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Testing construct independence in the Short Dark Triad using Item Response Theory

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ABSTRACT

The Dark Triad (i.e., Machiavellianism, narcissism and psychopathy) is a popular construct for describing socially aversive personality traits. In recent years, the Short Dark Triad (SD3; Jones & Paulhus, 2014) has become a popular measure for assessing the Dark Triad constructs. However, recent research has called the supposed dissimilarity between the Dark Triad constructs into question. In particular, theoretical and empirical evidence suggests that a distinction between Machiavellianism and psychopathy may not be tenable. In order to investigate this issue further, we analyzed the SD3 in a large sample (N = 1983) using Item Response Theory. We establish item response parameter estimates for each Dark Triad construct and further test whether the Dark Triad constructs can be modelled together. Results show that Machiavellianism and narcissism could not be modelled together, but the combinations Machiavellianism and psychopathy, and narcissism and psychopathy, yielded acceptable model fit. The implications of these results are discussed in terms of how the Dark Triad constructs may be interpreted and studied in the future.

In recent decades, interest in research about socially aversive personality traits in subclinical populations has grown. One of the more extensively researched constructs is the constellation of traits known as the Dark Triad (DT; Paulhus & Williams, 2002), which includes Machiavellianism, narcissism, and psychopathy. These three traits are supposedly both partially overlapping and yet distinct (e.g., Furnham, Richards, Rangel, & Jones, 2014; Paulhus & Williams, 2002). Machiavellianism is delineated by glib social charm and manipulativeness. Narcissism is characterized by entitlement, superiority, and dominance, while psychopathy is characterized by callous social attitudes, impulsivity, and interpersonal antagonism. The DT has proved to be a valuable predictor of various outcomes, including mating (Jonason, Li, Webster, & Schmitt, 2009), workplace (O'Boyle, Forsyth, Banks, & McDaniel, 2012), interpersonal (Jones & Paulhus, 2017), and educational behaviors (Nathanson, Paulhus, & Williams, 2006). A number of reviews have been written covering the differential predictive patterns of the respective DT constructs (e.g., Furnham, Richards, & Paulhus, 2013; Furnham et al., 2014; Paulhus, 2014).

One of the more popular measurements of the DT is the Short Dark Triad (Jones & Paulhus, 2014), which is a 27 item inventory (9 items per factor) measuring all three aspects of the DT. The SD3 has proven to be a relatively good inventory, in terms of its validity in relation to other DT inventories (Maples, Lamkin, & Miller, 2014). However, previous research has questioned the distinction between Machiavellianism and psychopathy for theoretical reasons (McHoskey, Worzel, & Szyarto, 1998), for empirical reasons pertaining to the DT in general (Miller, Hyatt, Maples-Keller, Carter, & Lynam, 2016; Vize, Lynam, Collison, & Miller, 2016), and regarding the SD3, opinions differ about whether Machiavellianism and psychopathy provide meaningful discriminant validity (cf. Dowgwillo & Pincus, 2017; Jones & Paulhus, 2014; Persson, Kajonius, & Garcia, 2017). On the basis of previous theoretical contributions (McHoskey et al., 1998), more recent empirical research has suggested that Machiavellianism and psychopathy may not provide independent divergent validity (Miller et al., 2016; Persson et al., 2017). For instance, Persson et al. (2017) used confirmatory factor analysis (CFA) for modelling SD3 Machiavellianism and psychopathy as one factor. Model fit increased, albeit non-significantly, in two factor models. On that basis, the authors concluded that a bi-factor model with a specific narcissism factor and a second specific Machiavellianism-psychopathy

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factor was more parsimonious than a three factor model (but see also McLarnon & Tarraf, 2017). Accordingly, an empirical distinction between Machiavellianism and psychopathy may not be viable, and is at the very least up for debate. Furthermore, a recent study related facets from the Five-Factor Model of personality (Digman, 1990) with the DT and concluded that Machiavellianism and psychopathy were highly correlated (DeShong, Helle, Lengel, Meyer, & Mullins-Sweatt, 2017). In the present study, we use Item Response Theory (IRT) to further the investigation of the SD3, and provide additional tests of the proposed independence of the three DT constructs.

