Humor styles and personality: A systematic review and meta-analysis on the relations between humor styles and the Big Five personality traits

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ABSTRACT

Health-promoting and health-endangering humor styles as measured with the Humor Styles Questionnaire have been repeatedly associated with personality traits. Yet, a comprehensive meta-analysis of all currently available studies on this topic as well as an exploration of the highly heterogeneous effect sizes found in this literature is still missing. We provide an updated overview of the literature, synthesize its results in a random effects model meta-analysis, and explore possible moderators. An extensive literature search identified 24 studies from 13 countries ($N = 11,791$). Health-promoting humor styles were positively correlated with extraversion, agreeableness, conscientiousness, and openness, and negatively correlated with neuroticism. Health-endangering humor styles were positively associated with neuroticism and negatively associated with agreeableness and conscientiousness. Between-study heterogeneity ranged from $I^2 = 41\%$ to 96% and could be only partially explained by moderator variables. The effects appear robust with respect to individual studies, publication bias, and measurement error, and appear mostly generalizable across sexes, sample composition, and continent. Further research is required to examine these associations in less developed countries, possible moderators for the high amount of effect size heterogeneity, and the development of these associations across the lifespan.

1. Introduction

1.1. Humor

Since the beginning of the 20th century, psychologists have examined the ways in which humor works, the functions it might fulfil, and how humor differs between individuals. While the first half of the century was dominated by Freudian theories (Freud, 1928; see Martin & Ford, 2018), the second half saw a rapid increase in empirical psychological research. Humor is reported to have a positive effect on persons' social lives (Hay, 2000), well-being (Szabo, Ainsworth & Danks, 2005; Vilaythong, Arnau, Rosen & Mascaro, 2003), mental-health (Schneider, Voracek & Tran, 2018), and aspects of physical health (Lefcourt, Davidson, Prkachin & Mills, 1997, 1990; Stuber et al., 2009). Research from the field of psychoneuroimmunology suggests that humor influences the hypothalamus-pituitary-adrenal axis and the sympathetic nervous system (Berk et al., 1989; Berk, Felten, Tan, Bittman & Westengard, 2001), thereby influencing resilience to stress.

In the past, humor mainly has been defined as a pleasant and prosocial phenomenon (Tanay, Roberts & Ream, 2013). However, recent studies suggest that certain aspects of humor can also be seen as malign phenomena, for example, as a form of aggression against oneself or others (Martin, Puhlik-Doris, Larsen, Gray & Weir, 2003). Due to the inherent interdisciplinary nature of humor research, many definitions of humor exist, and no single definition is accepted by all researchers. Most researchers agree that humor can be described as a relatively stable personality trait and a multi-dimensional construct (Ruch, 1998). However, no consensus has been reached with regards to their nature and number. For instance, Craik, Lampert and Nelson (1996) identified five bipolar humor styles related to everyday use of humor, Martin et al. (2003) identified four humor styles related to well-being, and Ruch, Heintz, Platt, Wagner and Proyer (2018) identified eight humor styles related to particular qualities of humor.

The currently most widely used scale to assess humor styles is the Humor Styles Questionnaire (HSQ; Martin et al., 2003). Considering the potential influence of humor on wellbeing, the instrument distinguishes

four trait-like humor styles. Two humor styles focus on a benign psychological function of humor—self-enhancing humor relating to intrapersonal processes and affiliative humor relating to interpersonal processes; two humor styles focus on a malign function of humor—self-defeating humor (intrapersonal) and aggressive humor (interpersonal) (Martin et al., 2003).

Self-enhancing humor refers to a humorous attitude towards stressful events and adversity in life. It functions as a coping strategy to regulate emotions and to reduce stress. Self-defeating humor entails humor which is directed against the own self in order to amuse others. Affiliative humor is used in a similar way to amuse others but is benign in nature. It aims at establishing and strengthening social bonds, and at reducing tension. Aggressive humor is used to downgrade other people via sarcasm and ridicule, and its underlying intent is to harm or expose other people (Martin et al., 2003).

A recent meta-analysis by Schneider et al. (2018) provides aggregate-level evidence that the affiliative and self-enhancing humor styles can indeed be considered as health-promoting. They may help to improve or maintain self-efficacy in a non-hostile way and aid in stress coping. In contrast, aggressive and self-defeating humor-styles can have health-endangering effects. They either endanger ties within one's social group or are directed against oneself. Thus, humor styles can be understood as either protective or risk factors and are associated with important life outcomes.

Furthermore, since the development of the HSQ, sex and age differences were reported in a consistent manner. Generally, men tend to obtain higher scores on all four scales (Martin et al., 2003), especially on aggressive humor (Stokenberga, 2008; Torres-Marín, Navarro-Carrillo & Carretero-Dios, 2018), which is also higher in younger people, and self-defeating humor, for which age differences appear to be inconsistent. Lower scores on affiliative humor in older people were attributed in previous research to a possibly decreased involvement in social activities of older adults (Martin et al., 2003; Torres-Marín et al., 2018).

