Research Article

Theoretical models of Short Dark Tetrad (SD4) and its relationship with socially desirable responding: Findings on the Croatian version

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ABSTRACT

The interest in the so-called dark traits in the area of individual differences is rising, and there are several instruments assessing currently the most prominent dark traits constellation, the Dark Tetrad. The first aim of this study was to examine the structure of the newly developed Short Dark Tetrad (SD4) measure in the Croatian context using latent variable modeling and testing two competing models: the confirmatory factor analytic model with four interrelated factors where items load only on their respective trait or factor, and the bifactor model with both the general "dark" factor where all the items load on and four specific orthogonal factors on which only their respective items load. The second aim of this study was to investigate the relationship between the Dark Tetrad traits and egoistic and moralistic socially desirable responding. Data were collected on a convenience sample of 439 participants (81% female) in Croatia. The results showed that, although some of the fit statistics of both tested models fell somewhat below the conventional acceptable fit threshold, their values were comparable to those from the original validation study, indicating that the Croatian version of SD4 is valid and can be used to assess the Dark Tetrad traits. Moreover, relations between the Dark Tetrad traits and egoistic and moralistic socially desirable responding point to the distinctiveness of narcissism from the rest of the Dark Tetrad.

Keywords: Dark Tetrad, structural models, socially desirable responding

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Introduction

After the introduction of the Dark Triad of personality (Paulhus & Willaims, 2002), the popularity of the dark traits in the area of individual differences has been exponentially rising. The Dark Triad consists of three distinct, but conceptually and empirically overlapping traits: Machiavellianism, narcissism, and psychopathy, and relatively recently, sadism was added to this constellation, forming the Dark Tetrad (Paulhus, 2014). These traits are socially offensive and aversive, but still within the normal or everyday range. Considering their relationship with basic personality traits, the most notable are negative relationships with agreeableness (e.g., Muris et al., 2017) and honesty-humility (e.g., Međedović & Petrović, 2015). Moreover, although overlapping, each Dark Tetrad trait has its distinguishing features. The key features of Machiavellianism are callousness and manipulation, of narcissism grandiosity and attention craving, of psychopathy impulsivity, and callous thrill-seeking, while enjoyment of cruelty is a distinctive feature of sadism (Paulhus, 2014). Although there are several instruments depicting each of the dark traits (see Dinić et al., 2020; Furnham et al., 2013), the most promising instrument capturing the Dark Tetrad traits seems to be the newly developed Short Dark Tetrad (SD4; Paulhus et al., 2020). As the Croatian version of this instrument was not previously evaluated, the question of the viability of the theoretical structure of this version arises. Moreover, as the common features of dark traits reflect socially aversive character prone to manipulative behavior (see Furnham et al., 2013; Paulhus, 2014), another interesting question is the relationship between the Dark Tetrad traits (as captured by SD4) and socially desirable responding.

Previous research demonstrated that SD4 has a good construct validity and is valid for the assessment of the Dark Tetrad traits in different cultural contexts (see Blötner, Ziegler, et al., 2022; Pechorro et al., 2022), and that the factor structure of SD4 can be meaningfully compared between cultures (Blötner et al., 2022). Thus, the aim of this study was to further examine the structure of the SD4 instrument in the Croatian context using