1. Item Response Theory

IRT is a family of psychometric methods well-suited for analysis of item and scale level properties. There are a number of IRT models available, but in the present study we used a graded response model (GRM), which is appropriate for polytomous (e.g., Likert scale) items. The GRM generates two defining characteristics for each item: a slope coefficient, or discrimination parameter alpha (a), and a location coefficient, or threshold parameter beta (b). The a-parameter shows how strongly an item relates to a given latent trait theta (θ), and can be analogized as a factor loading. The threshold parameters (b_{1-4}) relates to the level of the latent trait at which the next higher response category has at least 50% probability of being endorsed (e.g., b_1 denotes answering option 1 vs. 2, 3, 4, and 5). The b-parameters are scaled on the same metric as the latent trait (θ) and higher thresholds imply more difficult items. The a-parameter typically ranges from 0.5–2.0 in personality scales (Morizot, Ainsworth, & Reise, 2007). It's not uncommon for b-parameters to have extreme values (i.e., >3 and < -3), especially in clinical settings (Reise & Waller, 2009).

The IRT model utilized herein assumes unidimensionality. The assumption of unidimensionality states that item responses are caused by a single continuous latent variable (de Ayala, 2009). It is widely recognized that the majority of measures of psychological phenomena rarely adhere to a unidimensional factor structure. Violating the unidimensionality assumption can lead to biased IRT parameter estimates (Reise, Scheines, Widaman, & Haviland, 2013), but research has also shown that unidimensional IRT models are quite robust (Ip, 2010). For more information about IRT, numerous papers have been published making the topic more accessible (e.g., Morizot et al., 2007; Reise & Rodriguez, 2016; Reise & Waller, 2009; Thomas, 2011).

2. The present study

We extend the validation process (Cronbach & Meehl, 1955; Strauss & Smith, 2009) by modelling the SD3 using IRT in a large sample (N = 1983) collected using Amazon's Mechanical Turk (MTurk). This study had three specific goals. First, to establish item discrimination and location parameters in three separate IRT models, one for each factor. These parameters are of interest because they provide information about how different items relate to the latent variable and where on the latent trait spectrum the DT constructs provide information. We modelled each SD3 factor (i.e., 9 items per model) in three respective unidimensional IRT models. All analyses were carried out using the R package *MIRT* version 1.18 (Chalmers, 2012) in R version 3.2.4 (R Core Team, 2015).

Our second goal was to test the hypothesis that Machiavellianism items are more readily endorsed than psychopathy items. This hypothesis was based on the observation that psychopathy items are usually saturated by more aggressively antisocial content, whereas Machiavellianism is much less so. By extension, our reasoning was that individuals are more unlikely to endorse items that contain antisocial content. We test this hypothesis by analyzing the item locations (b) for the respective factors. The reasoning was that a lower level of the latent trait would be required for endorsement of Machiavellianism items because the item content is generally more benign (i.e., emphasis on hiding information, manipulating people) than for psychopathy items (i.e., aggressive impulsivity, meanness, revenge).

The third goal was to determine whether the SD3 constructs can be represented by a single unidimensional IRT model. Previous research on the SD3 has shown that Machiavellianism and psychopathy are almost indistinguishable while narcissism demonstrate clearer differential relations (Persson et al., 2017; Vize et al., 2016), thus we expected that Machiavellianism and psychopathy could be modelled together, while including narcissism would lead to poor model fit. In testing this, we fitted unidimensional models for all 27 items and for individual the constructs (9 items each). We also fit unidimensional IRT models with 18 items to investigate the consequences on model fit upon removing one of the factors (e.g., modelling Machiavellianism and narcissism without psychopathy). We subsequently compared these models with the 9 item models from the main analysis in order to assess whether parameter estimates changed markedly between models, thus serving as confirmation of the consequences of poor fit on parameter estimates. These models were believed to provide possible falsifications pertaining to the nature of the construct independence.