1.2. Personality

Personality traits can be defined as patterns of cognitions, emotions, and behaviors that are relatively stable and consistent over time and across situations (Allport, 1961; McCrae & Costa Jr, 2003). Multiple theories have been proposed on the structure of personality (Drapela, 1995) but the five-factor model of personality has emerged as the most prominent model in modern psychology (Digman, 1990; Costa Jr & McCrae, 1989) and constitutes the most widely used framework for measuring and conceptualizing personality traits (Almlund, Duckworth, Heckman & Kautz, 2011; John, Naumann & Soto, 2008).

According to the Big Five, it is assumed that personality consists of five dimensions: extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience (John & Srivastava, 1999; Costa Jr & McCrae, 1989). Individuals who score high in extraversion tend to prefer stimulating environments, report overall greater activity, and seek social interactions, while individuals who score low in extraversion do so to a lesser extent. People who score high in neuroticism tend to be less emotionally stable, are more vulnerable to stress, experience more anxiety, sadness, and self-consciousness than individuals who score low in neuroticism Agreeableness refers to the tendency to get along with others. Individuals who score high in agreeableness are perceived as kind, sympathetic, cooperative, warm, and considerate, while those who score low on agreeableness are perceived as cold, selfish, and lacking empathy. Highly conscientious individuals tend to be perceived as competent, orderly, dutiful, self-disciplined, and deliberate compared to low conscientious individuals. Individuals scoring high in openness to experience tend to be more open to feelings, emotions, imagination, aesthetic experiences, and liberalism (Costa Jr & McCrae, 1992; John et al., 2008; Costa Jr & McCrae, 1989, 1999;

Strus, Cieciuch & Rowiński, 2014).

To this date, the most comprehensive literature review on associations between the Big Five and crucial life outcomes suggests that interpersonal relationships, intrapersonal concepts (like self-concept, well-being, and psychopathology) as well as longevity and physical health are highly associated with personality traits (Kotov, Gamez, Schmidt & Watson, 2010; Ozer & Benet-Martínez, 2005; see also Soto, in press). Additionally, personality traits have been found to be reliably associated with occupational interests, occupational involvement, and academic success (Poropat, 2009). Therefore, certain personality traits appear to be associated with desirable life outcomes as either protective factors or risk factors.

1.3. Present study

Since the inception of the HSQ, personality traits were found to be associated with humor styles (Martin et al., 2003). In their initial study, Martin et al. (2003) reported correlations between the four humor styles and all personality dimensions (as measured with the NEO-PI-R), except openness to experience. Extraversion correlated positively with the benign humor styles, whereas neuroticism correlated positively, and agreeableness and conscientiousness negatively, with the malign humor styles.

Understanding these associations is highly relevant for multiple reasons: First, investigating the relationship between humor and personality might improve our understanding of factors influencing well-being, stress-resilience, pain management, and coping strategies for patients with and without mental illnesses. Second, a deepened understanding of this relationship might improve psychological interventions targeting adverse life outcomes. Third, understanding the associations of humor styles and personality traits might benefit fundamental psychological research on personality, emotion, cognition, and behavior. Ideally, this might help to distinguish between the effects that humor styles and personality traits may have on crucial life outcomes.

A previous meta-analysis by Mendiburo-Seguel, Páez and Martínez-Sánchez (2015) explored the link between humor styles, as measured by the HSQ, and personality. The authors found moderate to weak associations for several of the humor styles and personality traits. Affiliative humor correlated most strongly with extraversion ($r = 0.42$), and openness to experience ($r = 0.20$). Self-enhancing humor was most positively associated with extraversion ($r = 0.29$) and correlated most negatively with neuroticism ($r = -0.24$). Aggressive humor was negatively correlated with agreeableness ($r = -0.33$) and conscientiousness ($r = -0.20$), and self-defeating humor was most strongly correlated with neuroticism ($r = 0.23$).

Yet, the authors neither explored the observed effect size heterogeneity, nor assessed possible sources of bias, i.e. publication bias or low study quality.

The aim of the present study was to extend previous research by (1) evaluating the relationship between extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience with benign (self-enhancing and affiliative humor) and malign (self-defeating and aggressive humor) humor styles; (2) exploring possible moderating effects of sample characteristics (sex, age, proportion of students, origin) and of different scales used for the measurement of the personality traits; (3) identifying individual studies which contributed disproportionally to the previously reported effect size heterogeneity; (4) examining publication bias and study quality in this field of research; and (5) correcting for measurement error.

2. Methods

2.1. Literature search

We conducted an exhaustive literature search based on the

guidelines of the PRISMA statement (Moher et al., 2009), using multiple databases, including PsycInfo, Psyndex, Web of Science, PubMed, Google Scholar, [database blinded for the anonymity of review], and the preprint archive of the Open Science Framework. We searched with two sets of keywords, the first group of keywords referring to humor: *humor styles* OR *humor* OR *humor styles questionnaire*; and the second group to personality: *big five* OR *personality traits* OR *big five personality traits* OR *five factor personality model* or *NEO PI R* OR *HEXACO* or *Eyseneck* OR *Eyseneck personality theory* OR *Eyseneck personality model*. We searched for publications from the origination of the HSQ, i.e., 2003, to 2018. We accounted for English and American spelling conventions. Additionally, we examined the reference lists from all articles identified for inclusion.

