-B performed comparably in both samples.

Models of normal personality, such as the FFM (Costa & McCrae, 1992), are useful for understanding the dimensional representation of psychopathology, and openness to experience is especially promising for evaluating schizotypy. Historically, openness has been differentially associated with positive and negative schizotypy. However, personality traits are multifaceted, and relying on the domain level measures of openness is insufficient for understanding complex psychopathology. Furthermore, researchers have argued that traditional measures of openness do not adequately capture maladaptive facets of openness (e.g., Crego & Widiger, 2017; Widiger & Crego, 2019) that may be especially relevant to schizotypy. Some evidence for this argument comes from findings that traditional measures of openness do not consistently align with models of psychopathology that (1) were specifically conceptualized to align with the FFM of personality and (2) share conceptual overlap with schizotypy. Indeed, Widiger and Crego note that how openness is conceptualized and measured impacts the strength of associations between openness and schizotypy and related constructs. Therefore, it is necessary to evaluate comprehensively the expression of openness in multidimensional schizotypy using a facetlevel approach that captures the full range of adaptive and maladaptive expressions of this personality trait.

Based upon findings from Kemp, Burgin, et al. (2020) and the present study, positive schizotypy is generally associated with elevated openness to experience. In particular, positive schizotypy is associated with increased openness to fantasy and eccentricity, which aligns with the core components of positive schizotypy (i.e., unconventional beliefs and experiences). Negative schizotypy is inversely associated with openness to experience, especially feelings, aesthetics, and creativity, consistent with the conceptualization of negative schizotypy as a diminution of affect, thoughts, and interest in the world. Our findings for positive and negative schizotypy are consistent with Widiger and Crego's (2019) review of studies examining the association between HiTOP Thought Disorder and DSM-5 Psychoticism with openness to experience. For example, prior research similarly found that alternative measures of openness demonstrate the most consistent associations with psychoticism and that NEO Openness to Fantasy subscale demonstrates the strongest relationship with schizotypal experiences (e.g., Moorman & Samuel, 2018). Additionally, positive and negative schizotypy were associated with openness in opposite directions in prior studies beyond Kemp, Burgin, et al.'s study (e.g., Chmielewski et al., 2014; Ross et al., 2002). Finally, disorganized schizotypy is broadly unassociated with openness to experience, except with measures of eccentricity. Note that at the zero-order level, disorganized schizotypy was associated with eccentricity at the level of a medium effect. Although residualized disorganized schizotypy was still associated with these subscales, it appears that much of the variance is better accounted for by positive schizotypy. Note that current and historical conceptualizations of psychoticism only capture one facet of schizotypy - the positive schizotypy dimension. However, schizotypy (and by extension schizophrenia) is a multidimensional construct with negative and disorganized dimensions, too. As nicely demonstrated in Kemp, Bathery, et al.'s (2021) interview study, all three schizotypy dimensions are uniquely associated with impairment and have distinct associations with schizophrenia-spectrum symptoms and disorders. The fact that psychoticism only partially captures schizotypic symptoms and impairments represents a major limitation of such models.

In addition to replicating associations of schizotypy and openness, the present study replicated the factor structure of openness to experience identified in Kemp, Burgin, et al. (2020). These findings are especially relevant given the ongoing concerns regarding replication in psychological studies (e.g., Diener & Biswas-Diener, 2019). Although the ordering of the openness factors differed between the two samples, the same four factors emerged in each sample: Fantasy/Feelings, Eccentricity, Nontraditionalism, and Ideas. Both studies demonstrated similar patterns of association between the schizotypy subscales and openness factors. Positive schizotypy was directly associated with Fantasy/Feelings, and negative schizotypy was inversely associated with this factor. All three schizotypy subscales were associated with elevated Eccentricity, suggesting that this factor of openness links the three dimensions. As discussed in Kemp, Burgin, et al., the Eccentricity factor shares similarities with Eysenck's (1992) psychoticism, Watson et al.'s (2008) oddity, Knezevic et al.'s (2017) disintegration, and the DSM-5 dimensional psychoticism trait model (Krueger et al., 2012). Furthermore, there appear to be important similarities with HiTOP's Thought Disorder factor, which "describes individual differences that range from conventional and uncreative thinking to perception and cognition that are only tenuously based in reality" (Kotov et al., 2020, p. 152).

Despite the aforementioned similarities, there were two differences between the present study and Kemp, Burgin, et al. (2020) in the association of positive and negative schizotypy with openness factors. First, positive schizotypy was inversely associated with Nontraditionalism in Kemp, Burgin, et al. (2020), whereas they were not associated in the present study. Second, negative schizotypy was newly associated with Ideas in the present study. Nonetheless, these results provide support for understanding and evaluating openness to experience as a complex, multi-faceted construct with both adaptive and maladaptive manifestations. Restricting conceptualization and assessment of openness to traditional measures of the construct and to the domain level results in a loss of information, especially with respect to evaluating multidimensional schizotypy.

The present study provides additional support for schizotypy as a multidimensional construct with positive, negative, and disorganized dimensions. Schizotypy encompasses a broad range of subclinical and clinical expressions and thereby provides a useful framework for investigating the heterogeneous expression and etiology of schizophreniaspectrum psychopathology. Examining dimensions of normal personality, especially openness, provides a relevant method for evaluating the schizotypy dimensions. The results of this study provide further support for the use of alternative openness measures, and for the evaluation of facets of openness to experience in order to obtain a more nuanced assessment of the trait than that provided by the larger personality domain. Future research should expand this assessment by including measurements of HiTOP Thought Disorder and DSM-5 Psychoticism; although evaluation of these other taxonomic systems was outside of the scope of this study, Kemp, Kaczorowski, et al. (2021) found that the full-length MSS subscales are differentially associated with the domains and facets of the Personality Inventory for DSM-5 (Krueger et al., 2013), a measure that captures DSM-5 Psychoticism. The generalizability of the study is enhanced by the inclusion of student and MTurk participants, although future studies should examine these associations in more diverse samples and should employ methods beyond self-report (e.g., informant report). Finally, these results provide support for the construct validity of the MSS-B as a brief form of the full-length MSS and build upon a series of validation studies that have found comparable results between the scales. The MSS and MSS-B appear to offer a useful family of measures for evaluating schizotypy, and the MSS-B offers a brief alternative to the MSS with comparable validity and minimal reduction of psychometric properties.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/1614-0001/a000348

ESM 1. Factor Loadings for the Principal Components Analysis of 15 Facet Scores from the NEO-PI-3, HEXACO, IPC, and EPI (Table E1); Multidimensional Schizotypy Scale-Brief Subscale by Sample Interaction Analyses for Openness Measures (Table E2); Multidimensional Schizotypy Scale-Brief Subscale by Sample Interaction Analyses for Openness Factors (Table E3)

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Original Article



Psychopathic Traits, Academic Fraud, and the Mediating Role of Motivation, Opportunity, Rationalization and Perceived Capability

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Abstract: This study provides initial insights on the relation between psychopathic traits (disinhibition, meanness, and boldness) and academic fraud (prevalence and severity), while considering important mediators of fraud (perceived capability, opportunity, motivation, and rationalization). Based on a large sample of university students (N = 967), two structural equation models (test and replication) were built to test the study's main hypothesis and probe the robustness of the results. A direct link from disinhibition to prevalence was found, suggesting that disinhibition is associated with social deviance in the academic context. Higher motivation for cheating exclusively mediated this path. In meanness, rationalization explained lower rates of perceived severity of academic fraud, indicating that cognitive self-justifications trigger dishonest behavior in meanness. Boldness explained the prevalence of academic fraud via perceived capability, suggesting that low-fear, although adaptive in evaluation contexts, may increase the perceived capability for cheating. The reported significant associations support that academic fraud is part of the nomological network of psychopathy and unveil the complexity of the phenomenon.

Keywords: personality, psychopathy, academic fraud, cheating

Undergraduate students experience a lot of pressure in academic contexts, as the number of available workplaces reduces and the competitiveness for desired jobs increases (McCabe et al., 2006). Since grades are important measures in society, the concern to achieve success may be associated with different forms of academic fraud. Academic fraud includes any misconduct that allows someone to achieve a personal advantage in the academic context (e.g., cheating on exams and plagiarism) while compromising meaningful learning (Anderman & Murdock, 2007). The prevalence of students cheating at least once during enrollment has reached 87% (e.g., Muhney et al., 2008) and it is set forth that students are cheating in higher levels (Jones, 2011). Interestingly, risk factors for cheating are associated with a low perception of the seriousness of cheating (Taradi et al., 2012). As such, higher rates of cheating may substantially reduce the perceived severity of academic fraud and gradually normalize this behavior.

The Triangle Fraud Theory (Clinard & Cressey, 1954) is a theoretical model that attempts to describe the main causes of fraud based on three assumptions: (1) every unethical behavior has some financially, socially, or politically attractive incentive or pressure to be committed (motivation); (2) individuals take advantage of perceived circumstances, namely ineffective control (opportunity); and (3) individuals tend to generate cognitive selfjustifications to make the behavior morally acceptable (rationalization) (Brown et al., 2016). Wolfe and Hermanson (2004) have recently introduced a fourth element into the so-called Diamond Fraud Theory: perceived capability, which overlaps self-efficacy (Bandura, 1993; Doménech-Betoret et al., 2017). The efficacy expectations regarding the perceived personal capacities to perform a given behavior (Doménech-Betoret et al., 2017) represent a relevant aspect to commit fraud since, in order to take advantage of the situation, individuals need to trust their

skills and knowledge of the system (Wolfe & Hermanson, 2004).

Individual differences in some aspects of personality interfere with different levels of motivation and confidence to cheat, as well as proneness to disregard moral transgressions and to take risks. Psychopathy is one example of a personality disorder that may influence the prevalence and severity of academic fraud.

Psychopathy and Academic Fraud

Academic fraud is a precursor of corruption such that academic dishonesty and favorable attitudes toward students who cheat are associated with country corruption indexes (Magnus et al., 2002; Teixeira, 2013). The persistence of cheating over time has high repercussions on society; therefore, it is important to study the factors related to dishonest behavior at the university level. For instance, there is growing evidence that psychopathy not only relates to violent crimes (e.g., theft and physical aggression), but also to white-collar crimes, fraud, and corruption (Babiak et al., 2010; Gao & Raine, 2010). These individuals can engage in more premeditated strategies by taking advantage of some adaptive traits of their personality structure (e.g., low anxiety and social dominance), thus becoming more capable of masking their antisocial behavior (Gao & Raine, 2010). Considering the link between psychopathy and corruption, it is important to explore how academic fraud is an early precursor of this relationship. Nathanson and colleagues (2006) indeed observed a general positive association between psychopathy and academic cheating.

More recent perspectives assert, however, that psychopathy does not represent a unitary construct, but rather a confluence of multiple trait dispositions (Cooke & Michie, 2001; Patrick et al., 2009; Skeem et al., 2011). In other words, we should not rely on a unitary conceptualization by means of defining a homogeneous psychopathic group, but in turn, decompose the different dimensions that constitute this heterogeneous personality structure.

The dimensional approach conveyed by the Triarchic Model (Patrick et al., 2009) proposes that psychopathy can be decomposed into three different trait-related manifestations: positive adjustment (boldness), behavioral deviance (disinhibition), and lack of empathic resonance (meanness). Disinhibition is associated with the lack of inhibitory control, poor regulation of negative affect, impatient urgency, and limitations in delaying gratification; meanness refers to a lack of empathy, emotional detachment, callousness, premeditated aggression, and moral transgressions.

Boldness is a specific referent of positive adjustment in psychopathy and maps low anxiety, tolerance for unfamiliarity, social dominance, emotional resiliency, selfassurance, and the ability to remain calm in stressful situations. Empirical findings support the nomological network of the Triarchic Model (Almeida et al., 2014; Paiva et al., 2020; Skeem et al., 2011).

Although these traits can co-occur they should be examined independently because they share distinct etiological pathways (Cooke & Michie, 2001; Patrick & Bernat, 2009; Patrick et al., 2009; Skeem et al., 2011). Externalizing vulnerability is the etiological path of meanness and disinhibition, while low fear is the etiological path of boldness and meanness. Thus, disinhibition is relatively independent of boldness, although meanness moderately correlates with both boldness and disinhibition. The probabilistic combination of these traits will define distinct psychopathic profiles: high levels of disinhibition and meanness will likely characterize into a greater extent those individuals with an explosive/impulsive character, interpersonal relationships ruled by stronger levels of anger and violent-callous forms of antisocial behavior (e.g., relational aggression and theft). Boldness, per se, may be considered an adaptive manifestation of psychopathy, but when combined with meanness, it is likely to characterize those cold-blood individuals that engage in more premeditated, sophisticated forms of antisocial behavior that are also expected to occur in a context of emotional indifference and lack of remorse, guilt or shame (e.g., corruption). Considering the link of psychopathy with social deviance, it is important to assess the contribution of the different psychopathic traits to academic fraud and diamond elements (see next sections).

Disinhibition

Psychopathic traits, specifically disinhibition, are proposed to account for the prevalence of academic fraud, given the close link with antisocial behavior (Patrick et al., 2009). Previous studies report that academic cheaters score higher in impulsivity, compared to non-cheaters (Anderman et al., 2009), and that psychopathic impulsive traits are associated with academic dishonesty (Marcus et al., 2018). As a result,

Hypothesis 1 (H1): We expect disinhibition to predict directly and via perceived capability, opportunity, motivation, and rationalization of the prevalence of academic fraud.

Disinhibited individuals may: (1) perceive themselves as more capable of cheating, considering their continuous exposure to risk-seeking experiences and the mismatch between perceived self-efficacy and the disruptive outcomes of the actual behavior (Blatny et al., 2007; Patrick et al. 2009), (2) perceive more opportunities to cheat due to poor risk assessment and fallible analyses of the vigilance and control systems, (3) rationalize their non-moral conducts by externalizing their responsibility, and (4) be particularly motivated to cheat since boredom susceptibility, reduced control over urges and difficulties in delaying gratification are all features that may compromise goal-directed behavior and meaningful learning (Anderman et al., 2009; Patrick et al., 2009).

Meanness

Cold-heartedness- and fearlessness-related traits of psychopathy (Coyne & Thomas, 2008; Marcus et al., 2018) are found to be associated with academic dishonesty. However, given the distinctive features of these psychopathic traits, more specific aspects may contribute to academic dishonesty in both meanness and boldness.

The moral aspects of behavior are particularly irrelevant to callous and less empathic individuals (Almeida et al., 2014; Patrick et al., 2009). Individuals high in meanness may be more prone to rationalize and generate self-justifications by means of reducing the moral value of dishonest conduct. For example, the premeditated and cold-blood patterns of aggression in meanness are proposed to be rooted in moral disengagement (Patrick et al., 2009). Therefore, the neutralization of the moral aspects of the behavior through rationalization (Sykes & Matza, 1957) may substantially reduce the perceived severity of academic fraud. Moreover, premeditation may shape the perceived capability to cheat, considering that all the contingencies and circumstances of the conduct are properly anticipated. As a result,

Hypothesis 2 (H2): We expect meanness may predict the perceived severity via rationalization and perceived capability.

Boldness

Finally, boldness traits may be adaptive in situations where individuals will be evaluated by their academic performance. The high tolerance to new events and the ability to remain calm in stressful situations (Patrick et al., 2009) may potentiate the performance in evaluation contexts due to the low emotional arousal. In turn, these low-fear features may also influence the perceived capability to cheat. Academic dishonesty in boldness-related traits seems to be partially explained by a low resting heart rate (Portnoy et al., 2018), indicating that reduced autonomic responses and arousal in boldness ease academic cheating. Thus,

Hypothesis 3 (H3): We expect boldness to predict academic fraud prevalence via perceived capability.

Figure 1 shows all the hypothesized paths.

Method

Participants

Nine hundred sixty-seven university students (42% males, $M_{age} = 20.31$, SD = 2.38) were included in the sample of which 89% of participants were undergraduate students (1st- to 3rd-year students) and 10% postgraduate students (1% did not report the year of study) from a range of courses. The participants perceived their socioeconomic status as an upper-middle class (46%), middle class (35%), upper class (8%), lower-middle-class (6%), and lower class (1%). Fifty-seven percent of participants studied at a public high school, and 60% currently study at a public university. The self-reported Grade Point Average (grading system: 0–20) at the end of high school was 15.98 (SD = 8.09), and at university-level, it was 14.37 (SD = 7.77).

Procedure

This study is part of a larger project and had an approximate duration of 35 min. The study was approved by the Local Ethics Committee. All participants received and signed an informed consent form and were aware that the data was anonymized and would be used for research purposes only. Participants completed the protocol on an online questionnaire (Qualtrics) and were recruited from two university campuses located in the north region of the country via webmail and advertisements. The order of all scales and items was randomized.

Measures

Triarchic Psychopathy Measure (TriPM)

The TriPM (Patrick, 2010) operationalizes the core psychopathic traits of the Triarchic Model: (1) Boldness (e.g., "I am well-equipped to deal with stress"; 19 items, $\alpha = .76$), (2) Meanness (e.g., "How other people feel is important to me" – reversed, 19 items, $\alpha = .89$), and (3) Disinhibition (e.g., "I jump into things without thinking", 20 items, $\alpha =$.83), which are scored from a Likert scale (0 = *false*; 1= *somewhat false*; 2 = *somewhat true*; 3 = *true*). Recently, this



Figure 1. Proposed mediation model and hypothesized paths.

measure was validated for a Portuguese sample and showed higher internal consistency, a good fit for the three-dimensional structure, convergent and test-retest validity (Paiva et al., 2020). Boldness shows convergent validity with the Interpersonal facet of the most commonly used measure of psychopathy assessment - the Psychopathy Checklist-Revised (PCL-R) - and the Fearless Dominance scale of the Psychopathic Personality Inventory (PPI) (for a review see Paiva et al., 2020; Patrick, 2010). Meanness is associated with the PCL-R Affective facet and PPI Cold-heartedness, while disinhibition has positive associations with the PCL-R Lifestyle facet and the PPI Self-Centered Impulsivity factor. All the three TriPM scales contribute uniquely to the prediction of PCL-R total scores, even when accounting for the shared variance between the dimensions.