latent variable modeling. We opted to test the two competing theoretical models from the literature on the measures of the Dark Triad (e.g., Chiorri et al., 2019; Dinić et al., 2018; Persson et al., 2019), which were also previously tested in modeling SD4 (see Neumann et al., 2021). The first model was the confirmatory factor analytic (CFA) model in which four dark traits are defined as correlated, but distinct factors. In other words, this model included four interrelated factors where items loaded only on their respective trait or factor. The second one was the bifactor model, in which each item loads on its respective trait or factor, but also on a general factor, with all factors being orthogonal, thus allowing insight into the extent to which items are influenced by one common factor compared to the extent to which they are influenced by specific factors (Riese et al., 2010). In the context of the Dark Tetrad, this model included the general "dark" factor on which all the items loaded and four specific orthogonal factors on which only their respective items loaded (Figure 1).
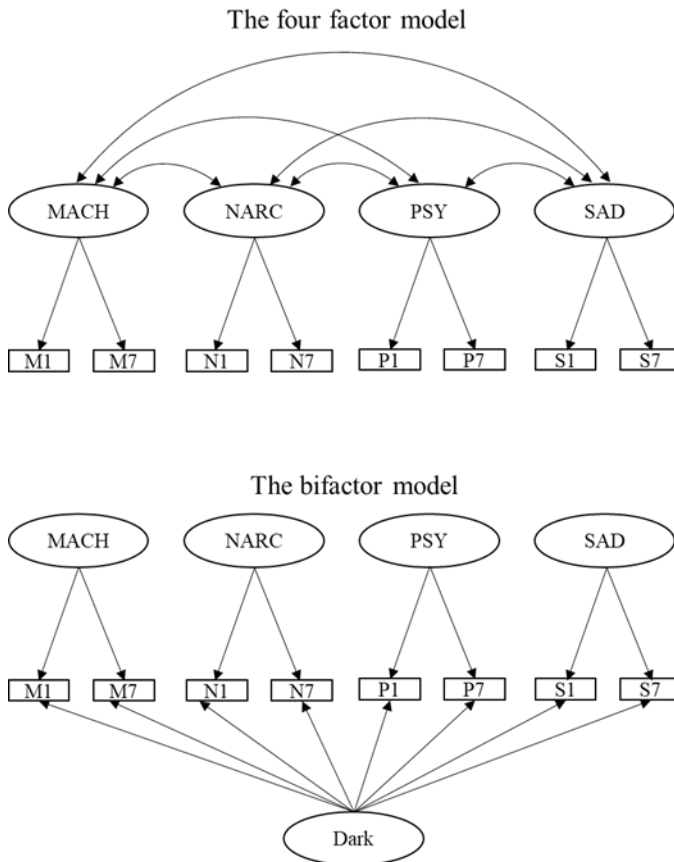
Figure 1. Two Tested Theoretical Models of the Dark Tetrad (Simplified Versions)
Note. MACH = Machiavellianism; NAR = narcissism; PSY = psychopathy; SAD = sadism.

Furthermore, given that the Dark Tetrad traits are socially aversive and characterized by manipulativeness, the second aim of this study was to investigate the relationship between the socially desirable responding and Dark Tetrad traits captured by SD4. Socially desirable responding can be defined as a tendency of giving overly positive self-descriptions (e.g., Paulhus, 2002), and whilst most conceptualizations consider it as a unidimensional construct, there is also evidence of its more complex structure (Holden & Passey, 2009). When it comes to the conceptualization of social desirability

as a unidimensional construct and its relationship with the Dark Triad traits, the results of previous research are inconsistent, and partly depend on the measure of dark traits. For example, some studies using full measures of each of the Dark Triad traits showed contradictory results for the relationship between narcissism and socially desirable responding, but more consistent results for Machiavellianism and psychopathy, indicating a negative relationship (Kowalski et al., 2016; 2018). Another study using two different short measures of the Dark Triad traits showed a consistent positive relationship between socially desirable responding and Machiavellianism, but inconsistent results for narcissism and psychopathy (Pineda et al., 2020). More specifically, socially desirable responding was positively related to psychopathy captured exclusively by Short Dark Triad (SD3; Jones & Paulhus, 2014), and narcissism captured exclusively by Dirty Dozen (DD; Jonason & Webster, 2010).

Paulhus (1984) proposed a two-component model of socially desirable responding, which includes self-deception and impression management. While self-deception is characterized by a person's belief in his or her positive self-report, impression management is characterized by deliberate positivity in self-reports. Research on the relationship between these two components of socially desirable responding and the Dark Triad traits (i.e., Gamache et al., 2018; Savard et al., 2017) primarily shows that the Dark Triad traits are not related to self-deception (with the exception of DD psychopathy; Gamache et al., 2018), and are negatively related to impression management, with the relationship being lowest in case of narcissism. Research including the Dark Tetrad traits also indicated they have a stronger negative relationship with impression management than with self-enhancement, except for narcissism which is positively related to self-enhancement (Womick et al., 2019).

In his later work, Paulhus (2002) proposed a new model according to which socially desirable responding can be classified by the levels of consciousness (i.e., conscious-unconscious) and content of self-presentation (i.e., egoistic-moralistic). More specifically, unconscious self-enhancement refers to positively biased self-descriptions that one believes to be true, while

conscious impression management represents a deliberate attempt to create a favorable self-image, depending on the characteristics of the situation. Regarding the content, egoistic bias manifests as a tendency of exaggerating social and intellectual competencies, and moralistic bias manifests as overemphasizing moral qualities and respect for social rules (Paulhus & John, 1998). Previous studies investigating relations between egoistic and moralistic socially desirable responding and basic personality traits indicated that egoistic socially desirable responding is more related to agentic traits, such as openness to experience/intellect and extraversion, while moralistic socially desirable responding is more related to communal traits, such as conscientiousness and agreeableness (e.g., Parmač Kovačić et al., 2014; Paulhus, 2002). Since previously described research indicated the stronger relationship of dark traits with deliberate impression management, or self-presentation, which can be conceptualized as egoistic and moralistic (Paulhus, 2002), the question of the relationship between dark traits and these two types of socially desirable responding arises. To the best of our knowledge, the relationship between these two types of socially desirable responding and the Dark Tetrad traits has not yet been examined.