2.2. Eligibility and inclusion criteria

Studies identified by our literature search were included in our meta-analysis based on the following criteria: studies had to report (1) a psychometrically valid measurement of at least one Big Five personality trait; (2) at least one measure of one of the four humor styles, as assessed with the Humor Styles Questionnaire (Martin et al., 2003); and (3) a correlation, or all necessary data to calculate the correlation, between humor-styles and personality traits. Eligible studies included healthy adults over the age of 18; specific groups within this population—like comedians—were not excluded. There were no geographical, cultural or language restrictions. Three out of the 24 examined primary studies had to be translated from Portuguese, Spanish, and Turkish in order to extract the information of interest. We included grey literature, i.e., master and doctoral theses, as well as preprints, in our analysis. Meta-analyses that exclude grey literature are more likely to over-represent studies with statistically significant findings, inflate effect size estimates, and provide less precise effect size estimates than meta-analyses including grey literature (Conn, Valentine, Cooper, & Rantz, 2003).

2.3. Coding procedure

The following information was extracted from all studies: Bibliographic references (authors, year of publication), sample description (sample size, home country of the sample, mean age, age range, sex), research design/sampling strategy, proportion of students in the sample (student vs. mixed vs. non-student), effect sizes (means and standard deviations for each personality dimension, as well as the correlations for each personality dimension with the four humor styles), reported reliabilities of all scales, coding quality (confidence ratings), and study quality. Study quality was assessed with items from the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart & Blood Institute, 2014).

The coding of the articles was conducted by two independent coders in its entirety, thus for each article two independent observations were obtained. Differences in coding were discussed until a consensus was reached.

2.4. Summary measures

The association between humor styles and Big Five personality traits was estimated with the random effects model (REM) and a restricted maximum likelihood estimator (REML). We chose REM mainly for two reasons: first, we expect that fixed-effect model assumptions might not apply due to differences in sample characteristics and in personality scales used to measure the Big Five in the primary studies. Second, the previous meta-analysis on the relationship between humor styles and personality traits (Mendiburo-Seguel et al., 2015) has reported highly heterogeneous effect sizes.

We report all associations with Pearson's correlation coefficient r. For synthesis, Pearson's r was first converted into Fisher's z; for the

summary effect size, aggregated Fisher's z scores were then converted back into r. We used R version 3.5.1 (R Core Team, 2018) as well as the R package metafor version 2.1.0 (Viechtbauer, 2010) in all our analyses (see Online Supplementary Material for the data and code under https://osf.io/6mhe4/). Significance was set to $p < .05$.

2.5. Publication bias

To examine publication bias—the tendency that statistically significant results are published more frequently than studies without significant results (Dickersin, 1990)—we inspected contour enhanced funnel plots, imputed potentially missing studies with the trim-and-fill method (Duval & Tweedie, 2000), and conducted Egger´s regression tests (Egger, Smith, Schneider & Minder, 1997). Contour enhanced funnel plots aid the interpretation of the traditional funnel plot in two ways: First, a potential asymmetry could be attributed to publication bias if studies appear to be missing in areas of statistical non-significance. Second, other causes of asymmetry can be detected, i.e. variable study quality, if missing studies are identified in areas of higher statistical significance (Peters, Sutton, Jones, Abrams & Rushton, 2008).

Additionally, *p*-uniform* analyses (van Aert & van Assen, 2018) were conducted to estimate summary effect sizes under the potential presence of publication bias. *p*-uniform* corrects for the possible overestimation of summary effect sizes with *p*-uniform (van Assen, van Aert, & Wicherts, 2015) in random effects models.

2.6. Heterogeneity analysis

Heterogeneity—the variability in the observed effect sizes of included primary studies—was assessed with the Cochran Q test. To assess the amount of heterogeneity we used the I^2 statistic. Higgins and Thompson (2002) provided benchmarks for interpreting I^2 values: $< 25\%$ = low, 25–50% = moderate, 50–75% = high, $> 75\%$ = very high heterogeneity.

We used meta-regression and subgroup analyses to examine heterogeneity, wherever the Cochran Q test was significant. We examined a number of possible sample effects. First, moderator analyses were conducted for geographical origin (continent) of the samples, as previous studies have reported cultural differences in the use of humor styles (Kazarian & Martin, 2006). Second, we investigated moderating effects of percentage of women and mean sample age, as there are known sex and age differences in the use of humor styles (Martin et al., 2003). Third, we investigated moderating effects of the proportion of students in the sample (pure student sample vs. mixed vs. non-student sample) and scale to measure personality on the correlation between personality traits and humor styles. A composite score for study quality—constructed with four items from the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Institutes of Health, 2014)—was used to investigate a potentially moderating influence of study quality. Moderators were evaluated in simple meta-regression analyses, but also in multiple meta-regression analyses to control for multicollinearity.

