



## Review

## Towards a personality model encompassing a Disintegration factor separate from the Big Five traits: A meta-analysis of the empirical evidence

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## ABSTRACT

Relying on a recent re-conceptualization of psychosis proneness as a personality trait, its relations with the Big Five traits were investigated in a meta-analytic study. This re-conceptualized trait – named Disintegration – is articulated as a broad, hierarchically organized, nine-faceted behavioral disposition. Disintegration is postulated to be a basic personality trait distinct from the Big Five traits. In accordance with this conceptualization, all the articles considered for this meta-analysis carry information on the relationship between Disintegration-like phenomena (referring to various aspects of symptomatology with prefix 'schizo-', both at the clinical and the sub-clinical level), and at least one Big Five trait. The benchmark for assuming distinctness of the trait Disintegration was .40, based on the meta-analytically derived correlations found among the Big Five traits. By computing inverse sampling variance weighted mean correlation coefficients under a random-effects assumption, the following associations were found between Disintegration and N, E, O, A, and C, respectively: .24, –.27, 0, –.19, and –.13. The differences in true correlations between the studies were substantial for each coefficient. Three variables were found to moderate Disintegration–personality correlations. The finding about the distinctness of Disintegration from other personality traits can have repercussions on the taxonomy of traits.

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## 1. Introduction

Substantial empirical evidence indicates that psychotic-like (schizo-) phenomena form a continuum from widely present sub-clinical forms to fully-developed schizophrenia (e.g., Hanssen, Krabbendam, Vollema, Delespaul, & van Os, 2006). Accordingly, ICD-10 (International Classification of Diseases) treats sub-clinical psychotic-like phenomena (schizotypal symptoms) as an indication of a general vulnerability to schizophrenia. There are several attempts to conceptualize dispositional roots of psychotic-like phenomena as a trait, with perceptual/cognitive distortions as its core content (e.g., Claridge, 1997; Eysenck & Eysenck, 1976; Watson, Clark, & Chmielewski, 2008). Recently, it has been argued that extensive previous evidence gave reasons to articulate psychosis proneness as a broad, hierarchically organized, multidimensional behavioral

disposition – a basic personality trait (Knežević, Savić, Kutlešić, & Opačić, submitted for publication). The trait was named Disintegration. The reason is that all of its facets, which will be discussed later, are postulated to stem from some level of *disintegration* of the information processing systems responsible for reality testing, resulting in peculiar, incoherent and distorted cognitions, emotions, and motivations. This disposition can be labeled as (a) Psychosis Proneness/Psychoticism/Schizotypy – if one wants to underlie predominant behavioral content, (b) Peculiarity – if a layman description of the behavior is to be emphasized, or (c) Disintegration/Apophenia if one tries to touch upon the process leading to behavior in question.

If different degrees of psychotic-like phenomena can be traced back to a trait-like (dispositional) structure, one of the first questions is whether this disposition can be mapped onto a personality space. Having in mind the central position of the Big Five taxonomy in modern personality research, and the claim of its comprehensiveness (John, Naumann, & Soto, 2008) the most important question is whether such a disposition could be (a) integrated into any of the five traits (N–Neuroticism, E–Extraversion, O–Openness, A–Agreeableness and C–Conscientiousness), or (b) treated as an additional and distinct personality trait.

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One early suggestion was to conceptualize Disintegration as an aspect of N (Widiger & Trull, 1992). Another suggestion, with a recently growing numbers of supporters, is that Disintegration represents the extreme point of O (DeYoung, Grazioplene, & Peterson, 2012; Haigler & Widiger, 2001). These attempts, entirely understandable from the point of view of parsimony and elegance, seem to be at odds with the available empirical evidence demonstrating low correlations between the basic personality traits and schizotypal personality disorders as an aspect of a general psychosis-proneness (Samuel & Widiger, 2008; Saulsman & Page, 2004). Accordingly, the overall aim of this meta-analytic study is to explore if Disintegration is distinct from the Big Five personality traits, that is, whether it shows discriminant validity.

## 2. Theoretical development

Firstly, we will describe the Disintegration trait, a recently developed conceptual framework for psychotic-like phenomena. This conceptualization will serve as a working definition of the domain, and will be used later to define the eligibility criteria and search terms for the studies to be included in the meta-analysis. Secondly, we will provide evidence from biological, construct, and predictive validity studies supporting the core assumption that Disintegration-type concepts are to be considered distinct from the established Big Five traits. Thirdly, we will discuss why Disintegration-type traits were not found using lexical approaches in defining the basic personality space. Finally, we will specify an empirically derived benchmark (i.e., maximum correlation) for assuming discriminant validity of Disintegration.

### 2.1. Conceptualization of Disintegration

Knežević et al. (submitted for publication) proposed a hierarchical taxonomy of Disintegration containing nine facets: General Executive Impairment, Perceptual Distortions, Enhanced Awareness, Depression, Paranoia, Mania, Flattened Affect, Somatic Dysregulations, and Magical Thinking. Extracted as latent structures in a series of factor analyses they were found to form a factor independent from the Five-Factor model (FFM, Costa & McCrae, 1992b). The finding was replicated across informants (self-, mother's and father's report), samples (undergraduate students and general population) and units of analyses (facets and items). In addition, Disintegration was found to be normally distributed in the general population.

