Associations between the dark triad of personality and unspecified/specific forms of Internet-use disorder

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Background and aims: Despite indications that the dark triad of personality might be associated with Internet-use disorder (IUD), research about these associations is lacking. *Methods:* Two studies were performed to grasp the links between these variables. In the first study, a sample consisting of $N = 468$ participants ($n = 130$ males) filled in the Short Dark Triad Questionnaire to assess scores in the dark triad of personality and the short Internet Addiction Test to assess tendencies toward unspecified IUD. In the second study, another independent sample of $N = 472$ participants ($n = 143$ males) filled in the same questionnaires plus items about specific forms of IUD. *Results:* Traits Machiavellianism and psychopathy were positively linked to tendencies toward unspecified IUD in both samples and males and females. Regarding the associations between tendencies toward specific IUDs and the dark triad of personality, no significant associations were found in males (at least not passing correction procedures for multiple testing). In females, trait Machiavellianism/psychopathy and tendencies toward Internet-shopping disorder, trait psychopathy, and tendencies toward Internet-pornography-use disorder as well as trait Machiavellianism and tendencies toward Internet-communication disorder were significantly positively correlated [at least one of the (sub)scales assessing the respective specific IUD was significantly associated with the respective dark triad trait even after correction procedures for multiple testing]. No robust pattern of associations between trait narcissism and unspecified/specific forms of IUD could be observed across (sub)samples. *Discussion and conclusions:* These results indicate positive associations of the traits Machiavellianism and psychopathy (on a subclinical level) with tendencies toward IUD, especially unspecified IUD. The associations with tendencies toward specific forms of IUD seem more complex with differential personality correlates for each specific IUD. These associations need to be replicated.

Keywords: dark triad, unspecified IUD, specific forms of IUD, Machiavellianism, narcissism, psychopathy

INTRODUCTION

The Internet plays a fundamental role in today's society. Given many positive aspects going along with Internet use (e.g., easy communication possibilities), in the meantime, more than 3.9 billion people around the world (http://www.internetlivestats.com/; May 29, 2018; 14:04) use the Internet for both private and business purposes. Although Internet use is positive in many areas, a growing number of scientists is concerned with respect to putative addictive tendencies toward Internet usage. In line with the terminology Internet Gaming Disorder in DSM-5 and Gaming Disorder in the upcoming ICD-11, the term Internet-use disorder (IUD) will be used to describe overusage of the Internet in the present work (synonymously used terms are, for example, "Internet addiction" or "digital/cyber addiction"). The estimated prevalence rates of IUD vary greatly, depending on the investigated sample (e.g., age, gender, nationality, etc.), the instrument used to assess IUD, and the chosen cut-off criteria. However, in a meta-analysis across 31 nations from seven world regions, a prevalence rate of 6.0% was reported (Cheng & Li, 2014). In detail, the highest prevalence rate of 10.9% was found in the samples from the Middle East. Furthermore, prevalence rates of 8.0% in North America, 7.1% in Asia, 6.1% in South-East Europe, 4.3% in Oceania, and 2.6% in North-West Europe were reported (Cheng & Li, 2014). Prevalence rates in Germany are estimated to be around 1%–2% in the general population (Rumpf, Meyer, Kreuzer, John, & Merkeerk, 2011). Of note, individual differences in IUD can be studied as a continuum ranging from healthy or normal Internet use through problematic to pathological Internet use (e.g., Montag, Jurkiewicz, & Reuter, 2010;

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Montag et al., 2011; Müller et al., 2017). Following such a dimensional approach to better characterize IUD, it becomes apparent that also the study of subclinical samples demonstrating variance in IUD symptom strength can give important insights to better understand IUD. The same approach is applied in the present work to assess individual differences in the dark triad. Aside from unspecified IUD, specific forms of IUD also reached growing attention within the past years (Davis, 2001; Montag et al., 2015). As such, tendencies to overuse online gaming channels (Internet-gaming disorder), online gambling (Internet-gambling disorder), online shopping (Internet-shopping disorder), online pornography (Internet-pornography-use disorder), or online social networking (Internet-communication disorder) websites have been investigated (e.g., Müller et al., 2017).