2.7. Sensitivity analyses

To identify individual studies which contribute disproportionally to the effect size heterogeneity, we conducted leave-one-out sensitivity analyses for each association between humor styles and personality traits by iteratively removing one study at a time and recalculating the summary effect sizes. Additional sensitivity analyses were performed by excluding studies with certain sample characteristics, i.e., consisting only of comedians or of twins, to evaluate the robustness of our associations between humor styles and personality traits.
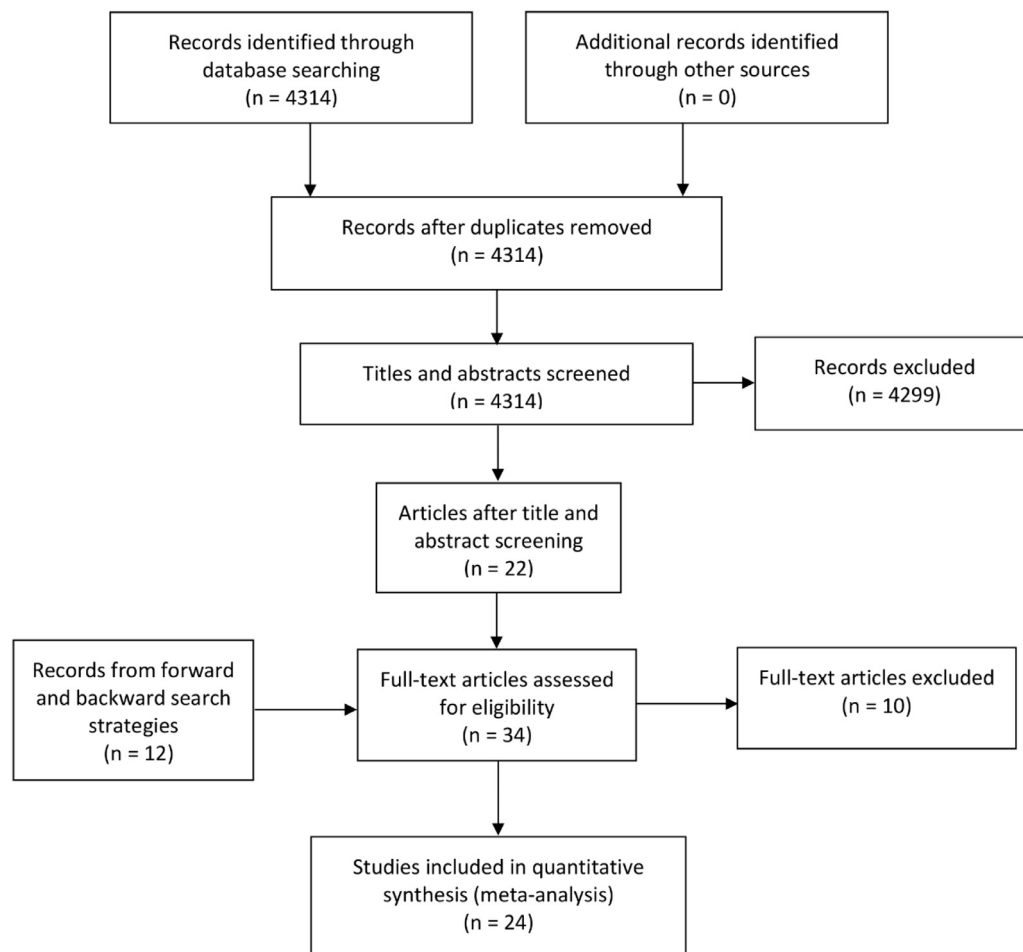
Fig. 1. Prisma flow chart of study inclusion and exclusion.

2.8. Correcting for measurement error

To obtain mean effect estimates which are corrected for the un-reliability of the measures, scale reliabilities were mean-centered and used as predictors in random-effects regression analyses (Hox, Moerbeek & van de Schoot, 2018). In contrast to the classic psychometric meta-analysis/Hunter-Schmidt method, this approach does not tend to produce predominantly larger effect estimates, which could lead to the overestimation of effects. Using mean-centered reliabilities, the intercept in this approach can be interpreted as the 'average outcome.'

3. Results

3.1. Study selection and study characteristics

We identified 4314 studies in our systematic literature search and 12 additional records through forward and backward search strategies. In total, 28 effect sizes from 24 studies were included in the meta-analysis for quantitative data synthesis. See Fig. 1 for a PRISMA flow chart of the study selection process.

Substantial aggregated sample sizes could be obtained for the correlations of humor styles with each personality trait dimension. The total sample size was $N = 11{,}791$. The sample sizes of individual studies ranged from $N = 31$ to $N = 2372$, with a mean of $N = 421$ individuals. Mean age was 27.45 ($SD = 9.18$) and ranged from 19 to 56 years. The mean proportion of women in the samples was 34% and ranged from 0% to 93%. Data stemmed from 13 countries, with the majority of studies conducted in North American (11 studies) and

European (13 studies) countries. The intercoder reliability between the two coders (intraclass correlations, calculated for descriptive variables age, N, sex, and all correlations) ranged from ICC = 0.8 to 1. Disagreements were discussed until consensus was reached.

The most important characteristics of all included studies are summarized in Table 1.

Our meta-analysis contained 10 additional studies and 12 additional effect sizes in comparison to the previous meta-analysis on this topic (Mendiburo-Seguel et al., 2015).