The major advantage of this model is that it subsumes the most influential models of schizotypy/psychosis proposed to date – the two-factor model (positive and negative symptoms – Kay, Opler, & Fiszbein, 1987), three-factor models (disorganization, positive and negative symptoms – Buchanan & Carpenter, 1994, or depression, positive and negative symptoms – Stefanis et al., 2002), the four-factor model (positive symptoms, negative symptoms, depression and mania, van Os et al., 1999) and Five-Factor models (disorganization, positive symptoms, negative symptoms, depression and mania – Lindenmayer et al., 2004, or disorganization, paranoia, negative symptoms, depression and mania – Serretti & Olgiati, 2004). Although sharing the same conceptual root with Eysenck's Psychoticism, the content specified by Disintegration is quite different from Eysenck's, which has been shown to share substantial variance with A and C (Costa & McCrae, 1992a), and whose validity as a measure of psychotic-like behavior has been seriously questioned (Zuckerman, 1989). Relying on this conceptualization implies the inclusion of not only narrow models of schizotypy/schizophrenia/psychosis in this meta-analysis (e.g., those focusing exclusively on schizotypal personality disorder), but also of various trait-like conceptualizations, including phenomena not frequently a part of the most famous models of schizotypy, such as depression or mania. The model of Disintegration assumes that although the two aspects of what is usually recognized as negative schizotypy (social anhedonia and flattened/blunted affect) covary, they are influenced by different dispositions: the former is the primary indicator of low E, while only

the latter is a primary aspect of Disintegration (Knežević et al., submitted for publication). By choosing this broader definition of psychosis-proneness the chances to find substantive correlations with the Big Five should be maximized.

### 2.2. Evidence for assuming Disintegration as a distinct personality factor

#### 2.2.1. Biological evidence

Firstly, neuroanatomical and neurochemical foundations of personality traits seems to be different for various personality traits (Panksepp, 1998; Zuckerman, 2005). It was postulated that each trait is related to the volume of different brain regions, and the evidence was found for all traits except for Openness (DeYoung et al., 2010). Several models developed to explain disorganized cognitions and perceptions in schizophrenia (Cohen & Servan-Schreiber, 1992; Philips & Silverstein, 2003) suggest that the biological mechanisms of individual differences in psychosis-proneness are different from those operating in the other five traits.

A second stream of biological evidence stems from genetic studies. Namely, it is accepted that the genetic structure of personality strongly resembles its phenotypic structure (Livesley, Jang, & Vernon, 1998). Therefore, if different genetic structures of Disintegration and the Big Five were to be found, phenotypic distinction of Disintegration should be expected as well. For example, the findings of, the distinctness of higher-order genetic factors describing psychosis-paranoia and those that could roughly be identified as E and N was demonstrated by Jang, Woodward, Lang, Honer, and Livesley (2005). However, there is also evidence of an overlapping genetic influence in case of schizotypy and N (Macare, Bates, Heath, Martin, & Ettinger, 2012), which leads to the expectation that phenotypic correlation of Disintegration and N might be higher than that between Disintegration and other personality traits.

Finally, an evolutionary perspective on individual differences regarding Disintegration empowers the expectation that the biological foundation of Disintegration is different from that of other traits. Namely, some authors argue that the most probable mechanism explaining heritable individual differences in Disintegration-like phenomena (and Intelligence) is the polygenetic mutation-selection balance (Keller & Miller, 2006). Unlike Disintegration, heritable variations of other personality traits are the consequence of an entirely different mechanism – balancing selection by environmental heterogeneity (e.g., Penke, Denissen, & Miller, 2007).

#### 2.2.2. Factor-analytic evidence (construct validity)

A significant body of empirical evidence shows that Disintegration phenomena tend to separate from Big Five Factors on a phenotypic level. For example, Watson et al. (2008) suggested that their factor capturing psychotic-like phenomena (named Oddity) reflects a trait-like disposition outside the FFM. Another study, using a joint factor analysis of facets of the NEO-PI-3 and PID-5 obtained a six-factor solution with a broad factor comprising disintegrative phenomena separated from the five factors (De Fruyt et al., 2013). Another group of studies demonstrated that Disintegration-like phenomena form a separate factor even when personality is described by influential personality models assuming more than five factors, like HEXACO (Ashton & Lee, 2012; Ashton, Lee, de Vries, Hendrickse, & Born, 2012).

