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„Psychometric properties of the German version of the
Assessment of D“

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Abstract

The present study focused on psychometric qualities of the German version of a newly introduced questionnaire to measure dark personality traits, the Assessment of D (D70, D35, D16). Therefore, a large German speaking sample ($N = 1,157$, 80% w, mean age = 34.11 years) completed the Assessment of D, as well as the HEXACO-PI-R-60 scales Honesty-Humility (convergent validity) and Openness to experience (discriminant validity). Factorial validity of the three versions of the Assessment of D, as well as convergent and discriminant validity were investigated. Therefore, a bifactor model for the D70, as well as single factor models for all three versions were tested. The D70 bifactor model was the best fitting model and showed adequate factorial, as well as convergent validity, while the discriminant validity was questionable. The shorter item sets failed to exhibit adequate factorial validity. This was contrary to previously conducted studies. Further research on the factorial structure of the shorter item sets is necessary. The results indicate that the German version of the complete Assessment of D is a well validated questionnaire, that may be used in further research.

Theoretical Background

Dark personality traits

The interest of psychological research concerning dark personality traits has been rising over the past 20 years. The number of publications including measurements of dark traits is constantly increasing. For example, when searching in Google Scholar for publications including the keywords “dark personality traits” between 1980 and 2000, 31,700 hits are resulting. When changing the timespan to 2000-2021, the number of publications including dark personality traits increases to 133,000. This increase can be well explained by the introduction of the Dark Triad during the later period in 2002 (Paulhus & Williams). The Dark Triad consists of three distinct but overlapping traits on a subclinical personality level, namely Narcissism, Machiavellianism, and Psychopathy (Paulhus & Williams, 2002). Subclinical Narcissism is associated with traits like grandiosity, dominance, entitlement, and superiority (Raskin & Hall, 1979). Machiavellianism is associated with manipulative and cold behavior (Christie & Geist, 1970). Subclinical Psychopathy is associated with high impulsivity and thrill-seeking behavior, alongside with low empathy (Hare, 1985). According to Google Scholar the article first introducing the Dark Triad (Paulhus & Williams, 2002) has been cited over 4,000 times, until now. This shows the popularity of the Dark Triad and dark personality traits in psychological research. Researchers associated the Dark Triad traits with different behavioral outcomes. For example, Psychopathy was associated with cyber-aggressive behavior on Facebook (Pabian et al., 2015). Similarly, the Dark Triad was associated with real life bullying with Psychopathy showing the strongest relation to bullying, followed by Machiavellianism and Narcissism (Baughman et al., 2012). Furthermore, the Dark Triad traits were also associated with counterproductive work behavior like employee theft, abusive supervision, and leadership derailment (O’Boyle et al., 2012). Therefore, the Dark Triad seems to be related to antisocial habits, we might face regularly in our everyday life.

Criticism of the traditional Dark Triad

Over the past years, the number of studies questioning the structure of the Dark Triad has been rising. Some authors stated that the Dark Triad is redundant, arguing that large amounts of their variance might be explained by Agreeableness or Honesty-Humility (Hodson et al., 2018; O’Boyle et al., 2015; Vize et al., 2020). For example, according to a meta-analysis, Agreeableness was the key predictor of the Dark Triad traits with Agreeableness

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accounting for 77% of the variance in Machiavellianism, for 62,8% of the variance in Narcissism and for 39.6% of the variance in Psychopathy (O'Boyle et al., 2015). Honesty-Humility is associated with sincerity, being fair-minded, and unpretentiousness (Ashton & Lee, 2007). Similarly, a person being associated with high scores in Agreeableness can be described as helpful, cooperative, and altruistic (McCrae & Costa, 2003). When reading these features, it is quite comprehensible that some authors viewed dark traits as low Agreeableness or low Honesty-Humility. Furthermore, there are multiple studies stating that the three traits are positive correlated with each other. For example, one study reported correlations between $r = .27$ and $r = .32$ between Narcissism, Psychopathy, and Machiavellianism (Chabrol et al., 2009). The introducing study of the Dark Triad even reported correlations up to $r = .50$ between Psychopathy and Narcissism (Paulhus & Williams, 2002). In this introduction, the components of the Dark Triad were presented as overlapping but still distinct traits. If those traits ought to be independent from each other, the reported correlations seem surprisingly large. Therefore, it is not surprising that many authors criticized the originally postulated structure of the Dark Triad. One theory proposed Hare's Factor 1 (i.e., primary Psychopathy) containing Callousness and manipulation as the core of the Dark Triad (Jones & Figueredo, 2013). This was supported by several other authors. Using confirmatory factor analyses and structural equation modelling as well as network analyses, they argued that the facets of the Dark Triad showed strong loadings on the same single factor, and that primary Psychopathy may account for most of the variance of the Dark Triad traits. Therefore, they suggested that the Dark Triad may be better represented by one factor or one common core, rather than modeling three independent facets (Bertl et al., 2017; Dinić et al., 2020; Glenn & Selbom, 2015).

Theory of the Dark Factor by Moshagen et al. (2018)

In line with research criticizing the independence of the Dark Triad components, underlining the commonalities of dark traits, and therefore arguing that dark traits may be best represented by a single dark core, Moshagen et al. (2018) published a new approach in modeling dark personality traits. They named the common core of dark traits the Dark Factor of Personality (D). The Dark Factor was conceptualized as the "...general tendency to maximize one's individual utility – disregarding, accepting, or malevolently provoking disutility for others–, accompanied by beliefs that serve as justifications." (Moshagen et al., 2018, p. 657). This definition is the common core of all dark personality traits. Each of those traits consists of at least one characteristic, that defines the Dark Factor. This importantly does

not rule out that dark personality traits may contain other attributes beyond the Dark Factor. Furthermore, the Dark Factor was defined as a fluid construct, meaning that the Dark Factor may take shape in various combinations of dark traits and therefore can be assessed (to a certain degree) by any assessment designed to measure dark traits (Moshagen et al., 2018).

The idea of Moshagen et al. (2018) was to identify a broad set of dark traits, which therefore would represent the common core of dark traits in a better way than only including three traits (as the Dark Triad). Hence, the authors first included the three traits of the Dark Triad (Machiavellianism, Narcissism, and Psychopathy), because they seem to be widely accepted as dark traits in psychological research. Afterwards the authors searched multiple journals dealing with personality research for articles introducing other dark personality traits. Their search ranged from 1999 to 2014 and finally included nine dark traits, namely Egoism, Machiavellianism, Moral Disengagement, Narcissism, Psychological Entitlement, Psychopathy, Sadism, Self-interest, and Spitefulness. With presenting the Dark Factor as the general factor and the nine dark traits as specific factors, a bifactor model was proposed (Moshagen et al., 2018). In this model, each item loaded on the general factor D and on its associated specific factor. The idea of modeling dark personality traits in a bifactor model was supported by other authors as well (Volmer et al., 2019). Using structural equation modeling adequate model fit for the bifactor model ($p(\chi^2) < .01$; Standardized Root Mean Square Residual (*SRMR*) = .069; Root Mean Square Error of Approximation (*RMSEA*) = .049) was reported (Moshagen et al., 2018). Also, information criteria indicated preferring the bifactor model over a model with one latent factor for each dark trait (Akaike Information Criterion (*AIC*) = 69.757 vs. *AIC* = 69.920, Bayesian Information Criterion (*BIC*) = 69.960 vs. *BIC* = 70.091). In several following studies with larger and more representative samples, the results could be replicated (Moshagen et al., 2018).

The Assessment of D (Moshagen et al., 2020a)

Twenty-five percent of the items used by Moshagen et al. (2018) to measure the Dark Factor exhibited low loadings on the Dark Factor, and therefore could be dismissed with only little loss of information (Moshagen et al., 2020a). Additionally, only ten out of 93 items were negatively keyed which could lead to response bias. Given those reasons, a measurement tailored to the Dark Factor was designed, and called The Assessment of D (Moshagen et al., 2020a). Before choosing adequate items to measure the Dark Factor, the search for newly introduced dark personality traits was extended. Again, the authors searched personality-related journals for other dark traits and added Amoralism-Crudelia, Amoralism-Frustralia,

Greed, and Self-centeredness to their list. While deriving an item set suited to measure the Dark Factor, Self-interest was not considered (which emerged from the search of Moshagen et al., 2018), because its definition does not seem to match the definition of the Dark Factor. Therefore 12 different dark traits resulted.

Taken those 12 dark personality traits and the Dark Factor together, a bifactor model with the Dark Factor as the general and 12 specific factors was proposed (Moshagen et al., 2020a). Items having the potential to indicate the Dark Factor well from established measures of those 12 traits were used by the authors to form an initial item pool (184 items). They then considered them for further inclusion based on their intercorrelations. Due to low correlations between the items ($r < .30$), 22 items were excluded. To evaluate the final item set, exploratory factor analyses were performed in a first step, which led to an exclusion of 44 items because of low loadings and overlapping item content. In a second step, they used Genetic Algorithms (Holland, 1992) to derive the final item set. Through a process of iterations, such algorithms identify the best fitting items. After applying the algorithm ten times and combining it with theoretical considerations regarding avoiding redundancies and measuring the Dark Factor in adequate breadth, the final questionnaire consisted of 70 items referring to 12 specific traits. The long version of the questionnaire is called D70. The algorithm was applied in the same way to determine two short versions with 35 (D35) and 16 items (D16). In the following section, the 12 specific traits are further described.

Amoralism-Crudelia and Amoralism-Frustralia

Crudelia and Frustralia, both belong to the Amoralism concept (Knežević, 2003). Crudelia refers to Amoralism caused by brutality, while Frustralia refers to Amoralism induced by frustration.

Egoism

Egoism is associated with being excessively concerned with one's own pleasure while not caring about the expense of community well-being (Weigel et al., 1999).

Greed

Greed can be characterized by an insatiable craving for more resources. (Krekels & Pandelaere, 2015).

Machiavellianism

Machiavellianism captures manipulative traits and a penchant for superficial social charm (Paulhus & Williams, 2002).

Moral Disengagement

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Moral Disengagement is associated with behaving unethically without feeling distress (Bandura, 1999).

Narcissism

Narcissism can be characterized by dominance, a sense of entitlement, and feeling superior (Paulhus & Williams, 2002).

Psychological Entitlement

Psychological Entitlement refers to thoughts, that one deserves more than other people of the social community. (Campbell et al., 2004).

Psychopathy

Psychopathy is characterized by impulsivity and callous behavior in interpersonal relationships (Paulhus & Williams, 2002).

Sadism

Sadism captures a tendency to engage in violent, aggressive, or demeaning behaviors for fun or dominance (O'Meara et al., 2011).

Self-centeredness

Self-centeredness refers to being indifferent or insensitive to the suffering of others (Arneklev et al., 1993).

Spitefulness

Spitefulness is associated with the tendency to punish others, even if it includes harming oneself (Marcus et al., 2014)

Empirical evidence regarding the Dark Factor and the Assessment of D

Using a confirmatory factor analysis and new data from a different sample, the bifactor structure of the D70 was tested (Moshagen et al., 2020a). A bifactor model with the Dark Factor as the general and 12 specific factors did not converge successfully, because some of the specific factors could not explain enough variance beyond the Dark Factor. Therefore, the authors calculated their bifactor model with only six specific factors remaining. The resulting model indicated adequate model fit ($p(\chi^2) < .01$; $SRMR = .040$, $RMSEA = .043$). The D35 and D16 were tested using the same data and a confirmatory factor analysis as well, but the models were specified as single factor models. The authors argued that the smaller number of items would not carry sufficient information to obtain relevant specific factors. Acceptable model fit for the D35 ($p(\chi^2) < .01$; $SRMR = .038$; $RMSEA = .050$) and the D16 ($p(\chi^2) < .01$; $SRMR = .034$; $RMSEA = .055$) was reported.