Given the health risk of (unspecified and specific forms of) IUD, unsurprisingly many studies investigate possible predisposing factors, vulnerability factors, and correlates of IUD [Kuss, Griffiths, Karila, & Billieux, 2014; The growing interest is also characterized by the following numbers: Searching in ScienceDirect for "Internet Use Disorder; Internet Addiction; Problematic Internet Use" led to 58 hits in 2010 vs. 242 hits in 2017 (March 2, 2018; 09:36)]. Such factors, which are potentially associated with IUD, are the dark triad traits of personality. The dark triad of personality comprises three intercorrelated but distinct socially aversive personality traits, namely Machiavellianism, narcissism, and psychopathy, assessed on a subclinical level (Furnham, Richards, & Paulhus, 2013; Jones & Paulhus, 2014). People scoring high in Machiavellianism tend to be manipulative, show indifference for morality, and focus on their own rather than on others interests (Jones & Paulhus, 2014; Muris, Merckelbach, Otgaar, & Meijer, 2017). High narcissism is characterized by ego-reinforcement as motive for behavior, feelings of self-grandiosity (on the outside, whereas feelings of insecurity prevail underneath), and admiring own attributes (Jones & Paulhus, 2014; Muris et al., 2017). Finally, deficits in affect and self-control (i.e., impulsivity), thrill-seeking, antisocial behaviors, and low empathy are hallmarks of (high) psychopathy (Jonason & Krause, 2013; Jones & Paulhus, 2014; Muris et al., 2017).

There is (indirect) evidence suggesting that unspecified IUD might be associated with the dark triad traits. As an example, high psychopathy has been associated with higher dysfunctional impulsivity (Jones & Paulhus, 2011). And impulsivity is also an important factor in the context of addictive behaviors, among others also IUD (Brand, Young, Laier, Wölfing, & Potenza, 2016; Cao, Su, Liu, & Gao, 2007). In addition, several studies indicate a positive link between trait psychopathy and tobacco use (Hudek-Knežević, Kardum, & Mehić, 2016), opioid, hallucinogen, and stimulant dependence in male offenders (Hopley & Brunelle, 2012), between Machiavellianism and alcohol dependence (Krampen, 1980), as well as between trait psychopathy (and to a smaller degree trait narcissism) and the number of substances used (Stenason & Vernon, 2016). Together this indicates that a link between the dark triad and behavioral addictions such as IUD is possible. Moreover, the Internet provides people with various channels to indulge in behaviors associated with the dark triad traits. Accordingly, associations between the dark triad traits and specific forms of IUD are likely. In this context, the

cognitive-behavioral model of pathological Internet use (corresponding to IUD) by Davis (2001) is of high importance. It assumes specific forms of IUD to be consequences of already existing psychopathologies in the offline world, which are transferred to the online world, where people receive a direct reinforcement. In this regard, there are several studies positively linking the dark triad traits to (overusage of) activities constituting offline counterparts of specific forms of IUD (e.g., video games and Internet gaming, offline gambling and Internet gambling, etc.). In the light of the model by Davis (2001), these studies lead to the conclusion that the dark triad traits are also potentially associated with the respective online counterparts of the offline activities. As such, previous studies found that Machiavellianism correlates positively with entertainment preferences for violent video games (however, not with non-violent video games) as well as with gambling behavior (Trombly & Zeigler-Hill, 2017; Williams, McAndrew, Learn, Harms, & Paulhus, 2001). Next, high scores in narcissism have been associated with disordered gambling behavior (Lakey, Rose, Campbell, & Goodie, 2008; Trombly & Zeigler-Hill, 2017) and compulsive buying (Rose, 2007). Finally, psychopathy has been associated with entertainment preferences for violent video games (Williams et al., 2001).