Fraud Diamond Scale

This self-report (Dias-Oliveira et al., 2020) measures the four dimensions of Fraud Diamond Theory: (1) Motivation (e.g., "Cheating can significantly increase grades"; 2 items, $\alpha = .75$), (2) Opportunity (e.g., "In general, a student can easily cheat at my faculty"; 3 items, $\alpha = .82$), (3) Rationalization (e.g., "Cheating is acceptable because teachers do not always explain the materials very well"; 8 items, $\alpha = .93$), and (4) Perceived Capability (e.g., "If I want to, I have the necessary confidence to cheat without being caught", 3 items, $\alpha = .82$), using a Likert Scale ranging from 1 = completely disagree to 7 = completely agree. This instrument was

previously validated for a Portuguese sample (Dias-Oliveira et al., 2020) and showed adequate psychometric properties.

Prevalence and Severity of Academic Fraud

The prevalence score (adapted from McCabe, 2003; Teixeira, 2011) consisted of 17 different statements measuring how frequently participants have engaged in each academic fraudulent behavior (e.g., "Copying material, almost word for word, from any written source and turning it in as your own work" with 0 = never, 1 = once, 2 = more than once). For each statement, participants also rated how severe they thought each fraudulent behavior was (0 = not fraud, 1 = trivial fraud, 2 = moderate fraud,3 = serious fraud) (McCabe, 2003). The prevalence of academic fraud shows predictive power to explain corruption indexes in 21 countries, including Portugal (Teixeira, 2013). Moreover, both prevalence and severity subscales were previously validated for Portuguese population and exhibited good psychometric properties for a two-factorial solution (Dias-Oliveira et al., 2020). In the current study, prevalence and severity yielded an internal consistency of .85 and .91, respectively.

Data Analysis Approach

Consistently with the Triarchic Model of Psychopathy, the shared variance between meanness-disinhibition (i.e., externalizing vulnerability) and meanness-boldness (i.e., low-fear) was modeled in our statistical model. Accordingly, the correlation values evidenced the expected nonsignificant link between boldness and disinhibition, as these traits share distinct etiological roots (cf. Table E1, Electronic Supplementary Material, ESM 1). Meanness showed the expected positive correlations with both boldness and meanness.

Boldness, meanness, and disinhibition were entered in the path analysis model to predict the prevalence and severity of academic fraud, via the mediators (cf. Figure 1). The set of causality effects that was defined in this mediation model is based on the assumption that behavioral outcomes are a secondary manifestation of personality and, therefore, should be placed in distinct hierarchical levels of analysis (e.g., Cooke & Michie, 2001; Patrick et al., 2009; Skeem et al., 2011). Moreover, the links between personality and behavior are presumed to be mediated by opportunity, motivation, rationalization, and perceived capability (Brown et al., 2016; Clinard & Cressey, 1954; Wolfe & Hermanson, 2004). In this sense, we included these mediators into the path analysis and we have specified correlations among these different dimensions of the diamond of fraud.

Importantly, under aegis of replication crisis on psychological science (Pashler & Wagenmakers, 2012), Pohlmann (2004) suggested that researchers could randomly split the data to test the robustness of factor analysis. Since path analyses on structural equation models can be described as a combination of exploratory factor analysis and multiple regression (Schreiber et al., 2006), this recommendation can be extended to these analyses. Replication with multiple samples has the potential to demonstrate the stability of the results (Schreiber et al., 2006). That is, in studies with larger sample sizes, it is useful to randomly split the data in half, estimate the model twice and compare the robustness of findings. As a result, the sample of the current study was randomly divided into (1) the test sample (n = 484; 50%), and (2) the replication sample (n = 483; 50%). The samples were comparable in gender, socioeconomic status, high school, and Grade Point Averages (GPA). Eleven participants were removed from the test sample (final n = 473) and 33 from the replication sample (final n = 448) due to missing values. The values of skewness and kurtosis indicated no severe violations of normality. No outliers were found and there is no evidence for multicollinearity (All variance Inflation Factors < 1.65). ESM 1 provides a detailed picture of preliminary analysis. Only effects that are statistically significant in both samples will be interpreted.

To assess the validity of the proposed mediation model (Figure 1), we estimated a second model including not only the mediation paths but all the direct paths from psychopathic traits to academic fraud outcomes. We estimated and compared χ^2 difference tests between both models to evaluate which one fitted the data best.

All the analyses were conducted using AMOS 26 (IBM Statistics, NY, USA). The models were evaluated by the fit indices of standardized Bentler's Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Models are considered acceptable when CFI exceeds .95, and the RMSEA is below .05 (Schreiber et al., 2006). Akaike Information Criterion (AIC) and Browne-Cudeck Criterion (BCC) were also provided to compare the models. Indirect effects were estimated using bootstrap (resample of 200).

Results

Fit Indices

In the mediation model, a good fit was found for both tests, $\chi^2(13, N = 473) = 7.32$, p = .885; CFI = .999; RMSEA < .001, p = .999; AIC = 89.3; BCC = 91.1, and replication samples: $\chi^2(13, N = 448) = 29.2$, p = .006; CFI = .983, RMSEA = .053, p = .389; AIC = 108.0, BCC = 110.5.

We compared the mediation model with other model which included not only the mediation paths but also direct paths from psychopathy to academic fraud outcomes. The latter model with direct paths had the following adjustment indexes, test sample: $\chi^2(8, N = 473) = 6.10, p = .636$; CFI = .999; RMSEA < .001, *p* = .971; AIC = 98.10; BCC = 100.10; replication sample: $\chi^2(8, N = 448) = 25.98, p = .001$; CFI = .981; RMSEA = .071, *p* = .112; AIC = 117.98, BCC = 120.08. The only significant direct effect occurred from disinhibition to prevalence of fraud ($\beta_{test sample}$ = .203, p < .001; $\beta_{\text{replication sample}} = .194, p < .001$) (Table E2, ESM 1), which is also represented in the proposed mediation model (Table E3, ESM 1). Moreover, a χ^2 -test comparing the model with direct paths against the proposed mediation model revealed that there are no significant differences among the models in the test sample, $\chi^2(5) = 1.22$, p = .943. However, the proposed mediation model proved to be more parsimonious and showed lower AIC and BCC. For the validation sample, the proposed model fits the data best than the model with direct paths, $\chi^2(5) =$ 18.66, p = .002. From these analyses, it can be concluded that the mediation model was more informative and a best fit for the data. For this reason, it was the selected model and it will be thoroughly presented below.

Mediation Model: Direct and Indirect Effects

Table E3 in ESM 1 presents all the estimates for the direct and indirect effects of the proposed mediation model.



Figure 2. Results for the test (and replication) samples on the direct paths from psychopathy to mediators and indirect paths from psychopathy to academic fraud outcomes.

Disinhibition (H1)

Disinhibition directly predicted academic fraud prevalence as postulated by the first hypothesis (H1; $\beta = .154/.214$, both p < .001 – Figure 2). These traits further predicted opportunity ($\beta = .152/.296$, both $p \leq .001$), rationalization ($\beta = .219$ to .277, both p < .001), and motivation ($\beta = .125/.249$, both $p \leq .008$), but not perceived capability ($\beta = .030/.230$, p = .603/.001).

However, the higher prevalence of academic fraud in disinhibition was uniquely mediated by motivation (H1; $\beta = .021/.032$, both $p \le .017$ – Figure 2). The indirect path in disinhibition from opportunity (H1; $\beta = -.010/.003$, both $p \ge .139$), rationalization (H1; $\beta = .023/.048$, p = .001/.121) and perceived capability to prevalence (H1; $\beta = .006/.068$, p = .001/.494) did not yield consistent significant findings. As a result, only partial support was found for H1: disinhibition traits increased the motivation to engage in academic fraudulent behavior, which explained uniquely the higher prevalence of such behaviors.

Additionally, exploratory post hoc analysis on disinhibition showed that individuals high in disinhibition display less perceived severity in academic fraud via rationalization ($\beta = -.106/-.067$, both $p \le .010$), prevalence ($\beta = -.045/$ -.044, both p = .001), and motivation and prevalence ($\beta = -.032/-.021$, both $p \le .013$).

Meanness (H2)

Meanness directly predicted rationalization ($\beta = .183/.213$, both p < .001), but not perceived capability ($\beta = .101/.247$, p = .001/.079).

For H2, the results showed that the higher the score on meanness, the higher the tendency to rationalize and then to perceive less severity (H2; $\beta = -.068/-.056$, both $p \le .003$ – Figure 2). Mediation effects on severity via perceived capability were non-significant (H2; $\beta = .004/.008$, both $p \ge .278$).

Furthermore, these variables did not consistently mediate prevalence across test and validation samples (*p*-values from .001 to .101), but the severity was mediated from the indirect path accounting for both perceived capability and prevalence effects ($\beta = -.051/-.030$, both $p \le .041$)

Boldness (H3)

Boldness was a significant direct predictor of perceived capability (β = .152./.256, both $p \le .001$). Supporting H3, boldness was associated with the prevalence of academic fraud via perceived capability (H3; β = .076/.031, both $p \le .001$ – Figure 2).

Besides that, an exploratory analysis showed that boldness led to less perceived severity via the indirect path, including both perceived capability and prevalence ($\beta = -.076/-.031$, both $p \le .001$).

Total Effects

Meanness and disinhibition explained both prevalence (respectively, $\beta = .048./.091$, both $p \le .020$; $\beta = .220/$.341, both $p \le .010$) and perceived severity of academic fraud (respectively, $\beta = -.088/-.075$, both $p \le .010$; $\beta = -.168/-.130$, both $p \le .010$). Boldness accounted uniquely for prevalence rates ($\beta = .031/.076$, both $p \le .010$).

Explained Variance

On the test sample (and replication sample, respectively), the mediation model explains 6% (2%) of motivation's variance, 9% (2%) of opportunity's variance, 19% (12%) of rationalization's variance, 16% (10%) of perceived capability's variance, 27% (24%) of prevalence's variance, and 23% (24%) of perceived severity's variance. The explained variance of each indirect effect can also be found in Table E4, ESM 1.

Discussion

The current study adds new insights into the relationship between psychopathic traits (meanness, boldness, and disinhibition) and academic fraud (prevalence and severity) when taking into account key psychological processes involved in academic fraud (perceived capability, opportunity, motivation, and rationalization). Overall, the model including direct paths had little explanatory power to explain the relationship between psychopathy and fraudulent behavior, while the proposed mediation model was more informative. In short, the results show that among a large sample of college students: (1) disinhibition predicts the prevalence of academic fraud both directly and via motivation; (2) meanness explains less perceived severity of academic fraud through rationalization processes, and (3) boldness relates to the prevalence of academic fraud via the higher perceived capability to cheat (Figure 2). These results will be discussed below and the contribution of each predictor in explaining academic fraud outcomes will be detailed. Only the results that were replicated across the test and replication models will be used to draw conclusions.

Disinhibition

Hypothesis 1 stated that disinhibition would directly, and via perceived capability, opportunity, motivation, and rationalization, predict the high prevalence of academic fraud. Some support was found for this assumption since More specifically, motivation emerged as the unique significant mediator explaining academic fraud in disinhibition. Following Patrick et al. (2009), disinhibited individuals show high boredom susceptibility, reduced control over urges, and difficulties in delaying gratification. These aspects may compromise goal-oriented behavior and meaningful learning within the class context, as well as disrupt study schedules. This is because distractors may be more tempting and gratifying in the short-term than planning learning strategies to achieve long-term goals related to academic success.

Furthermore, disinhibition predicted perceived opportunity and rationalization. Disinhibited individuals may perceive a high opportunity to cheat, due to a poor risk assessment (Patrick et al., 2009) of the actual control mechanisms. Risk-seeking features in disinhibition may also compromise the analysis of the risk/benefit ratio and trigger dishonest behavior by reducing the analysis of negative logical consequences of the conduct (Anderman et al., 2009) and by increasing the rationalization of the non-moral aspects of the conduct. Nevertheless, these variables did not mediate the relationship between psychopathy and the prevalence of academic fraud.

Of note, exploratory results further revealed that individuals high in disinhibition perceived less severity in academic cheating, probably due to repetitive engagement in dishonest behavior, a higher motivation to cheat, and a higher generation of self-justifications.

Meanness

Hypothesis 2 (H2) indicated that meanness would negatively predict perceived fraud severity via rationalization and perceived capability. Results partially supported H2 since no mediation effects were found for perceived capability, but rationalization emerged as the critical psychological process explaining academic fraud in meanness. That is, individuals with high levels of meanness seem to be more prone to justify their actions by discounting the severity of academic fraud to achieve an end, which in turn, reduces the perceived severity of such conduct.

Previous studies reported that psychopathic coldheartedness traits were associated with academic dishonesty (Marcus et al., 2018). Our work adds to the literature by acknowledging that prevalence may be less relevant when entering severity into the equation. As such, the blunted emotional resonance and lack of empathy in callous individuals seem to facilitate the formulation of cognitive self-justifications to disengage from the moral aspects of behavior and commit deviant acts. From a classical perspective (Sykes & Matza, 1957), rationalization precedes and proceeds deviant behavior, acting as a mechanism that neutralizes and legitimizes social deviance, while protecting the individual from feeling responsibility, blame, or shame. Therefore, rationalization might trigger the act and neutralizes its consequences in a recursive process. Ultimately, it is conceivable that deviant behavior does not imply an active opposition to social norms, but rather their neutralization. Importantly, the association between rationalization and severity was also observed in disinhibition, unveiling shared etiological mechanisms pertaining to externalizing vulnerability (Patrick et al., 2009).

Boldness

Hypothesis 3 (H3) stated that boldness would explain the higher prevalence of academic fraud via perceived capability. This link was fully observed in our study and is in line with previous research (Coyne & Thomas, 2008; Marcus et al., 2018; Portnoy et al., 2018).

According to Patrick and collaborators (2009), boldness reflects a confluence of traits etiologically connected with a low-fear disposition (e.g., low anxiety and emotional resilience to stressful and unfamiliar situations). These features may be either adaptive to situations where individuals are evaluated by their academic performance or to successfully undergo risky cheating behaviors. Our results are congruent with the former explanation: individuals' high boldness appears to perceive more ability to cheat without being caught, which leads to a higher prevalence of academic fraud in these individuals. Portnoy et al. (2018) previously documented that low resting heart rate underlies low-fear dispositions and partially explains academic cheating in psychopathy. Together with our findings, individuals high in boldness may mask dishonest behavior by taking benefit of their low-fear features (e.g., Gao & Raine, 2010), since the reduced autonomic reactions to stressful situations (e.g., cheating) may give them an advantage to accomplish dishonest behaviors.

Limitations

The main limitations of this study are threefold. First, selfreport measures may be easier to manipulate, but it is difficult to implement alternative methodologies to measure the objective cheating rates. Second, the sample included only university students; although it was not intended in the current work, it would be interesting to collect evidence from other educational contexts to increase generalization. Third, the sample size did not allow us to test alternative mediation models, as we chose a replication approach that unveiled good fit indexes and allowed reporting of the most consistent results. Future research should extend these findings and address the main limitations.

Closing Remarks

Despite these limitations, the current study provides a novel contribution to the research field. To our best knowledge, this is the first work assessing the influence of psychopathic traits on academic fraud, while considering the fraud diamond elements and the dimension of perceived severity. The significant associations not only support the idea that academic fraud is part of the nomological network of psychopathy but also unveil the complexity of the phenomenon, which may relate to later outcomes of antisocial behavior and corruption in this personality disorder. Overall, when psychopathic profiles combine meanness and disinhibition, one might expect a higher prevalence and severity of academic fraud due to these individuals being more motivated to cheat and generate more cognitive self-justifications to neutralize dishonest behaviors. In turn, when the psychopathic manifestation encompasses meanness and boldness traits to a higher extent, one can anticipate a higher prevalence of academic fraud, because these individuals perceive themselves as more capable of cheating without being caught. Knowing that interventions targeting personality might be difficult to conduct in educational settings, motivation and rationalization seem to be the mediators one can account for in the relationship between psychopathy and fraudulent behavior. As such, future action research can develop and test intervention strategies to reduce the extent to which motivations and rationalizations are used to legitimate academic cheating.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/1614-0001/a000349

ESM 1. File containing preliminary analysis; Correlation matrix, means (standard deviations), and VIF coefficients (collinearity) for all study variables (Table E1); Parameters' estimates for the test and replication samples in the model including all direct and mediation paths (Table E2); Parameters' estimates for the test and replication samples in of the proposed mediation model (Figure 1) (Table E3); Explained variance (R2) of the indirect effects for both the test and replication samples (Table E4)

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Are There Gender Differences in Executive Functions in Musicians and Non-Musicians?

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Abstract: Until now, better performance in executive functions (EF) in musicians compared to non-musicians has not been investigated in relation to possible gender differences. For that, it is the main goal of this study to investigate possible gender differences in executive functions. Sixty-three musicians and 64 non-musicians, 63 men and 64 women respectively, completed tests of (a) cognitive processing speed (ZVT), (b) working memory (2-Back Task), (c) inhibition (Flanker Task), and (d) cognitive flexibility (Wisconsin Card Sorting Test, WCST). Results showed a significantly better performance for the target accuracy in the working memory task for musicians compared to non-musicians but not in the other tasks of executive functions. Furthermore, women demonstrated a better performance than men for the target accuracy in the 2-Back Task. However, only cognitive processing speed predicted working memory performance but not the group affiliation or gender. This study revealed that gender differences in executive functions are less likely to appear also in a trained sub-group.