Given that previous research comparing different models in diverse cultural contexts showed mixed findings on the specific model which fits the data the best (e.g., Neumann et al., 2021; Pechorro et al., 2022), we approached this research question as exploratory. In line with narcissistic grandiosity and specific characteristics of the other three Dark Tetrad traits (Paulhus, 2014), as well as the previous findings on the relationship of egoistic and moralistic socially desirable responding and basic personality traits (e.g., Parmač Kovačić et al., 2014; Paulhus, 2002) and relationship of the Dark Triad with basic personality traits (i.e., negative relationship of all three Dark Triad traits to agreeableness, negative relationship of psychopathy and Machiavellianism to conscientiousness, and positive relationship of narcissism and openness; Muris et al., 2017), we expected that narcissism would be primarily positively related to egoistic socially desirable responding, while psychopathy, Machiavellianism, and sadism (which, captured by SD4, is strongly correlated to and has a quite similar nomological network as psychopathy; Blötner,

Ziegler, et al., 2022) would be primarily negatively related to moralistic socially desirable responding. In sum, the present study aimed at testing the structure of SD4 using two latent variable models (i.e., four factor and bifactor model), and examining the Dark Tetrad traits' relations with two types of socially desirable responding (i.e., moralistic and egoistic).

Method

Participants and procedure

Data were collected online, on a convenience sample of a total of 439 participants (81 male; age range: 18-64, M_{age} = 25.42, SD_{age} = 7.94) in Croatia. Data were collected online, using the 1KA platform (https://www.1ka.si/), and by sharing the questionnaire link through personal contacts and social networks. Thus, a convenient sample of participants was obtained, and collected by a non-probabilistic sampling method. All the aspects of the study were approved by the institutional Ethical Board (Protocol No. 11-73/21-1199).

At the beginning of the questionnaire, the goal and purpose of the research were explained to the participants. Data confidentiality and anonymization were guaranteed. It was pointed out that by agreeing to fill out the questionnaire, they confirm their voluntary participation, and they are aged ≥18. In the first part of the questionnaire, socio-demographic data related to age and gender were collected from the participants. Then the participants expressed a degree of (non)agreement with the statements from the measures described in the next section. Participants had the option of skipping the questions they did not want to answer, and the option of withdrawing from the questionnaire without data recording and any consequences. Due to this, the number of participants that completed the SD4 was 439, while it was somewhat lower for socially desirable responding. At the end of the questionnaire, the participants were thanked for their participation, and the researcher's contact information for the participants' inquiries was indicated.

Measures

Short Dark Tetrad (Paulhus et al., 2020)

Short Dark Tetrad (Paulhus et al., 2020) measures dark traits with seven items per trait, with a response scale ranging from 1 (*not at all*) to 5 (*very much*). Two researchers independently translated the SD4 items from English to Croatian, reaching a consensus for the translations in cases of disagreement. Croatian translation of the scale is shown in Appendix A. Reliabilities in this study, measured by Cronbach's alpha were Machiavellianism = .68, narcissism = .73, psychopathy = .77, sadism = .74.

Social Desirability Scale (Parmač Kovačić et al., 2014)

Social Desirability Scale (Parmač Kovačić et al., 2014) consists of two subscales: egoistic and moralistic socially desirable responding (10 items per subscale) with a response scale ranging from 1 (*completely false*) to 7 (*completely true*). In line with the recommended scoring procedure (Paulhus 2002), only responses of 6 and 7 on positively oriented or 1 and 2 on negatively oriented items were counted as socially desirable. Reliability in this study, measured by Cronbach's alpha were .72 and .69 for egoistic and moralistic socially desirable responding, respectively.