Besides the findings of associations with offline activities, Machiavellianism and psychopathy were already found to be positively correlated with entertainment preferences for social (instant messaging and chat rooms) as well as anti-social (among others, pornography; please note that the term "anti-social" is derived from the study by Williams and colleagues) Internet activities (Williams et al., 2001). Next, narcissism has already been brought into touch with risk for Internet-gaming disorder and entertainment preferences for social Internet activities, such as instant messaging and chat rooms (Kim, Namkoong, Ku, & Kim, 2008; Williams et al., 2001). Furthermore, there is also evidence that narcissism is positively linked to preferences for and usage of pornographic materials online (Kasper, Short, & Milam, 2015).

Next to the model of Davis (2001), another more complex model, namely the Interaction of Person-Affect-Cognition-Execution (I-PACE) model by Brand et al. (2016), is of additional importance. Going beyond Davis' model (2001), the I-PACE model directly draws attention to personality (belonging to the "P"-component) as an important variable predisposing a person to the (over)usage of specific online activities (Brand et al., 2016). At present, the I-PACE model does not directly address the dark triad of personality but among others impulsivity and low conscientiousness as predisposing factors of specific forms of IUD included in the "P"-component. As mentioned, impulsivity is also positively linked to the dark triad, especially psychopathy (Jones & Paulhus, 2011; see also Cao et al., 2007 for a relationship with unspecified IUD). Moreover, conscientiousness has been negatively linked to the dark triad (Jakobwitz & Egan, 2006; Muris et al., 2017; Paulhus & Williams, 2002). This together with the aforementioned empirical findings indicates that the dark triad (or single elements such as psychopathy) might represent relevant personality traits going beyond the often studied Big Five (conscientiousness) and impulsivity being involved in the development of IUD. Because interestingly, and in line with the differential associations between specific forms of IUD

and various (online) activities with personality traits found in previous literature (see above), in the I-PACE model it is also noted that different specific forms of IUD might show differential association with personality variables, hence, differential personality profiles. This makes it even more important to investigate potential associations of the dark triad of personality not only with unspecified IUD, but also specific forms of IUD. For the sake of brevity, we provide no further information on the complex I-PACE model and hint toward the original publication (Brand et al., 2016).

On the basis of the findings and theories outlined above, the aim of this study was to investigate the associations between the dark triad traits and tendencies toward unspecified IUD. These analyses were carried out in two independent samples to replicate findings. In addition, to go more into detail and examine potential differential personality profiles of different specific IUDs, the associations between the dark triad traits and tendencies toward specific forms of IUD were also investigated in the second sample.

METHODS

Participants

Participants of Study I were recruited through a university-internal online platform as well as via advertisement in different ways (e.g., personal communication and electronic invitation). In total, the data of $N = 468$ participants ($n = 130$ males, $n = 338$ females; mean age $= 29.64$, $SD = 14.15$) were available for the analyses. Around half of the participants were students ($n = 253$).

Participants of Study II were collected in the course of the Ulm Gene Brain Behavior Project. Complete data of $N = 472$ participants ($n = 143$ males, $n = 329$ females; mean age $= 23.19$, $SD = 8.42$) were available. As data were collected at a university, most of the participants were students ($n = 407$).

In both studies, questionnaires were assessed online. By checking the personal but anonymous codes of the participants, it was ensured that the samples were completely independent and therefore no participant was included in the analyses twice (in Studies I and II).

Self-report measures

The Short Dark Triad (SD3). The SD3 (Jones & Paulhus, 2014) was administered to assess individual differences in Machiavellianism, narcissism, and psychopathy on a sub-clinical level. The questionnaire includes 27 items with nine items for each dark triad trait. Responses are given on a 5-point Likert scale ranging from "*disagree strongly*" to "*agree strongly*." The here used German version was translated and retranslated by two bilingual speakers of our group. Information on the factorial structure is given in the Supplementary Material. Internal consistencies in the sample of Study I were $\alpha = .71$ (Machiavellianism), $\alpha = .63$ (narcissism), and $\alpha = .70$ (psychopathy). Internal consistencies in the sample from Study II were $\alpha = .78$ (Machiavellianism), $\alpha = .65$ (narcissism), and $\alpha = .74$ (psychopathy).