Keywords: musical experts, inhibition, working memory, cognitive flexibility

Over the last decades, there is an increasing interest in the effects of music on cognitive functions in children and adults (Schellenberg, 2004; Schellenberg & Weiss, 2013). It has been shown, that musically trained participants scored higher than untrained participants on an Intelligence Quotient (IO) composite score as well as on the verbal and nonverbal subtest. For the nonverbal subtest and the composite score, the result holds true if gender, socioeconomic factors as well as a first language were held constant (Schellenberg, 2011). There has been speculation that although mental or perceptual processing speed is important, executive functions (EF) seem to be a mediating variable between musical training and general cognitive abilities (Schellenberg & Weiss, 2013). EF are a family of effortful top-down mental processes needed to control, monitor, and regulate cognitive and emotional processes (Diamond, 2013). There is a consensus that three core EF's can be identified: updating and monitoring of working memory representations, inhibition of dominant or prepotent responses, and shifting between tasks or mental sets (Miyake et al., 2000). Working memory involves holding information in mind and mentally working with it. Inhibition is typically defined as the ability to keep your mind focused and to resist internal and external distractions. Shifting, or also named cognitive flexibility, is the ability to change flexibly between different mental sets, different task instructions, or the perspective spatially (Diamond, 2013).

Executive Functions in Musicians

In quasi-experimental studies, which investigate the effects of a long-lasting musical training in adults (compared to those who did not receive this training), musically trained adults scored higher than untrained adults in specific tests of EF. For example, in a study of Bialystok and DePape (2009) musicians showed a better performance in an auditory Stroop test, which measures inhibition compared to monolinguals and bilinguals on overall response speed. However, the musicians demonstrated only a smaller incongruent cost for conditions based on the pitch but not on the word. The relation of musical ability and EF was investigated in detail by Slevc et al. (2016). In their study, 48 participants had less than 2 years of formal musical training and another 48 participants had at least 5 years of formal training. The three different parts of EF were investigated with an auditory (auditory Stroop task) and a visual version (visual Simon arrow task) inhibition task, with an auditory pitch-back and a visual letter-back task for updating and an auditory and visual switching task for cognitive flexibility. Their results showed that individual differences in musical ability predict performance on working memory (updating) tasks (auditory and visual n-back tasks) but showed little relation to inhibition tasks (auditory and visual Stroop test) and cognitive flexibility (auditory and visual task switching). They did not analyze possible gender differences in their

sample. On a neuroscientific basis, it has been shown that practicing music for a longer time increases connectivity among others in the prefrontal cortex, which is a relevant active brain area for EF (Zuk et al., 2014).

Besides those quasi-experimental studies, some experimental designs exist in which, for example, the training of music lessons is compared to other kinds of training and the effects on EF are examined, however, these studies are very rare. For example, if 4- to 6-year-olds were assigned computer-based music or visual art training, only the music group showed better performance on a go/nogo task (Moreno et al., 2011).

One might conclude that most of the studies on EF in musicians and non-musicians are quasi-experimental, none of them had investigated possible gender differences. There was one individual difference approach in musical training and EF, in which it has been shown that for example musical training only predicted the latent variable of working memory updating, but not the one of inhibition and shifting, even if the results were controlled for IQ, socioeconomic status, and handedness (Okada & Slevc, 2018).

Gender Differences in Executive Functions

Today it seems to be widely agreed upon that men and women are much more similar in most cognitive aspects than anticipated (Jäncke, 2018). However, some studies or meta-analyses resume gender differences, whereby the strongest difference in cognitive abilities is reported in the spatial task of mental rotation with 3-dimensional stimuli (Voyer et al., 1995). Again, even this result is questioned in other studies (e.g. Jansen-Osmann & Heil, 2007). Regarding gender differences in EF, the picture is quite diverse: For example, in visual-spatial working memory, there was an advantage of men over women except for memory for location (Voyer et al., 2017). Saylik et al. (2018) showed that the processing of working memory components may differentiate by gender with either men outperforming women or vice versa. Regarding inhibition ability, the possible gender difference might depend on the task used. When applying a flanker task in combination with a go/no-go task, it could be demonstrated that incompatible flankers impaired performance, and this impairment was more pronounced in women than in men (Stoet, 2010). Investigating cognitive flexibility, the Wisconsin Card Sorting Test (WCST) is often used. In this test, participants must sort cards with symbols differing in color, shape, and numbers and alter their approach when unannounced shifts in the sorting principle appear. Gender differences in this task have been reported from the work of Boone et al. (1993) in a group of older adults from 45 years on favoring women. Grissom and Reyes (2019) concluded that overall, there was only little support of significant gender differences in EF, although single studies found some evidence (see above).

Gender Differences in Musicians in **Cognitive Tasks**

In general, there has been little research concerning gender differences in the area of music and cognition. Those studies, which have investigated gender differences, have focused mainly on perceptual aspects, like, for example, pitch perception. One study examined the influence of background music while solving a cognitive flexibility task, the WCST (Feizpour et al., 2018). Their results showed that music had both adverse and beneficial effects on various behavioral measurements in the WCST, with some of them being different between men and women. Regarding the cognition of music, one might be interested in the investigation of the general pattern of a musical system or of idiosyncratic representations in music. Here, it has been demonstrated that women are better in the recognition of well-known and novel melodies with or without lyrics than men, an effect which holds true for musicians and nonmusicians. The authors assume that declarative memory underlies knowledge about music and women have an advantage in declarative memory (Miles et al., 2016).

However, another interesting question is if the gender of musicians plays an important role while solving music independent cognitive tasks. For example, Pietsch and Jansen (2012) demonstrated that the gender difference favoring men in solving a mental rotation task disappears in musicians but not in students of pedagogy and sport science. One reason for this could have been that in this study female musicians showed a faster cognitive processing speed, which is related to mental rotation performance, than male musicians. Another possible explanation is that female musicians have a higher degree of androgynous characteristics and that they show some traits, which are more observable in males (Kemp, 1985).

Goal of the Study

It is the main goal of this study to investigate possible gender differences in EF in male and female musicians with a long-term deliberate practice (Platz et al., 2014) compared to non-musicians. According to Grissom and Reyes (2019), gender differences in EF are not expected in the group of non-musicians. Gender differences in musicians should be investigated, and if they exist it must be examined whether they relate to a different cognitive processing speed like in the study of Pietsch and Jansen (2012).

Methods

Participants

Sixty-three musicians (31 men, $M_{age} = 22.58$, SD = 2.95 and 32 women, M_{age} = 21.59, SD = 2.27) and 64 non-musicians (32 men, $M_{age} = 23.23$, SD = 3.44 and 32 women, $M_{age} =$ 22.16, SD = 1.74) participated in the current study. With a medium effect size f = 0.25, an α -level of p = .05 and a power of $1 - \beta = .80$ a power analysis with G*power (Faul et al., 2007) for the two-factorial analysis of variance (ANOVA) resulted in n = 128 to detect the main effects and possible interaction between both factors, 32 participants in each group. Participants were recruited by personal contact at the university. The musicians played their main instrument for more than 9 years (M = 14.38, SD = 3.10)and practiced more than 6 hr per week (M = 12.40, SD =7.48). Thirty-one (12 men and 19 women) of them played piano, 16 played wind instruments (6 men and 10 women), 4 students played violins (2 men and 2 women), 2 students played cello (1 man and 1 woman), 6 men played guitars and 4 men drums. The participants of the control group did not play any instrument. All participants gave their written informed consent and data were processed anonymously. The experiment was conducted according to the guidelines of the declaration of Helsinki.

Material

Demographic Questionnaire

Demographic data of the participants concerning gender, age, and time spent practicing their instrument was recorded with a self-generated questionnaire.

Cognitive Processing Speed

The "Zahlenverbindungstest" (ZVT; Oswald, 2016) measures cognitive processing speed. Participants were asked to connect 90 scrambled presented numbers on a sheet of paper in ascending order as fast as possible. In a single test situation, participants had to complete four sheets. The needed time to solve each sheet was measured in seconds and the meantime of the four sheets was calculated. The internal consistency and the 6-month test-retest reliability are about .90–.95. The correlation between processing speed, the number connection test, and the standard IQ test varies between r = .60-.80 (Vernon, 1993). Cronbach's α in this study was .94.

Executive Functions

The three different subcomponents of EFs, namely updating, inhibition, and cognitive flexibility, were investigated and assessed using the 2-Back Task, the Flanker Task, and the WCST. All three tasks, based on the experimental control program *Presentation* (version 19.0; Neurobehavioral Systems), were run on a 15" laptop located approximately 40 cm in front of the participants.

2-Back Task

A 2-Back Task is a specific form of the *n*-Back Task for the measurement of working memory and working memory capacity (Kirchner, 1958), also known as updating. Participants were presented a sequence of letters. They had to indicate with a right mouse click when the current letter matches the letter two letters before. If there were no matches, no reaction was required. The letter in each task is presented for 500 ms. Regardless of the reaction time, the next letter appears after 2,500 ms. In total, there was one practice block with 10 trials and three blocks of 50 trials (10 targets and 40 distractors each). The test lasted around 10 min. Reaction time and accuracy for the target items were measured.

Flanker Task

The Flanker Task (Eriksen & Eriksen, 1974) measures inhibition, which is a core component of EF. The test aims to analyze how well participants are able not to react to irrelevant stimuli. Participants were shown pictures of letters on a 15" laptop monitor. The letter in the middle was flanked by three other letters on each side. Participants had to press the left mouse key if the letter in the middle was an H or a K, and the right mouse button if the letter was an S or a C. The flanking letters were H or K (congruent if the middle letter was H or K, incongruent if the middle letter was S or C), S or C (congruent if the middle letter was S or C, incongruent if the middle letter was H or K), and A or P (neutral condition). According to this combination, there were 24 different tasks, eight in each condition. One task was shown and presented until the response. After 500 ms of the response the next task was presented. There were 10 practice trials with feedback. In total, there were three blocks of 32 trials (96 trials in total). Within each block the conditions were randomized. There were two short self-paced pauses between the three blocks. The test lasted around 10 min and participants could make short breaks between the blocks. Reaction times and accuracy in the three different conditions were measured; the maximum accuracy rate was 32 for each condition.

Wisconsin Card Sorting Test

According to Feizpour et al. (2018), the WCST measures cognitive flexibility and shifting (Dehaene & Changeux, 1991). Within this test, several cards with symbols of different colors and shapes were presented to the participants and they were asked to match the cards according to a specific rule, which they had to figure out using the computer's feedback (e.g., matching by color or shape). There

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was one block with five practice trials and 64 experimental trials. Stimuli were presented until the participant reacted, then the feedback was given and after 1,500 ms the next trial appeared. The participants were told whether a particular match was right or wrong. The test lasted around 15 min. The number of corrects sorts, as well as the perseverative errors, were measured.

Procedure

The tests were conducted in a laboratory of the University of Regensburg. Participants had to complete the tests in a single session in the following order: Demographic questionnaire, ZVT, 2-Back Task, Flanker Task, and WCST. Each test session lasted around 45 min.

Statistical Analysis

For the statistical analysis, SPSS 26 was used.

First, the effects of Group and Gender on cognitive processing speed and EF were investigated: An ANOVA with Group (musicians vs. non-musicians) and Gender (men vs. women) as independent between-subject factors was calculated for each outcome measure of the tests. The dependent variables thus were: the completion time for the ZVT, reaction time and accuracy for the 2-Back-Task, reaction time and accuracy for the Flanker Task, and correct sorts and perseverative errors for the WCST. Additionally for the Flanker Task, the within-subject factor Condition (congruent, incongruent, and neutral) was included as an independent variable.

Second, the relevance of cognitive processing speed on EF was investigated in more detail: For each task and measurement, a regression (Method: Enter) with the predictor's Group, Gender, and cognitive processing speed as well as the interaction between Group \times Cognitive Processing Speed and Gender \times Cognitive Processing Speed was calculated.

Results

The Effects of Group and Gender on Executive Functions

Cognitive Processing Speed: ZVT

Regarding the dependent variable ZVT, which measured cognitive processing speed, there was one significant main effect for the factor Gender, F(1, 123) = 14.60, p < .001, $\eta_p^2 = .106$ but not for the factor Group, F(1, 123) = 1.18, p = .279, $\eta_p^2 = .010$ nor a significant interaction between both factors, F(1, 123) = 0.102, p = .750, $\eta_p^2 = .001$. Women had lower values (M = 50.73, SD = 8.44) than men (M = 57.13,

SD = 10.23), which means that they were faster in completing the task.

Working Memory: 2-Back Task

Concerning the target accuracy, the effects of Group, F(1, 123) = 4.84, p = .030, $\eta_p^2 = .038$ as well as the one of Gender, F(1, 123) = 3.93, p = .050, $\eta_p^2 = .031$ but not the interaction between both factors, F(1, 123) = 0.18, p = .676, $\eta_p^2 = .001$ were significant. Musicians (M = 89.74%, SD = 8.21) had a higher accuracy than non-musicians (M = 85.52%, SD = 12.82), women (M = 89.49%, SD = 8.49) had a better performance than men (M = 85.70%, SD = 12.77) (Figure 1).

Regarding the target reaction time, there were neither main effects of Group, F(1, 123) = 0.138, p = .711, $\eta_p^2 = .001$ nor of Gender, F(1, 123) = 0.48, p = .827, $\eta_p^2 < .001$ and no interaction between both factors, F(1, 123) = 0.023, p = .880, $\eta_p^2 < .001$.

Regarding a possible speed-accuracy trade off, there was no correlation between the reaction time and accuracy, r(127) = -.031, p = .732 and neither for the musicians, r(63) = .028, p = .828 and non-musicians, r(64) = -.080, p = .531.

Inhibition: Flanker Task

Regarding the accuracy, there was only a main effect of Condition, F(2, 246) = 7.53, p = .001, $\eta_p^2 = .058$, whereas all other main effects and interactions were not significant (all ps > .222). The accuracy was lower in the incongruent condition (M = 30.70, SD = 1.39) compared to the neutral condition (M = 31.13, SD = 1.13), t(126) = -3.554, p = .001, and the congruent condition (M = 31.17, SD = 1.09), t(126) = 3.287, p = .001. There was no difference between the congruent and neutral condition, t(126) = -0.284, p = .777.

Concerning the reaction time, there was only a main effect of Condition, F(2, 246) = 17.90, p < .001, $\eta_p^2 = .127$, whereas all other main effects and interactions were not significant (all ps > .326). The reaction time was higher in the incongruent condition (M = 558.10, SD = 106.65) compared to the congruent condition (M = 530.44, SD = 96.20), t(126) = 5.972, p < .001. There was no difference between the incongruent and neutral condition (M = 553.10, SD = 105.30), t(126) = 1.013, p = .313, but between the congruent and neutral condition, t(126) = 4.365, p < .001).

Cognitive Flexibility: Wisconsin Card Sorting Test

Regarding the dependent variable correct sorts, there were neither significant main effects for the factor Group, F(1, 122) = 0.307, p = .581, $\eta_p^2 = .002$ and for the factor Gender, F(1, 123) = 2.291 p = .133, $\eta_p^2 = .018$ nor a significant interaction between both factors, F(1, 123) = 2.148, p = .145, $\eta_p^2 = .017$.



Figure 1. Mean and standard deviation of target accuracy in the 2back task (working memory) for musicians and non-musicians.

For the dependent variable perseverative errors neither significant main effects for the factor Group, F(1, 123) = 0.120, p = .730, $\eta_p^2 = .001$ and for the factor Gender, F(1, 123) = 0.784, p = .378, $\eta_p^2 = .006$ nor a significant interaction between both factors, F(1, 123) = 0.563, p = .454, $\eta_p^2 = .005$ could be detected.

Table 1 shows an overview of the results (p is given, p < .05) for the main effects of Group and Gender, and possible interactions. Only for the 2-Back Task, the main effects of Group and Gender were significant.

The Relevance of Cognitive Processing Speed on Executive Functions

Working Memory: 2-Back-Task

The regression showed that 18.7% of the target accuracy was predicted by cognitive processing speed, F(5, 121) = 5.583, p < .001 (Table 2). Only the cognitive processing speed predicted target accuracy. If the participants needed more time to complete the ZVT, the target accuracy was lower (r = -.311, p < .001).

The regression showed that 15.4% of the reaction time was predicted by cognitive processing speed, F(5, 121) = 4.408, p < .001 (Table 3). Only the cognitive processing speed predicted reaction time. If the participants needed more time to complete the ZVT, the reaction time was higher (r = .366, p < .001).

Inhibition: Flanker Task

For the Flanker Task the flanker effect (incongruentcongruent) was calculated for accuracy and reaction time. The regression showed that the flanker effect on accuracy could not be predicted by the factors included, F(5, 121) =0.923, p = .469. Furthermore, the analysis for the flanker effect on reaction time could not be predicted by the factors included, F(5, 121) = 0.784, p = .563.

Table 1. Overview of p-values of the possible Group and Gender effects for the different tasks

Task	Group	Gender	Interaction
2-Back Task			
Accuracy	.030*	.050*	.676
Reaction time	.711	.827	.880
Flanker Task			
Accuracy	.850	.223	.504
Reaction time	.672	.602	.445
Wisconsin Card Sorting			
Correct sorts	.581	.133	.145
Perseverative errors	.730	.378	.454

Note. *p < .05.

Cognitive Flexibility: Wisconsin Card Sorting Test

The two regression conducted for the correct sorts as well as the perseverative errors showed, that neither the correct sorts, F(5, 121) = 1.135, p = .346 nor the perseverative errors, F(5, 121) = 0.529, p = .754 could be predicted by the factors included.