3.2. Associations between humor styles and personality traits

Random effects estimates for all 20 overall effect sizes for the associations between the five personality traits and four humor styles are presented in Table 2. Most of the associations between personality traits and humor styles were significant. In the following, we present only the strongest associations for each personality trait.

Neuroticism was strongest negatively correlated with self-enhancing humor and strongest positively with self-defeating humor. Extraversion and Openness were both most strongly positively correlated with affiliative self-enhancing humor. Agreeableness and conscientiousness were both most strongly negatively correlated with aggressive and self-defeating humor.

3.3. Publication bias

We assessed publication bias by using contour enhanced funnel plots, with the trim-and-fill method, *p*-uniform*, and Egger´s regression test. No indication of publication bias could be detected for all but one

Table 1
Details on included studies, sample characteristics, and Big Five scales.

Authors (year)	N	Age	%f	Country	Scale	Student sample	Quality rating
D`Anello Koch, D'Orazio, Barreat Montero and Escalante (2009)	158	40.00	24.00	Venezuela	BFI	No	2
Ford, Lappi and Holden (2016)	194	32.59	55.15	USA	EPI-E	No	2
Galloway (2010)	318	36.10	41.80	Australia	IPIP	Mixed	2
Gignac, Karatamoglou, Wee and Palacios (2014)	309	23.85	35.00	Australia	EPI-E	Yes	2
Greengross (2008)	96	NA	33.33	USA	NEO-FFI	Yes	2
Greengross et al. (2012)	400	20.50	50.00	USA	NEO-FFI	Yes	2
Greengross et al. (2012)	31	38.90	90.32	USA	NEO-FFI	No	2
Greven, Chamorro-Premuzic, Arteche and Furnham (2008)	1038	24.15	28.90	Germany/UK	BFI	Yes	3
Hodson, Rush and MacInnis (2010)	135	19.43	35.56	Canada	BFI	Yes	2
Jovanovic (2011)	225	23.61	44.44	Serbia	VP + 2-SF	Yes	2
Moss (2010)	292	18.95	0.00	USA	BFI	Yes	2
Martin et al. (2003)	152	NA	30.26	Canada	NEO-PI-R	No	3
Andrade, Araujo, von de. and Souza (2017)	728	23.60	39.00	Brazil	IGFP-5	No	2
Özyezil, Deniz and Sahin (2013))	502	20.93	40.24	Turkey	ABPT	Yes	2
Páez, Mendiburo Seguel and Martínez-Sánchez (2013)	355	23.00	28.40	Spain	BFI	Yes	2
Reisoglu and Yazici (2017)	1534	20.66	NA	Turkey	FFPI	Yes	2
Ruch and Heintz (2013)	162	27.33	24.00	Switzerland	BFI	Mixed	2
Ruch and Heintz (2013)	164	28.45	18.00	Switzerland	BFI	Mixed	2
Ruch and Heintz (2017)	261	27.26	30.70	Switzerland	MRS-25	Mixed	2
Saroglou and Scariot (2002)	181	NA	29.83	Belgium	BRS	Yes	4
Schwehm et al. (2015)	64	34.10	33.00	USA	BFI	No	2
Schwehm et al. (2015)	89	19.56	32.00	USA	BFI	Yes	2
Stokenberga (2008)	183	20.01	16.94	Latvia	NEO-PI-R	Yes	2
Torres-Marín et al. (2018)	238	22.99	47.06	Spain	NEO-FFI	Yes	2
Torres-Marín et al. (2018)	105	22.56	47.62	Spain	HEXACO	Yes	2
Vernon et al. (2008)	912	41.20	30.70	Canada	NEO-PI-R	No	2
Veselka et al. (2010)	2372	56.40	8.43	UK	HEXACO	No	2
Vrabel, Zeigler-Hill and Shango (2017)	593	20.18	24.96	USA	HEXACO	Yes	2

Notes: N = number of participants; Age = mean age; NA = not available;%f = proportion of female participants; Scale: ABPT = Adjective Based Personality Test (Bacanli, İlhan & Aslan, 2009); BFI = Big Five Inventory (John & Srivastava, 1999); BRS = Bipolar rating scales based on the Five-Factor Model of personality; EPI-E = Extraversion subscale of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964); FFPI = The Five-Factor Personality Inventory (Hendriks, Hofstee & De Raad, 1999); HEXACO = HEXACO personality inventory (Ashton et al., 2004); IGFP-5 = Inventário dos Cinco Grandes Fatores de Personalidade (de Andrade, 2008); IPIP = International Personality Item Pool (Goldberg et al., 2006); MRS-25 = Inventory of Minimal Redundant Scales (Ostendorf, 1990); NEO-FFI = NEO-Five Factor Inventory (Costa Jr & McCrae, 1989); NEO-PI-R = Revised NEO Personality Inventory (Costa & McCrae, 1992); VP + 2-SF = The Big Five plus Two-Short Form (Smederevac, Mitrović & Čolović, 2010); Student sample: Yes = entire sample consisted of university students; Mixed = some proportion of the sample consisted of university students; No = sample did not consist of students; Quality rating: based on NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (1 highest/5 lowest possible value).

association—Egger's regression test was significant for the association between extraversion and self-enhancing humor (see Supplementary Material, Table S1 and Figures S1-S20). p-uniform* analyses yielded results similar to the random-effects estimates, with a tendency of slightly smaller effect estimates (Table 2).