Data analytic approach

Latent variable modeling was conducted in lavaan package, version 0.6-9 (Rosseel, 2012) in the R statistical environment (R Core Team, 2021), using robust weighted least squares estimation (weighted least square mean and variance adjusted; WLSMV estimator, where manifest variables were treated as categorical using ordered argument), and variances of all factors were fixed to 1. Model fit was assessed using the following indexes and guidelines: Tucker-Lewis index (TLI) and the comparative fit index (CLI) with values close to .95 indicating acceptable model fit, standardized root mean square residual (SRMR) with a value close to .08 and root mean square error of approximation (RMSEA) with a value close to .06 indicating acceptable model fit (Hu & Bentler, 1999), bearing in mind that these are only rough guidelines that may

be hard to reach in practice (Marsh et al., 2004). Since χ^2 difference test, like model χ^2, is sensitive to sample size, the differences in CFI < .01 and in RMSEA < .015 were treated as indicators of non-difference between the models (Chen, 2007).

The relationship between dark traits and socially desirable responding was examined at the level of bivariate relationships, but also by means of multiple regression analyses with two types of social desirability as criteria, and dark traits as predictors. Since dark traits were expected to be intercorrelated, multiple regression was conducted in order to examine their independent predictive contribution to socially desirable responding (Furnham et al., 2013). Prior to regression analyses, normal q-q plots of standardized residuals were examined and they did not indicate deviations of residual errors from normality.

Results

The structure of SD4

Means, standard deviations, and intercorrelations between SD4 items are shown in Appendix B. The bifactor model had somewhat better fit indices values (*RMSEA* = .06, *SRMR* = .07, *CFI* = .90, *TLI* = .88) than four factor model (*RMSEA* = .07, *SRMR* = .08, *CFI* = .85, *TLI* = .83). Considering acceptable model fit guidelines (Hu & Bentler, 1999), in the case of four factor model, only SRMR value indicated acceptable fit, although RMSEA was relatively close to be acceptable, while in case of bifactor model both SRMR and RMSEA values indicated acceptable model fit. However, considering the differences in *CFI* < .01 and in *RMSEA* < .015 as criteria for model comparison (Chen, 2007), it can be concluded that the four-factor model fitted the data equally well as the bifactor model. The latent correlation between the dark traits in the four-factor model was smallest in the case of narcissism and sadism, and largest in the case of psychopathy and sadism (Table 1).

Table 1

Latent Factor Intercorrelations Between the Dark Tetrad Traits in Four factor Model

Factor (trait)	1	2	3	4
1. Machiavellianism	-			
2. Narcissism	.35	-		
3. Psychopathy	.30	.46	-	
4. Sadism	.35	.25	.60	-

Note. All coefficients are significant at *p* < .001.

Loadings for each of the tested models are shown in Table 2. All factor loadings in four factor model were greater than .30, and most of them were greater than .50. In the bifactor model, factor loadings for the Machiavellianism and narcissism items were generally stronger in case of their respective factor compared to the general factor, while some psychopathy and sadism items loaded on general factor to a greater degree than on their respective factor.

Table 2

Standardized Factor Loadings for Each of the Tested Models

Short Dark Tetrad (SD4) dimensions and respective items	Four factor model	Bifactor model	
		Specific	General
Machiavellianism			
It's not wise to let people know your secrets.	.35	.42	.11
Whatever it takes, you must get the important people on your side.	.64	.50	.35
Avoid direct conflict with others because they may be useful in the future.	.51	.60	.15
Keep a low profile if you want to get your way.	.61	.55	.31
Manipulating the situation takes planning.	.32	.38	*.08*
Flattery is a good way to get people on your side.	.52	.46	.28
I love it when a tricky plan succeeds.	.70	.39	<u>**.43**</u>

Narcissism

People see me as a natural leader.	**.69**	**.59**	**.37**
I have a unique talent for persuading people.	**.70**	**.50**	**.44**
Group activities tend to be dull without me.	**.61**	**.40**	**.39**
I know that I am special because people keep telling me so.	**.63**	**.49**	**.36**
I have some exceptional qualities.	**.57**	**.72**	.12
I'm likely to become a future star in some area.	**.62**	**.69**	.21
I like to show off every now and then.	**.34**	.13	<u>**.30**</u>

Psychopathy

People often say I'm out of control.	**.71**	**.44**	<u>**.57**</u>
I tend to fight against authorities and their rules.	**.60**	.29	<u>**.50**</u>
I've been in more fights than most people of my age and gender.	**.66**	**.36**	<u>**.54**</u>
I tend to dive in, then ask questions later.	**.54**	**.47**	**.39**
I've been in trouble with the law.	**.66**	**.59**	**.45**
I sometimes get into dangerous situations.	**.73**	**.55**	**.54**
People who mess with me always regret it.	**.66**	*-.04*	<u>**.71**</u>

Sadism

Watching a fist-fight excites me.	**.88**	**.66**	**.57**
I really enjoy violent films and video games.	**.74**	**.78**	**.35**
It's funny when idiots fall flat on their face.	**.64**	**.47**	**.44**
I enjoy watching violent sports.	**.79**	**.73**	**.42**
Some people deserve to suffer.	**.57**	.19	<u>**.49**</u>
Just for kicks, I've said mean things on social media.	**.43**	*.15*	<u>**.38**</u>
I know how to hurt someone with words alone.	**.62**	.13	<u>**.58**</u>

Note. Loadings greater than .30 are typed in bold, and loadings not significant at $p <$ .05 are typed in italics. In the case of the bifactor model, loadings that were greater in the case of general compared to specific factors are underlined.