Discussion

Our results are straightforward: There was a significantly better performance for the target accuracy in the working memory task for musicians compared to non-musicians and for women compared to men. However, when accounting for cognitive processing speed this target accuracy was only significantly predicted by the cognitive processing speed and neither by gender nor group anymore. Men and women, and musicians and non-musicians did not differ in their performance in the inhibition task and the cognitive flexibility task.

Executive Functions in Musicians and Non-Musicians

A significant difference in the cognitive performance of musicians and non-musicians was only visible in the working memory measurement. In this study, the working memory capacity was measured with the 2-back task, demonstrating better performance at least in the accurate measurement for musicians compared to non-musicians. This is in line with a study of Gagnon and Nicoladis (2020) who demonstrate a better memory capacity measured in visual and motor memory. However, they did not find any differences between musicians and non-musicians in verbal memory tasks (forward and backward digit span test and two other tests of motor working memory). The result is also in line with a meta-analysis of Talamini et al. (2017) who showed among others a moderate effect

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	Target Accuracy 2-Back Task									
Variable	b	SE	β	t	р	95% CI				
Group	.126	.106	.578	1.193	.235	[083, .335]				
Gender	183	.112	839	-1.637	.104	[405, .038]				
ZVT	003	.001	230	-2.602	.010	[005;001]				
Group × ZVT	.002	.001	.756	1.557	.122	[.000, .003]				
Gender × ZVT	002	.001	947	-1.824	.071	[004, .000]				

Table 2. Regression for the dependent variable "Target Accuracy in the 2-Back Task" and the possible predictors Group, Gender, ZVT, InteractionGroup × ZVT, Interaction Gender × ZVT

Table 3. Regression for the dependent variable "Reaction Time in the 2-Back Task" and the possible predictors Group, Gender, ZVT, Interaction Group \times ZVT, Interaction Gender \times ZVT

		Reaction Time 2-Back Task										
Variable	b	SE	β	t	р	95% CI						
Group	-71.905	190.399	187	-0.378	.706	[-448.849, 305.040]						
Gender	165.164	201.604	.429	0.819	.414	[-233.963, 564.292]						
ZVT	7.796	1.770	.398	4.405	<.001	[4.292, 11.300]						
$Group\timesZVT$	-0.411	1.743	117	-0.236	.814	[-3.861, 3.040]						
Gender \times ZVT	1.139	1.864	.324	0.611	.542	[-2.551, 4.829]						

size of the difference between musicians and non-musicians in working memory tasks. Thereby the type of stimuli presented explained only a small part of the variability across studies. The musicians' advantage could be shown with verbal stimuli (also letters which were read as in this study). However, they did not investigate gender as a possible moderator of the results.

There were no differences in the inhibition and shifting performance between musicians and non-musicians, which is in contrast, for example, to the study of Meyer et al. (2020), who measured executive function with the dimensional change card sort test, which is like the WCST used here. They found better performance in the flanker test as well as in the processing speed (measured with the NIH TB pattern comparison process speed) whereas we could not find any difference between musicians and non-musicians in processing speed measured with the trail-making test. The flanker tests in the study of Meyer et al. (2020) used arrows, while we used letters in our study. Even though our results contradict the results of Meyer et al. (2020) they are in line with the study of Slevc et al. (2016). In their study, individual differences in musical ability predicted performance on working memory (updating) tasks (auditory and visual n-back tasks) but not in inhibition and cognitive flexibility. However, in their study, they also investigated musical ability by the musical ear test, which correlates to the years of musical training. To conclude, the "better" performance of musicians compared to non-musicians must be taken with caution. Studies differ due to the measurement of EF, the years of practice, the instrument played by the musicians and the possible control variables such as intelligence or socioeconomic status. Also, our study demonstrated, that not the group affiliation but the cognitive processing speed predicted working memory performance.

Gender Difference in Executive Functions

Women, musicians as well as non-musicians, showed better working memory capacity compared to men. However, as mentioned before, only cognitive processing speed predicted the working memory performance but not the gender. There were no gender differences in the inhibition and cognitive flexibility task, which is in line with the assumption of Grissom and Reyes (2019). The result also confirms the assumption of Jäncke (2018) that women and men are more similar in cognitive aspects than may be assumed.

Gender differences that only appear in musicians but not in non-musicians could not be shown in EF. Whereas for mental rotation performance the facilitating effect for female musicians was demonstrated (Pietsch & Jansen, 2012), this was not evident for EF. One reason for this might be that a possible gender difference in EF is much less explicit than in a cognitive domain like mental rotation where gender differences favoring men are quite common.

Limitations and Conclusion

The study is limited by the quasi-experimental design, allowing no causal conclusions and the fact that results could be influenced by other factors such as socioeconomic status or begin of musical training in young childhood. However, age, cognitive processing speed, and gender distribution were similar, SES was not obtained since the study of Slevc et al. (2016) excluded the SES as a relevant factor. The measurements were chosen due to other studies, however, working memory can be assessed regarding different subcomponents in a more differentiated way. Also, the WCST is used to measure cognitive flexibility, which is in line with recent other studies in the research on music cognition (e.g., Feizpour et al., 2018), however, also other shifting paradigms could be used in further studies.

To conclude, this study has demonstrated that (a) gender differences in EF are less likely to appear also in a trained sub-group, and (b) musicians might only have better working memory but not per se better EF. However, better working memory is related to cognitive processing speed. For this, the enhancing effect of music training on EF must be investigated more precisely as it is quite recently suggested for the possible benefit of sports activity on EF (Diamond & Ling, 2019).

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Measuring Individual Differences in Measures of Autism Spectrum Disorders

Recognizing the Role of General Intelligence

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Abstract: Previous research suggests that theory of mind tasks such as the Reading the Mind in the Eyes Test (RMET) are correlated with general intelligence (g). The present study replicated and extended this research by testing correlations between g, the RMET, and two related measures, the empathy quotient (EQ) and systematizing quotient (SQ). The RMET, EQ, and SQ were all significantly correlated with g (r = .27 with RMET; r = -.15 with EQ; r = .27 with SQ). To determine if the RMET, EQ, and SQ derive their predictive power from g, a hierarchical regression examined whether the RMET, EQ, and SQ predicted feelings toward STEM and humanities after controlling for g. The EQ and SQ continued to significantly predict feelings toward STEM ($\beta = .20$ for EQ; $\beta = .42$ for SQ) after controlling for g, and the RMET and EQ continued to significantly predict feelings toward humanities ($\beta = .10$ for RMET; $\beta = .20$ for EQ) after controlling for g, suggesting that these measures do not entirely derive their predictive power from g.

Keywords: individual differences, general intelligence, theory of mind, empathizing, systemizing

In 1985, Baron-Cohen et al. asked if children with autism spectrum disorders (ASD) have a theory of mind (ToM). In children, ToM is the ability to recognize that other people have unique mental states which may or may not match one's own (Baillargeon et al., 2010). In adults, ToM is expanded to include the ability to identify others' mental states and to use this knowledge to make predictions about others' actions (Premack & Woodruff, 1978). Whether children with ASD have a ToM started a line of research in which Baron-Cohen and colleagues developed several ToM measures which are commonly used for children with and without ASD. However, Baron-Cohen and colleagues recognized that many of the ToM measures created for children were not sensitive enough to detect individual differences in ToM abilities in adults with and without ASD. For this reason, Baron-Cohen et al. (1997) created, and Baron-Cohen et al. (2001) revised, the Reading the Mind in the Eyes Test (RMET).

The RMET is currently one of the most popular ToM measures for adults with and without ASD. However, research suggests that the RMET may at least partially derive its predictive validity from general intelligence (g). g is the variance shared across a variety of cognitive tests (Jensen & Weng, 1994). Although Baron-Cohen et al.

(2001) suggest that the RMET is not (or is only weakly) related to g, a recent meta-analysis by Baker et al. (2014) suggests that the RMET correlates moderately with g(r =.24; see also Coyle et al., 2018). The moderate relationship between the RMET and g is concerning because g is largely responsible for much of the predictive validity of cognitive tests. By removing the variance attributable to g, one can limit the predictive power of cognitive tests (Jensen, 1984, 1998). If removing the variance attributable to g from the RMET greatly reduces the predictive power of the RMET, that would suggest that g and not ToM is responsible for the RMET's predictive ability. This would call into question knowledge about ToM gained using the RMET. The present study attempts to replicate Baker et al. (2014) by examining the relationship between the RMET and g. Based on Baker et al. (2014; see also Coyle et al., 2018), the RMET was expected to correlate positively with g.

The present study also extends Baker et al. (2014) by examining the relationship between g and two related measures created by Baron-Cohen and colleagues, the Empathy Quotient (EQ) and the Systemizing Quotient (SQ) (Baron-Cohen et al., 2003; Baron-Cohen & Wheelwright, 2004; Wakabayashi et al., 2006). Like ToM, empathizing and systemizing were originally intended to explain behaviors associated with ASD (Baron-Cohen, 2009, 2010; Baron-Cohen et al., 2005; Baron-Cohen et al., 2003; Goldenfeld et al., 2007; Wheelwright et al., 2006), but have been expanded to explain behaviors of adults without ASD. Empathizing requires correctly identifying, responding to, and making predictions based on others' mental states. This involves a cognitive component where one is aware of and predicts another's mental state, which is theoretically similar to ToM (Baron-Cohen, 2010, p. 169). Based on the similarity between this cognitive component of empathizing and ToM, the EQ was expected to correlate positively with the RMET. Based on the EQ's relationship with the RMET (a cognitive test), and the fact that cognitive tests are related to *g* (to varying degrees), the EQ was also expected to correlate positively with *g*.

On the other hand, systemizing requires correctly analyzing a system and making predictions based on the set rules of that system (Baron-Cohen, 2009; Goldenfeld et al., 2007). While systemizing is sometimes described as very different from or even opposite to empathizing (Baron-Cohen et al., 2005), analyzing complex systems seems intuitively related to g which increases in predictive validity as complexity increases (Gottfredson, 1997). For this reason, and because many cognitive tests derive their predictive validity from g, the SQ was also expected to correlate positively with g.

In addition to replicating and extending Baker et al. (2014), the present study also seeks to answer a fundamental question about the predictive validity of the RMET, EQ, and SQ. For many cognitive tests, removing the variance attributable to g limits the test's predictive validity (Jensen, 1984, 1998). The present study explores whether the RMET, EQ, and SQ predict important, real-world outcomes after removing the variance attributable to g. Previous research suggests that the RMET, EQ, and SQ are all related to choosing either STEM or humanities majors in college. ToM and empathizing are related to choosing humanities majors (Billington et al., 2007; Focquaert et al., 2007; Thomson et al., 2015) and systemizing is related to choosing STEM majors (Billington et al., 2007; Focquaert et al., 2007). For this reason, the present study explores whether the RMET, EQ, and SQ predict feelings toward STEM and humanities majors after controlling for g. First, the present study examined whether the RMET, EQ, and SQ are related to feelings toward STEM and humanities majors without controlling for g. Based on previous research, the RMET and EQ were expected to correlate positively with liking humanities and negatively with liking STEM. On the other hand, the SQ was expected to correlate negatively with liking humanities and positively with liking STEM. Next, the present study explored whether these relationships would be significant after controlling for g.

The present study examines these predictions in an adult sample without ASD to determine whether or not the use of the RMET, EQ, and SQ in such samples is justified. This question is both timely and necessary as the EQ and SQ, like the RMET, are currently being used to explore individual differences in adult samples without ASD.

Methods

Participants

Participants were recruited through an undergraduate participant pool at a public university in Texas. Analyses included 431 participants (142 males and 289 females). Of these, 28.5% identified as White, 47.6% identified as Hispanic, 10.7% identified as Asian, 10.9% identified as Black, and 2.3% identified as Other. All participants provided informed consent.

Measures

General intelligence was based on the International Cognitive Ability Resource (ICAR, Condon & Revelle, 2014; The International Cognitive Ability Resource Team, 2014). The ICAR included 16 items, 4 items from each of the following sections: letter and number series, matrix reasoning, three-dimensional rotation, and verbal reasoning. *g* was calculated using principal axis factoring with no rotation on the total scores of the 4 ICAR sections and was based on the first factor on which the ICAR sections loaded highest. A *g* based on ACT test scores was used as a proxy for the *g* based on the ICAR in supplementary analyses as robustness checks for the primary and exploratory analyses. These are reported in Tables E2–E5 in the Electronic Supplementary Material 1, ESM 1.

Empathizing was measured using the Empathy Quotient Short Form (EQ, Wakabayashi et al., 2006). The EQ measures self-reported ability to make predictions by identifying and responding to others' mental states. The EQ includes 22 items such as "I can tune into how someone else feels rapidly and intuitively."

Systemizing was measured using the Systemizing Quotient Short Form (SQ, Wakabayashi et al., 2006). The SQ measures self-reported ability to use set rules to make predictions and analyze a system. The SQ includes 25 items such as "I am fascinated by how machines work."

Theory of Mind was measured using the Reading the Mind in the Eyes Revised Version (RMET, Baron-Cohen et al., 1997; Baron-Cohen et al., 2001). The RMET presents participants with 36 pairs of eyes and asks them to select the emotion which best describes what the person in the picture is thinking or feeling.

	g	RMET	EQ	SQ	STEM difference scores	Humanities difference scores
g	_					
RMET	.27**	-				
EQ	15**	00	-			
SQ	.27**	06	.05	-		
STEM difference scores	.25**	04	20**	.44**	-	
Humanities difference scores	.05	.11*	.19**	.02	22**	-

Table 1. Correlations without transformation

Note. Difference scores = like – dislike. Positive values indicate greater liking than disliking. g = General Intelligence; RMET = Reading the Mind in the Eyes Test Revised; EQ = Empathy Quotient Short Form; SQ = Systemizing Quotient Short Form. *p < .05, **p < .01.

Feelings toward STEM and humanities were measured using four Likert scales asking participants to rank the extent to which they like STEM, dislike STEM, like humanities, and dislike humanities. Difference scores were calculated for STEM and humanities by subtracting participants' dislike scores from their like scores. Positive values indicate a greater degree of liking.

Results

Primary Analyses

Table 1 reports correlations between *g*, RMET, EQ, SQ, STEM difference scores, and humanities difference scores. Descriptive statistics are reported in Table E1, ESM 1. Robustness checks partially replicate the results reported in the primary analyses (see Tables E2–E5 in ESM 1).

g correlated positively with the RMET (r = .27, p < .001), negatively with the EQ (r = ..15, p = .001), and positively with the SQ (r = .27, p < .001). The RMET correlated positively with humanities difference scores (r = .11, p = .02) and was not related to the EQ (r = -.003, p = .95). The EQ correlated negatively with STEM difference scores (r = .20, p < .001) and positively with humanities difference scores (r = .20, p < .001). The SQ correlated positively with STEM difference scores (r = .44, p < .001) but not with humanities difference scores (r = .02, p = .68). The EQ did not correlate with the SQ (r = .05, p = .27).

Exploratory Analyses

The present study also examined whether the RMET, EQ, and SQ predicted feelings toward STEM and humanities after controlling for g. To address this issue, we used a hierarchical regression, which entered g in step one and the remaining predictors in step two. Table 2 reports estimates predicting feelings toward humanities while Table 3 reports estimates predicting feelings toward STEM. A significant

increase in ΔR^2 would suggest that the RMET, EQ, and SQ predicted feelings toward STEM and humanities after controlling for (i.e., removing variance attributable to) *g*. Estimates in step two represent each variable's ability to predict the outcome after controlling for *g* and all other predictors entered in step two.

In step one, *g* did not significantly predict ($\beta = .05$, p = .34) or account for any variance in feelings toward humanities. This was expected as *g* and humanities difference scores were not significantly correlated. Unsurprisingly, in step two, *g* continued to fail to significantly predict ($\beta = .05$, p = .35) feelings toward humanities. The RMET was a marginally significant predictor ($\beta = .10$, p = .06) and the EQ was a significant predictor ($\beta = .20$, p < .001) of feelings toward humanities. The SQ was not a significant predictor ($\beta = .00$, p = .98) of feelings toward humanities. Adding the RMET, EQ, and SQ to the model significantly increased the variance accounted for from 0% to 5% (p < .001).

In step one, *g* significantly predicted ($\beta = .25$, p < .001) and accounted for 6% of the variance in feelings toward STEM. Again, this is to be expected as *g* and STEM difference scores were significantly correlated. In step two, *g* continued to significantly predict ($\beta = .12$, p = .01) feelings toward STEM. The RMET was not a significant predictor ($\beta = -.04$, p = .30) of feelings toward STEM. The EQ and SQ were significant predictors ($\beta = -.20$, p < .001 for EQ; $\beta = .42$, p < .001 for SQ) of feelings toward STEM. Adding the RMET, EQ, and SQ to the model significantly increased the variance accounted for from 6% to 25% (p < .001).

Discussion

The present study explored the relationships between the RMET, EQ, SQ, and g and examined whether the RMET, EQ, and SQ predicted meaningful academic outcomes (feelings toward STEM and humanities) after controlling

Table 2. Hierarchical regression of the RMET, EQ, and SQ on humanities difference scores after controlling for g

	0		, ,				0 0		
	В	SE B	р	BCa 95% CI	β	R^2	ΔR^2	F	р
Step 1						.00	-	0.91	.34
g	0.18	0.18	.34	[-0.18, 0.54]	.05				
Step 2						.05	.05	5.62	< .001
g	0.19	0.20	.35	[-0.20, 0.60]	.05				
RMET	0.08	0.04	.06	[-0.00, 0.17]	.10				
EQ	0.08	0.02	< .001	[0.04, 0.12]	.20				
SQ	0.00	0.02	.98	[-0.03, 0.04]	.00				

Note. g = General Intelligence; RMET = Reading the Mind in the Eyes Test Revised; EQ = Empathy Quotient Short Form; SQ = Systemizing Quotient Short Form.