It is important to note, that the Dark Factor theory is contested in psychological literature. Some authors question the differences of the Dark Triad and Honesty-Humility or Agreeableness (Hodson et al., 2018; O’Boyle et al., 2015; Vize et al., 2020). This is also applied to the Dark Factor. Some authors referred to the “jingle” and “jangle” fallacy (Kelley, 1927) when talking about Agreeableness and the Dark Factor (Vize et al., 2020). The jingle fallacy refers to giving the same name to different constructs while the jangle fallacy means naming similar/the same constructs differently. Some authors argued that the latter may be applied to the Dark Factor and low Agreeableness and as research on the Dark Factor is expanding, its similarities with Agreeableness should be noted and uncovered (Vize et al., 2020). Using a very wide operationalization of Agreeableness, consisting of 104 items from 22 different Agreeableness scales developed by Crowe et al. (2018), they reported a large latent correlation ($r = -.90$) between latent Agreeableness and latent D and therefore questioned the empirical distinctiveness of the two constructs. On the other hand, assessing Agreeableness with the BFAS (DeYoung et al., 2007), the BFI-2 (Soto & John, 2017), the IPIP-50 (Goldberg, 1992), and the NEO-FFI (McCrae & Costa, 2004) Moshagen et al. (2020b) reported that Agreeableness and the Dark Factor were functionally different constructs, with both sharing less than 50% common variance. Moshagen et al. (2020b) operationalized Agreeableness as implemented in Big Five questionnaires. As stated before, the operationalization of Crowe et al. (2018), used by Vize et al. (2020) is wider, including scales beyond Big Five Agreeableness. A reply to Moshagen et al. (2020b) argued that Agreeableness was measured insufficiently and did not include items from the Honesty-Humility and the interstitial Altruisms scales of the HEXACO-PI-R (Lee & Ashton, 2006), which must be included (Vize & Lynam, 2021). In turn another study stated that Agreeableness assessed by Vize et al. (2020) is basically a different construct than Agreeableness in terms of the Big Five (Hilbig et al., 2021). For example, the broader assessed Agreeableness showed twice as strong correlations with other Big Five dimensions as the traditionally assessed Agreeableness, ranging up to $r = .57$ for Agreeableness and Conscientiousness. Furthermore, it was argued, that “D represents a blend of basic traits” (Moshagen et al., 2018, p. 682), especially Honesty-Humility, Agreeableness, and Conscientiousness (Hilbig et al., 2021). Therefore, a broader dimension of Agreeableness spanning Honesty-Humility, Agreeableness and Conscientiousness among others may be equivalent to the Dark Factor (Hilbig et al., 2021; Vize & Lynam, 2021; Vize et al., 2020). However, Agreeableness operationalized and assessed traditionally with Big Five measures is functionally different from the Dark Factor (Hilbig et al., 2021).

The bifactor model of the D70 with 12 specific factors did not converge successfully (Moshagen et al., 2020a). Therefore, a further investigation of the factorial structure of the Dark Factor was suggested. Accordingly, a series of studies, including exploratory bifactor analyses and confirmatory factor analyses, to investigate the factorial structure of the Dark Factor were performed (Bader et al., 2021a). Summing up, the results indicated that the Dark Factor is best represented in a bifactor model with five underlying themes, namely Callousness, Deceitfulness, Narcissistic Entitlement, Sadism, and Vindictiveness. Regarding model fit, information criteria indicated this solution to outperform the other models and *RMSEA* as well as *SRMR* indicated good fit to the data. However, other empirical evidence supporting the presented findings seem to be missing. Therefore, a further investigation of the factorial structure of the Assessment of D and whether it is better represented by a bifactor model with 12 or five specific factors is needed.

The present study

The aim of the present study was to validate the German versions of the Assessment of D (D70, D35, D16; Moshagen et al., 2020a), considering the factorial structure, as well as the convergent and discriminant validity.

So far, the English versions of the questionnaires were validated (Moshagen et al., 2020a) and a validation of the German version was reported (Bader et al., 2021b). Beyond factorial validity, the English validation considered different criterion measures to measure convergent validity. The German validation also measured factorial validity, as well as measurement invariance and self-observer agreement, but not considered convergent validity. Both studies did not consider discriminant validity. So far, there is no published validation which is independent from the author group, who introduced the Assessment of D. Furthermore, the studies rely on data obtained through a website (darkfactor.org), where people can take the Assessment of D for self-assessment purposes. Therefore, it would be interesting to validate the questionnaires independently and based on a differently recruited sample. To address this issue, the factorial structure as proposed by Moshagen et al. (2020a) including the bifactor model for the D70 and the single factor models for the shorter item sets D35 and D16 was examined. Therefore, confirmatory factor analyses were calculated. I will expect the model fit indices for the bifactor, as well as for the single factor models to be acceptable. As stated before, dark personality traits seem to exhibit large negative correlations with Honesty-Humility, what indicates similarities between dark personality traits and low Honesty-Humility ($-.61 \leq r \leq -.41$; Howard & Van Zandt, 2020; Muris et al., 2017; Schreiber

& Marcus, 2020). Therefore, correlations of the Dark Factor and Honesty-Humility were calculated to investigate convergent validity of the Assessment of D. I will expect a negative correlation between the Dark Factor and Honesty-Humility. There are some other basic personality traits which dark personality traits do not seem to be associated with. For example, in different meta-analyses dark personality traits showed no or very small correlations with Openness to experience ($-.09 \leq r \leq .15$; Muris et al., 2017; Schreiber & Marcus, 2020). Openness to experience is associated with an open-mindedness towards new ideas, attitudes, and experiences (McCrae & Costa, 2003). Because Openness to experience does not seem to be related to dark personality traits, correlations of the Dark Factor and Openness to experience were calculated to investigate discriminant validity of the Assessment of D. I will expect no correlation between the Dark Factor and Openness to experience.

Method

The present investigation was pre-registered via the Open Science Framework (OSF; Center for Open Science, 2011) prior to data collection. The pre-registration can be obtained via OSF: <https://osf.io/9uxzd>. Unless otherwise stated, all analyses were performed as described in the pre-registration.

Participants and Procedure

Data collection took place during three months between April and July 2021. Participants were mainly recruited via social media. Data was collected online via SoSci Survey (Leiner, 2006). There was no compensation for taking part in this study. Participation was voluntary and the participants provided informed consent. Participants were able to refuse answering individual items but were reminded to fill out the questionnaire completely. Data from individuals who took the survey in less than five minutes was excluded. This was not part of the pre-registration, but was considered as reasonable, regarding the length of the survey. Cases that included at least 10% missing values for one scale were excluded as well, but only for the respective scale. For example, if a person did not answer two items of the Honesty-Humility scale (more than 10% missing values) but answered all items of the Openness to experience scale and 67 items of the D70 (less than 10% missing values), only the data of the Honesty-Humility scale respective to this person would be excluded. Data from 1,157 individuals (80% female, 18% male, 1% other) were used for this study. The sample was taken from the general population by means of a convenience sample. The age ranged

from 15 to 76 ($M = 34.11$; $SD = 12.94$) years. 42% lived in Austria, 54% in Germany and 4% in other countries. Due to technical issues with the survey, the first 80 participants did not answer the question regarding their educational status. Note that the following information therefore refers to a sample size of 1,077. Furthermore, assessing the educational status was not part of the pre-registration. One Percent had completed compulsory school, 25% had a high-school diploma, 12% had finished a professional training, 58% had a college degree and 2% had a PhD. 2% did not answer. After replying to questions regarding the demographics, participants answered the Openness to experience and Honesty-Humility scales of the HEXACO-PI-R-60 (Lee & Ashton, 2018). The German version of the D70 (Bader et al., 2021b) was presented at the end of the questionnaire, due to sensitive items that may cause a potential drop-out.

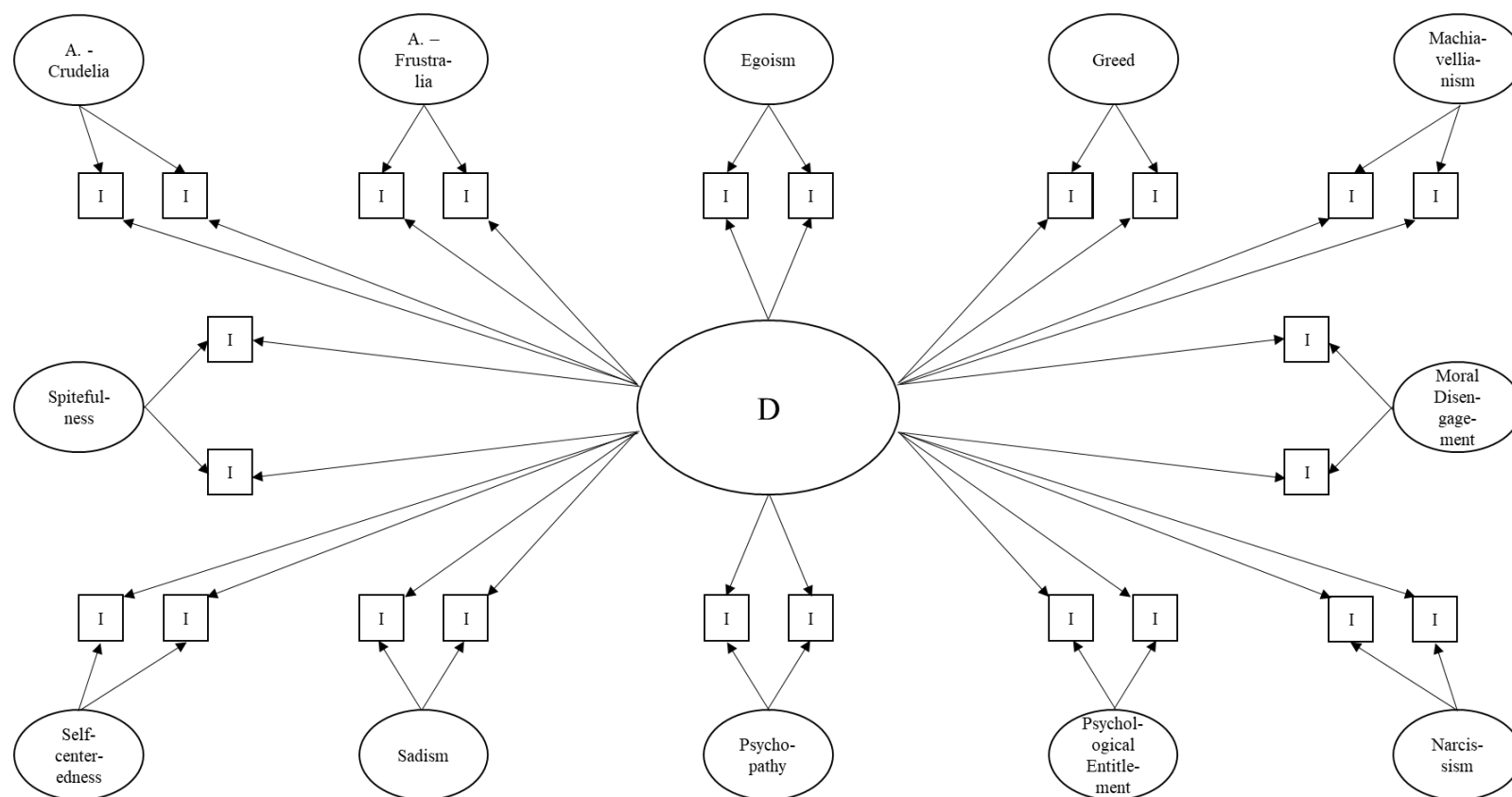
Measures

HEXACO-PI-R-60

The German version of the HEXACO-PI-R-60 (Lee & Ashton, 2018) was used to measure Openness to experience and Honesty-Humility. The remaining four traits of the questionnaire were not considered. The short version was chosen because of economic reasons. It contained ten items to measure Openness to experience and ten items to measure Honesty-Humility. Every item had to be answered on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). The items were balanced between positively and negatively keyed ones. The ten items reflecting Honesty-Humility and the ten items reflecting Openness to experience were separately averaged to create total scores for the participants. Higher scores indicated a stronger expression in Honesty-Humility or Openness to experience. Reliabilities as indicated by Cronbach's alpha for both, Honesty-Humility ($\alpha = .73$) and Openness to experience ($\alpha = .70$) in the present sample were acceptable.