3. Method

3.1. Participants

The participant data (N = 1983, $n_{males} = 803$, $n_{females} = 1180$) was collected through MTurk, which has demonstrated reliability and validity, providing a wider range of socio-economic backgrounds compared to, for instance, student samples (Casler, Bickel, & Hackett, 2013). The MTurk workers received 50 cents (US-dollars) as compensation for participating and only residents of the US were allowed to accept participation. Two control questions were added to the survey, to control for inattention. A total of 20 participants responded erroneously to one or both of the control questions and were thus eliminated. Mean age was 34.08, $SD = 12.15$. Three participants did not report their age. The data in this study has been used for other purposes previously (Persson et al., 2017).

3.2. Measures

The Short Dark Triad (SD3; Jones & Paulhus, 2014) consists of 27 items that are rated on a 5 point Likert scale (1 = "Disagree strongly" and 5 = "Agree strongly"). The items consist of statements such as "Most people can be manipulated" (Machiavellianism) and "Many group activities tend to be dull without me" (narcissism). Reliability estimates in the form of coefficient omega were computed using the R package MBESS version 4.0 (Kelley, 2016) with 5000 bootstrap samples. Omegas were (with 95% CIs in brackets): 0.77 [0.75, 0.78], 0.75 [0.73, 0.77], and 0.74 [0.72, 0.76], for Machiavellianism, narcissism, and psychopathy, respectively (we followed the steps in Dunn, Baguley, & Brunsden, 2014). Descriptive statistics for the SD3 are reported as Supplementary information. Psychopathy item 8 was highly skewed and kurtotic (cf. Table S1, Supplementary information).

4. Results

Goal one was to present item discrimination and location parameters. Being that we assumed that unidimensionality for the entire SD3 would be violated, we ran three separate unidimensional models, one for each subscale. Scale information curves reported in Fig. 1 reveals that all three SD3 constructs deliver most information when θ levels are approximately between 0 and 3. This is particularly true for the Machiavellianism subscale, which generates most information when θ is around 0. In contrast, the psychopathy subscale peaks at about 1.5–2 θ. The IRT parameters are presented (in descending order based on alphas) in Table 1.

As scale information functions are item functions added together (Reise & Waller, 2009), the same pattern naturally occurs at the item

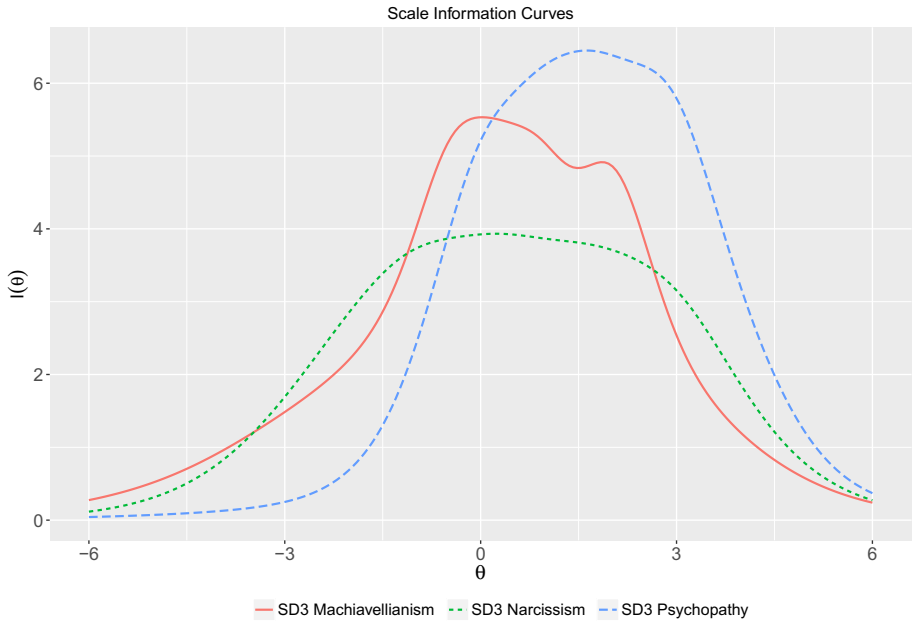

Fig. 1. Scale Information Curves for each SD3 construct.

level (cf. Fig. S1, Supplemental information). Interestingly, five psychopathy items have b_1 values larger than 0, which means that the probability for item endorsement even at the lowest step, require latent trait levels above 0.