 Table 3. Hierarchical regression of the RMET, EQ, and SQ on STEM difference scores after controlling for g

	В	SE B	р	BCa 95% Cl	β	R^2	ΔR^2	F	р
Step 1						.06	-	28.04	< .001
g	0.92	0.17	< .001	[0.59, 1.27]	.25				
Step 2						.25	.19	36.31	< .001
g	0.43	0.17	.01	[0.10, 0.78]	.12				
RMET	-0.03	0.03	.30	[-0.10, 0.03]	04				
EQ	-0.08	0.02	< .001	[-0.11, -0.04]	20				
SQ	0.14	0.02	< .001	[0.11, 0.17]	.42				

Note. g = General Intelligence; RMET = Reading the Mind in the Eyes Test Revised; EQ = Empathy Quotient Short Form; SQ = Systemizing Quotient Short Form.

for *g*. The RMET, EQ, and SQ were expected to correlate positively with *g*. The RMET and EQ were expected to correlate positively with each other and with liking humanities and to correlate negatively with liking STEM. The SQ was expected to correlate negatively with liking humanities and positively with liking STEM.

Primary Analyses

As expected, the RMET correlated positively with g. Both the direction and size of this effect replicate previous research (Baker et al., 2014). However, the RMET did not correlate with the EQ. This is surprising as ToM is conceptually similar to the cognitive component of empathizing (Baron-Cohen, 2010, p. 169) and does not replicate previously reported effects (Thomson et al., 2015; Voracek & Dressler, 2006). The lack of correlation may be due to the fact that the RMET is a performance-based measure while the EQ is a self-report measure. Previous research suggests that self-report emotional intelligence is not related to either performance-based emotional intelligence or outcomes in social situations (Brackett et al., 2006). The lack of relationship between self-report and performancebased measures may occur because people are not making accurate judgments about their ability to empathize, similar to a Dunning-Kruger effect (Dunning et al., 2003; Kruger & Dunning, 1999; see also Burson et al., 2006; Krueger & Mueller, 2002). It is also possible that the lack of relationship between self-report and performance-based measures occurs because the two types of tests are intentionally measuring distinct concepts (e.g., trait and ability EI; O'Connor et al., 2019).

The EQ and SQ correlated significantly with g as expected. For the SQ, this relationship was in the anticipated direction, suggesting that as perceived systemizing increases, g also increases. However, the EQ unexpectedly correlated negatively with g. This suggests that as perceived empathizing increases, g decreases. As suggested above, this unexpected relationship could potentially be caused by people not making accurate judgments about their ability to empathize. On the other hand, this negative relationship could suggest a compensatory relationship. Perhaps it is necessary for people with lower g to cultivate greater empathizing tendencies. Previous research suggests that both g and social intelligence are necessary for optimal team performance (Baggio et al., 2019; Freeman et al., 2016). For this reason, it might be beneficial for those with lower g to cultivate greater social intelligence (such as empathizing tendencies) to achieve outcomes more effectively through collaboration. However, because the effect size between the EQ and g is relatively small, any conclusions based on this relationship should be tentative until the effect is replicated using different measures of both empathizing and g.

As expected, the RMET correlated positively with feelings toward humanities, replicating previous research (Billington et al., 2007). However, unexpectedly, the RMET did not significantly correlate with feelings toward STEM. This may suggest that ToM is necessary to be successful in humanities majors but not in STEM majors. Consistent with prior research (Billington et al., 2007; Focquaert et al., 2007; Thomson et al., 2015), the EQ was negatively related to feelings toward STEM, whereas the SQ was positively related to feelings toward STEM. However, while the EQ was positively related to feelings toward humanities as expected, the SQ was not related to feelings toward humanities. As with the relationship between the RMET and feelings toward STEM, the lack of a relationship between the SQ and feelings toward humanities may suggest that systemizing is necessary to be successful in STEM majors but not in humanities majors.

It is also possible that this pattern of relationships may suggest that feelings toward STEM and humanities can be explained by related but distinct concepts such as a preference for people or things or vocational interests (Lippa, 1998; Su, Rounds, & Armstrong, 2009). Those with systemizing tendencies are likely to prefer things to people because one can use systemizing to understand things but not people (Baron-Cohen et al., 2005). On the other hand, those with empathizing tendencies are likely to prefer people to things because one can use empathizing to understand people but not things (Baron-Cohen et al., 2005). This pattern of relationships between empathizing and systemizing and feelings toward STEM and humanities might suggest that a related variable, such as a preference for people or things or vocational interests, affects the relationships between the EQ and SQ and feelings toward STEM and humanities. Graziano et al. (2012) suggest that STEM majors relate to a preference for things. However, certain humanities majors may relate to people (e.g., English literature, creative writing) while other humanities majors relate to things (e.g., art, architecture). This diversity would introduce error into estimates involving humanities majors or may cause a suppression effect, potentially explaining the moderate to the large relationship between the SQ and feelings toward STEM and the small to moderate relationship between the EQ and feelings toward humanities. However, Graziano et al. (2012) does not suggest a relationship between a preference for people and non-STEM majors.

It is also possible that this pattern of relationships occurs because of the relative difficulty of STEM majors compared to non-STEM majors. Chen (2015) suggests that the difficulty of the coursework in STEM courses may lead some students to switch to majors with easier coursework. It is possible that because STEM is more difficult, only those students with a high ability or interest in STEM continue in STEM majors. Students with less ability or interest in STEM may be more likely to leave STEM majors. This interpretation is supported by previous research which suggests that a g above a certain threshold is necessary to be successful in upper-level physics and mathematics classes (Hsu & Schombert, 2010). This would explain why both the EQ and SQ significantly predicted feelings toward STEM. However, it is possible that because non-STEM majors are easier, a high level of ability or interest in humanities may not be as necessary for students to continue in humanities majors. This would also explain the relatively small (or absent) relationships between the EQ and SQ and feelings toward humanities.

Exploratory Analyses

Exploratory analyses examined whether the RMET, EQ, and SQ predict feelings toward STEM and humanities majors, after controlling for g. The RMET and EQ significantly predicted feelings toward humanities and the EQ and SQ significantly predicted feelings toward STEM after controlling for g. In addition, both hierarchical regressions reported a significant increase in the variance accounted for after adding the RMET, EQ, and SQ to the model. This suggests that while there were significant correlations between each of these measures and g, none of these measures derived their entire predictive validity from their relationship with g. Because the standardized β estimates were very similar to the correlation estimates, it is likely that g does not meaningfully contribute to the ability of the RMET, EQ, and SQ to predict feelings toward STEM and humanities.

Limitations and Future Research

Because all participants were in college, the present sample likely lacks participants with low g. This may bias the results of the present study. In particular, Spearman's Law of Diminishing Returns (SLODR) suggests that test scores highly related to g (e.g., ICAR, SAT, ACT) should gradually become less predictive as ability level increases (Deary et al., 1996; see also Coyle, 2015; Coyle et al., 2011). Future research should attempt to replicate these findings with samples that include individuals with low g. The present study did not control for the presence of ASD or nonclinical ASD symptoms, which have been related to the RMET, EQ, and SQ. Future studies should replicate these results while tracking ASD diagnosis and symptoms. In addition, the study included only one measure of ToM and empathizing, the RMET and EQ, one of which is based on self-report. Future research should attempt to replicate these findings with other measures, preferably ones that are both performance-based.

Conclusion

The present study replicated research suggesting a relationship between the RMET and g while also showing relationships between g and two related measures, the EQ and SQ. Results indicated that ToM, empathizing, and systemizing correlated with g. Exploratory analyses suggested that the RMET and EQ predicted feelings toward humanities and that the EQ and SQ predicted feelings toward STEM after g was included in the model. Future research should consider the role of g when using these measures.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/ 10.1027/1614-0001/a000351

ESM 1. This file contains additional information about the study and measures, descriptive statistics for all measures, and robustness checks.

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History

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General Intelligence and the Dark Triad

A Meta-Analysis

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Abstract: The dark triad of personality (D3) – consisting of psychopathy, Machiavellianism, and narcissism – is a set of socially aversive personality traits. All three traits encompass disagreeable behavior and a particular disregard for the well-being of others, but also a tendency to strategic and deceptive manipulation of social environments in order to attain one's goals. To exercise these complex manipulations effectively it seems beneficial to have high cognitive abilities. Therefore, a meta-analysis was conducted to examine possible relationships between intelligence and the dark triad. A total of 143 studies were identified to estimate the strength of relationships between the D3 and general, verbal, and nonverbal intelligence. The results indicate that none of the constructs of the dark triad are meaningfully related to intelligence. However, there was a small negative correlation between intelligence and Factor 2 psychopathy. The substantial heterogeneity regarding the observed effect sizes could not be explained with meta-regression for the most part. There was no evidence for a publication bias. In total, the results challenge the notion that the dark triad is an adaptive set of personality traits that enables individuals to effectively manipulate their social surroundings.

Keywords: intelligence, psychopathy, Machiavellianism, narcissism, meta-analysis

Since Paulhus and Williams (2002) grouped three psychological constructs - psychopathy, Machiavellianism, and narcissism - into an infamous conglomerate, the so-called dark triad of personality (D3) has become a prominent model to describe, explain and predict socially aversive behavior. Psychopathy (P) is characterized by superficial charm, deceptive and manipulating behavior, a lack of remorse, empathy, and emotionality, a tendency to criminality, as well as antisocial behavior in general (Hare, 1999). Machiavellianism (M) describes a lack of effect in interpersonal relations, a utilitarian worldview with no firm moral standards, a tendency to manipulate others, and a lack of psychopathology (Christie & Geis, 1970). Narcissistic (N) individuals tend to feel superior to others, brag about themselves, and intend to dominate their social environment (Raskin & Hall, 1981).

On a conceptual level, the constructs of the D3 share several features, like low interpersonal effect, a tendency of manipulation, the need to dominate others, or a general tendency of indifference to the interests of others. This impedes a conceptual differentiation between the P, M, and N, which is also reflected in its operationalizations. Consequently, the triad shows high empirical overlap (Muris et al., 2017; Vize et al., 2018). Yet, some conceptual features of the dark triad are at odds with one another, for example, in regards to the role of impulsivity for M and P (Furnham et al., 2013; Jones & Paulhus, 2011; McHoskey et al., 1998). Recently, the dark triad has been expanded by the inclusion of *everyday sadism* to be described as the "dark tetrad" (Paulhus, 2014), but is also faced with theoretical "competition" due to the emergence of the *Honesty-Humility*-factor (HH) from the *HEXACO*-model by Lee and Ashton (2013). There is convincing empirical evidence that (low) HH is the "core" of the D3 and is best suited to explain the common D3-variance (Hodson et al., 2018). Moshagen et al. (2018) demonstrated that "D" – the so-called *dark factor of personality* that partly consists of shared D3-variance – has a strong empirical overlap with low HH. A strong negative correlation regarding D3 and agreeableness has also been reported (O'Boyle et al., 2015) which makes (dis-) agreeableness another valid candidate for the D3-core.

Several authors have argued that the D3 is an adaptive set of personality traits that enable D3-individuals to manipulate their social surroundings effectively: Psychopaths are thought to be "smooth operators" and exploitative social predators that are able to reach powerful positions as managers or politicians (Babiak & Hare, 2006; Babiak et al., 2010; Furnham, 2010; Hare, 1999; Porter et al., 2009), Machiavellians are seen as a cold manipulator with complex plans to achieve their objectives (Bereczkei, 2018; Christie & Geis, 1970; Simonton, 1986; Wilson et al., 1998) and narcissist are claimed to be charming entertainers (Back et al., 2010; Jauk et al., 2016; Jonason et al., 2012; Paulhus, 1998).



The Dark Triad and Intelligence

It is not uncommon among D3-researchers to assume that the tendency to show manipulative behavior goes along with the actual ability to manipulate others effectively (Jonason & Webster, 2012; Nagler et al., 2014). Although the empirical support for this claim is sparse and some authors have recently challenged this view of highly adaptive D3-individuals (Jones & Paulhus, 2009; Lilienfeld et al., 2015; Watts et al., 2013; Wright et al., 2015), it does not seem implausible at first. Consequently, one might deduce that either (a) certain theoretical aspects of the dark triad lead to successful manipulations or (b) that the D3 are then again positively related to other variables that are commonly connected to criteria of success. If one follows the logic of the latter aspect, intelligence seems to be a valid candidate for examination, since it has been shown to be a relevant predictor of several criteria of success (Schmidt & Hunter, 1998; Sternberg, 1997; Strenze, 2007). Additionally, it seems conceptionally plausible that complex manipulative behavior is more likely to be successful if the manipulator has high cognitive abilities. One might even argue that D3-individuals actually "need" a certain level of intelligence to conduct their socially aversive behavior in an effective manner (Salekin et al., 2004). This might especially apply to social intelligence and emotional intelligence which can be conceived as sub-branches of intelligence (Conzelmann et al., 2013; Mayer et al., 2016). Currently, there is almost no empirical evidence on the D3-relations regarding social intelligence, but there have been metaanalyses on the dark triad and emotional intelligence (Megías et al., 2018; Miao et al., 2019; Vize et al., 2018).

In this study, a possible relation between the dark triad of personality and cognitive ability was examined in order to further inspect if D3-individuals are able to function normally and if they are predisposed for (mal-)adaptive behavior due to their (low) intelligence. The method of choice was a systematic literature review in combination with a meta-analysis. In this study, the primary issue was the D3-relation with general intelligence. The D3-relations with potential sub-branches of intelligence were examined: *verbal* (to examine if D3-individuals might have superior verbal abilities that might support their manipulation tactics specifically in social situations) and *non-verbal* intelligence (to examine if D3-individuals might have special abstract abilities that might enable them to generate complex manipulative plans in advance).

Theory-Based Expectations

For M and P, there are a few theoretical/conceptual allusions that might constitute a relationship with intelligence. In the course of the first psychopathy concept, Cleckley (1941) describes the psychopath as an individual with "good 'intelligence'," although he mostly refers to psychopathic pseudo-intellectuality rather than actual high cognitive abilities. Most studies with the P-intelligence-relation as their main topic refer to Checkley's casuistic reports (Johansson & Kerr, 2005; Salekin et al., 2004; Sharratt et al., 2019; Vitacco et al., 2008) as the reason to examine this relationship: Some individuals have shown psychopathic behavior and had high intelligence at the same time. Studies on cognitive features of psychopathy seem to suggest that there are very specific deficits or abnormalities in bottom-up and hemispheric processing (Hiatt & Newman, 2006) with no relation to general intelligence, but rather emotional deficits and impulsivity (Fowles & Dindo, 2006). Criminal behavior has been linked to lower intelligence (Bartels et al., 2010; Gendreau et al., 1996) and since one crucial aspect of (secondary) psychopathy is a history of criminality, it might constitute a negative empirical connection between intelligence and P. Vitacco et al. (2008) expect no overall effect for intelligence and P, but presume that there might be different relations on the P-facet-level to intelligence (positive relations to primary P and negative relations to secondary P). The concept of "Machiavellian Intelligence" suggests that Machiavellians possess special cognitive abilities - although the term is originally used in evolutionary psychology and not personality/social psychology (Whiten & Byrne, 1997). Nevertheless, Bereczkei (2018) refers to the concept and argues that Machiavellians do have certain cognitive abilities that enable them to effectively exploit others. One might consider Machiavellian behavior as "smart" since it (conceptionally) relies on careful planning and complex manipulations, but note that the attempt to act in a complex way is not necessarily related to that specific ability. Furthermore, there is no convincing evidence that high-scorers on existing M-tests behave in a "Machiavellian," that is, carefully planned manner. Although narcissists themselves claim to have high cognitive abilities, they have shown to overstate their intelligence more than others (Gabriel et al., 1994). Zajenkowski and Dufner (2020) state that self-perceived (high) intelligence plays a key role in narcissistic self-views: Narcissists attribute their successes to their (assumed) high intelligence and are eager to appear as intelligent individuals to others - although narcissism was unrelated to performance in IQ-tests. Nevertheless, it might be possible that individuals with high intelligence might "acquire" a form of narcissism as a consequence of their various successes in life which would result in a positive link between narcissism and intelligence. Beyond that, there is no theoretical reason to assume that there is a relationship between N and intelligence. Note that no D3-model specifically includes or mentions any relation to intelligence. Finally, there was no reason to expect that the D3-traits might be related to sub-branches of intelligence distinctively, for example,

M being related to verbal intelligence, but not non-verbal intelligence. Taken together, no relations between the dark triad and general intelligence can be expected based on their concepts.

Empirically-Based Expectations

Apart from the aforementioned conceptional examination, note that work by Mischel (1968) already demonstrated that personality is at most moderately related to external criteria - consequently, meaningful relations seem unlikely in the first place. Various studies have shown that cognitive ability is often weakly related to personality. This has been shown for the Five-Factor-Model of personality (Ackerman & Heggestad, 1997; Furnham et al., 2005), but also the HEXACO-model (Oh et al., 2014). Especially the latter finding is notable for this study: Since low Honesty-Humility seems to be the empirical (not theoretical) core of the dark triad and HH is unrelated to cognitive ability, it appears unlikely that there is an empirical connection between intelligence and the dark triad. Furthermore, there are already two meta-analyses on the D3-intelligence relation that find a small negative effect for psychopathy and intelligence (de Ribera et al., 2017) and no relation at all for the complete triad (O'Boyle et al., 2013). Both analyses either rely on D3-self-reports or include D3-tests that have not shown to be valid operationalizations. The metaanalysis by de Ribera et al. (2017) included effect sizes for psychopathy that might not be suited for aggregation due to heterogeneous psychopath-vs.-nonpsychopath-comparisons. The meta-analysis by O'Boyle et al. (2013) had a comparably small study sample. Consequently, it seemed reasonable to conduct a new meta-analysis.