Short Internet Addiction Test (s-IAT). To assess individual scores in tendencies toward unspecified IUD, the s-IAT (Pawlikowski, Altstötter-Gleich, & Brand, 2013) was used. It consists of 12 items answered on a 5-point Likert scale ranging from "*never*" to "*very often*." Besides a total scale, the sum scores of two subscales can also be built. These are "loss of control/time management" (LC/TM) and "craving/social problems" (C/SP) with six items each. According to the cut-off criteria as proposed by Pawlikowski et al. (2013), problematic Internet use is assumed with a score above 30 (in the total scale) and pathological Internet use is assumed, if the individual score is above 37 (in the total scale). Accordingly, scores of ≤ 30 indicate normal usage of the Internet. The here used German version of the s-IAT has already been used in previous studies (e.g., Lachmann, Sariyska, Kannen, Stavrou, & Montag, 2017; Müller et al., 2017; Sariyska, Lachmann, Markett, Reuter, & Montag, 2017) and the internal consistencies in the sample of Study I were satisfying [$\alpha = .87$ (total scale), $\alpha = .82$ (LC/TM), and $\alpha = .77$ (C/SP)]. The same was true for the internal consistencies in the sample of Study II [$\alpha = .85$ (total scale), $\alpha = .80$ (LC/TM), and $\alpha = .75$ (C/SP)].

Different specific forms of IUD. Above tendencies to unspecified IUD, in Study II, individual tendencies toward specific forms of IUD were also assessed. As such, tendencies toward overusage of online gaming channels, online gambling channels, online shopping (compulsive buying), online pornography usage, and online social networking (assessing tendencies toward Internet-gaming, -gambling, -shopping, -pornography-use, and -communication disorder, respectively) were assessed. Therefore, the same items as in Müller et al. (2017) were used. For each of them, a short description was followed by four items based on the s-IAT. Next to a sum score of the four items, the scores of the two subscales LC/TM and C/SP can also be calculated with two items per scale. As for the s-IAT, each item is answered on a 5-point Likert scale ranging from "*never*" to "*very often*." Internal consistencies (for the scores calculated from the four items) were: Internet-gaming: $\alpha = .86$, Internet-gambling: $\alpha = .88$, Internet-shopping: $\alpha = .81$, Internet-pornography: $\alpha = .83$, Internet-communication: $\alpha = .82$.

Statistical analyses

All analyses were carried out using SPSS statistics 24 and separately in the samples of Studies I and II. As the distributions of most of the scales showed a significant deviation from the normal distribution (using Kolmogorov–Smirnov and Shapiro–Wilk tests) in the samples of both studies, it was decided to implement all analyses using non-parametric tests.

First, associations of age and gender with all scales of interest were investigated using Spearman's correlations and Mann–Whitney U tests. The descriptive statistics of all scales of interest are presented for the whole samples as well as split by gender and split by normal, problematic, and pathological Internet use (according to the cut-off criteria by Pawlikowski et al., 2013) in the Supplementary Material. Associations between the dark triad traits and tendencies toward unspecified IUD were investigated using partial Spearman's correlations corrected for age in the complete samples as well as split by gender (see "Results" section with regard to significant associations with age and gender). All associations were tested two-sided for significance and

correlations between the male and female samples were compared using the Fisher's z-tests (Myers & Sirois, 2006; http://www.markenkunde.de/korrleation_tool/markenkunde_corrcomparer1_0.xls). For the associations between the dark triad traits and unspecified IUD, the following Bonferroni correction was applied to control for multiple testing issues: $\alpha = .05/(3 \times 3 \times 2) = 0.0028$ (as we investigated the associations between three dark triad traits and three s-IAT scales in males and females).

Additionally and only in Study II, partial Spearman's correlations corrected for age were also used to investigate the associations between the dark triad traits and specific forms of IUD. Again, all associations were tested two-sided for significance and correlations between the male and female samples were compared using the Fisher's z-tests (Myers & Sirois, 2006; http://www.markenkunde.de/korrleation_tool/markenkunde_corrcomparer1_0.xls). When testing the associations between the dark triad traits and specific forms of IUD, the following Bonferroni correction was applied to control for multiple testing issues: $\alpha = .05/(3 \times 15 \times 2) = 0.00056$ (as we investigated the associations between three dark triad traits and five specific forms of IUD with three scales each in males and females). This correction procedure might be too conservative. Therefore, we present all analysis in detail, so that independent researchers can search for replication, particularly with respect to the associations between the dark triad traits and specific forms of IUD.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The local ethics committee at Ulm University, Ulm, Germany, approved both of the studies. All subjects were informed about the study and all provided informed consent prior to participation.