Although both tested models fitted the data equally well, it should be kept in mind that substantial, or non-trivial loadings of all items on general and specified specific factors would imply the validity of the bifactor model (Riese et al. 2010; Watts et al., 2019). Since that was not the case here, for further analyses we opted to include the originally proposed four correlated

factors model. An additional reason for choosing four factor model was following the recommendation that it might be best for uncovering how etiological factors are linked to the expression of each dark domain (Neumann et al., 2021) and with the intention to facilitate the interpretability and comparability of our findings with previous and future ones.

The relationship between the Dark Tetrad traits and egoistic and moralistic socially desirable responding

Egoistic socially desirable responding was strongly and positively correlated with narcissism and weakly and positively with psychopathy and sadism, while moralistic socially desirable responding was negatively correlated with all four Dark Tetrad traits (Table 3).

Table 3

Descriptive Statistics and Intercorrelations Between Study Variables

Variable	M	SD	1	2	3	4	5	6
1. Egoistic socially desirable responding	2.19	2.14	-					
2. Moralistic socially desirable responding	3.23	2.27	.10*	-				
3. Machiavellianism	3.27	0.57	.04	−.34**	-			
4. Narcissism	2.99	0.62	.48**	−.14**	.24**	-		
5. Psychopathy	2.03	0.67	.15**	−.30**	.21**	.37**	-	
6. Sadism	1.98	0.69	.14**	−.46**	.27**	.20**	.47**	-

$p < .05$, ** $p < .01$.

Regression analyses were conducted to get a better insight into the relationship between the Dark Tetrad and socially desirable responding, when the shared variance between dark traits is taken into account (Table 4). The Dark Tetrad traits explained 25% of the variance of egoistic socially desirable responding, $R^2 = .246$, $F(4, 421) = 34.29$, $p < .001$, and 27% of the variance of moralistic socially desirable responding, $R^2 = .272$, $F(4, 419) = 39.16$, $p < .001$). Higher narcissism was significantly associated with a higher level of egoistic

socially desirable responding, while the contribution of Machiavellianism and sadism was negative and marginally significant. Both lower Machiavellianism and sadism were significantly associated with a higher level of moralistic socially desirable responding, with the contribution of psychopathy being negative and marginally significant.

Table 4

Standardized Regression Coefficients of the Dark Tetrad Traits on Each Type of Socially Desirable Responding

	Egoistic (*N* = 426)		Moralistic (*N* = 424)	
Predictor	β	*p*	β	*p*
Machiavellianism	−.09	.048	−.24	< .001
Narcissism	.51	< .001	.03	.472
Psychopathy	−.06	.243	−.10	.051
Sadism	.10	.051	−.36	< .001

Discussion

This study aimed to examine the structure of the Croatian version of SD4, as well as the relationship of the Dark Tetrad traits (measured with SD4) with two types of deliberate socially desirable responding – egoistic and moralistic. The structure of SD4, although not perfect in comparison with rough acceptable model fit guidelines (Hu & Bentler, 1999), an inspection of factor loadings and their comparison with those from other studies indicated that the Croatian version has an acceptable structure. Its relationship with the two examined types of socially desirable responding was in line with expectations based on previous research and those that were theoretically driven.

The first aim of this study was to examine the structure of SD4 in the Croatian context using latent variable modeling, testing two competing models: the four-factor model and the bifactor model. The results showed that some of the fit statistics fell somewhat below the conventionally acceptable fit thresholds (Hu & Bentler, 1999); however, as previously noted,