Hypotheses

Taken together, there are only weak conceptual and empirical arguments that might feed the expectation of a meaningful D3-intelligence-relation. Based on the theoretical relationships between the constructs as well as the available empirical evidence referred to in the previous sections, it was hypothesized that (a) there is no relation between psychopathy and general, verbal, and non-verbal intelligence. Furthermore, the author expected (b) Machiavellianism and (c) narcissism each to be unrelated to general, verbal, and non-verbal intelligence. The hypotheses were not preregistered.

Several authors show that the D3 is related to relevant criteria of success in a non-linear way and argue that there might be an optimal level of D3-constructs (Grijalva et al., 2015; Leary & Ashman, 2018; Zettler & Solga, 2013). In an exploratory analysis, it was additionally tested if there are meaningful non-linear relations with P and intelligence. To test for these relations it was necessary to analyze raw data from the studies.

Method

Literature Search and Study Selection Inclusion Criteria

The systematic literature search was conducted in July 2017 and ended in April 2019. The databases PsycINFO, PsycAR-TICLES, Psyndex, Medline, Psychology, and Behavioral Sciences Collection and ISI - Web of Knowledge were searched by using the following terms and their combinations ("dark triad" OR psychopathy OR psychopath OR psychopathic OR sociopath* OR narcissist* OR Machiavellian*) and (intelligent* OR "cognitive ability*" OR "cognitive skill*" OR "mental ability*" OR "cognitive competence*") to retrieve publications written in English ("dark triad" OR psychopathy OR psychopath OR psychopathic* OR sociopath* OR narcissist* OR Machiavelli*) and (Intelligen* OR "Kognitive Fähigkeit*" OR "Kognitive Kompetenz*") for publications in German. In addition to searching the databases, reference lists of pertinent articles and the two recent meta-analyses by De Ribera et al. (2017) and O'Boyle et al. (2013) were inspected in order to identify additional relevant publications. Figure 1 shows a PRISMA flow diagram (Moher et al., 2009) documenting the literature search results.

The total number of potentially relevant publications identified through the full-text search for screening was 9636 (set B). Since the author was unable to properly assess such a high number of studies, a subset of B - the set A - was identified by using a regular search strategy (no full-text search; only title, keywords, and abstracts were considered; n = 1,446). Five hundred studies with a DOInumber and 100 studies without a DOI-number were randomly selected from the complement of A (n = 8,190) to check if the complement embodied a substantial amount of relevant studies. Only 3 studies were relevant. Consequently, the remaining studies from the complement of A were not screened for relevance. The studies from set A were screened for relevance and 301 studies were identified as potentially relevant. After the exclusion of duplicates and the inclusion of studies from additional sources that were not embodied in Set B (n = 43 studies from the meta-analyses, n = 5 identified by chance) and the 3 studies from the complement of A, 302 full-text articles were assessed for eligibility.

To be included in the meta-analysis, studies had to provide sufficient information for effect size and the associated

standard error that indicated the strength of association between at least one of the D3-constructs and general, verbal, or nonverbal intelligence. Furthermore, to ensure a minimum psychometric quality of the instruments used in the included studies, the reliability of both instruments used to estimate the strength of the association had to reach a level of at least .60. Most of the studies provided Pearson correlations as effect sizes. Nevertheless, it is common that psychopathy is dichotomized: a "psychopathgroup" is often compared with a "non-psychopath-group." To be included these particular studies had to fulfill a few conditions that were derived from the Psychopathy-Checklist-Revised-Manual (PCL/PCL-R; Hare, 2003): These studies were eligible if (a) a PCL-R-Cut-Off of 30 points was used for the psychopath-group, (b) the non-psychopathgroup had a PCL-R-mean lower than 16 or a PCL-R-Cut-Off of 20 points, and (c) the intelligence-test-mean and standard deviation was provided for both groups. In a few cases (n = 2) comparison studies with other psychopathy tests than the PCL-R were accepted due to comprehensible reasoning regarding the comparison, for example, test scores at least in the upper and lower quartiles of published norms for their respective age groups (Anderson & Stanford, 2012). Since a lot of studies were excluded as a consequence, some of these studies were coded nevertheless (but separate from the other studies) to be included in a sensitivity analysis (n = 38). For each included comparison study a point biserial correlation was calculated in order to aggregate the results with the studies that reported Pearson correlations.

Subsequently, 170 studies were excluded: Some effect sizes were based on the same sample and published in different papers (n = 4), some effect sizes could not be aggregated to be used for the meta-analysis due to miscellaneous statistical and methodological reasons (n = 55), several studies made it impossible to calculate an effect size due to an inadequate group comparison regarding psychopathy (n = 75), some studies used inadequate D3- or intelligencetests (n = 24), some studies were "gray," unpublished literature (n = 8) or the studies were simply irrelevant for the research question (n = 4). Fortunately, some authors of the primary studies were contacted (see below) and were able to provide effect sizes (or raw data); these studies could be integrated into the analysis (n = 11). The final sample for the meta-analysis (n = 143) comprised 15 effect sizes for narcissism, 15 effect sizes for Machiavellianism, and 192 effect sizes for psychopathy (Pearson correlations: k = 137; point biserial correlations: k = 55). The information on the included studies and the reference list can be found in the dataset for this meta-analysis which is uploaded to the Open Science Framework and can be inspected by using the following link: https://osf.io/ws6kj/.

Coding Studies

A coding manual was used to extract the relevant information from the research reports by two independent coders. All discrepancies were inspected and resolved by the author of this study. When effects sizes (based on identical sample sizes) were only available for subscales of the tests, they were aggregated to a single effect size by simply determining the arithmetic mean of the effect sizes (only if effect sizes for every subscale were available). When studies reported more than one effect size based on different tests (e.g., one effect size for the Psychopathic Personality Inventory (PPI) and one for the PCL), then the effect size based on the PCL was preferred for P since the PCL is considered to be the gold standard test for P (Boduszek & Debowska, 2016). The operationalizations of intelligence were categorized into three groups: (a) non-verbal intelligence (nvI; e.g., the Raven Progressive Matrices Test; Raven, 1981), for tests or subtests whose content was predominantly non-verbal, (b) verbal intelligence (nI; e.g., the Quick Word Test; Borgatta & Corsini, 1964), for tests or subtests whose content was predominantly verbal, and (c) general intelligence (gI; e.g., the Wechsler Adult Intelligence Scale; Wechsler, 2012), for tests that incorporated at least two subtests with verbal and also non-verbal content. The complete coding rational can be found in the dataset for this meta-analysis.

Method of Meta-Analysis

The meta-analytic model used for the psychopathyintelligence relation is the random-effects model (RE model). For the intelligence-relation with N and M, it appears to be more reasonable to use the *fixed-effect model* (FE) since the heterogeneity variance that plays an important role in the alternative RE model cannot be estimated with sufficient precision to avoid biased results if less than 30 studies are used to aggregate correlations in meta-analyses (Schulze, 2004). Additionally, it is difficult to argue that the available studies on N and M are a random sample from a well-defined universe of studies on that specific topic. Hence, the fixed-effect model was used because it is appropriate for the intended inference and does not suffer from statistical result distortions under the given circumstances in this meta-analysis. As a result, for the intelligencerelations to N and M, the inference needs to be restricted to the set of studies included in the meta-analysis - while for P-intelligence inference about the average effect in the entire population of studies is possible. However, the results for both models are reported. For the aggregation of effect sizes, the minimum variance unbiased estimator as proposed by Olkin and Pratt (1958) was used. All computations were conducted with the package *metafor*

(Viechtbauer, 2010) in R using the inverse sampling variance as weights.

Collecting Raw Data

Since the data from the primary studies only reported linear effect sizes it is not possible to draw any conclusions regarding possible non-linear relations. To examine those kinds of relations, it was indispensable to gain access to raw data. In August 2019, ninety studies from the systematic literature search were identified as potentially relevant. The focus was on the intelligence-psychopathy-relation since there were only a few studies for N and M regarding intelligence and the D3-tests in these studies on N and M were too heterogeneous – consequently, raw data from these studies could not have been pooled into a single data set.

The included studies had a sample size of at least n = 100 with the PCL (or any of its variants) as the measure for psychopathy. 55 studies did not report any effect sizes but included relevant operationalizations, 35 studies included information regarding an effect size and had been included in the meta-analysis from the beginning. The author contacted the authors, provided information on the intentions, and asked for raw data regarding the P-intelligence-relation. It was specifically mentioned that nothing else but the PCL- and intelligence scores were needed and there were no intentions of using the data for anything else than calculating effect size. If the authors were unable to provide the relevant data, they were asked to report the Pearson correlation regarding the P-intelligence-relation (if it had not been stated in the paper already).

The author of this study contacted the authors via e-mail. A valid e-mail address for the 3 authors could not be found. 11 e-mail-accounts seemed to be inactive since mail delivery failure messages were received. Several authors responded to the message: 6 authors provided Pearson correlations and 7 authors sent the requested raw data. As a result, 11 additional studies could be included in the meta-analysis (see Figure 1). Some scale scores from raw data had to be transformed in order to aggregate them in one data set: (a) the PCL-Short-Version-scores (PCL-SV; Hart et al., 1995) were adjusted to the PCL-R-equivalent (possible values between 0 and 40) and (b) the intelligence scores from the Shipley Institute of Living Scale (SILS; Shipley, 1940) and the Leistungsprüfsystem 2 (LPS-2; Kreuzpointner et al., 2013) were transformed to IQ-values in accordance with norm values from Zachary et al. (1985) and the LPS-2manual. The included data sets stem from studies by Caldwell and Van Rybroek (2005), Copestake et al. (2013), Hale et al. (2004), Jumper et al. (2012), Kennealy et al. (2007), Köhler et al. (2016), and Snowden et al. (2004) and comprised a total sample size of N = 966. Additional information regarding the studies can be retrieved from the dataset.

Results

The overall effect sizes are depicted in Table 1. All mean effect sizes are close to $\bar{r} = 0$ with a tendency of negative effect sizes for P. Most relations are nonsignificant and none constitute a small effect size. The *k* for M and N is considerably lower than the *k* for P. The mean effect sizes resulting from the FE model or the RE model are very similar for almost all relationships. Note that there seem to be no meaningful differences between general, verbal and nonverbal intelligence.

The overall effect sizes at the facet level of psychopathy are depicted in Table 2. The results show that the aspects of psychopathy that reflect an impulsive, haphazard and thrillseeking lifestyle, and a penchant for criminality (Factor 2, similar to secondary psychopathy) are negatively related to intelligence, whereas the interpersonal aspects of P, e.g., a tendency to manipulate others with superficial charm and a feeling of grandiosity, (Facet 1) seem to be completely unrelated to intelligence.

Additionally, overall effect sizes were calculated with no distinction for general, verbal and nonverbal intelligence. If studies reported more than one effect size for different intelligence-branches that were based on the same sample, the effect size for general intelligence was chosen, otherwise the effect size for verbal intelligence. For psychopathy, there was a negative effect size of $\bar{r} = -.0751$ (CI [-.0999; -.0502]; k = 152; N = 34,253; RE model). There were non-significant effects for Machiavellianism ($\bar{r} = .0238$; CI [-.0216; .0691]; k = 15; N = 1,901; FE model) and narcissism ($\bar{r} = .0249$; CI [-.0133; .0630]; k = 13; N = 2,634; FE model).

Sensitivity Analysis

In the course of a meta-analysis, many decisions have to be made by researchers that regularly influence the overall results. The exclusion of studies in the aforementioned systematic literature review might be considered too "rigorous" by some. An additional sensitivity analysis was conducted for a set of studies that had been excluded from the main analysis due to an inadequate group comparison regarding psychopathy (e.g., psychopathy-group-formation based on psychopathy test scores in that specific sample, see above). There was an average effect size of \bar{r} = -.1989 (k = 32; N = 1,574; RE model) for general intelligence and an average effect size of \bar{r} = .1298 (k = 4; N = 199; FE model) for verbal intelligence. These findings seem to be slightly at odds with the results from the main analysis. Nevertheless, the inclusion would have been almost inconsequential and would lead to a weighted average effect size of $\bar{r} = -.0898$ (CI [-.1220; -.0576]; k = 141; N = 20,703; RE model) for general intelligence – which would still be very close to zero.



Figure 1. PRISMA flow chart for the systematic literature search.

Moderator Analyses

To quantify the heterogeneity of effect sizes I^2 -values were calculated (Higgins & Thompson, 2002) and are shown in Table 1. The relations regarding psychopathy showed a

substantial proportion of variance in observed effect sizes that is due to heterogeneity. The confidence intervals for M and N were relatively large due to the low number of studies available. Consequently, the I^2 -values for M and N are not informative.

Table 1. Overall relationships between the dark triad and intelligence

Relation	k	Ν	¯ r _{FE}	95% CI (FE)	r _{RE}	95% CI (RE)	l^2	95% CI
P-gl	109	19,129	0687	[0827;0546]	0635	[0933;0336]	71.8581	[60.9400; 79.7704]
P-vI	47	16,749	0996	[1144;0847]	0784	[1268;0299]	88.6153	[82.3225; 93.2156]
P-nvl	36	10,743	0671	[0859;0484]	0203	[0700; .0294]	77.4833	[55.3071; 86.3980]
M-gl	2	337	.0758	[0315; .1830]	.0758	[0315; .1830]	0.0000	[0.0000; 99.8407]
M-vl	9	1,235	.0047	[0515; .0609]	.0047	[0515; .0609]	0.0702	[0.0000; 86.2028]
M-nvl	4	329	.0422	[0679; .1523]	.0422	[0679; .1523]	0.0000	[0.0000; 86.2169]
N-gl	3	168	.0450	[1106; .2005]	.0450	[1106; .2005]	0.0000	[0.0000; 93.7032]
N-vl	10	1,919	0172	[0620; .0275]	0229	[0966; .0508]	51.6779	[0.0000; 90.6688]
N-nvl	2	774	.1120	[.0423; .1818]	.0999	[0039; .2038]	44.9483	[0.0000; 99.9459]

Notes. gI = general intelligence; vI = verbal intelligence; nvI = non-verbal intelligence; k = number of independent effect sizes; N = aggregate sample size; \bar{r}_{FE} = overall effect size for a FE model; \bar{r}_{RE} = overall effect size for a RE model; 95% CI = 95% confidence interval for ρ (FE/RE model) or l^2 ; l^2 = proportion of variance in observed effect sizes that is due to heterogeneity.

Table 2. Overall relationships between psychopathy facets and intelligence

Relation	k	<i>r</i> _{FE}	95% CI (FE)	\bar{r}_{RE}	95% CI (RE)
Facet 1	17	0322	[0618;0027]	0072	[0713; .0570]
Facet 2	17	1945	[2228;1661]	1560	[2308;0812]
Facet 3	17	2343	[2620;2065]	2020	[2876;1163]
Facet 4	17	2027	[2312;1743]	1718	[2293;1143]
Factor 1	38	0674	[0875;0474]	0327	[0810; .0155]
Factor 2	38	1664	[1861;1468]	1432	[1871;0992]

Notes. Facet 1 = Interpersonal Manipulation; Facet 2 = Callous Affect; Facet 3 = Erratic Lifestyle; Facet 4 = Anti-Social Behaviour; Factor 1 = Facet 1 and Facet 2; Factor 2 = Facet 3 and Facet 4. The Facet/Factor-structure is derived from common models of psychopathy (e.g., Hare, 2003). The Self-report Psychopathy Scale –Forth Edition (SRP-4; Paulhus et al., 2016) and the PCL-tests are based on this model.

A meta-regression was conducted with the following independent variables: (a) proportion of females in the sample, (b) mean age of the sample, (c) country in which the study was conducted, (d) sample type, (e) operationalization of intelligence, (f) operationalization of D3-constructs, and (g) sample mean of the D3-test compared to norm values. The possible categories of these variables are shown in the dataset (e.g., for the variable "subjects" there were the categories "offender," "kid," "community," "patient," and "student"). The moderator analysis was exploratory since there were no prior hypotheses regarding possible moderator effects.

Although there is no empirically or conceptually substantiated minimum k to conduct meta-regression (Borenstein et al. 2009), its results should be interpreted with caution when the number of effect sizes is low. Therefore, the minimum k to conduct a meta-regression in this study was set to ten studies. The overall results are presented in Table 3. Some of the predictors showed significant moderator effects. A consistent pattern of moderators does not exist, although the operationalizations of intelligence and P seem to be potential moderators for the psychopathy-intelligence relation. Note that the number of effect sizes dropped substantially in some cases (e.g., D3-level) since studies with no information regarding the moderator variables had to be excluded from the model. Consequently, subgroup analyses were inconclusive for most variables. A subgroup analysis for the psychopathy-intelligence-relation regarding P-tests showed the combined effect sizes for the PCL ($\bar{r} = .0817$, k = 78, RE model) were incomparable to other P-tests (that were not part of the PCL-test-"family," e.g., the PCL-SV) since the number of effect sizes that were based on other tests was very low (k < 6).

Note that it is impossible to attribute the moderator effects to specific moderators only due to their mutual confounding and their potential confounding with other known and/or unknown variables that might be the actual cause for the heterogeneity in observed effect sizes. For example, the PCL-test is commonly used only in forensic samples, whereas psychopathy-self-reports are predominantly used outside of prison. It is unknown if differences in effect sizes might exist due to the test itself or real differences in the samples. However, even if there are differences in effect sizes they appear to be very small.