Goal two was to test the hypothesis that Machiavellianism items are more readily endorsed than psychopathy items. We present the probability of item endorsement in two different ways. First, the so-called item trace lines are presented in Fig. 2. We observed that the response categories were relatively indistinguishable for a few items. This is particularly clear on the reversed psychopathy item number 7 ("I have never gotten into trouble with the law."), and to a less extent on psychopathy item 2 ("I avoid dangerous situations."), which is also a reversed item.

In addition to the trace lines we present line diagrams that more clearly depict how the items were endorsed across latent trait levels. In Fig. 3 we present the mean location parameter for each SD3 construct. The mean latent trait level for endorsement of the first response category is below −2 for Machiavellianism, but approximately 0 for psychopathy. This trend is increasing in a linear fashion for all three constructs. This clearly depicts that item endorsement for psychopathy items required relatively higher levels of the latent trait than did item endorsement of the Machiavellianism items, thus confirming our hypothesis. These results are further broken down on the item level in Fig. 4. With the exception of psychopathy item 2, all b_1 parameters were larger than −1. In comparison, only Machiavellianism items 5 and 6 were larger than −1. Thus, a much higher level of θ is required for endorsement of psychopathy items than Machiavellianism items. Accordingly, we can confirm the hypothesis that Machiavellianism is more readily endorsed than psychopathy items, as reflected in the fact that psychopathy delivers more information at relatively higher levels of θ.

Having established that items tapping the latent domain of Machiavellianism are more readily endorsed than psychopathy items, we present results concerning the third goal of this study. As previous research has shown that the SD3 will likely violate the assumption of unidimensionality, we expected a single unidimensional IRT model for all 27 items to fit poorly. Accordingly, we were interested in fit differences between a model with all 27 items and models with combinations of two constructs (i.e., 18 items).[1] We hypothesized that the inclusion of narcissism would yield poor fit and that Machiavellianism and psychopathy would show good fit. Cutoffs for model fit have not been established in the IRT literature, but suggestions have been made to interpret them in accordance with the structural equation modelling (SEM) literature. We report M_2 (Cai & Hansen, 2013), Tucker-Lewis index (TLI; Tucker & Lewis, 1973), and the comparative fit index (CFI; Bentler, 1990). A commonly relied on benchmark in the SEM literature is TLI and CFI > 0.95, and RMSEA values < 0.06 (Hu & Bentler, 1999), although strict reliance on model fit indices do not guarantee correct model specification (see McNeish, An, & Hancock, 2017).

Table 1
Item Response Analysis of the Short Dark Triad.

Item	a	b_1	b_2	b_3	b_4
Machiavellianism 5	2.60	−0.39	0.22	0.87	2.01
Machiavellianism 6	2.09	−0.50	−0.08	0.81	2.06
Machiavellianism 9	1.30	−1.52	−0.78	0.20	2.09
Machiavellianism 8	1.17	−1.35	0.03	1.48	3.11
Machiavellianism 3	1.01	−2.36	−0.80	0.90	3.21
Machiavellianism 2	0.98	−2.71	−0.62	0.39	2.98
Machiavellianism 7	0.98	−3.18	−2.44	−1.23	1.26
Machiavellianism 4	0.83	−2.85	−1.27	0.32	3.23
Machiavellianism 1	0.70	−4.79	−3.08	−1.64	1.52
Narcissism 3	1.60	−1.01	0.40	1.61	2.99
Narcissism 4	1.37	−0.88	0.23	1.50	3.13
Narcissism 5	1.31	−1.86	−0.98	0.17	2.11
Narcissism 2	1.22	−1.78	−0.17	0.99	2.41
Narcissism 1	1.18	−2.28	−1.02	0.25	2.17
Narcissism 9	1.07	−1.72	−0.61	0.61	2.77
Narcissism 7	1.03	−0.59	0.61	1.32	3.69
Narcissism 6	1.00	−2.88	−0.26	0.66	2.20
Narcissism 8	0.92	−2.24	0.36	1.22	2.64
Psychopathy 1	2.06	−0.03	0.98	1.71	2.77
Psychopathy 3	1.91	0.01	0.89	1.88	2.94
Psychopathy 9	1.80	0.05	1.21	1.89	3.09
Psychopathy 8	1.68	1.25	2.36	3.08	4.16
Psychopathy 4	1.64	0.43	1.61	2.25	3.40
Psychopathy 6	1.56	−0.47	0.51	1.58	2.68
Psychopathy 5	1.23	0.59	1.28	1.88	2.99
Psychopathy 2	0.61	−1.94	1.17	2.46	4.45
Psychopathy 7	0.56	−0.74	1.05	1.55	3.87