#### 2.2.3. Potential relevance of Disintegration in predicting various behavioral criteria

Having in mind the importance of psychosis-proneness in explaining and predicting both psychotic disorders and non-psychotic psychopathology (e.g., Rössler et al., 2011), demonstrating its independence from the Big Five would have high relevance for understanding and predicting various aspects of maladaptive behaviors. However, since we argue that Disintegration has general relevance, it should also be demonstrated that it plays a noticeable role in behaviors not only restricted to psychopathology. For example, a considerable amount of

data demonstrates the role of psychotic-like behavior in creative production (Brod, 1997; Eysenck, 1995), although this still remains controversial (Simonton, 2014). Furthermore, Disintegration disposition is related to many other types of behavior, such as neurocognitive functions and social behavioral problems (Barrantes-Vidal et al., 2003), motor coordination and sensory integration (Kaczorowski, Barrantes-Vidal, & Kwapil, 2009), emotional processing (Kerns, 2006), spiritual experiences (Jackson, 1997), paranormal beliefs (Goulding, 2005), early adolescent cannabis misuse (Stefanis et al., 2004), militant extremism (Stankov, Saucier, & Knežević, 2010), quality of intimate relationships (Kwapil, 1998), and elevated social Internet use (Mittal, Tessner, & Walker, 2007). Recently, Disintegration was found to have incremental validity over the Big Five traits in predicting right wing orientation and prejudice toward minorities (Knežević & Keller, 2015).

#### 2.2.4. If Disintegration is a basic personality trait, why was it not found in lexical studies?

Firstly, traditional lexical approaches were based on the exclusion of so-called evaluative adjectives. Bearing in mind that lay-persons' language encodes psychotic-like phenomena by highly evaluative adjectives, excluding them from the analysis (even if they are adequately represented in a language) prevents the possibility of finding anything Disintegration-like. Watson et al. (2008) argued that since unusual beliefs or perceptions cannot be reduced to single words or short phrases, the domain had been systematically underrepresented in lexical analyses. Secondly, it is possible that more benign expressions of this dimension are either irrelevant in person description or might be influenced by other personality traits, while more pathological expressions are probably so rare that there was no need to use a number of different terms to describe them, but just a few crude synonyms instead (Ashton & Lee, 2012). Thirdly, it could be that some broad dispositions beyond the Big Five do exist but were not of sufficient social importance in our historical time to be adequately represented in all natural languages. Piedmont and Aycok (2007) showed that the terms describing traits did not appear simultaneously in English, but sequentially – E, A and C appeared early, but N and O fairly recently, in the 17th/18th century. It seems that full awareness of mental states of human beings and the rising interest in them, reflects historically recent orientations. Namely, an increased emphasis on rationality principles and science as a consequence of the Enlightenment era fostered the development of psychiatry and psychology, which focused on mental issues and fine-grained descriptions of various mental states. This led to the replacement of religious, spiritual, and folk understanding of mental phenomena with theoretical and empirical findings of these disciplines (Bracken & Thomas, 2001). Descriptors based on this knowledge gradually found their way into the layperson's language. It could be hypothesized that even if Disintegration hasn't reached the threshold of social importance to be massively represented in a language at present, it does not mean that it will not be relevant in the future. Fourthly, there is evidence of Disintegration-like phenomena/behavior appearing in some lexical analyses, although far less robust than the evidence for the Big Five traits. For example, when evaluative descriptors were not excluded or when words were chosen on the basis of high frequency of use (Saucier & Goldberg, 1998), or when sampling from other types of words was used (e.g., type-nouns, Saucier, 2003b) the so-called 'Negative Valence' factor clearly appeared in some languages, containing descriptors of socially undesirable characteristics, including those which may be considered psychotic-like. Importantly, the Seven-Factor model (including "Negative Valence") based on descriptors found in emic studies of Hebrew and Filipino languages replicates in English as well as the Five-Factor model (descriptors with the highest loading on the 'Negative Valence' factor were: Insane, Crazy, Good-for-nothing, Corrupt, Evil, Weird, and Stupid – Saucier, 2003a). To conclude, it seems that the problem resides in the under-representation (for whatever reasons) of psychotic-like descriptors in the majority of the languages, and not in the (non)existence of the factor.

#### 2.3. Criteria for accepting discriminant validity of Disintegration

By which empirical criterion could one judge whether a trait is distinct from the Big Five? We posit that the correlations among the Big Five traits provide guidance and a reasonable benchmark. Therefore, if the average correlation between psychosis-proneness and Big Five traits does not exceed the highest correlation found among any of the Big Five traits, this should be taken as evidence of discriminative validity of Disintegration from the Big Five. Consequently, we focus on the correlations among the Big Five traits which have been previously summarized meta-analytically (Table 1). Taking these highly aggregated findings into account, we regard correlations below .40 as evidence of independence of Disintegration from the Big Five, because at least four Big Five intercorrelations are in the range from .30 to .50 (N–C, E–O, C–A, and N–A). Correlations below .30 would obviously be in the zone of safe conclusions.

### 3. Research questions

We assume indicators of Disintegration are non-substantially correlated with each of the personality traits defined by the Big Five model. As the empirical benchmark for supporting the notion of Disintegration as a trait distinct from Big Five, we have set the bar at a meta-analytically estimated mean correlation coefficient amounting to .40.

Furthermore, we will analyze if, and to what extent, the correlations between Disintegration and the Big Five traits are moderated by the following variables: (1) sub-dimension of Disintegration (positive, negative, other), (2) mean age of sample, (3) clinical versus non-clinical sample, (4) self- versus expert rating, (5) student versus non-student sample, (6) continent of sample (America, Europe, other), (7) language within which the study has been conducted (English versus non-English), and (8) year of study publication.