RESULTS

Study I

Associations with age and gender. Age was not significantly associated with any of the dark triad traits (all p values >.270), but with the total s-IAT scale ($\rho = -.30$, $p < .001$), as well as its subscales (LC/TM scale: $\rho = -.32$, $p < .001$; C/SP scale: $\rho = -.20$, $p < .001$).

Differences between genders were found in all dark triad traits (all p values <.001; males > females) and the s-IAT LC/TM scale ($U = 18,828.000$, $Z = -2.40$, $p = .016$; males < females). The descriptive statistics are demonstrated in Supplementary Tables 1 and 2.

Associations between the dark triad traits and the tendencies toward unspecified IUD. According to the cut-off criteria by Pawlikowski et al. (2013), in the complete sample of Study I, 400 participants (115 males and 285 females) showed a normal usage of the Internet, 46 participants (9 males and 37 females) showed problematic usage of the Internet, and 22 participants (6 males and 16 females) showed pathological usage of the Internet, hence IUD.

Table 1. Partial Spearman's correlations between the dark triad traits and unspecified IUD in the sample of Study I

	Machiavellianism	Narcissism	Psychopathy
Complete sample			
s-IAT	.24***	.03	.32***
s-IAT LC/TM	.15***	.02	.26***
s-IAT C/SP	.30***	.04	.33***
Males			
s-IAT	.28**	.12	.33***
s-IAT LC/TM	.20*	.19*	.31***
s-IAT C/SP	.31***	−.04	.25**
Females			
s-IAT	.24***	.01	.35***
s-IAT LC/TM	.18***	(−).00	.30***
s-IAT C/SP	.29***	.04	.35***

Note. Age was included as covariate in the analyses. In the complete and female samples, all significant associations would also hold after Bonferroni correction for multiple testing [$\alpha = .05/(3 \times 3 \times 2) = 0.0028$]. In the male sample, the associations between Machiavellianism and the total s-IAT and the s-IAT C/SP scale, and between psychopathy and the total s-IAT and the s-IAT LC/TM scale would remain significant. IUD: Internet-use disorder; s-IAT: short Internet Addiction Test; LC/TM: loss of control/time management; C/SP: craving/social problems.
***$p < .001$. **$p < .01$. *$p < .05$ (two-sided).

As shown in Table 1, Machiavellianism and psychopathy were moderately positively associated with the s-IAT (sub)scales across genders. Fisher's z-tests revealed no significant differences in the correlations between males and females (all p values >.064). After Bonferroni correction [$\alpha = .05/(3 \times 3 \times 2) = 0.0028$] in the complete and the female samples, all associations between Machiavellianism and psychopathy and all s-IAT scales would remain significant. In the male sample, however, not all associations would remain significant. However, note that the male sample was smaller and therefore statistical power was lower.

Study II

Associations with age and gender. Age was significantly associated with Machiavellianism ($\rho = -.12$, $p = .007$) and narcissism ($\rho = -.12$, $p = .007$), as well as with the total s-IAT scale ($\rho = -.17$, $p < .001$), its subscales (LC/TM scale: $\rho = -.19$, $p < .001$; C/SP scale: $\rho = -.10$, $p = .038$), the LC/TM scale of Internet-pornography-use disorder ($\rho = .10$, $p = .027$), and all scales of Internet-communication disorder (total scale: $\rho = -.23$, $p < .001$; LC/TM scale: $\rho = -.23$, $p < .001$; C/SP scale: $\rho = -.20$, $p < .001$).

Gender differences were found in all dark triad traits (all p values <.001; males > females) as well as the s-IAT C/SP scale ($U = 20,400.000$, $Z = -2.31$, $p = .021$; males > females), and all scales about each specific form of IUD (all p values <.003; males scored higher in all scales about Internet-gaming, -gambling, and -pornography-use disorder; females scored higher in all scales about Internet-shopping and -communication disorder). The descriptive statistics are demonstrated in Supplementary Tables 4 and 5.