Note. Items are sorted (within each scale) based on a-levels of the latent trait. b_1 to b_4 reports the item locations, reflecting the threshold level of the latent trait necessary to have at least a 50% probability of endorsing the next scale-step.

[1] We do not report model fit for the 9 item models, as the degrees of freedom are too low for model fit calculation. Another study using confirmatory factor analysis showed acceptable model fit for equivalent models (Persson et al., 2017).

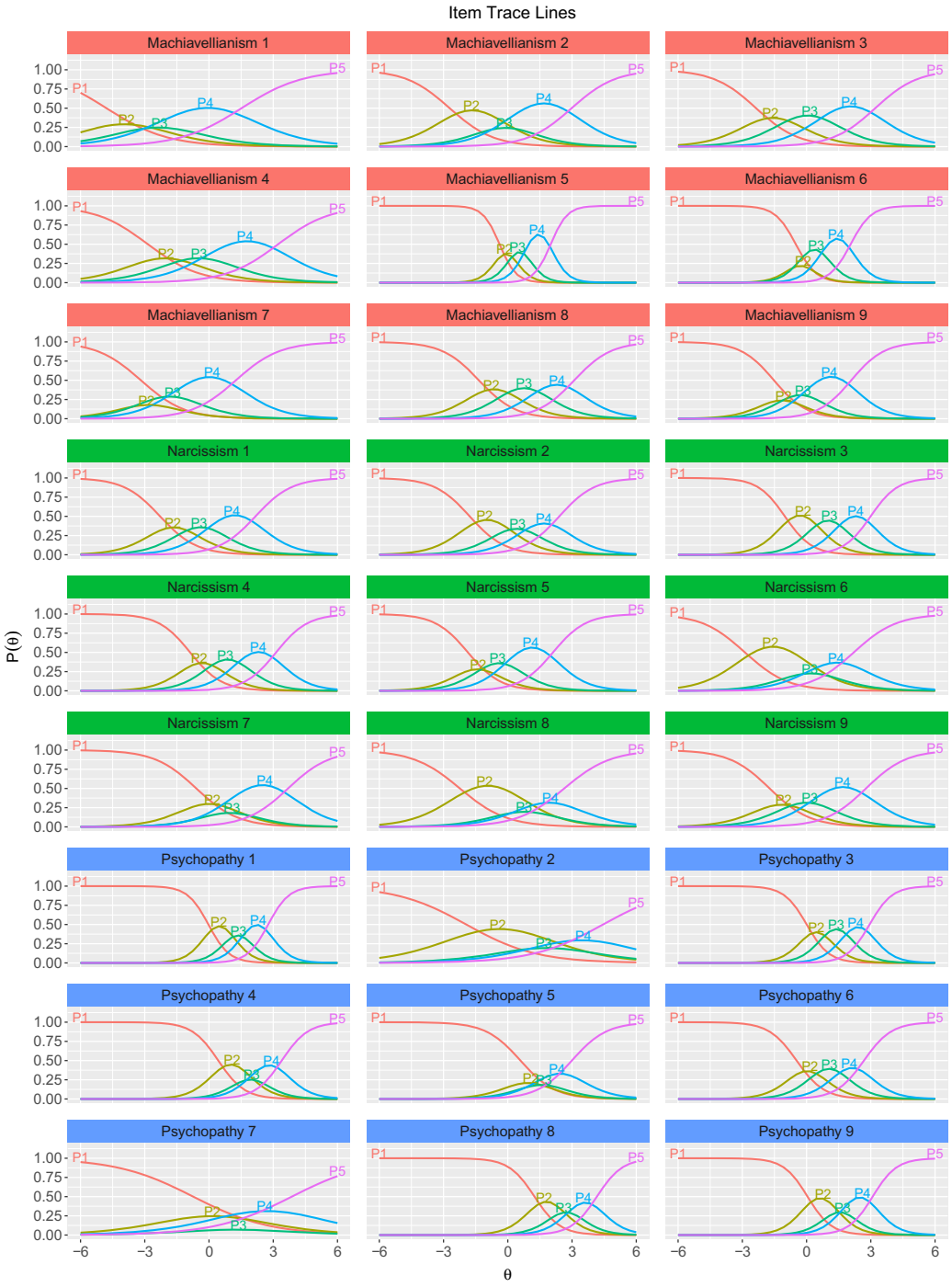

Fig. 2. Item trace lines for all SD3 items. Note that each factor has been analyzed separately.

As expected, running a unidimensional model on all 27 items yielded poor model fit. The fit indices are reported in Table 2. However, our hypothesis that the inclusion of narcissism would lead to poor fit was only partially confirmed, as this was only the case when narcissism was modelled with Machiavellianism.[2] In other words, narcissism and psychopathy fit rather well together in a unidimensional model. Although none of the models reached the traditional SEM benchmarks, this was expected as previous studies have shown similar misfit using CFA (Jones & Paulhus, 2014; Persson et al., 2017). The effect of the misfit was clear when parameter estimates were compared between models. For instance, the Pearson correlations between the alpha parameter in the misfitting 27 item model and the separate models with only 9 items was 0.39 for narcissism, but 0.96 and 0.94 for Machiavellianism and