Figure 1

Bifactor model of the D70 with 12 specific factors.



Note. To enhance clarity, only two items per specific factor are displayed. In total, there are 70 items. A. = Amoralism; D = Dark Factor of personality; I = Item

D70

The German version of the D70 (Bader et al., 2021b) was used to measure the Dark Factor. The D70 consisted of 70 items measuring 12 specific factors (Amoralism-Crudelia: 7 items; Amoralism-Frustralia: 6 items; Egoism: 10 items; Greed: 5 items; Machiavellianism: 13 items; Moral Disengagement: 10 items; Narcissism: 10 items; Psychological Entitlement: 9 items; Psychopathy: 12 items; Sadism: 15 items; Self-centeredness: 4 items; Spitefulness: 11 items). Regarding the theory of the factorial structure with five themes by Bader et al. (2021a), the 70 items are distributed over five specific factors as follows: Callousness: 15 items, Deceitfulness: 9 items, Narcissistic Entitlement: 11 items, Sadism: 18 items, and Vindictiveness: 17 items. The items were translated into German using the translation-back translation method (Bader et al., 2021b). The items were equally positively and negatively keyed and had to be answered on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). The 70 item responses of the D70 were averaged to calculate total scores for the D70 for the participants. Higher scores indicated a stronger expression in the Dark Factor. In the present sample, reliability as reflected by Cronbach's alpha for the whole questionnaire was excellent ($\alpha = .94$). Cronbach's alphas for the 12 subscales of the D70 were unsatisfactory (Egoism: $\alpha = .50$; Moral Disengagement: $\alpha = .52$; Narcissism: $\alpha = .59$; Psychological Entitlement: $\alpha = .56$; Self-centeredness: $\alpha = .59$; Spitefulness: $\alpha = .59$), questionable (Amoralism-Frustralia: $\alpha = .66$; Machiavellianism: $\alpha = .63$; Psychopathy: $\alpha = .68$), and acceptable (Amoralism-Crudelia: $\alpha = .74$; Sadism: $\alpha = .72$). Regarding the items distributed over the five themes, Cronbach's alphas of the subscales were better, ranging from questionable (Deceitfulness: $\alpha = .69$), acceptable (Narcissistic Entitlement: $\alpha = .75$) to good (Callousness: $\alpha = .82$; Sadism: $\alpha = .83$; Vindictiveness: $\alpha = .86$). The items of the German version of the D70, as well as items in other languages can be found at <https://darkfactor.org/>.

D35

To calculate scores for the German version of the D35 (Bader et al., 2021b), the same sample was used, with only considering the items reflecting the D35. The 35 items distributed over the 12 factors as follows: Amoralism-Crudelia: 4 items, Amoralism-Frustralia: 2 items, Egoism: 3 items, Greed: 1 item, Machiavellianism: 4 items, Moral Disengagement: 1 item, Narcissism: 3 items, Psychological Entitlement: 2 items, Psychopathy: 6 items, Sadism: 5 items, Self-centeredness: 2 items, and Spitefulness: 2 items. Regarding the theory of the factorial structure with five themes by Bader et al. (2021a), the 35 items are distributed over five specific factors as follows: Callousness: 9, Deceitfulness: 4, Narcissistic Entitlement: 3,

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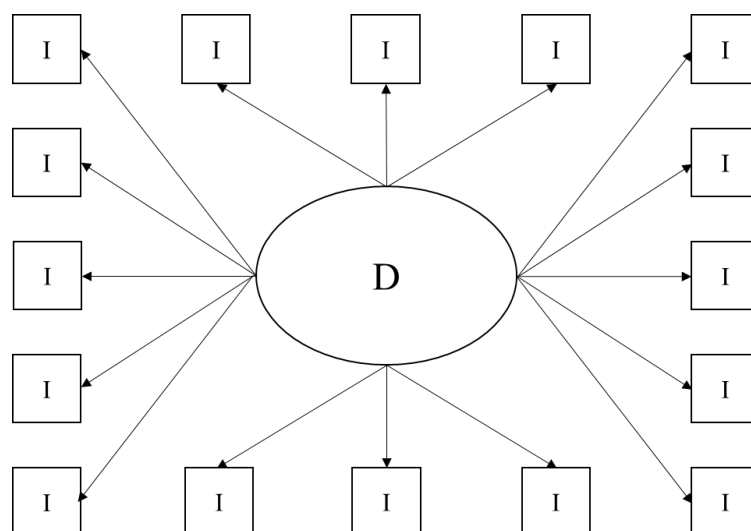
Sadism: 10, Vindictiveness: 9. The item responses to the 35 items of the D35 were averaged to calculate total scores. Higher scores indicated a stronger expression in D. Reliability indicated by Cronbach's alpha was excellent in the present sample ($\alpha = .90$).

D16

Total scores for the German version of the D16 (Bader et al., 2021b) were calculated with only considering the items reflecting the D16. Regarding the 12 specific factors, the items distributed as follows: Amoralism-Crudelia: 3 items, Amoralism-Frustralia: 1 item, Egoism: 1 item, Greed: 0 items, Machiavellianism: 2 items, Moral Disengagement: 1 item, Narcissism: 0 items, Psychological Entitlement: 0 items, Psychopathy: 3 items, Sadism: 3 items, Self-Centeredness: 1 item, Spitefulness: 1 item. Regarding the theory of the factorial structure with five themes by Bader et al. (2021a), the 16 items are distributed over five specific factors as follows: Callousness: 5, Deceitfulness: 1, Narcissistic Entitlement: 0, Sadism: 5, Vindictiveness: 5. The item responses to the 16 items of the D16 were averaged to calculate total scores. Higher scores indicated a stronger expression in D. Reliability as indicated by Cronbach's alpha is good in the present sample ($\alpha = .84$).

Figure 2

Single factor model of the D16.



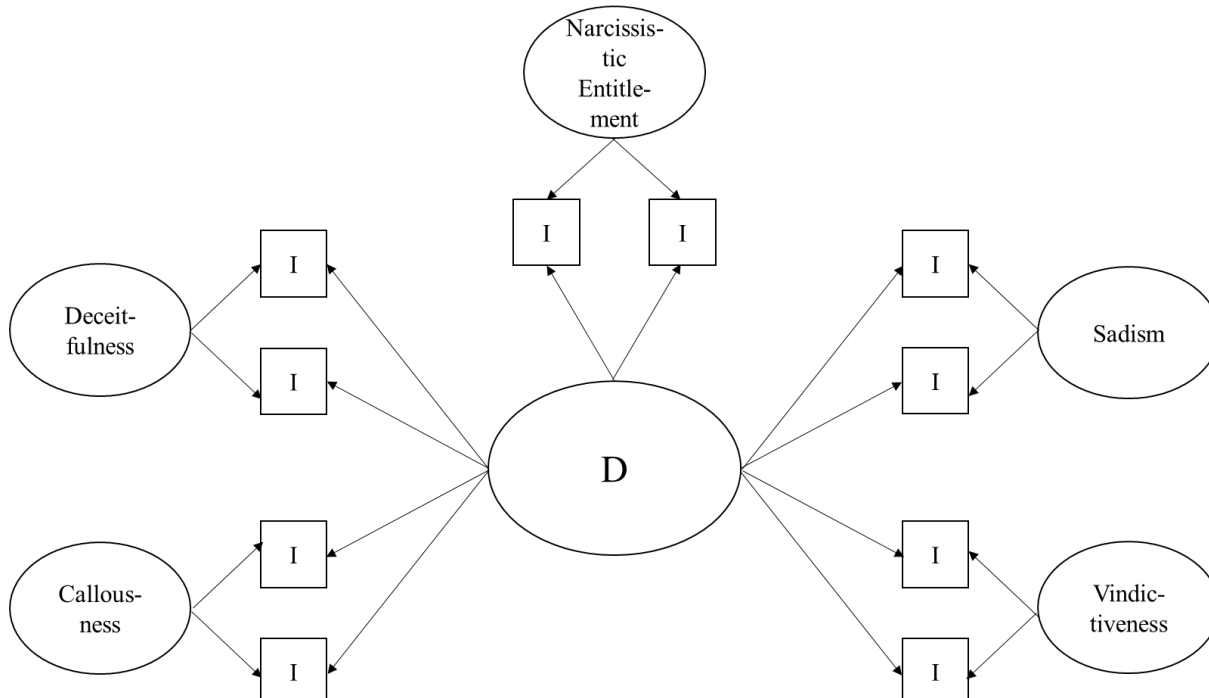
Note. This model can be applied for the D35 as well by adding the remaining 19 items. D = Dark Factor of personality; I = item.

Statistical analysis

All analyses were performed using R (R Core Team, 2021). The confirmatory factor analyses were run using the R package lavaan (Rosseel, 2012). To validate the factorial structure of the D70, two models were calculated, both including D as the general factor, one including 12 specific factors and another one including five specific factors. Both models were specified with all items loading on the general factor D and on one of the 12 specific factors/five themes. The general and the specific factors were constrained to orthogonality. The bifactor model for the D70 with 12 specific factors can be found in Figure 1, and the bifactor model with five specific factors in Figure 3. To confirm the factorial structure of the D35 and the D16, single factor models were specified. The single factor model for the D16 is displayed in Figure 2. When adding the remaining 19 items, the model displayed in Figure 2 is also applicable for the D35. In terms of construct validity, correlations were calculated for the D70 and Honesty-Humility (convergent) and for the D70 and Openness to experience (discriminant).

Figure 3

Bifactor model of the D70 with five themes as specific factors.



Note. To enhance clarity, only two items per specific factor are displayed. In total, there are 70 items. D = Dark Factor of personality; I = item.

As stated above, cases with only a few missing values were not excluded. To account for these missing values and non-normality in the data, the maximum likelihood estimation with robust (Huber-White) standard errors (*MLR*) was used during the confirmatory factor analyses. This was contrary to the pre-registration, due to considerations regarding the present incomplete data. As fit indices I considered *RMSEA*, *SRMR*, the robust comparative fit index (*CFI*) and the chi-square model test. According to well-established thresholds I regarded *RMSEA* under .05, *SRMR* under .06 and *CFI* above .90 as indices for adequate model fit (Browne & Cudeck, 1992). The explained common variance (*ECV*; Ten Berge & Socan, 2004) was calculated to estimate the strength of the general factor. The *ECV* is the ratio of the common variance explained solely by the general factor compared to the common variance explained by the general factor and the specific factors. According to well-established thresholds, correlations of $r = .01$ were considered as small, $r = .03$ as medium and $r = .05$ as large (Cohen, 1988). Furthermore, reliability of D was assessed by calculating Cronbach's alpha.

Results

Confirmatory analysis

The mean score of the Assessment of D was 1.99. The data was not normally distributed, and the variance of D was low. The relatively low variance of the total scores referring to D, as well as its general low scores are displayed in Figure 4. Means and standard deviations of all included scales are displayed in Table 1.

Table 1

Means and standard deviations for D, Honesty-Humility, and Openness to experience.