3.4. Heterogeneity

For all associations between humor styles and personality traits, we found a moderate to substantial amount of heterogeneity, ranging from $tau^2 = 0.002$, 95% CI [0.001, 0.015], $Q(24) = 45.56$, $p = .005$, $I^2 = 41\%$, 95% CI [18, 86], for the association between agreeableness and self-defeating humor style, to $tau^2 = 0.061$, 95% CI [0.036, 0.115], $Q(26) = 751.67$, $p < .001$, $I^2 = 96\%$, 95% CI [93, 98], for the association between neuroticism and self-enhancing humor (see Table 2). This indicates a substantial variability of the underlying population effect sizes.

3.5. Sensitivity analyses

To evaluate the robustness of our associations between humor styles and personality traits, we conducted leave-one-out sensitivity analyses for each meta-analysis by iteratively removing one study at a time and recalculating the summary effect sizes. The summary effect sizes remained mostly stable (see Online Supplementary Material, R Markdown file), indicating that our results were not disproportionally influenced by any single study. Furthermore, in additional sensitivity analyses, we excluded studies that might have had a distorting influence due to translational uncertainty (Reisoğlu & Yazıcı, 2017), or because of study

sample characteristics, i.e., consisting only of comedians (Greengross, Martin & Miller, 2012; Schwehm, McDermut & Thorpe, 2015) or of twins (Vernon, Martin, Schermer & Mackie, 2008; Veselka et al., 2010). No relevant differences could be observed, indicating the robustness of our overall findings.

3.6. Moderator analyses

To investigate the effect size heterogeneity for the summary effect sizes reported in Table 2, we conducted mixed-effects meta-regressions for two moderators (age and gender) as well as mixed-effects subgroup analyses for three moderators (continent of study, proportion of students, and type of personality measurement). Correcting for false discoveries by using the Benjamini-Hochberg method (Benjamini & Hochberg, 1995), the following ten associations remained significant (see Supplementary Material for detailed information on all moderation analyses, Table S2-S5).

Age was found to moderate the negative correlation between conscientiousness and aggressive humor style ($Q(1) = 30.97$, $p < .001$; Table S2). In samples with younger participants, the correlation between conscientiousness and aggressive humor styles was more negative than in samples with older participants.

The utilized personality scales moderated effect sizes for four associations (Table S3). The association between neuroticism and aggressive humour was negative for the HEXACO scales, $r = -0.16$, 95% CI [−0.28, −0.04], but positive for the NEO scales, $r = 0.15$, 95% CI [.09, 0.21], and all other-category measures, $r = 0.06$, 95% CI [.01, 0.11]. Extraversion and self-enhancing humor had a weaker positive correlation for the other-category measures, $r = 0.28$, 95% CI [.23,

Table 2
Meta-analysis of the relationship between the Big Five personality traits and humor styles.

Big Five	Meta-Analytic Effect Sizes									Heterogeneity						
	k	N	r	95% CI		p	$r_{p\text{-uniform*}}$	95% CI		Q ($df = k-1$)	Tau^2	95% CI		I^2	95% CI	
Humor Style				Lower	Upper			Lower	Upper			Lower	Upper		Lower	Upper
Neuroticism																
Self-Enhancing Humor	27	11,597	−0.224	−0.314	−0.129	<0.001	−0.100	−0.267	.077	751.67***	0.061	0.036	0.115	96	93	98
Self-Defeating Humor	27	11,597	0.193	.127	.258	<0.001	.168	.058	.273	204.12***	0.028	0.015	0.056	92	86	96
Affiliative Humor	27	11,597	−0.084	−0.147	−0.020	.010	−0.049	−0.145	.044	287.13***	0.024	0.013	0.046	91	84	95
Aggressive Humor	27	11,597	0.061	.007	.114	.026	.056	−0.022	.138	210.35***	0.015	0.008	0.034	86	76	93
Extraversion																
Self-Enhancing Humor	28	11,791	0.328	.301	.355	<0.001	.347	NA	.377	57.59***	0.003	0.001	0.008	53	19	77
Self-Defeating Humor	28	11,791	−0.018	−0.056	.019	.336	.009	NA	NA	97.38***	0.006	0.002	0.015	70	48	86
Affiliative Humor	28	11,791	0.455	.419	.489	<0.001	.505	.469	.542	110.40***	0.010	0.005	0.023	80	65	90
Aggressive Humor	28	11,791	0.080	.033	.127	.001	.083	.012	.156	118.39***	0.012	0.006	0.025	82	69	91
Agreeableness																
Self-Enhancing Humor	25	11,063	0.204	.171	.235	<0.001	.205	NA	NA	53.03**	0.003	0.001	0.014	58	30	85
Self-Defeating Humor	25	11,063	−0.066	−0.094	−0.038	<0.001	−0.058	NA	NA	45.56*	0.002	0.001	0.015	41	18	86
Affiliative Humor	25	11,063	0.140	.090	.189	<0.001	.144	.068	.217	173.97***	0.012	0.006	0.027	83	69	92
Aggressive Humor	25	11,063	−0.382	−0.427	−0.336	<0.001	−0.408	−0.462	−0.352	147.99***	0.013	0.007	0.033	85	73	93
Conscientiousness																
Self-Enhancing Humor	24	10,905	0.098	.066	.130	<0.001	.070	NA	NA	49.44*	0.003	0.001	0.011	55	21	82
Self-Defeating Humor	24	10,905	−0.216	−0.255	−0.177	<0.001	−0.227	−0.273	−0.178	76.38***	0.006	0.003	0.021	73	52	90
Affiliative Humor	24	10,905	0.043	−0.010	.095	.112	.009	−0.059	.081	112.90***	0.013	0.006	0.032	84	72	93
Aggressive Humor	24	10,905	−0.263	−0.292	−0.233	<0.001	−0.278	−0.310	NA	62.12***	0.003	0.001	0.016	53	267	87
Openness																
Self-Enhancing Humor	24	10,905	0.240	.211	.268	.363	.249	NA	NA	49.25*	0.002	0.001	0.010	50	17	81
Self-Defeating Humor	24	10,905	−0.014	−0.044	.016	−0.014	−0.022	NA	NA	46.99*	0.002	0.000	0.007	49	11	75
Affiliative Humor	24	10,905	0.262	.221	.301	<0.001	.255	.201	.306	86.87***	0.007	0.004	0.027	75	60	92
Aggressive Humor	24	10,905	−0.049	−0.103	.005	.076	−0.072	−0.160	.010	209.97***	0.014	0.007	0.030	85	73	93