psychopathy, respectively. Similar results were found for the *b*-parameters. Accordingly, we can confirm that fitting a unidimensional model to all 27 SD3 items will create biased parameter estimates, because the SD3 is not unidimensional across all three constructs. Furthermore, some caution is merited when modelling narcissism together with Machiavellianism, as this yielded poor fit in the present study. Unexpectedly, narcissism and psychopathy fit rather well when modelled together.

[2] We expected that this misfit might be caused by reverse-coded items in the narcissism factor, but removing those items did not yield better fit.

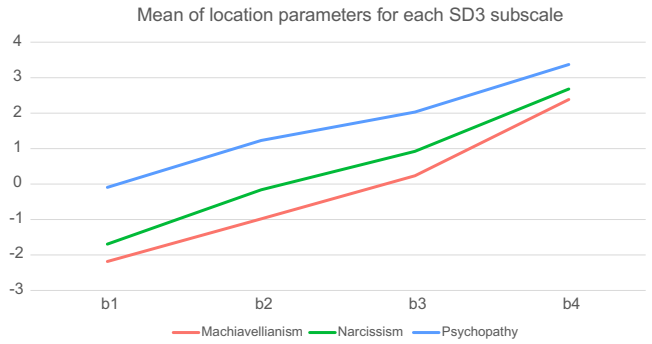

Fig. 3. Mean values for each location (b) parameter on each SD3 construct.

5. Discussion

The purpose of the present study was to extend our knowledge about the SD3 by analyzing the functioning of its items, as well as the relationship between the three constructs. The IRT analysis informs us that the SD3 subscales are variable across the θ range in a similar fashion as the Dirty Dozen (see Kajonius, Persson, Rosenberg, & Garcia, 2016). The SD3 provides less information at low levels (i.e., when θ is <0) of the latent trait, especially for psychopathy. This phenomenon is not unusual in clinical psychology, and the DT is arguably at the borderline as it focuses on traits that have been traditionally studied in clinical populations. Furthermore, subclinical populations can naturally include extreme community members (Ray & Ray, 1982). In fact, the "skewed" information