	<i>M</i>	<i>SD</i>
D	1.99	0.42
Honesty-Humility	3.58	0.61
Openness to experience	3.65	0.56

Confirmatory factor analyses

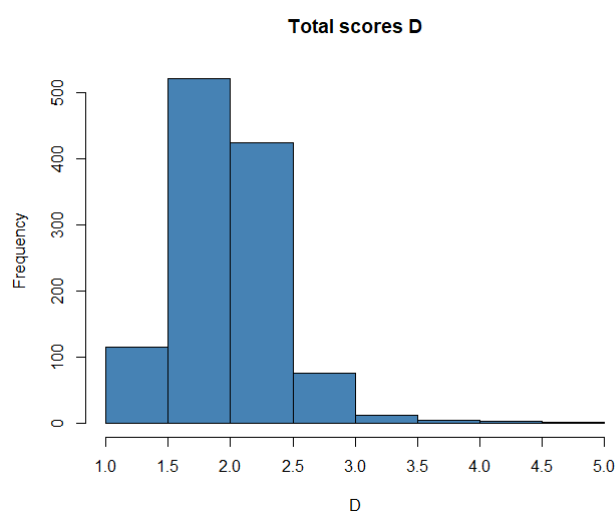
As expected, the bifactor model for the D70 with one general (D) and 12 specific factors did not converge successfully. This may be explained because some specific factors

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failed to exhibit any variance beyond D, meaning that the variance of the associated items is completely explained by D. All other specified models did converge successfully. Regarding the bifactor model for the D70 with D as the general and the five themes as specific factors, *RMSEA* and *SRMR* indicated acceptable model fit, while *CFI* indicated poor model fit ($\chi^2(2275) = 6519.079$, $p < .001$; robust *RMSEA* [90% *CI*] = 0.045 [0.044, 0.046]; *SRMR* = 0.050; robust *CFI* = 0.767). Therefore, the results do not fully support my expectation.

Figure 4

Distribution of total D scores.



Although all item loadings on D were significant, five items did not benchmark on any factor with magnitudes below .30. The mean score across all participants of the five lower loading items is by one standard deviation larger ($M = 2.49$ vs. $M = 1.99$) than the total mean score including all items. In general, item loadings on D ranged from .117 to .614 ($M = .432$, $SD = .103$). Item loadings on specific factors were lower, in absolute values ranging from .143 to .621 ($M = .210$, $SD = .145$). 18 items showed no significant loadings, and 48 item loadings did not benchmark on their respective factor (magnitudes below .30). All item loadings on D can be found in Table 2. Regarding the explained common variance, *ECVs* of D showed large values. Across all items, *ECV* of D was .78. Across the five themes, *ECVs* ranged from .59 (Narcissistic Entitlement) to .82 (Callousness).

Table 2*Item loadings on D regarding the D70.*

#	D70	#	D70	#	D70	#	D70
1	.460	19	.569	37	.407	55	.510
2	.463	20	.530	38	.475	56	.466
3	.323	21	.613	39	.357	57	.441
4	.319	22	.432	40	.583	58	.487
5	.307	23	.390	41	.521	59	.350
6	.434	24	.361	42	.592	60	.539
7	.443	25	.343	43	.486	61	.277
8	.431	26	.388	44	.551	62	.435
9	.206	27	.344	45	.361	63	.382
10	.292	28	.408	46	.467	64	.622
11	.566	29	.443	47	.117	65	.379
12	.304	30	.592	48	.461	66	.614
13	.434	31	.312	49	.393	67	.476
14	.463	32	.567	50	.561	68	.510
15	.510	33	.409	51	.373	69	.317
16	.537	34	.337	52	.389	70	.301
17	.445	35	.397	53	.292		
18	.506	36	.361	54	.509		

Note. All items exhibited significant loadings on D ($p < .005$).

The single factor model for the shorter item set D35 only showed acceptable model fit regarding *SRMR*. Model fit indicated by *RMSEA* and *CFI* was poor ($\chi^2(560) = 2270.994$, $p < .001$; robust *RMSEA* [90% *CI*] = 0.058 [0.055, 0.060]; *SRMR* = 0.052; robust *CFI* = 0.789). Therefore, my expectation could not be supported. Although all items showed significant loadings on D, two item loadings did not benchmark on D with magnitudes below .30. The loading magnitudes ranged from .257 to .638 ($M = .471$, $SD = .103$). All item loadings on D of the D35 are displayed in Table 3.

Table 3*Item loadings on D regarding the D35.*

#	D35	#	D35	#	D35	#	D35
1	.459	10	.469	19	.399	28	.538
2	.454	11	.497	20	.470	29	.475
3	.551	12	.635	21	.515	30	.304
4	.334	13	.396	22	.584	31	.501
5	.530	14	.514	23	.410	32	.257
6	.539	15	.369	24	.390	33	.616
7	.457	16	.514	25	.572	34	.270
8	.570	17	.369	26	.513	35	.581
9	.638	18	.357	27	.580		

Note. All items exhibited significant loadings on D ($p < .001$).

As well as the single factor model for the D35, the single factor model of the D16 exhibited adequate model fit regarding *SRMR*. On the other hand, *CFI* and *RMSEA* indicated poor model fit ($\chi^2(104) = 464.055$, $p < .001$; robust *RMSEA* [90% *CI*] = 0.062 [0.056, 0.067]; *SRMR* = 0.048; robust *CFI* = 0.876). Therefore, my expectation could not be supported. All items showed substantial loadings on D. The loading magnitudes ranged from .404 to .598 ($M = .502$, $SD = .055$). Item loadings on D are fully described in Table 4.

Table 4*Item loadings on D regarding the D16.*

#	D16	#	D16	#	D16	#	D16
1	.468	5	.413	9	.537	13	.470
2	.479	6	.520	10	.403	14	.597
3	.442	7	.498	11	.534	15	.494
4	.494	8	.534	12	.527	16	.586

Note. All items exhibited significant loadings on D ($p < .001$).

Correlations

Regarding the convergent validity of the D70, there was a large negative correlation between the D70 and the Honesty-Humility scale of the HEXACO-PI-R-60 (r [95% *CI*] = -.59 [-.63, -.55], $p < .001$). Therefore, my expectation regarding Honesty-Humility and D was

supported. Regarding the discriminant validity of the D70, there was a small negative correlation between the D70 and the Openness to experience scale of the HEXACO-PI-R-60 (r [95% CI] = -.21 [-.27, -.16], $p < .001$). This was surprising and therefore my expectation regarding Openness to experience and D was not supported. Correlations between the long version and the short item sets were large (D70 & D35: r [95% CI] = .97 [.97, .97], $p < .001$; D70 & D16: r [95% CI] = .92 [.91, .93], $p < .001$). Furthermore, correlations between the subscales of the D70 represented as five themes were large, underlining the common core of the dark personality traits. All correlations can be found in Table 5.

Table 5

Correlation matrix.

	D70	D35	D16	C	D	N	S	V	H-H	O
D70	1									
D35	.97	1								
D16	.92	.95	1							
C	.85	.86	.81	1						
D	.75	.70	.63	.55	1					
N	.76	.69	.62	.59	.50	1				
S	.89	.87	.86	.69	.62	.62	1			
V	.88	.87	.84	.69	.59	.54	.69	1		
H-H	-.59	-.53	-.48	-.40	-.58	-.55	-.50	-.50	1	
O	-.21	-.24	-.18	-.29	-.08	-.18	-.12	-.18	.03	1

Note. C = Callousness, D = Deceitfulness, N = Narcissistic Entitlement, S = Sadism, V = Vindictiveness, H-H = Honesty-Humility, O = Openness to experience.

Exploratory analyses

While calculating the bifactor model of the D70, some of the loadings on the specific factors were very small. Also, the *ECV* of D was relatively large with .78. The *ECV* can be an indicator of whether a model is better represented unidimensional or multidimensional. However, an *ECV* of .78 is ambiguous. It is possible to argue in favor and against a unidimensional model (Quinn, 2014; Rodriguez, 2016). Therefore, it seemed interesting to investigate, whether a bifactor model including the 12 or five specific factors fits the data best, or if a single factor model for the D70 with D as the only higher order factor would

exhibit a better model fit. Note, that this investigation was not part of the pre-registration and solely an exploratory analysis. To address this subject, a single factor model for the D70 was calculated. When adding the remaining 54 items, the single factor model of the D70 is identical to the presented model in Figure 2. Fit indices for the single factor model indicated adequate model fit regarding *SRMR*, but poor model fit regarding *RMSEA* and *CFI* ($\chi^2(2345) = 8143.177, p < .001$; robust *RMSEA* [90% *CI*] = 0.052 [0.051, 0.053]; *SRMR* = 0.055; robust *CFI* = 0.682). Model fit therefore slightly decreased, compared to the bifactor model with five specific factors. Also comparing information criteria *AIC* and *BIC* of the single factor and the bifactor model, indicated a better fit for the bifactor model. Fit indices for all models can be found in Table 6.

Table 6

Fit indices for the different proposed models.

	<i>CFI</i>	<i>RMSEA</i>	<i>SRMR</i>	<i>AIC</i>	<i>BIC</i>
D70 – bifactor	0.768	0.045	0.050	193117.125	194174.901
D35	0.789	0.058	0.052	96251.816	96605.081
D16	0.876	0.062	0.048	43227.185	43388.789
D70 – single factor	0.682	0.052	0.055	195023.080	195728.264

Discussion

The goal of the current study was to validate the factorial structure of the Assessment of D (Moshagen et al., 2020a), including the bifactorial structure of the long version and the single factorial structure of the shorter item sets. Furthermore, convergent and discriminant validity was investigated by associating the Dark Factor with Honesty-Humility and Openness to experience.

The bifactor model with the Dark Factor as general and 12 specific factors did not converge successfully. One explanation could be, that some specific factors failed to exhibit any variance beyond the Dark Factor, meaning that the variance of the associated items is completely explained by the Dark Factor. Furthermore, the present sample was rather homogenous, what could lead to lower loadings and therefore too little information to identify a model with 12 specific factors, indicating that the model must be simplified. A model with

the Dark Factor as general and five specific factors as recommended by Bader et al. (2021a) did converge successfully and showed adequate model fit, although *CFI* was poor. Therefore, the factorial structure of the D70 seems to be better represented by five, rather than 12 specific factors.

Some of the present results are well in line with existing literature. That the bifactor model with 12 specific factors did not converge successfully was also reported earlier (Moshagen et al., 2020a). Some of the present results regarding the model fit are also well in line with previous studies. *RMSEA* and *SRMR* for the bifactor model indicated adequate model fit. This is consistent with results of previous studies (Bader et al., 2021b; Moshagen et al., 2020a). Regarding the *CFI*, results differ from the literature, where adequate model fit indicated by *CFI* for the bifactor model was reported (Bader et al., 2021a). The present *CFI* indicated poor model fit. Other studies did not include *CFI* in their calculations (Bader et al., 2021b; Moshagen et al., 2020a). It is important to note, that the homogeneity of the present sample and the resulting little variance in total scores of the Dark Factor could lead to lower loadings and therefore a low *CFI*. This could explain the lower *CFI* compared to the other studies. The present findings indicated that the Dark Factor is a strong general factor, explaining 78% of the common variance across all items. The *ECV* can also function as an indicator of whether data would be better represented by a single factor or bifactor model. The Dark Factor explaining 78% of the common variance indicates that there is substantial variance beyond the Dark Factor explained by specific factors and therefore suggests that the data is better represented by a bifactor model, rather than a single factor model (Quinn, 2014; Rodriguez, 2016).

This is well in line with the results of the exploratory analysis. In the exploratory analysis, a single factor model for the D70 with all items loading solely on the Dark Factor was calculated. The model fit did not improve and overall, the bifactor model fitted the data better than the single factor model. Therefore, the fit indices as well as the *ECV* indicated that the D70 is better represented by a bifactor, than a unidimensional structure. This is well in line with the literature, where bifactor solutions outperformed single factor ones (Moshagen et al., 2020a).