Taken together, the results from the moderator analyses are limited and should be interpreted with great caution.

Moderators	P-gl	P-vl	P-nvl	N-nvl	
F	.0032 (103)	.0010 (41)	.0010 (33)	.2352 (7)	
Age	.0523 (84)	.0899 (26)	.0121 (29)	.6907 (5)	
Nationality	.1714 (105)	.0980 (46)	.3818 (36)	.5555 (10)	
Sample type	.1755 (108)	.2265 (47)	.0727 (36)	.3888 (10)	
I-test	.0249 (109)	.4983 (47)	.4862 (36)	.4210 (10)	
D3-test	.1894 (109)	.4854 (47)	.3909 (36)	.2777 (10)	
D3-level	.0228 (43)	.1666 (15)	.0344 (12)	-	

Table 3. Moderator analysis

Notes. The values in the cells show the amount of heterogeneity explained in the D3-intelligence-relation by the moderators (Q-statistic for test of moderators/total Q-statistic). "-" indicates no variance in the variable hence no moderator analysis was possible. Studies with NAs were omitted from model fitting. The k that the moderator analysis is based on is in each case shown in parentheses. All outcomes are based on the fixed-effect model.

File-Drawer-Analysis

To test for a possible risk of publication bias, a fail-safe-N-analysis and tests for funnel-plot-asymmetry were conducted. The results can be seen in Table 4. The failsafe-N by Rosenthal (1979) is only high (> $5 \times k + 10$) for the relations regarding P. For M and N the fail-safe-N is zero (except for N-nvI) since the overall meta-analytic effects were insignificant in the first place. Due to decreasing power of the tests to distinguish chance from real asymmetry, the tests for funnel-plot-asymmetry (Egger et al., 1997) were only conducted when at least ten studies were available as recommended by Sterne et al. (2008). None of tests, for funnel-plot-asymmetry showed significant results as can be seen in Table 4. Consequently, the author refrained from doing further analyses, for example, a trimand-fill-analysis (Duval & Tweedie, 2000).

Although there was no reason to suspect a possible publication bias in the first place (almost no study in the metaanalysis had the D3-intelligence-relation as its main topic which would have indicated a lively discussed topic and therefore the risk of a publication bias), none of the results indicated a potential bias. However, the most convincing argument against a publication bias (in the sense of the withholding of studies with nonsignificant results) might be that almost all effect sizes in the analysis were very small and mostly nonsignificant. One can assume that there is indeed a negative relationship between psychopathy and intelligence with the notion that it is probably too small to be of any practical significance.

Analysis of Raw Data

Seven data sets were aggregated (total N = 966). The PCLscores were rather high with M = 25.14 (SD = 8.07) and the average IQ was comparably low with M = 93.41 (SD =13.21). The isolated single data sets mostly showed correlations around r = -.1. Surprisingly, the psychopathyintelligence-relation in the aggregated data set was r =-.322 (p < .001, 95% CI [-.377; -.264], two-tailed test)

 Table 4. Fail-safe-N analyses and Egger's regression test for funnelplot-asymmetry

	2				
Relation	\overline{r}_{FE}	FSN_{RT}	$5 \times k + 10$	FSN _{ORW}	$p_{\rm Egger}$
P-gl	0687	1120	555	0	.9086
P-vl	0996	824	245	0	.1086
P-nvl	0671	25	190	0	.6490
M-gl	.0758	0	20	0	-
M-vI	.0047	0	55	0	-
M-nvl	.0422	0	30	0	-
N-gl	.0450	0	25	0	-
N-vl	0172	0	60	0	.2981
N-nvl	.1120	1	20	0	-

Notes. According to Rosenthal (1979), a publication bias seems unlikely if the fail-safe-N is higher than 5 × k + 10. FSN_{RT} = Fail-safe-N by Rosenthal (1979) with target significance level α = .01; *FSN*_{ORW} = Fail-safe-N by Orwin (1983), tested for $\bar{r} \leq -.1$ and $\bar{r} \geq .1$), $p_{Egger} = p$ -value for Egger's regression test for funnel-plot-asymmetry (not applied for overall effect sizes based on less than 10 effect sizes, based on the RE model for P and the FE model for N).

which was considerably different from the meta-analytic results and might be due to range restriction in the isolated samples. Tests for linear and non-linear relationships were conducted: R^2 (with the PCL-value as the independent variable) was estimated for the optimal linear, quadratic and cubic regression models. The linear regression model explained $R^2 = .104$ of the variance in IQ-values while the nonlinear regression models did not explain a meaningful additional amount of variance (quadratic: $R^2 = .112$; cubic: $R^2 = .113$). Therefore, linear models seem quite adequate to display the P-intelligence-relation.

Discussion

The meta-analysis showed that the D3 and intelligence are at most weakly related. Whereas the psychopathyintelligence-relation is negative, for M and N there seems to be no relation at all. It should be noted that the study sample for M and N is considerably lower compared to P. Two of three expectations were corroborated. Whereas M and N were (as expected) not related to cognitive abilities, the relation between psychopathy and intelligence was significant but very small. The cause for the effect might be the overlap between P and criminality: the latter has shown to be negatively related to intelligence. This becomes particularly evident considering the small negative relation between intelligence and the P-Factor 2 (the aspect of psychopathy that comprises norm-violating behavior). Since criminality is part of many P-test-items, it would be inadequate to interpret this overlap as confounding. Furthermore, intelligence is negatively related to impulsivity (Schweizer, 2002; Vigil-Colet & Morales-Vives, 2005) and aggression (Ackerman & Heggestad, 1997) - two conceptual features of Factor 2 psychopathy. Alternatively, the negative P-intelligence-relation might be due to range restriction in the primary studies and might disappear in the course of a secondary analysis of all raw data - yet the analysis of raw data mentioned above suggests the opposite. Nevertheless, the results indicate that D3-individuals do not have superior cognitive abilities that might enable them to show complex manipulative behavior. On the other hand, they do not seem to have relevant cognitive deficits as well. If one assumes that D3-individuals can indeed be more successful in some contexts than others (an assumption that should be scrutinized in the first place), this analysis demonstrates that this possible success is not a consequence of high cognitive abilities.

Surprisingly, the reanalysis of the raw data showed a moderate negative relation with intelligence: it is unclear if the study sample coincidently showed a moderate effect or if the meta-analytic results might have to be reinterpreted. A reanalysis of the original data from the primary studies might have shown similar results due to an underestimation of effect sizes due to range restriction in the isolated studies. But note that an overestimation of the effect in this meta-analysis is also possible due to range restriction. On the other hand, for example, Watts et al. (2016) found similar results as in this meta-analysis regarding P-intelligence and did correct for range restriction using a formula for correcting correlation estimates by Hunter and Schmidt (1990), which did not alter their overall results. However, the results from a P-gI-meta-analysis with k > 100 might be more credible than the reanalysis of only 7 datasets. The reanalysis of raw data did not raise any reason to further inspect the D3-relations to intelligence in regards to non-linear relationships.

Limitations of the Meta-Analysis

A few limitations of this meta-analysis should be considered: First, the combined effect sizes remained heterogeneous even after moderators had been taken into account. As a result, the reported overall effects may be quite different in subpopulations not under investigation in the present study. Second, the number of studies for M and N was very small, so that the inference had to be restricted to the types of studies under investigation and cannot be further generalized due to the use of the FE model. Third, the selection of tests for M and N that were used in the primary studies was narrow - which also made possible subscale-analyses for M and N impossible. This does not apply for P and most of the studies used the PCL (which is considered the "gold standard"-measure for psychopathy). Forth, a more fine-grained analysis of intelligence subdimensions on the basis of an overarching model of intelligence - preferably the Cattell-Horn-Carroll theory (Carroll, 1993) - would have been desirable. Since the number of effect sizes per effectsize-category (e.g., P-gI) would have dropped substantially, a rather rough separation into verbal and non-verbal was the pragmatic consequence. Lastly, no gray literature was included in this analysis: Since there was no specific search for unpublished studies on the research question, a substantial body of literature might have been missed - nevertheless, the gray studies that were identified did not differ in methodology nor the reported effect size. Consequently, there was no reason to include them.

Concluding Remarks

The results relativize the assumption that the dark triad of personality is related to special abilities and is therefore an adaptive set of traits. None of the three traits is positively related to intelligence - D3-individuals do not have special cognitive abilities that fuel the effectiveness of their manipulative endeavors. For some readers, these results might raise a question: If D3-individuals are not smarter than others, how are they capable to effectively manipulate others? The author does not regard this as a valid question, since it implies that D3-individuals are indeed more successful in some areas of activities. There is no convincing empirical evidence that shows that D3-individuals are indeed "getting ahead." A plausible requirement for high cognitive abilities to show certain behavior (e.g., successful manipulations) does not constitute the actual presence of such high abilities. Although the dark triad and intelligence are unrelated, it has yet to be explored if there are interaction effects for D3-intelligence in regards to meaningful external criteria: At least for the psychopathycriminality-relation intelligence is often discussed as a potential moderator (Hall & Benning, 2006; Heilbrun, 1982; Vitacco et al., 2008). Taken together, a meaningful D3-intelligence-relation was not expected and none was found.

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Conflict of Interest

The author has no conflict of interest.

Open Data

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Episodic Memory Reliving and Personality

Do Good *Time Travelers* Have Distinctive Personality Profiles?

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Abstract: There are considerable individual differences in remembering past episodes. The current study aimed to examine the link between episodic memory reliving and the Five-Factor Model personality traits. Altogether 422 participants (67% women) described an autobiographical episode and rated the vividness and clarity of that recollection. Next, they assessed their general tendencies of autobiographical recollections, which resulted in two autobiographical episodic memory scores (AEMS) for each participant – episodic and general. Participants also filled in the Estonian version of the International Personality Item Pool NEO questionnaire. Findings from partial correlation analysis (controlling for age and gender) revealed distinguishable patterns of associations for the episodic and general-level reports of memory reliving: the episodic AEMS was positively associated with E4: Activity Level and E1: Friendliness, whereas the general AEMS was negatively correlated with N4: Self-Consciousness, and positively with E1: Friendliness, E6: Cheerfulness, 01: Imagination, 05: Intellect, C2: Orderliness, and C3: Dutifulness (all significant at p < .005). The associations between the general (but not the episodic) AEMS and personality facets were significantly correlated with the average social desirability ratings of the respective facets. We conclude that greater social adaptation together with the motivation of positive self-perception are plausible explanations of the links between personality traits and reporting the quality of reliving personal memories.

Keywords: episodic memory, mental time travel, social desirability, five-factor model of personality

The episodic memory system contains sensory, cognitive, and affective details that invoke visual imagery and autonoetic experience of mentally "reliving" a past event (Wheeler et al., 1997) and traveling back in time (Nyberg et al., 2010). There are individual differences in mental time travel tendencies, ranging from severely deficient memory (e.g., Palombo et al., 2015) to individuals with highly superior autobiographical memory (e.g., LePort et al., 2015). Most people are located somewhere between these two extremes. Previous research has suggested that differences in episodic memories are linked to personality (e.g.; Amrhein et al., 1999; Fossati et al., 2004; Kamiya & Ito, 2000; Klaming et al., 2017; Quoidbach et al., 2008; Rasmussen & Berntsen, 2010; Rubin & Siegler, 2004; Rönnlund et al., 2011; Sutin & Robins, 2008a). However, only a handful of these studies have measured personality traits according to the Five-Factor Model (FFM), which is the most widely used model of personality structure (Soto et al., 2016), consisting of a set of trait dimensions (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness) that efficiently capture a wide range of individual differences in personality (Soto et al., 2016). Only a couple of those studies (e.g., Sutin & Robins, 2008a) have looked at these associations at the level of specific FFM facets, which are more unique aspects of personality traits. This study focuses specifically on examining the FFM domains and facets associated with autobiographical time travel tendencies.

The two most important aspects of re-experiencing past situations seem to be the accompanying mental imagery and emotional engagement (Boyer, 2008) – constructs which are also to some extent represented in personality models. For example, Openness to Experience includes narrower facets describing having a vivid imagination as well as attentiveness to – and intense experience of – emotions. A previous study indeed found that open individuals remember differently due to their enhanced creative and narrative abilities (Rasmussen & Berntsen, 2010). Relationships of Extraversion and Neuroticism with affective reactivity – an important aspect of personal memories – have been well-documented (e.g., Clark et al., 1994). Extraversion has a relevant role in the retrieval and reliving of positive autobiographical memories (e.g., Denkova et al., 2012), whereas self-generating vivid thoughts have been argued to be the hallmark of the neurotic individual (Perkins et al., 2015; Quoidbach et al., 2008). At a more specific level, reliving past events is associated with two emotion-related facets – O3: Openness to Feelings as well as E6: Cheerfulness (Rubin & Siegler, 2004).

It is possible that memory reliving and personality dispositions are associated because they are all part of the wider personality system. From the perspective of different personality layers (see McAdams & Pals, 2006), we speculate that reliving autobiographical memories is one of the many characteristic adaptations, which help the individual fit into the ever-changing social environment (McCrae & Costa, 1999). Although autobiographical (e.g., self-defining) memories have previously been regarded as part of the narrative identity (McAdams & Pals, 2006), we argue that autobiographical recollection could be - through its motivated nature - one of the important factors of coping with challenges and adapting to the social world. At large, adaptive coping (e.g., Carver & Connor-Smith, 2010), as well as other favorable life outcomes (Roberts et al., 2007), have been associated with low levels of Neuroticism and high levels of Extraversion, Openness to Experience, Agreeableness, and Conscientiousness indicating a well-adjusted personality profile.

The Present Study

The main aim of the present study was to find out which FFM domains and facets are most strongly associated with memory reliving tendencies. To examine this, we constructed a measure (Autobiographical Episodic Memory Scale or the AEMS), which was partly based on previous questionnaires measuring self-reported episodic memory characteristics (D'Argembeau & Van Der Linden, 2006; Fitzgerald & Broadbridge, 2013; Greenberg et al., 2005; Johnson, 1994; Palombo et al., 2015; Sutin & Robins, 2007). The AEMS differs from previous self-report memory scales by its two-focused approach to exploring remembering: participants are asked to rate a single episode (AEMS-Episode) as well as their general tendencies of recalling past events (AEMS-General), enabling us to explore the personality-associations of memory reliving separately at two distinct levels. Based on the research literature cited above, we predict that both the AEMS-Episode and the AEMS-General are most strongly associated with the facets of Openness to Experience and Extraversion. Considering the importance of emotional experience in the retrieval of episodic and autobiographical memories, we also expect the AEMS-Episode to be significantly associated with some of the "affective" facets of Neuroticism (such as N3: Depression) and Extraversion (such as E6: Cheerfulness; Schimmack et al., 2004). As an additional exploration, we examined the links between the AEMS-personality associations and the social desirability of personality traits. Emotionally and socially well-adjusted personality is generally considered desirable, given the advantages it can provide in the social world. Significant associations of reliving personal memories with socially desirable personality profiles could provide preliminary support regarding autobiographical memory reliving as a characteristic adaptation.

Method

Participants

Altogether, 422 respondents participated in this study. Sixty-six percent (279) of participants were women. The mean age of the participants was 22.4 years (SD = 6.5), ranging from 16 to 58 years; about half of the participants were aged 19-21 years. In subsequent analyses, three participants were removed from analyses due to being younger than 16 years. Of all the participants, 55% had completed secondary education, 25% had higher (tertiary) education, 8% had completed post-secondary vocational education, and 12% had compulsory elementary education (i.e., 9 years in Estonia). The data were collected from 2008 to 2011. The majority of participants (75%) filled in all questionnaires (which took about 1 hr) using an online survey platform, but there was also an opportunity to complete a paper questionnaire. If requested, participants received feedback about their personality traits. Most participants were recruited from the local university. The remaining part of the sample consisted of the acquaintances and relatives of recruited students (to increase the sample's age range and variability of education level). According to a post hoc calculation, to detect a simple correlation of r = .21(an average the published effect in the field of personality; see Richard et al., 2003), using 0.5% significance level (see Benjamin & Berger, 2019) with 80% power, the required sample size is approximately n = 296, but detecting a slightly smaller correlation (e.g., r = .18) requires studying over 400 participants (n = 405, respectively).

Materials

Autobiographical Episodic Memory Scale (AEMS)

Participants were instructed to retrieve a personally experienced memory episode from their relatively recent past. The episode should have taken place more than 1 month, but no more than 5 years prior, and be related to a specific time and place. Apart from these restrictions, memory episodes were freely chosen. Participants were first instructed to describe this memory episode briefly in their own words. Variety of episodes was represented, but the most frequent content categories of specific memories were different public events (such as concerts and gatherings; n = 32), graduation ceremonies (n = 28), unlucky incidents (n = 28) and traffic accidents (n = 21), outings (n = 28), examinations (n = 26), and birthdays (n = 26). In addition, many accounts were combinations of different events. The descriptions varied greatly in length: from 4 words to 655 words. The mean word count of the specific episode description was 63.1 (SD = 65.8), with a median of 44.

After the free description, participants were asked to make various judgments about the episode. They were instructed to rate the extent of their agreement with the items they were judging on a 5-point Likert-type scale (1 = do not agree at all; 5 = totally agree). Items adapted from previous memory rating scales (D'Argembeau & Van Der Linden, 2006; Greenberg et al., 2005; Sutin & Robins, 2007) were supplemented with various additional items. The items concerning time travel were part of a larger measure describing different qualities of the memory event, but in this study, 19 items (e.g., "As I recall this event, I get the feeling of having travelled back in time") were selected because of their high loadings on the first principal component. Reverse coded items were also used (8 items in the first part of the AEMS) to reduce acquiescence bias. The reversed items referred to the vagueness, fogginess, and unreality of the recalled episode. Cronbach's α for the 19 AEMS-Episode items was .84, and the average inter-item correlation was r = .22. Participants also rated the emotional valence of the reported memory episode: most episodes were positive in valence (n = 322, 77%).