Note: k = number of independent effect sizes; N = sample size; r = weighted average correlation (random-effects model); CI: Lower = lower bound of confidence interval; Upper = upper bound of confidence interval; $r_{p\text{-Uniform*}}$ = weighted average correlation (p-uniform* estimation); Q = Cochran Q test of effect size heterogeneity; df = degrees of freedom; I^2 = percentage of variation across studies that is due to heterogeneity; *** $p < .0001$, ** $p < .001$, * $p < .05$.

0.33] than for NEO scales, $r = 0.38$, 95% CI [.33, 0.43], or HEXACO scales, $r = 0.36$, 95% CI [.25, 0.46].

Agreeableness and aggressive humor were more negatively correlated for the NEO scales, $r = −0.48$, 95% CI [−0.56, −0.41] than for the HEXACO scales, $r = −0.28$, 95% CI [−0.32, −0.25]. Overall, associations between openness and self-enhancing humor were stronger for the BFI scales, $r = 0.30$, 95% CI [.27, 0.34] than for the HEXACO scales, $r = 0.17$, 95% CI [.14; 0.21].

The proportion of students in the sample (student vs. mixed vs. non-student) was a significant moderator for two associations (Table S4). The association between extraversion and affiliative humour was stronger in mixed samples, $r = 0.65$, 95% CI [.56, 0.74] than in non-student samples, $r = 0.43$, 95% CI [.34, 0.51]. Openness and self-defeating humour showed a weak negative correlation in student samples, $r = −0.04$, 95% CI [−0.07, −0.01], but a weak positive correlation in non-student samples, $r = 0.04$, 95% CI [.01, 0.08].

The association of extraversion and affiliative humour was a stronger positive in Europe $r = 0.54$ 95% CI [.47, 0.60] than in North America $r = 0.41$ 95% CI [.34, 0.48] (Table S5).

It was not possible to conduct a subgroup analysis for study quality due to lack of variability in the ratings (see Table 2). Most studies were rated identically for several reasons: First, the exposure measures and the study population were clearly defined in most cases. Secondly, the selection process for participants was clearly described for most studies. Thirdly, not a single primary study did calculate power a priori. The resulting median rating for the quality of all studies was 2, while ratings could range from 1, best, to 5, worst. Thus, the overall study quality rating for 21 out of 24 studies could be considered "good".

Three out of the ten results remained significant in multiple meta-regression analyses containing all five moderators—the influence of continent on the association between extraversion and affiliative humor; the influence of personality scales on the association between neuroticism and aggressive humor as well as the association between agreeableness and aggressive humor. Intercorrelations of the continuous moderators (proportion of women, mean age) with publication year and study N are provided in Table S6 (Supplementary Material).

3.7. Correcting for measurement error

Correcting for measurement error did not change the outcome of the meta-analyses, see Table S7 (Supplementary Material).

4. Discussion

4.1. Summary of evidence

The present study systematically examined the associations between humor styles, as described by Martin et al. (2003), and personality traits. Aggregating the data of 24 studies with 11,791 healthy adults we found that the benign humor styles self-enhancing humor and affiliative humor were positively correlated with extraversion, agreeableness, conscientiousness, and openness, and negatively correlated with neuroticism. The malign humor styles self-defeating humor and aggressive humor were positively associated with neuroticism and negatively associated with agreeableness and conscientiousness. Our results are consistent with a previous meta-analysis conducted by Mendiburo-Seguel et al. (2015). Yet, we almost doubled the number of included effect sizes, explored effect size heterogeneity, and examined possible sources of bias. Furthermore, despite recent studies postulating a change in study quality within social and personality psychology (Anderson et al., 2019; Sassenberg & Ditrich, 2019) the quality of included primary studies was rated as predominantly good.