these thresholds may be hard to reach in practice (Marsh et al., 2004). Many widely used personality inventories that measure multiple dimensions fail to reach conventional adequate fit criteria, so results should be interpreted in the context of previous validation studies since they could be more reasonable criteria for evaluation than conventional rules of a thumb (Hopwood & Donnellan, 2010). The values of fit statistics of both models tested in this study were comparable to those from the original study testing these models (see Neumann et al., 2021), along with the pattern of factor loadings for tested models. Although the values of four correlated factors model fit statistics were lower than those obtained in the Portuguese sample (Pechorro et al., 2022), they were comparable to those obtained in the German sample (Blötner, Ziegler, et al., 2022). The finding that some psychopathy and sadism items in the bifactor model loaded on general factor to a greater degree than to their respective factors is in line with previous findings indicating that general factor mostly reflected item content of these two dark traits (Neumann et al., 2021). The plausible reason for the representation of both psychopathy and sadism in the general factor could be a high correlation between them; however, such a high correlation is in line with the results of the recent meta-analysis (Bonfá-Araujo et al., 2022). Moreover, there are findings indicating that the conceptualization of sadism in SD4 is problematic and should be revised (Blötner & Beisemann, 2022), so this question remains open for further research on the Croatian version of SD4.

Although the bifactor model had somewhat better fit statistics than the four correlated factors model, the difference between the fit statistics was not large enough to conclude that the bifactor model was superior. Moreover, the pattern of factor loadings in each model was used as an additional criterion to evaluate the models' viability. First, since in the bifactor model general and group factors are orthogonal, it can be used as guidance whether the scale is multidimensional or unidimensional, and large loadings on general and low loadings on group factors would imply unidimensionality (Riese et al., 2010), which was not the case in our model. Second, in order for the bifactor model to be a valid representation of data, it should have non-

trivial loadings on all factors (specific and general; Riese et al. 2010; Watts et al., 2019), which was also not the case in our data. Therefore, the four correlated factors model was chosen as a better representation of SD4 and used for further analyses. The additional reason was to facilitate the interpretability and comparability of our findings with previous and future ones, following the recommendations and findings that the choice of the SD4 analytic model may not matter substantially in examining the external correlates of dark traits (see Neumann et al., 2021).

In the four correlated factors model all loadings were satisfactory in size, with most of them greater than .50. Reliabilities of SD4 scales measured by Cronbach's alpha were adequate (i.e., around .70 or above), and although they were somewhat lower compared to the original validation samples (Paulhus et al., 2021) or Portuguese version (Pechorro et al., 2022), they were comparable to German version (Blötner, Ziegler, et al., 2022). If we interpret the sizes of Pearson correlations of .10, .20, .30, and .40 as small, medium, large, and very large effect sizes, respectively (Funder & Ozer, 2019; Gignac & Szodorai, 2016), intercorrelations between SD4 subscales in our research ranged from medium to very large. Obtained effect sizes are in the range of those from previous studies (Blötner, Ziegler, et al., 2022; Paulhus et al., 2021; Pechorro et al., 2022). The patterns of correlations most closely followed those obtained in the German sample (Blötner, Ziegler, et al., 2022), with the highest correlation between psychopathy and sadism, followed by the correlation between psychopathy and narcissism. Furthermore, the narcissism item regarding showing off every now and then had the lowest loadings in four factor model both in Croatian, German and Portuguese contexts (see Blötner, Ziegler, et al., 2022; Pechorro et al., 2022). Taken together, our findings indicate that the Croatian version of SD4 is valid and comparable to the original version.

The second aim of this study was to investigate the relationship between the Dark Tetrad traits and egoistic and moralistic socially desirable responding. In line with expectations, narcissism was positively related to egoistic socially desirable responding, while psychopathy, Machiavellianism, and sadism were negatively related to moralistic socially desirable

responding. The positive relationship between egoistic socially desirable responding and primarily narcissism was expected, given that egoistic socially desirable responding reflects a tendency of exaggerating one's competencies, which resembles grandiosity, a key feature of narcissism (Paulhus, 2014), and is in line with previous findings that narcissism, compared to other dark traits is related to exhibiting self-enhancement the most (Blötner, Ziegler, et al., 2022; Paulhus & Williams, 2002). Furthermore, the negative relationship between moralistic socially desirable responding and the other three Dark Tetrad traits reflects both theoretical assumptions and empirical findings (see Parmač Kovačić et al., 2014) indicating that moralistic socially desirable responding correlates higher with communal traits (i.e., agreeableness and conscientiousness). Namely, among the Dark Triad traits, narcissism has the lowest correlations with agreeableness and is not related to conscientiousness, while the correlations of psychopathy and Machiavellianism with these traits are similar (see Muris et al., 2017). Finally, the relations of the Dark Tetrad traits and egoistic and moralistic socially desirable responding point to the distinctiveness of narcissism from the rest of the Dark Tetrad, contributing to findings that narcissism is different from the other Dark Tetrad traits (e.g., Book et al., 2016; Dinić et al., 2020).