In the second part of the questionnaire, participants were instructed to rate the characteristics of their autobiographical memories in general. The questionnaire included further items about different autobiographical memory characteristics, but again, 19 items (e.g., "When I think about past events, I usually feel like going back to the moment when these events took place") about the general reliving of past episodes were analyzed here (eight items were reverse coded). Items were rated on a 5-point Likert- type scale (1 = do not agree at all; 5 = totally agree). Cronbach's α for the scale of the 19 AEMS-General items was .89 and the average inter-item correlation was r =.30. The specific and general subscales of the AEMS were significantly related to each other, r = .51, p < .001. All items of the AEMS scales can be found in the Electronic Supplementary Material, ESM 1 (Table E1).

Personality Traits

Personality traits were measured by the 240-item Estonian version of the International Personality Item Pool NEO (EE.PIP-NEO; Mõttus et al., 2006), which is an adaptation

of the International Personality Item Pool (IPIP; Goldberg et al., 2006). Like its original, the EE.PIP-NEO assesses the FFM personality domains – Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C). Each of these is described by six facet scales/subscales, each of which is measured by eight items. Items are rated on a 5-point Likert-type scale (O = *do not agree at all*; 4 = *totally agree*). The structure of the EE.PIP-NEO is analogous to the NEO PI-R (Costa & McCrae, 1992) and it has psychometric properties comparable to those of the NEO PI-R (Mõttus et al., 2006). On average, the Cronbach's α s of the EE.PIP-NEO facet scales (M_{α} = .79) are slightly higher than those of the NEO PI-R facet scales (M_{α} = .76; Mõttus et al., 2006).

Social Desirability Ratings

Previously, an independent group of participants (n = 124; 68% women; $M_{age} = 19.4$, SD = 1.1) had rated social desirability of each of the 240 EE.PIP-NEO (Mõttus et al., 2006) items. These data were collected as part of a separate study, during an introductory psychology course in 2005. Students were given the following instruction:

Some personality characteristics are considered more socially desirable receiving approval from other people, whereas others are undesirable. If someone agrees strongly with this item – does this present that person in favourable or unfavourable light, or is agreeing with this item neutral as regards to others' approval?

Ratings were made on a 7-point Likert scale ranging from 1 = extremely undesirable to 7 = extremely desirable, with 4 as neutral (Konstabel et al., 2006). Ratings of these 240 items were averaged across respondents and thereafter averaged across facet scales to obtain the mean social desirability ratings of 30 personality facets. The mean scores of average ratings varied from 2.2 (*SD* = 0.4, for N3: Vulnerability) to 5.9 (*SD* = 0.2; for E1: Friendliness).

Results

Preliminary Analyses of the AEMS

Means and *SD*s of AEMS-Episode and AEMS-General scores (as well as those of personality traits and facets) can be found in ESM 1 (Table E2). According to the preliminary analyses, women had slightly higher scores than men in case of both AEMS-Episode (t = 3.25, p = .001, Cohen's d = 0.33) and AEMS-General (t = 2.55, p = .011, Cohen's d = 0.28). The age of the respondent was not statistically significantly (p < .05) correlated with either of the AEMS scores.

Associations Between the AEMS and Personality Traits

We calculated partial correlations between the five domains and 30 facets of EE.PIP-NEO and the AEMS-Episode and AEMS-General scores when controlling for age and gender. All partial correlations between personality and the AEMS scores can be found in Table 1 and all zero-order correlations are shown in ESM 1 (Table E3).

AEMS and the FFM Personality Domains

AEMS-Episode was not significantly (p < .005, see Benjamin & Berger, 2019) correlated with any of the broad traits. There was a trend toward a significant correlation only in case of Extraversion, r = .13, p = .009, 95% CI [.04; .22]. The AEMS-General was negatively correlated with Neuroticism (r = -.16, 95% CI [-.25; .07]) and positively with Extraversion (r = .15, 95% CI [.06; .24]), Openness to Experience (r = .15, 95% CI [.06; .24]), and Conscientiousness (r = .16, 95% CI [.07; .25]; all significant at p < .005).

AEMS and the 30 Personality Facets

As seen in Table 1, the AEMS-Episode was significantly (p < .005) correlated with two facets of Extraversion: E4: Activity Level (r = .17, 95% CI [.08; .26]) and E1: Friendliness (r = .15, 95% CI [.06; .24]). The AEMS-General was significantly correlated with seven personality facets – negatively with the N4: Self-Consciousness facet (r = -.16, 95% CI [-.25; .07]), and positively with E1: Friendliness (r = .19, 95% CI [.10; .28]), E6: Cheerfulness (r = .15, 95% CI [.06; .24]), O1: Imagination (r = .15, 95% CI [.06; .24]), O5: Intellect (r = .16, 95% CI [.07; .25]), C2: Orderliness (r = .15, 95% CI [.06; .24]), and C3: Dutifulness (r = .14, 95% CI [.05; .23]; all significant at p < .005).

Exploratory Analysis: The Role of Social Desirability in the AEMS

The pattern of findings reported above points to possible associations of AEMS-General with a socially desirable personality profile. Therefore, we decided to carry out a datadriven exploratory analysis to examine this possibility. For both episodic and general AEMS, we took the partial correlations (controlling for age and gender) with 30 personality facets and correlated (using Spearman's ρ) these with the average social desirability ratings of the respective personality facets that had been previously provided by an independent panel of judges. For these analyses, we reflected the facets of Neuroticism into Emotional Stability, as this allows the direction of effects to be consistent across the FFM traits. Results showed that there was a significant

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Table	1. Partial	correlations	between	Autobiographical	Episodic
Memor	ry Scale (AE	MS) and pers	onality dor	mains and facets (c	ontrolling
for age	e and gende	er)			

	AEMS-Episode	AEMS-General
domains/facets	r [95% Cl]	r [95% CI]
Neuroticism	08 [17: .02]	16 ** [25: .07]
Extraversion	.13 [.04; .22]	.15* [.06; .24]
Openness to Experience	.06 [04; .16]	.15* [.06; .24]
Agreeableness	.05 [05; .15]	.11 [.01; .20]
Conscientiousness	.05 [05; .15]	.16 ** [.07; .25]
N1: Anxiety	08 [17; .02]	07 [16; .03]
N2: Anger	.03 [07; .13]	12 [21; .02]
N3: Depression	04 [14; .06]	11 [20;01]
N4: Self-Consciousness	12 [21; .02]	- .16 ** [25; .07]
N5: Immoderation	07 [17; .03]	09 [18; .01]
N6: Vulnerability	07 [17; .03]	13 [22;04]
E1: Friendliness	.15* [.06; .24]	.19 ** [.10; .28]
E2: Gregariousness	.04 [06; .14]	.05 [05; .15]
E3: Assertiveness	.08 [02; .18]	.13 [.04; .22]
E4: Activity Level	.17 ** [.08; .26]	.12 [.02; .21]
E5: Excitement-Seeking	.00 [10; .10]	.02 [08; .12]
E6: Cheerfulness	.12 [.02; .21]	.15* [.06; .24]
01: Imagination	.05 [05; .15]	.15* [.06; .24]
02: Artistic Interests	01 [11; .09]	.10 [.00; .19]
03: Emotionality	.06 [04; .16]	.07 [03; .17]
04: Adventurousness	.05 [05; .15]	.00 [10; .10]
05: Intellect	.03 [07; .13]	.16 ** [.07; .25]
06: Liberalism	.06 [04; .16]	.06 [04; .16]
A1: Trust	02 [12; .08]	.08 [02; .18]
A2: Morality	.10 [.00; .19]	.13 [.04; .22]
A3: Altruism	.07 [03; .17]	.11 [.01; .20]
A4: Cooperation	.03 [07; .13]	.04 [06; .14]
A5: Modesty	04 [14; .06]	.01 [09; .11]
A6: Sympathy	.08 [02; .18]	.08 [02; .18]
C1: Self-Efficacy	.01 [09; .11]	.13 [.04; .22]
C2: Orderliness	.09 [01; .18]	.15* [.06; .24]
C3: Dutifulness	.04 [06; .14]	.14* [.05; .23]
C4: Achievement Striving	.04 [06; .14]	.12 [.02; .21]
C5: Self-Discipline	.05 [05; .15]	.11 [.01; .20]
C6: Cautiousness	03 [13; .07]	.08 [02; .18]

Note. N = 418. The values in bold are statistically significant at p < .005. 95% CI = 95% confidence interval of the Pearson correlation. EE.PIP-NEO = Estonian version of the International Personality Item Pool NEO. *p < .005; **p < .001.

positive correlation of the socially desirable profile with the associations between the AEMS-General and personality facets (Spearman's $\rho = .41$, p = .024, 95% CI [.07; .76]; see Figure 1). Social desirability was not significantly correlated with the associations between the AEMS-Episode and personality (Spearman's $\rho = .10$, p = .611, 95% CI [-.35; .54], see Figure E1 in ESM 1). C2

Figure 1. Partial correlations between general assessments of the Autobiographical Episodic Memory Scale (AEMS-General) and thirty personality facets, and the average social desirability ratings of the respective personality facets (standardized). Solid line shows the linear trend and the dotted lines show the 95% confidence interval. Personality self-reports and social desirability ratings were obtained using the Estonian version of the International Personality Item Pool NEO questionnaire (EE.PIP-NEO). S1–S6 refer to facets of Emotional Stability (i.e., reversed facet scales of Neuroticism), E1–E6 refer to facets of Extraversion, 01–06 refer to facets of Openness to Experience, A1–A6 refer to facets of Agreeableness, and C1–C6 refer to facets of Conscientiousness.

Discussion

0,20

0.18

0,16

0,14

0.12

0,10

0.08

0,06

0,04

0,02

0,00

-0.02

-2.5

Correlations (Partial)

AEMS-General x Personality

According to previous studies, Extraversion seems to facilitate and Neuroticism to inhibit episodic memory performance (Arbune et al., 2015; Bombardier et al., 2016; Klaming et al., 2017; Quoidbach et al., 2008; Siegler et al., 1991), but there is no clear evidence that vivid autobiographical memories are associated with any specific personality profile at the level of personality facets. Based on the scarce research literature, we expected that the quality of autobiographical memories (i.e., the AEMS-Episode and AEMS-General scores) is most strongly associated with the imagination- and emotion-related personality facets from the Openness to Experience and Extraversion domains, and we also predicted that the AEMS-Episode would be associated with the "affective" facets of Neuroticism and Extraversion.

When controlling for age and gender, Neuroticism was significantly negatively and Extraversion, Openness to Experience, and Conscientiousness positively associated with the AEMS-General, that is, how people evaluate their overall episodic memories. People with higher scores of AEMS-General scored also higher on E1: Friendliness, E6: Cheerfulness, O1: Imagination, O5: Intellect, C2: Orderliness, and C3: Dutifulness, and lower on N4: Self-Consciousness. The reliving of a single episode (the AEMS-Episode) was not significantly associated with any of the FFM

domains (at p < .005), but it was correlated with the E4: Activity Level and E1: Friendliness facets from the Extraversion domain. Thus, looking at the results of this study, the association between personality traits and remembering past experiences appears to be somewhat different for how people describe the reliving of a single memory episode and how they assess their general recollection tendencies.

For some reason, people who are more active and outgoing, who do and interact more (i.e., have higher levels of E4: Activity Level and E1: Friendliness), described their specific memory episodes as more vivid and rich in detail, compared to those who are less lively and warm. It is possible that we were unable to detect some other personality effects due to the variability of the reported memory episodes - participants of this study described episodes of different topics, time frames, and emotional valence. In future research, it would be useful to analyze the personality correlations separately for positive and negative memory events. This could not be done in this study due to the small proportion of negative episodes (less than 20%). Therefore, there remains a possibility that exploring the personality associations of just negatively valenced memories would yield different results.

Regarding the general assessments of memory reliving, we found significant associations with Openness to Experience, which was in line with previous research showing that open individuals remember differently due to their enhanced creative and narrative abilities (Rasmussen & Berntsen, 2010). In addition, the facet-level personality associations were not only "affective" (e.g., with E6: Cheerfulness), but also "social" in nature. Namely, the significant negative correlation with N4: Self-Consciousness and positive correlation with E1: Friendliness seem to suggest the importance of social feelings and behavior in autobiographical time travel. These findings lend some support to the idea that autobiographical remembering is linked to how individuals adapt to their social environment. The significant negative association of AEMS-General with Neuroticism and positive correlations with Conscientiousness pointed to the possible link with a socially desirable personality profile, which was confirmed by an exploratory analysis. More specifically, there was a statistically significant trend toward reporting more vivid recall tendencies in association with personality traits that are regarded as socially desirable. We could speculate that vivid autobiographical recollection has an important advantage in social life, facilitating social adjustment. It is possible that mental time travel and autobiographical remembering, in general, is one of the motivational tools for defining how individuals perceive themselves (McAdams & Pals, 2006). Studies have indeed shown that episodic recollection helps us identify people (MacKenzie & Donaldson, 2016) and make rapid social inferences (Klein et al., 2009). According to



05S

01

E1

Davidson et al. (2012), episodic memory may serve as a kind of "social glue," enabling people to form and maintain social bonds more easily.

As an alternative explanation, however, people's descriptions of their personality traits and general tendencies to recollect past events may be to some degree affected by the response bias of presenting one-self - intentionally or unintentionally - in a desirable and positive manner. Research has shown that people with higher self-esteem tend to self-enhance more over a variety of contexts (e.g., Kwan et al., 2004). Different self processes, including the motive for self-esteem, play an active role already in the retrieval of personal memories (Sutin & Robins, 2008b). One of the mechanisms of the desired self-perception is a selective recall of autobiographical memories, as motivation selectively increases the accessibility of information consistent with the desired self (Brunot & Sanitioso, 2004). At present, it remains unanswered why social desirability played no significant role in how people recalled a specific episode. It is plausible that the decision of choosing the memory episode for detailed evaluation was influenced by self-presentational or self-esteem motives, to begin with. Future research should address the possibility that socially desirable personality profiles could be associated with reporting specific types of memory episodes (e.g., regarding sensitive topics).

In conclusion, our findings indicated a distinctive personality profile of individuals with vivid and detailed episodic memories, highlighting the role of Extraversion (especially the subscales tapping activity level and friendliness) in reliving a single episode, and a more varied set of socially desirable traits (including lower levels of N4: Self-Consciousness, and higher levels of E1: Friendliness, E6: Cheerfulness, O1: Imagination, O5: Intellect, C2: Orderliness, and C3: Dutifulness) when assessing the recollection of autobiographical memories in general. Greater social adaptation together with the motivation of positive selfperception are possible explanations to the links between personality traits and reporting the general quality of reliving personal memories.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1027/1614-0001/a000353

ESM 1. Autobiographical episodic memory scale (AEMS) items (Table E1); means and standard deviations of key variables (Table E2); zero-order and partial (controlling for age and gender) correlations of AEMS-episode and AEMS-general with personality facets and domains (Table E3);

associations between the AEMS-episode-personality correlations and social desirability ratings of personality (Figure E1)

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Erratum Correction to Michels, 2021

The article entitled "General Intelligence and the Dark Triad: A Meta-Analysis" by Moritz Michels (*Journal of Individual Differences*, 1-12. Advance online publication. https://doi.org/10.1027/1614-0001/a000352) has now been published as an open access article with "© The Author(s)" and under a CC BY-NC-ND 4.0 license.

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Psychological Assessment and Treatment of Older Adults

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Mental health practitioners are encountering an ever-growing number of older adults and so an up-to-date and comprehensive text addressing the special considerations that arise in the psychological assessment and treatment of this population is vital. This accessible handbook does just that by introducing the key topics that psychologists and other health professionals face when working with older adults. Each area is introduced and then the special considerations for older adults are explored, including specific ethical and healthcare system issues. The use of case examples brings the topics further to life.

An important feature of the book is the interweaving of diversity issues (culture, race, sexuality, etc.) within the text to lend an inclusive, contemporary insight into these important practice components. The Pikes Peak Geropsychology Knowledge and Skill Assessment Tool is included in an appendix so readers can test their knowledge, which will be helpful for those aiming for board certification in geropsychology (ABGERO).

This an ideal text for mental health professionals transitioning to work with older clients, for those wanting to improve their knowledge for their regular practice, and for trainees or young clinicians just starting out.



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Improve the mental health of people with intellectual disability with this needsoriented approach

New



Tanja Sappok Sabine Zepperitz Mark Hudson The Developmental Approach

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Tanja Sappok/Sabine Zepperitz/Mark Hudson Meeting Emotional Needs in Intellectual Disability

The Developmental Approach

2022, x/194 pp. US \$45.80/€ 39.95 ISBN 978-0-88937-589-5

Using a developmental perspective, the authors offer a new, integrated model for supporting people with intellectual disability (ID). This concept builds upon recent advances in attachment-informed approaches, by drawing upon a broader understanding of the social, emotional, and cognitive competencies of people with ID, which is grounded in developmental neuroscience and psychology. The book explores in detail how challenging behaviour and mental health difficulties in people with ID arise when their basic emotional needs are not being met by those in the environment. Using individually tailored interventions, which complement existing models of care, practitioners can help to facilitate maturational processes and reduce behaviour that is challenging to others. As a result, the "fit" of a person within his or her individual environment can be improved. Case examples throughout the book illuminate how this approach works by targeting interventions towards the person's stage of emotional development.

This book will be of interest to a wide range of professionals working with people with ID, including: clinical psychologists, psychiatrists, occupational therapists, learning disability nurses, speech and language therapists, and teachers in special education settings, as well as parents and caregivers.