### 4. Method

#### 4.1. Inclusion and exclusion criteria

In order to be included in the meta-analysis, studies had to meet five criteria: (1) each study needed to include a measure of at least one Big Five domain, as assessed by various Big Five measures; (2) the studies needed to include an instrument assessing any symptom-cluster postulated to be a part of a model of psychotic-like phenomena with perceptual/cognitive distortions as its core content. The aforementioned meta-analytic studies were concentrated only on the relationships between personality and schizotypal personality disorders, in other words those aspects of Disintegration-like phenomena confined to the nosological category of personality disorders. In accordance with our concept of Disintegration we have decided to include a broader range of phenomena regardless of the segment of the continuum to which they belong (e.g., sub-clinical or clinical forms), the clinical picture within which they were presented in clinical samples (e.g., schizophrenia or schizotypal personality disorder), and whether they were confined only to the core symptoms of perceptual/cognitive distortions or were more inclusive in this respect, given that the core symptoms were present.<sup>1</sup> The concept of Disintegration is best captured by a spectrum of phenomena listed under the models labeled by words with the prefix 'schizo-'. Articles in which Eysenck's Psychoticism scale had been used were not considered due to its aforementioned questionable validity; (3) all studies needed to report zero-order correlations of the Big Five domains with Disintegration; (4) we limited our search to adult samples; (5) all studies published in peer-reviewed journals before June

<sup>1</sup> This means that, for example, measures of Depression or Mania are *not* included in the analysis unless they are a part of a model including the core symptoms of perceptual/cognitive distortions.

**Table 1**  
Big Five intercorrelations – previous meta-analytical evidence.

	2.	3.	4.	5.
1. Neuroticism				
Mount, Barrick, Scullen, and Rounds (2005) <sup>a</sup>	–.24	–.19	–.42	–.52
Rushton and Irwing (2008) <sup>b</sup>	–.23	–.19	–.44	–.44
	(–.15 to –.31)	(–.08 to –.29)	(–.34 to –.52)	(–.34 to –.54)
van der Linden, te Nijenhuis, and Bakker (2010) <sup>c</sup>	–.26	–.12	–.26	–.32
2. Extraversion				
Mount et al. (2005)		.45	.26	.17
Rushton and Irwing (2008)		.41	.05	.12
		(.32 to .50)	(–.07 to .17)	(.04 to .21)
van der Linden et al. (2010)		.31	.18	.21
3. Openness				
Mount et al. (2005)			.17	.09
Rushton and Irwing (2008)			.11	.21
			(–.01 to .23)	(.09 to .32)
van der Linden et al. (2010)			.14	.14
4. Agreeableness				
Mount et al. (2005)				.39
Rushton and Irwing (2008)				.41
				(.27 to .54)
van der Linden et al. (2010)				.31

<sup>a</sup> Correlations corrected for sampling error and unreliability.

<sup>b</sup> Uncorrected correlations and 90% confidence intervals.

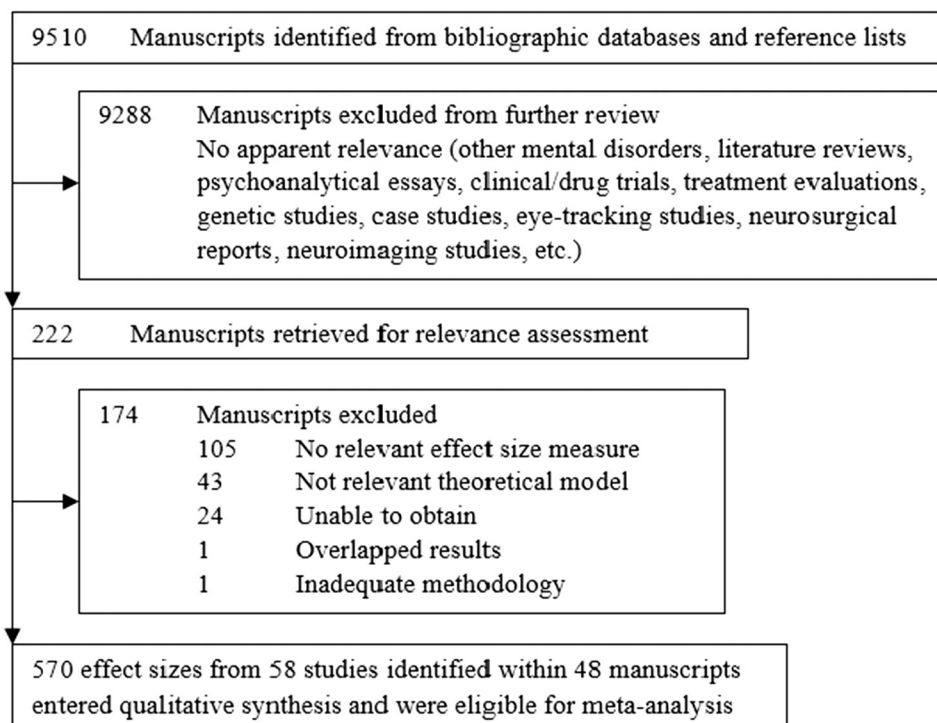
<sup>c</sup> Uncorrected correlations.