There are several limitations imposed on the generalizability of the findings due to restriction to self-report questionnaires, cross-sectional study design, and sample characteristics – a convenience sample of mainly younger females. Primarily, as our sample consisted of more than 80% females, invariance across gender could not be tested. To overcome this shortcoming, we encourage future research to investigate the psychometric properties of the SD4 scales in more gender-balanced samples. Another proof of the scale's construct validity would be to examine its nomological network and compare obtained relationships to those from other studies (see Blötner, Ziegler, et al, 2022; Paulhus et al, 2021; Pechorro et al., 2022), as well as its longitudinal stability or invariance. To corroborate the associations established by the present research between SD4 and socially desirable responding it would be useful to explore the relationships among these constructs using behavioral and observational paradigms (e.g., *fake-good* or *fake-bad*), as the recent

meta-analysis showed that the Dark Triad traits are fakable, with similar effect sizes to previous meta-analyses of Big Five measures (Walker et al., 2022). Therefore, in future research emphasis should be given to the exploration of the relationship between SD4 and socially desirable responding in different social situations and in longitudinal designs to better understand cross-situational stability and the temporal order of these relationships.

In conclusion, the results of our study indicate that the Croatian version of SD4 is valid and can be used to assess the Dark Tetrad traits. Concerning the two examined models, our results did not indicate the superiority of the bifactor model compared to the four-factor model, and the general factor did not reflect all, nor most of the SD4 items. Thus, we did not find support for the use of the general "dark" factor. The relations of the Dark Tetrad traits and egoistic and moralistic socially desirable responding corroborated the distinctiveness of narcissism from the rest of the Dark Tetrad since narcissism was positively related to egoistic socially desirable responding, while psychopathy, Machiavellianism, and sadism were negatively related to moralistic socially desirable responding. Moreover, since these relationships were in line with theoretically and empirically based expectations, they can be viewed as an indicator of the usefulness of the Croatian version of SD4. Although our study design did not allow us a more comprehensive insight into its validity (e.g., measurement invariance, nomological network), we hope that this study will provide the first step toward more comprehensive future tests of its validity.

Conflict of interest

We have no conflicts of interest to disclose.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix A

Croatian Translation of SD4 Items

Item label	Croatian item content
Mach_1	Nije pametno odavati svoje tajne.
Mach_2	Bez obzira na cijenu, neophodno je pridobiti važne ljude na svoju stranu.
Mach_3	Dobro je izbjegavati izravne sukobe s drugima jer mogu biti od koristi u budućnosti.
Mach_4	Potrebno se pritajiti da bi dobio ono što želiš.
Mach_5	Za kontrolu nad situacijom potrebno je planiranje.
Mach_6	Laskanje je efikasno u pridobivanju ljudi na svoju stranu.
Mach_7	Volim kad domišljat plan uspije.
Narc_1	Ljudi me vide kao rođenog vođu.
Narc_2	Talentiran/a sam za uvjeravanje drugih.
Narc_3	Grupne aktivnosti znaju biti dosadne bez mene.
Narc_4	Znam da sam poseban/na jer mi drugi to stalno govore.
Narc_5	Imam puno izvrsnih kvaliteta.
Narc_6	Vjerojatno ću postati iznimno uspješan/na u nečem.
Narc_7	Povremeno se volim hvaliti.
Psy_1	Često za mene kažu da sam van kontrole.
Psy_2	Sklon/a sam suprotstavljati se autoritetima i njihovim pravilima.
Psy_3	Češće sam se tukao/la od većine ljudi moje dobi i spola.
Psy_4	Prvo uletim u nešto, a tek onda postavljam pitanja.
Psy_5	Imao/la sam problema sa zakonom.
Psy_6	Ponekad upadnem u opasne situacije.
Psy_7	Ljudi koji mi se zamjere uvijek požale.
Sad_1	Gledanje tučnjave me uzbuđuje.
Sad_2	Uživam u nasilnim filmovima i video-igrama.
Sad_3	Zabavno je kad neka budala padne i razbije se.
Sad_4	Volim gledati nasilne sportove.
Sad_5	Neki ljudi zaslužuju patnju.
Sad_6	Radi zabave, pisao/la sam zlobne stvari po društvenim medijima.
Sad_7	Znam kako povrijediti nekoga samo riječima.

Note. Mach = Machiavellianism; Narc = Narcissism; Psy = Psychopathy; Sad = Sadism.