Associations between the dark triad traits and the tendencies toward unspecified IUD. According to the cut-off criteria by Pawlikowski et al. (2013), in the complete sample of Study II, 362 participants (110 males and 252 females) showed a normal usage of the Internet, 86 participants (27 males and 59 females) showed problematic usage of the Internet, and 24 participants (6 males and 18 females) showed pathological usage of the Internet, hence IUD.

As shown in Table 2, only Machiavellianism and psychopathy were significantly positively associated with unspecified IUD as measured with the s-IAT in males as well as females. Fisher's z-tests revealed no significant differences in the correlations between males and females (all *p* values >.070). Of note, when adjusting α to control for multiple testing [α = .05/(3 × 3 × 2) = 0.0028], in the complete and the female samples, all associations between Machiavellianism and psychopathy and all s-IAT scales would remain significant. In the male sample, however, again only some associations would remain significant. But as in Study I, the group of males was smaller than the group of females.

Associations between the dark triad traits and tendencies toward specific forms of IUD. Table 3 presents the associations between the dark triad traits and the tendencies toward specific forms of IUD in the complete, the male, and the female samples. As can be seen in this table, descriptively, some gender-specific effects were observed. In males, only single associations between narcissism and psychopathy and tendencies toward Internet-gambling (LC/TM scales) and psychopathy and tendencies toward Internet-pornography-use disorder (all scales) and Internet-communication disorder (total scale and LC/TM scale) reached significance. Several associations were significant in the female sample. As such, Machiavellianism was positively associated with tendencies

Table 2. Partial Spearman's correlations between the dark triad traits and unspecified IUD in the sample of Study II

	Machiavellianism	Narcissism	Psychopathy
Complete sample			
s-IAT	.30***	.00	.29***
s-IAT LC/TM	.26***	.03	.24***
s-IAT C/SP	.31***	−.01	.33***
Males			
s-IAT	.28***	−.08	.27**
s-IAT LC/TM	.30***	−.01	.23**
s-IAT C/SP	.17*	−.14	.29***
Females			
s-IAT	.31***	.02	.29***
s-IAT LC/TM	.25***	.03	.24***
s-IAT C/SP	.34***	.01	.31***

Note. Age was included as covariate in the analyses. In the complete and female sample all significant associations would also hold after Bonferroni correction for multiple testing [α = .05/(3 × 3 × 2) = 0.0028]. In the male sample, the associations between Machiavellianism and the total s-IAT and the s-IAT LC/TM scale, and between psychopathy and the total s-IAT and the s-IAT C/SP scale would remain significant. IUD: Internet-use disorder; s-IAT: short Internet Addiction Test; LC/TM: loss of control/time management; C/SP: craving/social problems. ***p < .001. **p < .01. *p < .05 (two-sided).

toward Internet-gaming disorder (total scale), Internet-shopping disorder (total scale and C/SP scale), Internet-pornography-use disorder (total scale and C/SP scale), and Internet-communication disorder (all scales). Moreover, narcissism was positively associated with tendencies toward Internet-shopping disorder (total scale and C/SP scale), only. Psychopathy was positively associated with tendencies toward Internet-gaming disorder (all scales), Internet-shopping disorder (total scale and C/SP scale), Internet-pornography-use disorder (all scales), and Internet-communication disorder (all scales) in females. Significant differences between the correlations in the male and female samples were only found for the correlations of Machiavellianism and psychopathy with the C/SP scale of Internet-shopping disorder ($z = 3.01$, $p = .003$ and $z = 2.11$, $p = .035$, respectively), and between psychopathy and the LC/TM scale of Internet-gambling disorder ($z = 2.01$, $p = .044$).

Note that in the male sample, none of the correlations would still be significant after Bonferroni correction for multiple testing. And also in the female sample, not all associations would remain significant. Moreover, the variance of some of the (sub)scales to assess tendencies toward specific forms of IUD is rather small (see Supplementary Material) and therefore the results need to be treated cautiously. In addition, an explanation about why sometimes the correlation found in the complete sample is descriptively different from the correlations found in the male and female samples separately is given in the Supplementary Material.