2014 were included. No language, geographical or cultural restrictions were imposed.

#### 4.2. Literature search strategy and study selection

The literature search was conducted within the following bibliographic databases: EBSCO, PsycNET, Science Direct, SpringerLink, Oxford Journals, Wiley Library, Cambridge Journals, HighWire, Free Medical Journals, JSTOR, OvidSP, Open Access Archives and SAGE Journals. In order to ensure an exhaustive search for the studies of interest, “schizo\*” was searched in the title, abstract, and/or the keywords of the paper, while “personality trait” was searched throughout the whole text. In addition, relevant published meta-analyses (Dinzeo & Docherty,

2007; Horan, Blanchard, Clark, & Green, 2008; Malouff, Thorsteinsson, & Schutte, 2005; Miettunen & Raevuori, 2012; Samuel & Widiger, 2008; Saulsman & Page, 2004) were inspected in order to identify references that were not located in the initial search. Fig. 1 describes all stages of the selection process. The final set of manuscripts considered for this meta-analysis consisted of 48 manuscripts reporting 570 effect sizes from 58 studies (Ashton & Lee, 2012; Bagby, Costa, Widiger, Ryder, & Marshall, 2005; Bagby, Marshall, & Georgiades, 2005; Bagby, Sellbom, Costa, & Widiger, 2008; Ball, Tennen, Poling, & Kranzler, 1997; Blais, 1997; Burch, Hemsley, Pavelis, & Corr, 2006; Camisa, Brockbrader, Lysaker, Rae, Brenner, O'Donnell, 2005; Chmielewski, Bagby, Markon, Ring, & Ryder, 2014; Coolidge, Becker, DiRito, Durham, Kinlaw, & Philbrick, 1994; Costa & McCrae, 1990; De Clercq & De Fruyt, 2003; De



**Fig. 1.** Selection process of the studies included in the meta-analysis.

Clercq, De Fruyt, & Van Leeuwen, 2004; Del Giudice, Klimczuk, Traficante, & Maestripieri, 2014; DeYoung, et al., 2012; Duijsens & Diekstra, 1996; Dyce & O'Connor, 1998; Egan, Austin, Elliot, Patel, & Charlesworth, 2003; Foti, Kotov, & Hajcak, 2013; Furnham & Crump, 2005; Groth-Marnat & Jeffs, 2002; Henriques-Calado, Duarte-Silva, Junqueira, Sacoto, & Keong, 2014; Holtgraves & Stockdale, 1997; Hyer, Braswell, Albrecht, Boyd, Boudewyns & Talbert, 1994; Larøi, DeFruyt, van Os, Aleman, & Van der Linden, 2005; Larøi, Van der Linden, DeFruyt, van Os, & Aleman, 2006; Madsen, Parsons, & Grubin, 2006; McMurrin, Oaksford, & Christopher, 2010; Miller & Tal, 2007; Mullins-Sweatt & Widiger, 2007; Nelson & Rawlings, 2010; Nestadt, Costa, Hsu, Samuels, Bienvén & Eaton, 2008; O'Connor, 2005; Plaisant, Srivastava, Mendelsohn, Debray, & John, 2005; Ross, Lutz, & Bailley, 2002; Rossier, Rigozzi, & Personality Across Culture Research Group, 2008; Ruiz, Pincus, & Ray, 1999; Soldz, Budman, Demby, & Merry, 1993; Swami, Pietschnig, Stieger, & Voracek, 2011; Tien, Costa, & Eaton, 1992; Trull, 1992; Trull, Widiger, & Burr, 2001; Wang, Miyazato, Hokama, Hiramatsu, & Kondo, 2004; Wang, Hu, Mu, Chen, Song, Zhou et al., 2003; Westen, Dutra, & Shedler, 2005; Wuthrich & Bates, 2001; Yeung, Lyons, Waternaux, Faraone, & Tsuang, 1993). Details about the studies included in the meta-analysis are displayed in the online Supplementary materials. List of the studies that were not possible to obtain or did not have usable data are available upon request from the corresponding author.

#### 4.3. Coding procedure

Studies were coded by all authors of this report. All coders possess expertise in the field of personality psychology: two are senior lecturers in the field of individual differences, the rest have PhD in psychology. Each report was coded by one person. However, for a small number of studies when coding was not entirely straightforward, e.g., the underlying personality model was not specified, or the number of participants on which the correlations were calculated was not clear, at least three coders examined the manuscript in detail until agreement was reached.

In addition to targeted effect sizes, information about potential moderators were extracted, namely manuscript-level, sample-level and effect-size-level variables. Manuscript-level variables encompass the names of the authors, the journal name, the year of publication, language of the study, and country of the first author. Sample-level variables refer to characteristics inherent to the sample used for computing correlation estimates, that is the mean age of the sample, continent of sample (America, Europe, other), clinical versus non-clinical sample, student versus non-student sample, and language within which the study had been conducted in the sample (English versus non-English). Effect-size-level variables refer to the characteristics of the scale used to assess Big Five personality traits, the sub-dimension of Disintegration assessed (positive, negative, other), and whether the data were obtained from self-reports or expert ratings. Data-base is available in the online Supplementary materials.