Appendix B

Means, Standard Deviations, and Intercorrelations Between SD4 Items

Item label	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. Mach_1	3.70	0.88	-																											
2. Mach_2	2.44	1.03	.20	-																										
3. Mach_3	3.13	1.09	.17	.36	-																									
4. Mach_4	2.47	1.00	.31	.35	.32	-																								
5. Mach_5	3.67	0.91	.15	.18	.13	.19	-																							
6. Mach_6	3.32	1.07	.17	.22	.31	.27	.19	-																						
7. Mach_7	4.18	0.78	.17	.24	.25	.24	.26	.24	-																					
8. Narc_1	2.72	1.09	.10	.11	-.05	.05	.09	.01	.23	-																				
9. Narc_2	3.15	1.04	.03	.20	.13	.12	.07	.10	.32	.53	-																			
10. Narc_3	2.46	1.02	.11	.20	.10	.09	.07	.10	.17	.33	.31	-																		
11. Narc_4	2.54	1.08	-.02	.14	.11	.09	.12	.08	.17	.34	.31	.45	-																	
12. Narc_5	3.68	0.77	-.02	.07	.08	.00	-.01	-.03	.16	.33	.28	.25	.35	-																
13. Narc_6	3.44	0.84	.00	.11	.04	.07	.02	-.06	.26	.40	.33	.23	.31	.53	-															
14. Narc_7	2.96	1.13	-.03	.21	.09	.09	-.02	.15	.09	.12	.10	.11	.11	.14	.19	-														
15. Psy_1	2.03	1.03	.05	.18	.04	.21	.04	.17	.08	.15	.18	.28	.24	.05	.07	.19	-													
16. Psy_2	2.83	1.19	.04	.08	-.06	.15	.00	.07	.09	.29	.24	.18	.18	.15	.19	.11	.44	-												
17. Psy_3	1.57	0.98	.05	.08	.07	.17	.00	.15	.09	.11	.15	.09	.05	.00	-.03	.09	.38	.32	-											
18. Psy_4	2.40	1.12	-.01	.13	.00	.16	-.08	.12	.08	.08	.08	.22	.17	.07	.08	.12	.48	.30	.26	-										
19. Psy_5	1.37	0.78	.03	.09	-.03	.12	-.04	.14	.09	.10	.11	.14	.05	.04	.05	.08	.27	.23	.35	.22	-									
20. Psy_6	1.97	1.10	0.00	.03	.02	0.08	-.04	.16	.10	.12	.22	.15	.19	.11	.11	.16	.41	.31	.33	.39	.49	-								
21. Psy_7	2.05	1.01	.20	.31	.07	.17	.05	.12	.20	.28	.24	.27	.26	.14	.24	.16	.32	.31	.29	.20	.22	.28	-							
22. Sad_1	1.50	0.92	.01	.16	.08	.12	-.05	.09	.18	.09	.15	.12	.07	.03	.12	.06	.30	.21	.32	.20	.20	.33	.27	-						
23. Sad_2	1.73	1.09	-.03	.10	.10	.04	-.04	.03	.20	.09	.15	.01	.02	.03	.04	.10	.11	.14	.25	.09	.08	.18	.16	.57	-						
24. Sad_3	2.01	1.20	.05	.20	.07	.14	.09	.16	.20	.04	.06	.10	.10	.01	.02	.12	.23	.14	.21	.18	.11	.16	.22	.41	.43	-					
25. Sad_4	1.76	1.10	-.06	.10	.01	.06	-.02	.03	.19	.09	.11	.09	.06	.06	.14	.04	.20	.19	.23	.14	.10	.31	.19	.62	.61	.35	-				
26. Sad_5	2.26	1.33	.13	.21	.20	.23	.07	.16	.24	.06	.11	.11	.02	-.03	.01	.05	.18	.17	.18	.13	.21	.24	.31	.24	.23	.35	.17	-			
27. Sad_6	1.29	0.69	-.01	.10	.10	.12	.07	.12	.00	-.01	-.02	.03	.09	-.03	-.03	.14	.16	.12	.10	.07	.15	.13	.17	.12	.11	.17	.08	.16	-		
28. Sad_7	3.32	1.20	.08	.05	.07	.16	.07	.14	.22	.28	.28	.13	.07	.09	.11*	.21	.28	.19	.18	.20	.31	.27	.26	.23	.26	.24	.35	.23	-	

Notes. Mach = Machiavellianism; Narc = Narcissism; Psy = Psychopathy; Sad = Sadism. Correlation coefficients significant at $p < .01$ are typed bold and underlined, and correlation coefficients significant at $p < .05$ are underlined.