DISCUSSION AND CONCLUSIONS

The aim of this study was to investigate possible associations between the dark triad traits of personality and tendencies toward unspecified IUD as well as specific forms of IUD. The results indicate that especially the traits Machiavellianism and psychopathy are positively associated with tendencies toward unspecified IUD in males and females. These associations could be independently replicated in two different samples. Regarding associations between the dark triad traits and the tendencies toward specific forms of IUD, the picture gets more complex with possible gender-specific effects and differential effects on the LC/TM and C/SP subscales of the s-IAT. However, we will not focus on these subscales. Of note, we used the SD3 questionnaire, which assesses the three dark triad traits as "normal" personality traits mainly on a subclinical level. The questionnaire does not assess narcissism and psychopathy (or Machiavellianism) as a clinical syndrome. Consequently, all interpretations are only applicable to the usually considerable range of individual differences in personality traits.

First, in both males and females trait psychopathy was positively associated with tendencies toward Internet-pornography-use and -communication disorder. The link between trait psychopathy and preferences for (Internet) pornography use has already been found in a previous study (Williams et al., 2001). Moreover, another study found that trait psychopathy was positively associated with bondage and sadistic sexual fantasies (Williams, Cooper, Howell, Yuille, & Paulhus, 2009). Finding such sexual explicit

Table 3. Partial Spearman's correlations between the dark triad traits and specific forms of IUD in the complete sample of Study II, the male sample of Study II and the female sample of Study II

	Machiavellianism			Narcissism			Psychopathy		
	Complete	Males	Females	Complete	Males	Females	Complete	Males	Females
Internet gaming	.20***	.04	.12*	.06	−.04	−.01	.25***	.11	.15**
LC/TM	.18***	.07	.09	.04	−.03	−.02	.21***	.10	.13*
C/SP	.18***	.01	.10	.06	−.04	−.01	.22***	.09	.13*
Internet gambling	.06	(−).00	.01	.07	.10	(−).00	.11*	.10	.05
LC/TM	.06	.08	−.03	.11*	.19*	.00	.12*	.21*	.01
C/SP	.09	−.03	.08	.06	.05	.02	.13**	.05	.10
Internet shopping	.02	−.03	.12*	.05	−.01	.12*	.04	.03	.14**
LC/TM	−.02	.02	.05	.03	.01	.09	.01	.07	.08
C/SP	.09	−.08	.22***	.08	.04	.13*	.09*	.00	.21***
Internet pornography use	.26***	.11	.12*	.19***	.12	.10	.32***	.17*	.24***
LC/TM	.19***	.08	.03	.17***	.12	.07	.25***	.17*	.12*
C/SP	.26***	.12	.12*	.17***	.10	.08	.32***	.18*	.23***
Internet communication	.13**	.13	.22***	−.06	.01	−.02	.09	.18*	.14*
LC/TM	.11*	.16	.18**	−.04	.05	−.02	.09	.22**	.13*
C/SP	.13**	.09	.24***	−.06	−.06	−.01	.07	.09	.13*

Note. Age was included as covariate in the analyses. After Bonferroni correction for multiple testing [$\alpha = .05/(3 \times 15 \times 2) = 0.00056$] the following correlations would remain significant in the complete sample: between Machiavellianism and psychopathy and tendencies toward Internet-gaming disorder (all scales), and between all dark triad traits and tendencies toward Internet-pornography-use disorder (all scales). None of the significant associations in the male sample would remain significant after Bonferroni correction for multiple testing [$\alpha = .05/(3 \times 15 \times 2) = 0.00056$]. The following association would survive Bonferroni correction for multiple testing in the female sample: between Machiavellianism and psychopathy and tendencies toward Internet-shopping disorder (C/SP scale), between psychopathy and tendencies toward Internet-pornography-use disorder (total scale and C/SP scale), and between Machiavellianism and tendencies toward Internet-communication disorder (total scale and C/SP scale). IUD: Internet-use disorder; LC/TM: loss of control/time management; C/SP: craving/social problems.
***$p < .001$. **$p < .01$. *$p < .05$ (two-sided).

material and following these fantasies as well as finding people with the same preferences in an anonymous online setting is potentially very easy (especially compared to the offline world). The simplicity to access pornographic material/Internet pages online and consuming the pornographic material itself probably serves as reinforcement that further strengthens the tendencies toward Internet-pornography-use disorder (Brand et al., 2016; Davis, 2001).