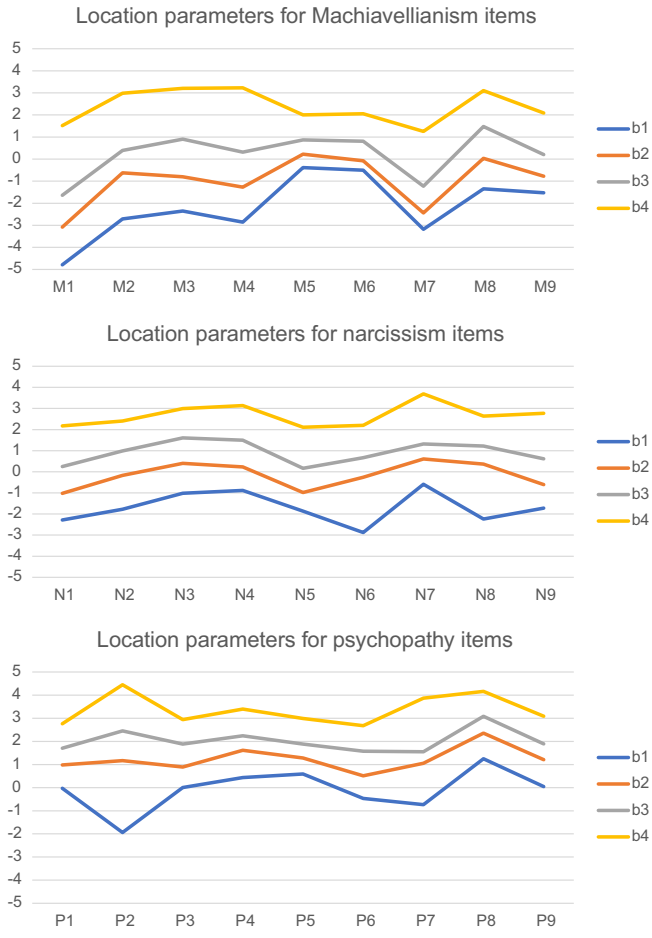

Fig. 4. Location parameters (b_{1-4}) for each SD3 construct. M1–M9 = Machiavellianism item number 1–9, N1–N9 = Narcissism item number 1–9, P1–P9 = Psychopathy items number 1–9.

Table 2
Model fit comparison of Item Response Theory models.

Model	Items	M_2	*df*	CFI	TLI	RMSEA
Mach & Psych	18	684.71	81	0.90	0.88	0.06
Mach & Narc	18	1601.30	81	0.63	0.55	0.10
Narc & Psych	18	568.89	81	0.90	0.87	0.06
Mach & Narc & Psych	27	3849.11	243	0.68	0.64	0.09

Note. Mach = Machiavellianism, Narc = narcissism, Psych = psychopathy. CFI = comparative fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation.

functions have been discussed as being potentially caused by a problem in the conceptualization of some psychopathological constructs. In clinical settings, it is common that inventories are unipolar, thus having a "quasi-trait" status (Reise & Waller, 2009), meaning that one end of the scale represent severity, and the other absence. In the case of the DT, the question arises whether a low score indicates benevolent behavior, or merely the absence of malevolent behavior. In fact, the DT may be especially problematic in this regard. If we grant that all three DT constructs have something in common, do their opposites also have something in common?

Regarding the second goal, results confirmed that Machiavellianism is more easily endorsed than psychopathy, which gives tentative support of our hypothesis that Machiavellianism contains more "benign", or less anti-social, content. This finding is of theoretical interest and relates to the third goal of this study; the dimensionality of the SD3 constructs. As expected, Machiavellianism and psychopathy fit decently together. Unexpectedly, however, was that model fit was only poor when Machiavellianism was fitted with narcissism, but not for narcissism and psychopathy. Albeit narcissistic features have historically been conceptualized as being part of the psychopathy construct, prior evidence in the DT literature has been quite consistent in showing that narcissism is more independent than Machiavellianism and psychopathy (e.g., Vize et al., 2016). It is thus difficult to reconcile these findings with the current literature. We hope that others attempt to replicate these findings in order to gain better understanding of the extent to which the DT constructs are independent.