As expected, correlations between the five themes were large, underlining the dependence of dark personality traits from each other and providing evidence for the existence of the Dark Factor summarizing those commonalities.

The loading patterns of the present study are well in line with existing literature, although in previous studies the items loaded stronger on the Dark Factor, as well as on the

specific factors, compared to the present study (Bader et al., 2021a; Bader et al., 2021b). This could be attributed to the homogeneity of the present sample which may have led to lower loadings. However, loadings of five items of the D70 did not benchmark on the Dark Factor. Taking a closer look on the content of the respective items, one could speculate that they are worded in a way, where most people would probably agree with the statement (e.g.: “It is not okay to spread rumors, not even to defend those you care about.” (reversed), “Someone who hurts me cannot count on my sympathy.”). In line with the former speculation that those items represent statements where most people would agree with, participants exhibited higher scores on the Dark Factor regarding those items. It seems questionable, if those five items represent the same dimension as the remaining items. It may be considered to exclude these items in a further use of the D70. Nevertheless, these results are only applicable for the present sample. Further research with other, less homogenous samples is needed to address the inclusion of the low loading items. Item loadings on specific factors were generally smaller than on the Dark Factor, with more item loadings not benchmarking on the specific factors. However, items only loading on the general factor are common in bifactor modeling and desired to simplify the identification of bifactor models (Eid et al., 2017; Zhang et al., 2021).

Regarding the shorter item sets D35 and D16, *SRMR* indicated adequate model fit. This is well in line with previous studies (Bader et al., 2021a; Bader et al., 2021b; Moshagen et al., 2020a). However, regarding *RMSEA* and *CFI* results differ from the literature, where adequate model fit indicated by *RMSEA* and *CFI* was reported. The present *RMSEA* and *CFI* indicated poor model fit. Therefore, the single factor model regarding the D35 and D16 does not seem to reflect the factorial structure of the questionnaires appropriately. This is contrary to previous studies where the factorial validity for both questionnaires was reported as good (Bader et al., 2021a; Bader et al., 2021b; Moshagen et al., 2020a). It could be, that the two shorter item sets, just like the D70, are better represented by a bifactor model, rather than single factor models. However, researchers should focus on further exploring the factorial structure of the D35 and the D16 in the future. The factor loading patterns of the D36 and the D16 are well in line with previous studies (Bader et al., 2021a; Moshagen et al., 2020a).

Regarding reliabilities, Cronbach’s alphas were excellent for the D70 and the D35 and good for the D16, indicating overall at least good internal consistencies. Furthermore, correlations between the D70 and the two short versions were large, indicating that the D35 and the D16 are good approximations of the D70. Both, correlations, and reliabilities are well in line with results from other authors (Bader et al., 2021a; Moshagen et al., 2020a).

The data showed a large negative correlation between Honesty-Humility and the Dark Factor, supporting the convergent validity of the D70. The correlation is well in line with previous large scale meta-analyses where large negative correlations between Honesty-Humility and dark personality traits represented by the Dark Triad components were reported (Muris et al., 2017; Schreiber & Marcus, 2020).

The data showed a small negative correlation between Openness to experience and the Dark Factor. This was surprising, because previous large scale meta-analyses did not report an association of dark personality traits represented by the Dark Triad components and Openness to experience, or small positive correlations of Narcissism and Openness to experience (Muris et al., 2017; Schreiber & Marcus, 2020). However, there are some studies that reported small to medium negative correlations between some of the Dark Factor defining traits like Machiavellianism, Moral Disengagement, or Psychopathy and Openness to experience (Keem et al., 2018; Nai, 2019). The previously mentioned meta-analyses focused only on the Dark Triad traits. However, the Dark Factor is a broader construct, including many different dark personality traits, beyond the three traits spanning the Dark Triad. There may not be a correlation between the Dark Triad and Openness to experience, but the present study indicates, that there may be one between the Dark Factor and Openness to experience. However, the present results indicate that the D70 may not be able to distinguish the Dark Factor from Openness to experience and therefore, the concern about the discriminant validity of the D70 remains. Further investigations considering other variables as indicator for the discriminant validity of the D70 would be interesting.

As mentioned earlier, some authors argue that the Dark Triad and low Honesty-Humility are basically the same (Hodson et al., 2018; O'Boyle et al., 2015). Although the present correlation between the Dark Factor and Honesty-Humility was large, the Dark Factor explained only 35% of the variance in Honesty-Humility. Therefore, there is a large amount of remaining variance in Honesty-Humility that lies beyond the Dark Factor that cannot be explained by dark personality traits. This is well in line with results of a previously conducted meta-analysis regarding Honesty-Humility and the Dark Triad components (Howard & Van Zandt, 2020). Furthermore, the Dark Factor contains many traits beyond the three spanning the Dark Triad. Some of the 12 included traits exhibit noteworthy differences. For example, Egoism is defined by: "the excessive concern with one's own pleasure or advantage at the expense of community well-being" (Weigel et al., 1999, p. 349), while Spitefulness is defined by "a preference that would harm another but that would also entail harm to oneself. This harm could be social, financial, physical, or an inconvenience." (Marcus et al., 2014, p. 566).

These two definitions are counterintuitive. A purely egoistic person, who is only concerned about their own well-being and gratification would rather not accept self-harm only for punishing others, what represents a key feature of Spitefulness. Those differences underscore the breadth and variety that lies within the Dark Factor. Furthermore, the data shows that the latter extends Honesty-Humility by a substantial amount. Collectively, the present results suggests that Honesty-Humility and the Dark Factor are not identical.

To summarize, the inclusion of 12 different dark personality traits is an advantage of the Dark Factor, operationalized by the D70. This allows assessing dark personality structures exhaustively, so they do not have to be reduced to three dark traits or even a single personality trait like Honesty-Humility. However, the decision which questionnaire to choose should depend on the specific research purpose and design. Low Honesty-Humility may be interpreted as a disposition for dark personality traits, if someone is interested in a general personality profile of the participants. For a more detailed assessment of dark personality traits, the use of the D70 would be more appropriate. Overall, in the present study the D70 showed adequate factorial and convergent validity, as well as good reliability. Nevertheless, the discriminant validity of the D70 seems to be questionable. Also, the shorter item sets did not reach adequate factorial validity. Further research on the factorial structure of the D35 and D16 and on the discriminant validity of the D70 would be interesting.

Limitations

Some limitations must be considered while interpreting the results. First, the D70 was used as a self-report. Response bias is always a risk in self-report studies. Furthermore, like any measure of dark personality traits, the D70 includes many statements which are socially undesirable. Therefore, people answering in a socially desirable way is a typical problem when working with self-report questionnaires containing dark personality traits. However, by ensuring confidentiality of the participant responses, effects of socially desirable responding should have been minimized.

The second limitation to mention regards the *CFI*. Although *CFI* was used in the present study as a model fit indicator, the use of *CFI* in confirmatory factor analyses remains contested. Some authors argued that *CFI* is strongly dependent on loading magnitudes and therefore not solely represents the goodness of fit (Moshagen & Auerswald, 2018). Accordingly, they did not recommend using *CFI* as a fit index for evaluating the model fit, especially not by setting a fixed cutoff. This recommendation was also already made before, where the issue of *CFI* and *RMSEA* often offering different evaluations of models was

addressed (Lai & Green, 2016). Also, some authors recommended the use of *CFI* rather for exploratory analyses, than for confirmatory analyses (where *RMSEA* should be used as a fit index) (Rigdon, 1996). Therefore, the suboptimal *CFI*-values of the present models do not necessarily indicate bad model fit and therefore bad factorial validity.

The last limitation regards the sample and the sampling procedure. Most of the participants were recruited via Facebook by advertising the questionnaire in several groups. This results in a convenience sample where only a certain kind of people were contacted and participated in the present study. Maybe, many people scoring high on the Dark Factor chose not to participate because helping a stranger with their research without getting something back does not seem to be typical for people who have stronger expressions on dark personality traits like Egoism. Furthermore, more women participated in the present study than men, which is a common phenomenon in convenience samples (Saleh & Bista, 2017). Meta-analytical evidence state that women exhibit lower scores in dark personality traits than men (e.g., Muris et al., 2017). Taken the points together, the variance of the Dark Factor in this sample may be lower than in the population, because maybe more helpful people and more women participated in the present study. However, the recruited sample was very large and did not rely on relatively young (psychology) students like many other studies on dark personality traits do. Therefore, the presented limitations restrict the present results only mildly.

Conclusion

The present study provides insight on the psychometric properties of the German version of the Assessment of D, including the full length with 70 items, as well as the shorter item sets with 35 and 16 items. Reliabilities in the present sample of all three questionnaires were good. The factorial validity as well as the convergent validity of the D70 was adequate, while the discriminant validity of the D70 regarding Openness to experience seems to be questionable. The two shorter item sets did not reach acceptable factorial validity and further research should focus on exploring the factorial structure of the D35 and the D16.

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Appendix

Abstract (English)

The present study focused on psychometric qualities of the German version of a newly introduced questionnaire to measure dark personality traits, the Assessment of D (D70, D35, D16). Therefore, a large German speaking sample ($N = 1,157$, 80% w, mean age = 34.11 years) completed the Assessment of D, as well as the HEXACO-PI-R-60 scales Honesty-Humility (convergent validity) and Openness to experience (discriminant validity). Factorial validity of the three versions of the Assessment of D, as well as convergent and discriminant validity were investigated. Therefore, a bifactor model for the D70, as well as single factor models for all three versions were tested. The D70 bifactor model was the best fitting model and showed adequate factorial, as well as convergent validity, while the discriminant validity was questionable. The shorter item sets failed to exhibit adequate factorial validity. This was contrary to previously conducted studies. Further research on the factorial structure of the shorter item sets is necessary. The results indicate that the German version of the complete Assessment of D is a well validated questionnaire, that may be used in further research.

Abstract (German)

Die vorliegende Studie untersucht die psychometrische Qualität eines neuen Fragebogens zur Erhebung dunkler Persönlichkeitseigenschaften, der deutschen Version des Assessment of D (D70, D35, D16). Zu diesem Zweck füllte eine große, deutschsprachige Stichprobe ($N = 1157$, 80% w, Durchschnittsalter = 34,11 Jahre) das Assessment of D, sowie einen Teil des HEXACO-PI-R-60 (Skalen Honesty-Humility und Openness to experience) aus. Hinsichtlich der Konstruktvalidität des D70 wurde Honesty-Humility als Indikator konvergenter Validität und Openness to experience als Indikator diskriminanter Validität verwendet. Weiters wurde die faktorielle Validität der drei Fragebögen untersucht. Dazu wurde ein zweifaktorielles Modell für den D70, sowie einfaktorielle Modelle für alle drei Versionen getestet. Das zweifaktorielle Modell des D70 zeigte die beste Passung zu den Daten. Der D70 weist demnach eine angemessene faktorielle Validität auf. Auch die konvergente Validität des D70 war angemessen, wobei die diskriminante Validität fraglich war. Die kürzeren Versionen zeigten keine angemessene faktorielle Validität. Dies ist konträr zu bisher publizierten Studien. Weitere Untersuchungen zur faktoriellen Struktur des D35 und D16 scheinen notwendig. Zusammenfassend deuten die Ergebnisse darauf hin, dass es sich bei der deutschsprachigen Langversion des Assessment of D um einen gut validierten Fragebogen handelt, der in zukünftiger Forschung eingesetzt werden kann.