Humor styles have been found to be associated with several crucial life outcomes and can be understood as either protective factors or risk factors for mental health (Schneider et al., 2018), well-being (Szabo et al., 2005; Vilaythong et al., 2003) and physical health (Stuber et al., 2009). Similarly, personality traits are associated with crucial life outcomes, ranging from academic success, mental and physical health to happiness (Kotov et al., 2010; Ozer & Benet-Martínez, 2005; Poropat, 2009; Soto, in press). Thus, both humor styles

and personality traits are associated with physical and mental health in either a promoting or endangering way. Therefore, the associations of the benign humor styles with personality are not surprising. Extraverted individuals tend to seek social interactions, which is consistent with a propensity to use humor for the amusement of others and to strengthen social bonds (affiliative humor). Individuals scoring high in agreeableness tend to get along well with others and are perceived as kind, sympathetic, and considerate. A humorous attitude towards stressful events and adversity in life (self-enhancing humor) likely is one outward expression of this warmth and kindness, whereas affiliative humor one means of getting along well with others. Besides neuroticism, low conscientiousness is one of the strongest predictors of psychopathology (Kotov et al., 2010). Hence, positive associations of conscientiousness with health-promoting humor styles, like self-enhancing humor, can be expected. In turn, high neuroticism is the strongest predictor for psychopathology (Kotov et al., 2010); its negative associations with benign humor styles therefore fits from the perspective of their health-promoting effects (Schneider et al., 2018).

The malign humor styles self-defeating and aggressive humor were positively associated with neuroticism and negatively associated with agreeableness and conscientiousness. Positive associations with neuroticism are consistent with the tendency of highly neurotic individuals to be more affected by stress, anxiety, sadness, and self-consciousness. Additionally, they seem to be lacking the benign humor styles that might be beneficial coping mechanisms against such stressors. Individuals scoring high in agreeableness tend to go along well with others, thus humor styles that aggravate and offend others might be less pronounced. Interestingly, the negative associations of maladaptive humor styles with conscientiousness suggest that conscientiousness is not only associated with health-promoting humor styles, but that it might also guard against health-endangering cognitive strategies.

The high amount of observed effect size heterogeneity could only be partially explained. The most relevant moderator appeared to be the utilized personality scale (HEXACO, NEO, BFI, and other scales), followed by world region (North America vs. Europe), sample composition, and age. Overall, moderators explained only small amounts of the observed heterogeneity. The HEXACO scales yielded directionally different results for the association between neuroticism and aggressive humor style (negative) compared to the NEO, BFI, and other scales (positive). This difference was also the largest in all moderator analyses. Here, it could be argued that the facets 'emotionality' of the HEXACO and 'neuroticism' (as measured by the NEO or BFI) measure distinct constructs, which is also supported by their relatively low overall intercorrelation, ranging from $r = 0.52$ (see Table 1; Gaughan, Miller & Lynam, 2012) to $r = 0.55$ (see Table 3; Ashton, Lee & de Vries, 2014).

The difference in the association between extraversion and affiliative humor between studies from North America and Europe (more pronounced in the latter), though statistically significant, is negligible. Similarly, differences in the associations between affiliative humor and extraversion, and self-defeating humor and openness, for mixed and non-student samples appeared practically of only small relevance.

4.2. Limitations, future research, and conclusions

Certain aspects of humor are not covered by the HSQ. A recent study by Heintz and Ruch (2019) suggests that the HSQ accounts only for four out of nine humor styles (the others being nonsense, wit, irony, satire, and cynicism), which arise from a combination of the HSQ with the Comic Style Markers questionnaire (CSM), which assesses eight styles of humor on its own (Ruch et al., 2018). Therefore, it is possible that personality entails further humor styles which are not captured by the HSQ. Ruch et al. (2018) report several strong associations between humor styles and personality, similarly to the present study, but also for the additional humor styles of the CSM. Extraversion was found to be positively associated with wit and satire. Neuroticism was found to be negatively associated with nonsense and wit. Agreeableness was found

to be negatively associated with sarcasm, cynicism, irony, and satire. Openness to experience was found to be associated with most humor styles, i.e. fun, humor, nonsense, wit, irony, and satire, which is suspected to be due to its involvement in the production of humor in general. Additional studies are necessary to further examine these relationships and arrive at a more detailed analysis of humor and its association with personality.

Open science practices, i.e., open code, open data, pre-registration or registered report format, were not present in any of the studies, which would have increased the trustworthiness of the individual studies substantially.

Most studies were conducted in Western countries, especially in North America and Europe. Therefore, further research is required to examine the extent of the examined associations across other and more diverse cultures.

Overall, our study provides further support for associations between humor styles, as operationalized with the HSQ, and the Big Five personality traits, accentuating the importance of benign humor styles for subjective well-being. Furthermore, our study adds important insights to the literature of personality psychology and points towards issues that need to be addressed in future research, i.e., to extend the operationalization of humor, establish open science practices in personality and humor research, and to increase cultural validity by investigating non-Western samples.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.paid.2019.109676.

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