#### 4.4. Meta-analysis procedure

To compute an overall mean correlation for each bivariate relationship of interest (Disintegration and each of the Big Five dimensions), extracted zero-order correlations were synthesized using a Hedges/Olkin-type random effects model (e.g., Hedges & Olkin, 1985; Raudenbush, 2009). In Hedges/Olkin-type meta-analyses, observed effect sizes are synthesized using a weighted mean procedure, with the inverse sampling variances of each correlation coefficient serving as weights. This procedure ensures that more precise correlations, that is, those being associated with a smaller sampling variances, are being assigned a larger weight when computing the overall mean correlation across all studies considered. In addition, the estimated amount of 'true' variability (T-square) around the estimated mean correlation coefficient is being computed. As a next step, the

homogeneity of the overall weighted mean is estimated, answering the question if, and to what extent, the variability between observed correlations can be explained by sampling error only, and/or by systematic differences among effect sizes. Three heterogeneity estimators are typically being reported: (1) the Q statistic indicating heterogeneity if significant, (2) the  $I^2$  statistic estimates (in percent) how much of the total variability in the correlations can be attributed to heterogeneity among the true correlations, and (3) the  $H^2$  statistic, a ratio of the total amount of variability in the observed correlations to the amount of sampling variability. In case of heterogeneity, moderator analyses are being performed aimed at explaining the variability among correlations. For an in-depth treatment of meta-analytic procedures, we recommend Bornstein, Hedges, Higgins, and Rothstein (2009) and Card (2011).

The rma-function with zero-order correlations along with the corresponding sample sizes as input, implemented in the R package metafor, Version 1.9.5 (Viechtbauer, 2010), was used. The rma function provides a general framework for fitting various meta-analytic models that are typically used in practice. Moderator analyses were performed with the aid of mixed-effects meta-regressions with Knapp and Hartung (2003) adjustments implemented in metafor. The R script is available in the online Supplementary material.

## 5. Results

### 5.1. Main results

As summarized in Table 2, Disintegration was found to have moderate to low mean overall correlations with Extraversion, Neuroticism, Agreeableness, and Conscientiousness. The correlation with Openness was zero. These correlations are considerably below .40, i.e., below the empirically based criterion for regarding a trait distinct from the Big Five as described in Section 2.3. These values are even below .30, clearly supporting our main hypothesis. The only exception was Disintegration–Extraversion correlation whose 95% confidence interval of absolute values (.22 to .31) included the value .30.

### 5.2. Moderator analyses

Moderator analyses, i.e., meta-regressions, have been conducted for each set of Disintegration–Big Five dimensions correlations. Meta-regressions were performed including all moderators in order to predict the variability of effect sizes simultaneously. Heterogeneity estimators, Q and  $H^2$ , suggest that the true correlations differ between the studies for all six estimated mean correlations, and the  $I^2$  statistic (i.e., percentage of the overall variance due to between-studies heterogeneity) indicates that the heterogeneity is substantial.

Mixed-effects meta-regressions aimed to explain heterogeneity using conceptual (e.g., positive and negative symptoms) and study descriptors (e.g., age or gender of participants) as moderators showed that the chosen descriptors explain between 3% (in case of Agreeableness) to 45% (in case of Openness) of heterogeneity among correlations. The moderator analyses demonstrated that crucial conceptual moderators are positive/negative symptoms, and that they explain a part of heterogeneity in all correlations except in Disintegration–Agreeableness, meaning that the variations in between-study correlations depend on whether positive or negative symptoms are chosen to represent Disintegration.

Characteristics of the participants (i.e., students or non-students) explain a part of the heterogeneity in case of Openness, specifically slightly higher Disintegration–Openness correlation in case of students, than if subjects were non-students, and Conscientiousness, specifically slightly lower correlation in case of students than non-students. The mean age of the participants was found to moderate the Disintegration–Conscientiousness correlations, i.e., a 10 year increase in age decreases this correlation by an average of .05.