R Code

```
##load packages
library(car)
library(corr)
library(data.table)
library(DescTools)
library(effsize)
library(here)
library(Hmisc)
library(psych)
library(QuantPsyc)
library(tidyverse)
library(readxl)
library(haven)
library(dplyr)
library(sjPlot)
library(lavaan)
library(BifactorIndicesCalculator)

##read in data
data<-read_spss(file.choose())

dt<-as.data.table(data)

##remove impossible data
data1<-dt[TIME_SUM > 299]

##all variables as numeric
data_num<-data1%>% mutate_all(as.numeric)

##reverse items
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

#HEXACO Honesty-Humility

```
data_num$HH_02 = car::recode(data_num$HH_02, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HH_04 = car::recode(data_num$HH_04, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HH_05 = car::recode(data_num$HH_05, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HH_07 = car::recode(data_num$HH_07, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HH_08 = car::recode(data_num$HH_08, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HH_10 = car::recode(data_num$HH_10, '1=5; 2=4; 3=3; 4=2; 5=1')
```

#HEXACO Openness

```
data_num$HO_01 = car::recode(data_num$HO_01, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HO_04 = car::recode(data_num$HO_04, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HO_06 = car::recode(data_num$HO_06, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HO_09 = car::recode(data_num$HO_09, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$HO_10 = car::recode(data_num$HO_10, '1=5; 2=4; 3=3; 4=2; 5=1')
```

#Assessment of D

```
data_num$D_C_01r = car::recode(data_num$D_C_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_E_01r = car::recode(data_num$D_E_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_M_01r = car::recode(data_num$D_M_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_N_01r = car::recode(data_num$D_N_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_PE_01r = car::recode(data_num$D_PE_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_MD_01r = car::recode(data_num$D_MD_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_Sp_01r = car::recode(data_num$D_Sp_01r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_F_02r = car::recode(data_num$D_F_02r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_N_02r = car::recode(data_num$D_N_02r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_02r = car::recode(data_num$D_S_02r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_M_03r = car::recode(data_num$D_M_03r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_PE_02r = car::recode(data_num$D_PE_02r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_MD_02r = car::recode(data_num$D_MD_02r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_M_04r = car::recode(data_num$D_M_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_P_04r = car::recode(data_num$D_P_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_04r = car::recode(data_num$D_S_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_C_05r = car::recode(data_num$D_C_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_F_04r = car::recode(data_num$D_F_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```

data_num$D_M_05r = car::recode(data_num$D_M_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_P_05r = car::recode(data_num$D_P_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_PE_03r = car::recode(data_num$D_PE_03r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_05r = car::recode(data_num$D_S_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_C_06r = car::recode(data_num$D_C_06r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_E_04r = car::recode(data_num$D_E_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_N_05r = car::recode(data_num$D_N_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_P_06r = car::recode(data_num$D_P_06r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_06r = car::recode(data_num$D_S_06r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_SC_03r = car::recode(data_num$D_SC_03r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_G_04r = car::recode(data_num$D_G_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_N_06r = car::recode(data_num$D_N_06r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_PE_05r = car::recode(data_num$D_PE_05r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_07r = car::recode(data_num$D_S_07r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_SC_04r = car::recode(data_num$D_SC_04r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_Sp_06r = car::recode(data_num$D_Sp_06r, '1=5; 2=4; 3=3; 4=2; 5=1')
data_num$D_S_08r = car::recode(data_num$D_S_08r, '1=5; 2=4; 3=3; 4=2; 5=1')

```

```
##calculate total scores
```

```

data_num$HH_total <- rowMeans(subset(data_num, select = c(HH_01, HH_02, HH_03,
HH_04, HH_05, HH_06, HH_07, HH_08, HH_09, HH_10)), na.rm = TRUE)
data_num$HO_total <- rowMeans(subset(data_num, select = c(HO_01, HO_02, HO_03,
HO_04, HO_05, HO_06, HO_07, HO_08, HO_09, HO_10)), na.rm = TRUE)
data_num$D_total <- rowMeans(subset(data_num, select = c(D_C_01r, D_E_01r, D_F_01,
D_M_01r, D_N_01r, D_P_01, D_PE_01r, D_S_01, D_MD_01r, D_Sp_01r,
D_C_02, D_F_02r, D_G_01, D_M_02, D_N_02r,
D_P_02, D_S_02r, D_Sp_02, D_C_03, D_E_02, D_F_03,
D_G_02, D_M_03r, D_P_03, D_PE_02r, D_S_03,
D_MD_02r, D_SC_01, D_Sp_03, D_C_04, D_M_04r,
D_N_03, D_P_04r, D_S_04r, D_C_05r, D_E_03,
D_F_04r, D_M_05r, D_N_04, D_P_05r, D_PE_03r,
D_S_05r, D_MD_03, D_SC_02, D_Sp_04, D_C_06r,
D_E_04r, D_F_05, D_G_03, D_M_06, D_N_05r,

```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```

D_P_06r, D_PE_04, D_S_06r, D_MD_04, D_SC_03r,
D_Sp_05, D_C_07, D_E_05, D_F_06, D_G_04r,
D_M_07, D_N_06r, D_P_07, D_PE_05r, D_S_07r,
D_MD_05, D_SC_04r, D_Sp_06r, D_S_08r)), na.rm = TRUE)
data_num$D35_total<-rowMeans(subset(data_num, select = c(D_C_01r, D_P_01, D_E_01r,
D_Sp_02, D_M_01r, D_C_02, D_P_02, D_S_02r, D_E_02, D_S_07r, D_M_02, D_SC_04r,
D_F_03, D_P_03, D_N_02r,
D_S_04r, D_E_03, D_P_06r, D_PE_03r, D_F_05,
D_M_06, D_SC_01, D_N_05r, D_P_05r, D_MD_04, D_C_04, D_S_06r, D_M_05r,
D_PE_04, D_Sp_05,
D_G_04r, D_P_07, D_N_01r, D_C_03,
D_S_08r)),na.rm=T)
data_num$D16_total<-rowMeans(subset(data_num, select = c(D_C_01r, D_P_01, D_E_01r,
D_C_02, D_S_04r, D_MD_04, D_S_02r, D_M_06, D_SC_04r, D_P_03, D_C_04, D_F_05,
D_M_05r, D_P_05r, D_Sp_05, D_S_06r)), na.rm=T)

##Remove people with more than 7 missing items in D
data_numdf<-as.data.frame(data_num)

count_na<-function(x) sum (is.na(x))

D_cols <- colnames(data_numdf)[28:97]

data_num<- data_numdf %>%
  mutate(DNA = apply(.[D_cols], 1, count_na))

data_naremoved<-subset (data_num, DNA < 7)

##calculate total scores of D70 subscales
data_naremoved$calltotal<- rowMeans(subset(data_naremoved, select = c(D_C_01r,
D_M_01r, D_C_02, D_N_02r, D_C_03, D_SC_01, D_C_04, D_C_05r, D_M_05r, D_SC_02,
D_C_06r, D_C_07, D_PE_05r, D_SC_04r, D_Sp_06r)), na.rm=T)

```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```

data_naremoved$deceittotal<- rowMeans(subset(data_naremoved, select = c(D_E_01r,
D_F_02r, D_M_02, D_P_02, D_MD_02r, D_M_04r, D_E_03, D_MD_03, D_E_04r)),
na.rm=T)

data_naremoved$vindtotal<- rowMeans(subset(data_naremoved, select = c(D_P_01, D_E_02,
D_F_03, D_P_03, D_Sp_03, D_N_03, D_Sp_04, D_M_06, D_PE_04, D_MD_04, D_Sp_05,
D_E_05, D_F_06, D_M_07, D_P_07, D_MD_05)), na.rm = T)

data_naremoved$narcttotal<- rowMeans(subset(data_naremoved, select = c(D_N_01r,
D_PE_01r, D_G_01, D_G_02, D_M_03r, D_PE_02r, D_N_04, D_PE_03r, D_G_03,
D_G_04r, D_N_06r)), na.rm=T)

data_naremoved$sadttotal<- rowMeans(subset(data_naremoved, select = c(D_S_01,
D_MD_01r, D_Sp_01r, D_S_02r, D_Sp_02, D_S_03, D_P_04r, D_S_04r, D_F_04r,
D_P_05r, D_S_05r, D_F_05, D_N_05r, D_P_06r, D_S_06r, D_SC_03r, D_S_07r,
D_S_08r)), na.rm=T)

##descriptives
#age
mean(data_naremoved$Alter, na.rm = T)
sd(data_naremoved$Alter, na.rm = T)

#gender
H_G<-table(data_naremoved$Geschlecht, na.rm = T)
H_G_rel<-prop.table(H_G)
cbind(H_G, H_G_rel)

#nationality
H_N<-table(data_naremoved$Nationalität)
H_N_rel<-prop.table(H_N)
cbind(H_N, H_N_rel)