5.1. Theoretical implications and relations with the overall literature

The overlap between Machiavellianism and psychopathy is straightforward to reconcile, given that persuasive arguments for their similarity were marshalled many years ago (McHoskey et al., 1998). The psychopathy literature has long recognized Machiavellian behavior as an important component (Lilienfeld & Andrews, 1996). As we have shown, Machiavellianism is more easily endorsed than psychopathy, while evidence also suggests that the same latent dimension is being assessed. This may give credence to McHoskey et al.' (1998) position that the psychopathy and Machiavellianism literatures are aimed at the same phenomenon, but merely have targeted different populations (i.e., clinical and subclinical). This raises further questions about how we should think about the nature of psychopathy and Machiavellianism. The DT is a subclinical construct and DT psychopathy thus reflects subclinical manifestations of psychopathic behavior. If we grant that Machiavellianism is a more "benign" version of subclinical psychopathy, does it assess subsubclinical psychopathy? Our proposal is that items accurately assessing Machiavellianism and subclinical psychopathy assess the same latent construct (i.e., psychopathy), but at different levels of severity, in much the same way as the five abnormal trait domains assessed by the Personality Inventory for DSM-5 (Krueger, Derringer, Markon, Watson, & Skodol, 2012) taps into the Big Five factors (cf. Suzuki, Samuel, Pahlen, & Krueger, 2015).

It is more difficult to provide a theoretical rationale for why narcissism fits with psychopathy, but doesn't fit with Machiavellianism. One potential explanation could be that SD3 narcissism taps into grandiose narcissism (as opposed to vulnerable narcissism; see Maples et al., 2014), which should overlap with psychopathy but not Machiavellianism, as a

cynical negativistic outlook is central to the latter. This explanation is admittedly post-hoc, and it should be noted that no a priori hypotheses were specified about the relation between Machiavellianism and narcissism.

5.2. Limitations and conclusions

A limitation is the use of three unidimensional IRT models. Using unidimensional models entails that controlling for covariance among the factors is not possible. However, unidimensional models are more easily interpreted than multidimensional IRT models and allow for graphical representation. Additionally, as with all modelling endeavors we cannot conclude that any model we have used is correct; at best, they are plausible representations of the data. In this case, we can conclude that narcissism and Machiavellianism diverge too much to be modelled together, whereas the other combinations seem possible to model together in one factor, albeit the model fit is far from perfect. Additionally, although the sample size is relatively large, it was collected using MTurk and we know very little about each participant. Studies attempting to replicate our findings in other samples are therefore highly encouraged.

In the present study, we have merely provided more groundwork. We hope that future research build on the interesting relationship between these three constructs, as there is still uncertainty in terms of how the constructs interrelate. Many issues remain unresolved. For instance: a limited number of inventories have been tested, findings have not been independently replicated, and perhaps no inventory hitherto has been able to capture Machiavellianism (cf. Rauthmann & Will, 2011). In this study, we showed that Machiavellianism is easier to endorse than psychopathy, but contrary to expectations, only Machiavellianism and narcissism fit poorly together, thus raising questions regarding whether only Machiavellianism and psychopathy are subsumable in the SD3. Perhaps these two constructs differ on the latent total score continuum, an idea that has been creatively applied to the Narcissistic Personality Inventory (Foster, Shiverdecker, & Turner, 2016).

In recent years, DT research has been heavily data driven. We urge researchers to also focus on conceptual and theoretical issues. A particular problem where we believe headway can be made, is to attempt to clarify what the necessary and sufficient conditions are for each construct. This logic has previously been applied to psychopathy in the triarchic theory (Patrick, Fowles, & Krueger, 2009). In elucidating such conditions, hopefully clearer demarcations of which combination of behavior constitutes which DT trait, and as a consequence, which outcomes would serve as the strongest falsifiers (cf. "risky tests", Meehl, 1978, 1990).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.paid.2017.05.025.

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