**Table 2**  
Summary of meta-analytic findings of correlations between Disintegration and the Big Five Factors.

Disintegration and:	Meta-analytic summary statistics (random effects models)				Heterogeneity estimators			Summary of mixed-effects meta-regressions aimed at explaining heterogeneity using conceptual and study descriptors as moderators		
	<i>N</i>	<i>k</i>	Mean <i>r</i> (95% CI)	<i>T</i> <sup>2</sup> (95% CI)	<i>Q</i> <sub>total</sub> ( <i>df</i> , <i>p</i> )	<i>I</i> <sup>2</sup> (95% CI)	<i>H</i> <sup>2</sup> (95% CI)	Model fit: <i>R</i> <sup>2</sup> %	Residual heterogeneity: <i>Q</i> <sub>e</sub> ( <i>df</i> , <i>p</i> )	Statistically significant moderators ( <i>p</i> < .01)
Neuroticism	30,401	117	.24 (.20, .28)	.04 (.03, .05)	1459.96 (116, <.01)	91.96 (89.48, 94.00)	12.43 (9.50, 16.66)	22.23	844.27 (87, <.01)	Disintegration sub-dimension (positive–negative symptoms) <i>r</i>  .30  > <i>r</i>  .14
Extraversion	29,894	113	–.27 (–.31, –.22)	.05 (.04, .07)	2738.24 (112, <.01)	94.99 (93.42, 96.22)	19.96 (15.19, 26.45)	17.56	1471.01 (87, <.01)	Disintegration sub-dimension (positive–negative symptoms) <i>r</i>  –.19  < <i>r</i>  –.40
Openness	32,873	118	.00 (–.04, .03)	.04 (.03, .05)	1670.61 (117, <.01)	94.48 (90.06, 94.24)	13.30 (10.06, 17.37)	45.44	677.32 (92, <.01)	Disintegration sub-dimension (positive–negative symptoms) <i>r</i>  .09  < <i>r</i>  –.17  Type of sample (students–nonstudents): <i>r</i>  .07  > <i>r</i>  –.03
Agreeableness	29,759	111	–.19 (–.22, –.16)	.02 (.01, .03)	550.94 (110, <.01)	83.27 (79.02, 89.00)	5.98 (4.77, 9.09)	3.42	323.58 (85, <.01)	None
Conscientiousness	29,759	111	–.13 (–.16, –.10)	.02 (.01, .02)	602.17 (110, <.01)	81.11 (74.04, 85.77)	5.29 (3.85, 7.03)	37.53	284.25 (85, <.01)	Disintegration sub-dimension (positive–negative symptoms) <i>r</i>  –.18  > <i>r</i>  –.06  Type of sample (students–nonstudents): <i>r</i>  –.11  < <i>r</i>  –.13  Mean age: 10 years age increase, decreases correlation by .05 on average

Note: our hypothesis is related to the absolute strength between Disintegration and the Big Five Factors, and therefore only the amount of the respective correlation coefficients is taken into account here (not the direction).

However, as indicated by high residual heterogeneity (*Q*<sub>e</sub>), even after introducing proposed moderators, the substantial amount of heterogeneity in Disintegration–Big Five correlations remain unexplained. Mental health status of the respondents (clinical vs. non-clinical samples), assessment method (self-reports vs. ratings by others), country of the respondents and publication date did not show moderating influence on Disintegration–personality correlations.

## 6. Discussion

The most important finding of this meta-analysis is that correlations between Disintegration and any of the five basic traits are below the level of .40 (and below .30 for all traits except Extraversion), which is within the range of correlation coefficients found to exist among the Big Five traits. The two highest correlations (Disintegration–E and Disintegration–N), are approximately at the level of N–E correlations (between .20 and .30) reported in the three aforementioned meta-analytical studies. These correlations are below the levels found for four of the ten Big Five pairs (N–C, N–A, C–A and E–O, found to be in the range .30 to .50). Disintegration–A and Disintegration–C correlations in our study were negative, slightly below .20.

The curious and slightly unexpected finding is the zero correlation between Disintegration and O, the trait proposed to represent normal variations of the same continuum of which Disintegration supposed to be the extreme point (DeYoung et al., 2012). However, the low total Disintegration–O correlation could be caused by Disintegration comprising phenomena (positive and negative symptoms) that show opposite correlations with O (Chmielewski & Watson, 2008; Ross et al., 2002). Namely, it has been argued that since positive and negative schizotypal phenomena correlate with Openness with opposite signs, combining them conceals these true correlations, and produces near zero Disintegration–O correlation. Indeed, moderator analysis revealed opposite sign correlations of positive (.09) and negative symptoms (–.17) with O (in the expected direction). However, these correlations are low by any standard of evaluation, and certainly far from representing evidence supporting the claim that O and

Disintegration reflect variations on different levels of one and the same personality dimension. Therefore, the expectation, favored by some authors (e.g., DeYoung et al., 2012) that Disintegration phenomena should be conceptualized as the extreme point of O (especially the claim that positive symptoms are a consequence of extreme O) was not supported by our meta-analysis. There is also a possibility that the correlation between Disintegration and O was not found because of the complexity of the O factor. Namely, it has been already noticed that O consists of two connected, but still different types of phenomena, that could have even opposite correlations with Disintegration: They were labeled by some authors (e.g., DeYoung et al., 2012) as Intellect (more IQ-related aspects of O, such as FFM Openness to Ideas, Action and Values) and 'pure' Openness (absorption-like phenomena, such as FFM Openness to Fantasy, Emotions and Aesthetics). However, the expectation that the correlations of some Disintegration-like phenomena (Schizotypal Personality Disorder) with facets of 'pure' Openness would be considerably higher than correlations with Intellect facets was not supported by the previous meta-analysis (Samuel & Widiger, 2008). The construct of Disintegration, although broader, is similar to PID-5 (Personality Inventory for DSM-5) Psychoticism factor (Krueger, Derringer, Markon, Watson, & Skodol, 2012). Having this similarity in mind, our findings do not favor preference to relate Psychoticism factor to O (Dilchert, Ones, & Krueger, 2015).