#educational status
H_B<-table(data_naremoved$Bildungsstatus)
H_B_rel<-prop.table(H_B)
cbind(H_B, H_B_rel)

```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
##Correlations regarding convergent, divergent validity and short item sets
```

```
corHH_D<-cor.test(data_naremoved$HH_total, data_naremoved$D_total, method =  
"pearson", use = "complete.obs")
```

```
corHH_D
```

```
corHO_D<-cor.test(data_naremoved$HO_total, data_naremoved$D_total, method =  
"pearson", use = "complete.obs")
```

```
corHO_D
```

```
cor70_35<-cor.test(data_naremoved$D_total, data_naremoved$D35_total, method =  
"pearson", use = "complete.obs")
```

```
cor70_35
```

```
cor70_16<-cor.test(data_naremoved$D_total, data_naremoved$D16_total, method =  
"pearson", use = "complete.obs")
```

```
cor70_16
```

```
##Correlations of subscales of D70
```

```
subset_cor5T<-subset(data_naremoved, select = c(D_total, D35_total, D16_total, calltotal,  
deceittotal, vindtotal, narcttotal, sadtotal, HH_total, HO_total))
```

```
cor5t_tab<-cor(subset_cor5T)
```

```
cor5t_tab
```

```
##Cronbachs Alphas
```

```
#D70
```

```
psych::alpha(subset(data_naremoved, select = c(D_C_01r, D_E_01r, D_F_01, D_M_01r,  
D_N_01r, D_P_01, D_PE_01r, D_S_01, D_MD_01r, D_Sp_01r,
```

```
          D_C_02, D_F_02r, D_G_01, D_M_02, D_N_02r, D_P_02, D_S_02r,  
D_Sp_02, D_C_03, D_E_02, D_F_03,
```

```
          D_G_02, D_M_03r, D_P_03, D_PE_02r, D_S_03, D_MD_02r,  
D_SC_01, D_Sp_03, D_C_04, D_M_04r,
```

```
          D_N_03, D_P_04r, D_S_04r, D_C_05r, D_E_03, D_F_04r, D_M_05r,  
D_N_04, D_P_05r, D_PE_03r,
```

```
          D_S_05r, D_MD_03, D_SC_02, D_Sp_04, D_C_06r, D_E_04r,  
D_F_05, D_G_03, D_M_06, D_N_05r,
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

D_P_06r, D_PE_04, D_S_06r, D_MD_04, D_SC_03r, D_Sp_05,
D_C_07, D_E_05, D_F_06, D_G_04r,

D_M_07, D_N_06r, D_P_07, D_PE_05r, D_S_07r, D_MD_05,
D_SC_04r, D_Sp_06r, D_S_08r), check.keys = F))

#D70 12 specific factors

#crudelia

psych::alpha(subset(data_naremoved, select = c(D_C_01r, D_C_02, D_C_03, D_C_04,
D_C_05r, D_C_06r, D_C_07)))

#egoism

psych::alpha(subset(data_naremoved, select = c(D_E_01r, D_E_02, D_E_03, D_E_04r,
D_E_05)))

#frustralia

psych::alpha(subset(data_naremoved, select = c(D_F_01, D_F_02r, D_F_03, D_F_04r,
D_F_05, D_F_06)))

#machiavellianism

psych::alpha(subset(data_naremoved, select = c(D_M_01r, D_M_02, D_M_03r, D_M_04r,
D_M_05r, D_M_06, D_M_07)))

#narcissism

psych::alpha(subset(data_naremoved, select = c(D_N_01r, D_N_02r, D_N_03, D_N_04,
D_N_05r, D_N_06r)))

#psychopathy

psych::alpha(subset(data_naremoved, select = c(D_P_01, D_P_02, D_P_03, D_P_04r,
D_P_05r, D_P_06r, D_P_07)))

#psychological entitlement

psych::alpha(subset(data_naremoved, select = c(D_PE_01r, D_PE_02r, D_PE_03r, D_PE_04,
D_PE_05r)))

#sadism

psych::alpha(subset(data_naremoved, select = c(D_S_01, D_S_02r, D_S_03, D_S_04r,
D_S_05r, D_S_06r, D_S_07r, D_S_08r)))

#moral disengagement

psych::alpha(subset(data_naremoved, select = c(D_MD_01r, D_MD_02r, D_MD_03,
D_MD_04, D_MD_05)))

#spitefulness

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
psych::alpha(subset(data_naremoved, select = c(D_Sp_01r, D_Sp_02, D_Sp_03, D_Sp_04,
D_Sp_05, D_Sp_06r)))
```

```
#greed
```

```
psych::alpha(subset(data_naremoved, select = c(D_G_01, D_G_02, D_G_03, D_G_04r)))
```

```
#self centeredness
```

```
psych::alpha(subset(data_naremoved, select = c(D_SC_01, D_SC_02, D_SC_03r,
D_SC_04r)))
```

```
#D70 5 themes subscales
```

```
#callousness
```

```
psych::alpha(subset(data_naremoved, select = c(D_C_01r, D_M_01r, D_C_02, D_N_02r,
D_C_03, D_SC_01, D_C_04, D_C_05r, D_M_05r, D_SC_02, D_C_06r, D_C_07,
D_PE_05r, D_SC_04r, D_Sp_06r)))
```

```
#deceitfulness
```

```
psych::alpha(subset(data_naremoved, select = c(D_E_01r, D_F_02r, D_M_02, D_P_02,
D_MD_02r, D_M_04r, D_E_03, D_MD_03, D_E_04r)))
```

```
#vindictiveness
```

```
psych::alpha(subset(data_naremoved, select = c(D_P_01, D_N_01r, D_E_02, D_F_03,
D_P_03, D_Sp_03, D_N_03, D_Sp_04, D_M_06, D_PE_04, D_MD_04, D_Sp_05, D_E_05,
D_F_06, D_M_07, D_P_07, D_MD_05)))
```

```
#narcissistic entitlement
```

```
psych::alpha(subset(data_naremoved, select = c(D_N_01r, D_PE_01r, D_G_01, D_G_02,
D_M_03r, D_PE_02r, D_N_04, D_PE_03r, D_G_03, D_G_04r, D_N_06r)))
```

```
#sadism
```

```
psych::alpha(subset(data_naremoved, select = c(D_S_01, D_MD_01r, D_Sp_01r, D_S_02r,
D_Sp_02, D_S_03, D_P_04r, D_S_04r, D_F_04r, D_P_05r, D_S_05r, D_F_05, D_N_05r,
D_P_06r, D_S_06r, D_SC_03r, D_S_07r, D_S_08r)))
```

```
#D35
```

```
psych::alpha(subset(data_naremoved, select = c(D_C_01r, D_P_01, D_E_01r, D_Sp_02,
D_M_01r, D_C_02, D_P_02, D_S_02r, D_E_02, D_S_07r, D_M_02, D_SC_04r, D_F_03,
D_P_03, D_N_02r,
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```

D_S_04r, D_E_03, D_P_06r, D_PE_03r, D_F_05, D_M_06,
D_SC_01, D_N_05r, D_P_05r, D_MD_04, D_C_04, D_S_06r, D_M_05r, D_PE_04,
D_Sp_05,
D_G_04r, D_P_07, D_N_01r, D_C_03, D_S_08r)))

```

```
#D16
```

```

psych::alpha(subset(data_naremoved, select = c(D_C_01r, D_P_01, D_E_01r, D_C_02,
D_S_04r, D_MD_04, D_S_02r, D_M_06, D_SC_04r, D_P_03, D_C_04, D_F_05, D_M_05r,
D_P_05r, D_Sp_05, D_S_06r)))

```

```
#HEXACO-HH
```

```

psych::alpha(subset(data_naremoved, select= c(HH_01, HH_02, HH_03, HH_04, HH_05,
HH_06, HH_07, HH_08, HH_09, HH_10)))

```

```
#HEXACO-O
```

```

psych::alpha(subset(data_naremoved, select = c(HO_01, HO_02, HO_03, HO_04, HO_05,
HO_06, HO_07, HO_08, HO_09, HO_10)))

```

```
##Means and standard deviations of all scales
```

```
mean(data_naremoved$D_total)
```

```
sd(data_naremoved$D_total)
```

```
mean(data_naremoved$HO_total)
```

```
sd(data_naremoved$HO_total)
```

```
mean(data_naremoved$HH_total)
```

```
sd(data_naremoved$HH_total)
```

```
##plot of D total scores
```

```

hist(data_naremoved$D_total, xaxt = "n", breaks = 10, main = "Total scores D", xlab = "D",
col = "steelblue")

```

```
axis(side = 1, at=seq(1, 5, 0.5))
```

```
##Means of low loading items
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
mean(data_naremoved$D_MD_01r, na.rm = T)
```

```
mean(data_naremoved$D_Sp_01r, na.rm = T)
```

```
mean(data_naremoved$D_E_04r, na.rm = T)
```

```
mean(data_naremoved$D_PE_04, na.rm = T)
```

```
mean(data_naremoved$D_G_04r, na.rm = T)
```

```
(2.75 + 1.76 + 2.42 + 3.65 + 1.89)/5
```

```
##CFA D70 12 factors
```

```
D_12F<-"D =~ D_C_01r + D_E_01r + D_F_01 + D_M_01r + D_N_01r + D_P_01 +
```

```
D_PE_01r + D_S_01 + D_MD_01r + D_Sp_01r +
```

```
D_C_02 + D_F_02r + D_G_01 + D_M_02 + D_N_02r + D_P_02 + D_S_02r + D_Sp_02 +
```

```
D_C_03 + D_E_02 + D_F_03 +
```

```
D_G_02 + D_M_03r + D_P_03 + D_PE_02r + D_S_03 + D_MD_02r + D_SC_01 +
```

```
D_Sp_03 + D_C_04 + D_M_04r +
```

```
D_N_03 + D_P_04r + D_S_04r + D_C_05r + D_E_03 + D_F_04r + D_M_05r + D_N_04 +
```

```
D_P_05r + D_PE_03r +
```

```
D_S_05r + D_MD_03 + D_SC_02 + D_Sp_04 + D_C_06r + D_E_04r + D_F_05 + D_G_03
```

```
+ D_M_06 + D_N_05r +
```

```
D_P_06r + D_PE_04 + D_S_06r + D_MD_04 + D_SC_03r + D_Sp_05 + D_C_07 + D_E_05
```

```
+ D_F_06 + D_G_04r +
```

```
D_M_07 + D_N_06r + D_P_07 + D_PE_05r + D_S_07r + D_MD_05 + D_SC_04r +
```

```
D_Sp_06r + D_S_08r
```

```
Crudelia =~ D_C_01r + D_C_02 + D_C_03 + D_C_04 + D_C_05r + D_C_06r + D_C_07
```

```
Egoism =~ D_E_01r + D_E_02 + D_E_03 + D_E_04r + D_E_05
```

```
Frustralia =~ D_F_01 + D_F_02r + D_F_03 + D_F_04r + D_F_05 + D_F_06
```

```
Machiavellianism =~ D_M_01r + D_M_02 + D_M_03r + D_M_04r + D_M_05r + D_M_06
```

```
+ D_M_07
```

```
Narcissism =~ D_N_01r + D_N_02r + D_N_03 + D_N_04 + D_N_05r + D_N_06r
```

```
Psychopathy =~ D_P_01 + D_P_02 + D_P_03 + D_P_04r + D_P_05r + D_P_06r + D_P_07
```

```
Psychological Entitlement =~ D_PE_01r + D_PE_02r + D_PE_03r + D_PE_04 + D_PE_05r
```

```
Sadism =~ D_S_01 + D_S_02r + D_S_03 + D_S_04r + D_S_05r + D_S_06r + D_S_07r +
```

```
D_S_08r
```

```
Moral Disengagement =~ D_MD_01r + D_MD_02r + D_MD_03 + D_MD_04 + D_MD_05
```

```
Spitefulness =~ D_Sp_01r + D_Sp_02 + D_Sp_03 + D_Sp_04 + D_Sp_05 + D_Sp_06r
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

Greed =~ D_G_01 + D_G_02 + D_G_03 + D_G_04r

Self Centeredness =~ D_SC_01 + D_SC_02 + D_SC_03r + D_SC_04r

Crudelia + Egoism + Frustralia + Machiavellianism + Narcissism + Psychopathy +
Psychological Entitlement + Sadism + Moral Disengagement + Spitefulness + Greed + Self
Centeredness ~~ 0*D

Egoism + Frustralia + Machiavellianism + Narcissism + Psychopathy + Psychological
Entitlement + Sadism + Moral Disengagement + Spitefulness + Greed + Self Centeredness ~~
0*Crudelia

Frustralia + Machiavellianism + Narcissism + Psychopathy + Psychological Entitlement +
Sadism + Moral Disengagement + Spitefulness + Greed + Self Centeredness ~~ 0*Egoism

Machiavellianism + Narcissism + Psychopathy + Psychological Entitlement + Sadism +
Moral Disengagement + Spitefulness + Greed + Self Centeredness ~~ 0*Frustralia

Narcissism + Psychopathy + Psychological Entitlement + Sadism + Moral Disengagement +
Spitefulness + Greed + Self Centeredness ~~ 0*Machiavellianism

Psychopathy + Psychological Entitlement + Sadism + Moral Disengagement + Spitefulness +
Greed + Self Centeredness ~~ 0*Narcissism

Psychological Entitlement + Sadism + Moral Disengagement + Spitefulness + Greed + Self
Centeredness ~~ 0*Psychopathy

Sadism + Moral Disengagement + Spitefulness + Greed + Self Centeredness ~~
0*Psychological Entitlement

Moral Disengagement + Spitefulness + Greed + Self Centeredness ~~ 0*Sadism

Spitefulness + Greed + Self Centeredness ~~ 0*Moral Disengagement

Greed + Self Centeredness ~~ 0*Spitefulness

Self Centeredness ~~ 0*Greed"

D12F.fit<-sem(D_12F, data = data_naremoved, estimator = "MLR")

summary(D12F.fit, stand = T, fit.measures = T)

#CFA D35

D35<-"D =~ D_C_01r + D_P_01 + D_E_01r + D_Sp_02 + D_M_01r + D_C_02 + D_P_02 +
D_S_02r + D_E_02 + D_S_07r + D_M_02 + D_SC_04r + D_F_03 + D_P_03 + D_N_02r +
D_S_04r + D_E_03 + D_P_06r + D_PE_03r + D_F_05 + D_M_06 + D_SC_01 + D_N_05r +
D_P_05r + D_MD_04 + D_C_04 + D_S_06r + D_M_05r + D_PE_04 + D_Sp_05 +
D_G_04r + D_P_07 + D_N_01r + D_C_03 + D_S_08r"

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
D35.fit<-sem(D35, data = data_naremoved, estimator = "MLR")
```

```
summary(D35.fit, stand = T, fit.measures = T)
```

```
#CFA D16
```

```
D16<- "D =~ D_C_01r + D_P_01 + D_E_01r + D_C_02 + D_S_04r + D_MD_04 + D_S_02r  
+ D_M_06 + D_SC_04r + D_P_03 + D_C_04 + D_F_05 + D_M_05r + D_P_05r + D_Sp_05  
+ D_S_06r"
```

```
D16.fit<-sem(D16, data = data_naremoved, estimator = "MLR")
```

```
summary(D16.fit, stand = T, fit.measures = T)
```

```
#CFA single factor
```

```
D_1F<- "D =~ D_C_01r + D_E_01r + D_F_01 + D_M_01r + D_N_01r + D_P_01 +  
D_PE_01r + D_S_01 + D_MD_01r + D_Sp_01r +  
D_C_02 + D_F_02r + D_G_01 + D_M_02 + D_N_02r + D_P_02 + D_S_02r + D_Sp_02 +  
D_C_03 + D_E_02 + D_F_03 +  
D_G_02 + D_M_03r + D_P_03 + D_PE_02r + D_S_03 + D_MD_02r + D_SC_01 +  
D_Sp_03 + D_C_04 + D_M_04r +  
D_N_03 + D_P_04r + D_S_04r + D_C_05r + D_E_03 + D_F_04r + D_M_05r + D_N_04 +  
D_P_05r + D_PE_03r +  
D_S_05r + D_MD_03 + D_SC_02 + D_Sp_04 + D_C_06r + D_E_04r + D_F_05 + D_G_03  
+ D_M_06 + D_N_05r +  
D_P_06r + D_PE_04 + D_S_06r + D_MD_04 + D_SC_03r + D_Sp_05 + D_C_07 + D_E_05  
+ D_F_06 + D_G_04r +  
D_M_07 + D_N_06r + D_P_07 + D_PE_05r + D_S_07r + D_MD_05 + D_SC_04r +  
D_Sp_06r + D_S_08r"
```

```
D1F.fit<-sem(D_1F, data = data_naremoved, estimator = "MLR")
```

```
summary(D1F.fit, stand = T, fit.measures = T)
```

```
##CFA of solution with five specific factors of the D70
```

```
D_5T<- "D =~ D_C_01r + D_E_01r + D_F_01 + D_M_01r + D_N_01r + D_P_01 +  
D_PE_01r + D_S_01 + D_MD_01r + D_Sp_01r +
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

$D_C_02 + D_F_02r + D_G_01 + D_M_02 + D_N_02r + D_P_02 + D_S_02r + D_Sp_02 +$
 $D_C_03 + D_E_02 + D_F_03 +$
 $D_G_02 + D_M_03r + D_P_03 + D_PE_02r + D_S_03 + D_MD_02r + D_SC_01 +$
 $D_Sp_03 + D_C_04 + D_M_04r +$
 $D_N_03 + D_P_04r + D_S_04r + D_C_05r + D_E_03 + D_F_04r + D_M_05r + D_N_04 +$
 $D_P_05r + D_PE_03r +$
 $D_S_05r + D_MD_03 + D_SC_02 + D_Sp_04 + D_C_06r + D_E_04r + D_F_05 + D_G_03$
 $+ D_M_06 + D_N_05r +$
 $D_P_06r + D_PE_04 + D_S_06r + D_MD_04 + D_SC_03r + D_Sp_05 + D_C_07 + D_E_05$
 $+ D_F_06 + D_G_04r +$
 $D_M_07 + D_N_06r + D_P_07 + D_PE_05r + D_S_07r + D_MD_05 + D_SC_04r +$
 $D_Sp_06r + D_S_08r$
 Callousness = $\sim D_C_01r + D_M_01r + D_C_02 + D_N_02r + D_C_03 + D_SC_01 +$
 $D_C_04 + D_C_05r + D_M_05r + D_SC_02 + D_C_06r + D_C_07 + D_PE_05r +$
 $D_SC_04r + D_Sp_06r$
 Deceitfulness = $\sim D_E_01r + D_F_02r + D_M_02 + D_P_02 + D_MD_02r + D_M_04r +$
 $D_E_03 + D_MD_03 + D_E_04r$
 Vindictiveness = $\sim D_P_01 + D_E_02 + D_F_03 + D_P_03 + D_Sp_03 + D_N_03 +$
 $D_Sp_04 + D_M_06 + D_PE_04 + D_MD_04 + D_Sp_05 + D_E_05 + D_F_06 + D_M_07$
 $+ D_P_07 + D_MD_05$
 Narcissistic Entitlement = $\sim D_N_01r + D_PE_01r + D_G_01 + D_G_02 + D_M_03r +$
 $D_PE_02r + D_N_04 + D_PE_03r + D_G_03 + D_G_04r + D_N_06r$
 Sadism = $\sim D_S_01 + D_MD_01r + D_Sp_01r + D_S_02r + D_Sp_02 + D_S_03 + D_P_04r$
 $+ D_S_04r + D_F_04r + D_P_05r + D_S_05r + D_F_05 + D_N_05r + D_P_06r + D_S_06r +$
 $D_SC_03r + D_S_07r + D_S_08r$
 Callousness + Deceitfulness + Vindictiveness + Narcissistic Entitlement + Sadism $\sim 0 * D$
 Deceitfulness + Vindictiveness + Narcissistic Entitlement + Sadism $\sim 0 * Callousness$
 Vindictiveness + Narcissistic Entitlement + Sadism $\sim 0 * Deceitfulness$
 Narcissistic Entitlement + Sadism $\sim 0 * Vindictiveness$
 Sadism $\sim 0 * Narcissistic Entitlement$

```

D5T.fit<-sem(D_5T, data = data_naremoved, estimator = "MLR")
summary(D5T.fit, stand = T, fit.measures = T)

```

```
##Explained common variance D70
```

```
Dcal<-c("D_C_01r", "D_M_01r", "D_C_02", "D_N_02r", "D_C_03", "D_SC_01",
"D_C_04", "D_C_05r", "D_M_05r", "D_SC_02", "D_C_06r", "D_C_07", "D_PE_05r",
"_SC_04r", "D_Sp_06r")
Ddec<-c("D_E_01r", "D_F_02r", "D_M_02", "D_P_02", "D_MD_02r", "D_M_04r",
"D_E_03", "D_MD_03", "D_E_04r")
Dvin<-c("D_P_01", "D_N_01r", "D_E_02", "D_F_03", "D_P_03", "D_Sp_03", "D_N_03",
"D_Sp_04", "D_M_06", "D_PE_04", "D_MD_04", "D_Sp_05", "D_E_05", "D_F_06",
"D_M_07", "D_P_07", "D_MD_05")
Dnar<-c("D_N_01r", "D_PE_01r", "D_G_01", "D_G_02", "D_M_03r", "D_PE_02r",
"D_N_04", "D_PE_03r", "D_G_03", "D_G_04r", "D_N_06r")
Dsad<-c("D_S_01", "D_MD_01r", "D_Sp_01r", "D_S_02r", "D_Sp_02", "D_S_03",
"D_P_04r", "D_S_04r", "D_F_04r", "D_P_05r", "D_S_05r", "D_F_05", "D_N_05r",
"D_P_06r", "D_S_06r", "D_SC_03r", "D_S_07r", "D_S_08r")
```

```
est <- parameterestimates(D5T.fit, standardized = T)
```

```
#loadings on D
```

```
lg.all <- est[est$op=='~' & est$lhs=='D' , 'std.all']
lg.cal <- est[est$op=='~' & est$lhs=='D' & est$rhs %in% Dcal, 'std.all']
lg.dec <- est[est$op=='~' & est$lhs=='D' & est$rhs %in% Ddec, 'std.all']
lg.nar <- est[est$op=='~' & est$lhs=='D' & est$rhs %in% Dnar, 'std.all']
lg.sad <- est[est$op=='~' & est$lhs=='D' & est$rhs %in% Dsad, 'std.all']
lg.vin <- est[est$op=='~' & est$lhs=='D' & est$rhs %in% Dvin, 'std.all']
```

```
#loadings on themes
```

```
ls.all <- est[est$op=='~' & est$lhs %in% c('Callousness', 'Deceitfulness', 'Narcissistic
Entitlement', 'Sadism', 'Vindictiveness') , 'std.all']
ls.cal <- est[est$op=='~' & est$lhs=='Callousness' & est$rhs %in% Dcal, 'std.all']
ls.dec <- est[est$op=='~' & est$lhs=='Deceitfulness' & est$rhs %in% Ddec, 'std.all']
ls.nar <- est[est$op=='~' & est$lhs=='Narcissistic Entitlement' & est$rhs %in% Dnar,
'std.all']
ls.sad <- est[est$op=='~' & est$lhs=='Sadism' & est$rhs %in% Dsad, 'std.all']
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
ls.vin <- est[est$op=='~' & est$lhs=='Vindictiveness' & est$rhs %in% Dvin, 'std.all']
```

```
#ecv
```

```
ecv.all <- sum(lg.all^2) / (sum(lg.all^2)+sum(ls.all^2)) # across all items
```

```
ecv.cal <- sum(lg.cal^2) / (sum(lg.cal^2)+sum(ls.cal^2)) # callousness
```

```
ecv.dec <- sum(lg.dec^2) / (sum(lg.dec^2)+sum(ls.dec^2)) # deceitfulness
```

```
ecv.nar <- sum(lg.nar^2) / (sum(lg.nar^2)+sum(ls.nar^2)) # narc. entitlement
```

```
ecv.sad <- sum(lg.sad^2) / (sum(lg.sad^2)+sum(ls.sad^2)) # sadism
```

```
ecv.vin <- sum(lg.vin^2) / (sum(lg.vin^2)+sum(ls.vin^2)) # vindictiveness
```

```
ecv <- c(ecv.all, ecv.cal, ecv.dec, ecv.nar, ecv.sad, ecv.vin)
```

```
names(ecv) <- c('ecv.all', 'ecv.cal', 'ecv.dec', 'ecv.nar', 'ecv.sad', 'ecv.vin')
```

```
round(ecv, 4)
```

```
#ls.nar doesn't work -> calculating it here
```

```
ecv.nar<-sum(lg.nar^2)/(sum(lg.nar^2) + (0.0441229628^2 + (-0.1425982331)^2 +
```

```
0.6209502552^2 + 0.4390799174^2 + 0.1284010641^2 + 0.0071219046^2 +
```

```
0.2128434876^2 +
```

```
(-0.0855694285)^2 + 0.6836818077^2 + 0.1423563156^2 +
```

```
0.1615272251^2))
```

```
mean(lg.all)
```

```
sd(lg.all)
```

```
mean(ls.all)
```

```
sd(ls.all)
```

```
##means of D35 and D16 loadings
```

```
LadungenD35<-c(0.482, 0.454, 0.551, 0.334, 0.530, 0.539, 0.457, 0.570, 0.638, 0.469,  
0.497, 0.635, 0.396, 0.514, 0.369, 0.514, 0.369, 0.357, 0.399, 0.470, 0.515, 0.584, 0.410,  
0.390, 0.572, 0.513, 0.580, 0.538, 0.475, 0.304, 0.501, 0.257, 0.616, 0.270, 0.581, 0.332)
```

```
mean(LadungenD35)
```

```
sd(LadungenD35)
```

PSYCHOMETRIC PROPERTIES OF THE ASSESSMENT OF D

```
LadungenD16<-c(0.480, 0.442, 0.494, 0.414, 0.520, 0.498, 0.535, 0.537, 0.404, 0.533, 0.527,  
0.471, 0.598, 0.493, 0.586)
```

```
mean(LadungenD16)
```

```
sd(LadungenD16)
```