Our results are in line with the expectation that negative symptoms will have considerably higher correlations with E than positive symptoms or general Disintegration score. Indeed, if negative symptoms are used instead of total score of Disintegration, the correlations with E increase substantially from –.27 to –.40 (positive symptoms – E correlation is –.19). Although this correlation is still lower than the values obtained between some other Big Five traits, it suggests that negative symptoms (or at least some aspects of it) are noticeably closer to E. In the light of the Disintegration model, this finding means that social anhedonia has been wrongly classified as a primary indicator of schizotypal phenomena instead of E. This is not to say that social anhedonia is not an aspect of psychosis, but rather that traits *other* than Disintegration might contribute to some important aspects of psychotic disorder. It

is important to emphasize that this reasoning does not hold for some other aspects of negative symptoms: e.g., Flattened Affect, was found to be the primary indicator of Disintegration (Knežević et al., submitted for publication).

There are several moderators of the Disintegration–personality relations. Positive–negative symptoms is the most important one, and it influences correlations between Disintegration and each personality trait except for A. This means that positive and negative aspects of Disintegration entail sufficiently distinct phenomena to lead to a differential pattern of correlations with almost all personality traits. It further means that the conclusions about Disintegration–personality relations will depend on whether the positive or negative symptoms/scales predominate in a particular model of Disintegration. If the positive symptoms predominate it will increase Disintegration–N, and Disintegration–C correlations, but decrease Disintegration–E and Disintegration–O correlations (and vice versa). However, our main conclusion – independence of Disintegration phenomena from the Big Five – is not questioned by this moderation. Namely, none of the correlations between both positive or negative symptoms and Big Five traits exceeds .30 except the correlation between negative symptoms and E. Nevertheless, as already argued, we expect the correlations of negative symptoms of Disintegration (as well as Disintegration total score) with E to be lower if social anhedonia is not conceptualized as an aspect of Disintegration.

Another significant moderator is whether the sample is student or non student, and it moderates two correlations. The Disintegration–O correlation is slightly higher in student samples, which may be a consequence of the tendency of those phantasy-prone (which is a manifestation of Openness, usually higher in students) to endorse Disintegration-like items. The negative Disintegration–C correlation is slightly lower in students and might be explained by the higher cognitive competences of students enabling them to compensate for the adverse impact of Disintegration on behavioral control.

The correlation between Disintegration and C is also found to be moderated by the age of the participants. Specifically, the correlation decreases with increase in age, which means that behavioral control in elderly will be less related to Disintegration than in young people. This is likely due to the fact that older people have had more opportunity to develop mechanisms that can buffer the negative influences of high Disintegration on behavioral control.

It is of theoretical interest to emphasize that the variable clinical vs. non-clinical sample did not moderate the Disintegration–personality correlations. Such moderation should be expected if psychopathology was the reason for the separation of Disintegration from the rest of personality traits. Namely, it could be argued that the presence of some psychopathological processes can cause appearance of a separate factor, which, consequently, should not be viewed as a personality dimension, but the dimension of psychopathology. If this interpretation were true, variations along the Disintegration dimension would either be non-meaningful, or nonexistent in non-clinical populations. Another possibility is that they would be of different nature, reflecting in the different pattern of correlations with the five basic traits. Obviously, the finding that Disintegration–personality relations are not dependent on whether they are studied in samples with or without psychopathology is more in line with the interpretation of the Disintegration as a trait-like disposition, not a factor of psychopathology.

One can argue that the main limitation of this study is a substantial amount of heterogeneity unexplained, even after the introduction of the moderators. However, since our main goal was to explore the correlations between Disintegration and Big Five, and not why estimations vary between the studies, the unexplained heterogeneity does not take our main conclusions into question. A potential limitation of the study is the fact that we could only code for the language of the study, but not the language of the questionnaire that was used in the study. Additionally, we focused exclusively on Big Five studies, and therefore, examination of relations between Disintegration and some concurrent

model of personality (like HEXACO or Cloninger's, which is often used in clinical practice) would also be relevant for the understanding of Disintegration–personality relations.

To conclude, the findings clearly support the distinctness of Disintegration from Big Five traits.<sup>2</sup> There is no indication that the nature of variation along the Disintegration continuum is different in general population in comparison to clinical populations. These findings are in line with the idea of recognizing Disintegration as an important variable of individual differences, i.e., an additional basic personality trait. Our results confirm previous findings that positive and negative disintegrative symptoms correlate differently with the Big Five traits. There are indications that if some aspects of negative symptoms (social anhedonia according to our model) are conceptualized as an aspect of Big Five space (E), rather than Disintegration, the discriminant validity of Disintegration might be even better.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.paid.2016.02.044>.

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<sup>2</sup> This does not mean that we assume the Big Five model to be the one representing basic personality space the best. Namely, there is considerable evidence favoring six-factor taxonomy of personality (e.g. HEXACO model) in which the existence of the basic personality trait (Honesty) additional to Big Five has been postulated. If HEXACO is taken as the most adequate model of personality, then Disintegration should be considered the seventh basic personality trait.

<sup>3</sup> References marked with an asterisk indicate studies included in the meta-analysis.

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