The link between trait psychopathy and tendencies toward Internet-communication disorder could derive from the tendency of people scoring higher in trait psychopathy to lie and cheat on other people (Halevy, Shalvi, & Verschuere, 2014). Due to the anonymity and distance (e.g., visually) between the people in the Internet, lying and cheating might be easier than in the offline world and potentially more successful. This in turn may serve as reinforcement further encouraging the use of Internet social networking sites and ultimately promoting tendencies toward a disordered usage.

However, in males, none of the associations between the dark triad traits and tendencies toward specific forms of IUD remained significant after correction for multiple testing (see "Limitations" section for possible reasons) and in females the association between psychopathy and tendencies toward Internet-communication disorder would also not remain significant. But the positive correlation between trait Machiavellianism and tendencies toward Internet-communication disorder (total scale and C/SP scale) would remain significant after applying Bonferroni correction in the female sample.

As can be seen by the differential associations between the dark triad traits and tendencies toward the different forms of specific IUDs especially in females, these findings further support the hypotheses of the I-PACE model that different specific forms of IUDs might be associated with differential personality profiles (Brand et al., 2016). Hence, including the dark triad traits as additional variables in the "P"-component of the I-PACE model is worth considering, at least for some specific IUDs (e.g., pornography-use). Moreover, these differential findings hopefully encourage other researchers to not only associate the same personality variables to unspecified IUD or all specific forms of IUD, but to derive and test new hypothesis about personality associations separately for each specific form of IUD.

As potential limitations of this study, one might argue that the skewed gender ratio (less males compared to females) could constitute a limitation of the present studies. However, this problem could be minimized by presenting results split by gender. Nevertheless, different from what was expected [see preregistration at Open Science Framework (https://osf.io/p5fzs/): power analyses with expected correlations of .30, $\alpha = .05$, and a power of .95 lead to a necessary sample size of $n = 134$], the effects with regard to specific forms of IUD were weaker (in males and females). This might have led to power problems in the male sample and might therefore explain some of the non-significant findings (after Bonferroni correction and in the Fisher's z-tests regarding associations with specific forms of IUD), especially in interaction with the low variances in most of

the scales about tendencies toward specific forms of IUD. Another potential limitation of this study is that data about IUD were assessed by means of self-report measures, only. In our opinion, this is a reasonable approach to assess the subjectively experienced symptoms of (possible) IUD. Nevertheless, future studies might want to additionally use objective measures of Internet use [e.g., adding variables such as tracking the time spent on the Internet using tools of Psychoinformatics (Markowetz, Blaszkiewicz, Montag, Switala, & Schlaepfer, 2014; Montag, Duke, & Markowetz, 2016)]. Furthermore, due to the cross-sectional design of this study, it is not possible to carve out the causal relationship between IUD and the dark triad traits. Possible explanations for the associations found were so far only explained by the dark triad traits as predisposing variables and the IUD variables as dependent variables. Such explanations were used above, because classically personality traits – including the dark triad traits – are considered as rather stable characteristics over time and different situations, whereas IUD is a more variable phenomenon. In addition, also in the I-PACE model, personality is considered as a predisposing factor for IUD (Brand et al., 2016). However, also the other causal direction or a bidirectional association is possible. In the end, the causal direction can ultimately only be investigated in longitudinal studies, which would be an interesting new research objective for future studies. Moreover, as already mentioned in the "Introduction" section above, (unspecified) IUD as well as the dark triad traits (especially trait psychopathy) have been associated with impulsivity in previous studies (e.g., Cao et al., 2007; Jones & Paulhus, 2011). To shortly test the possibility that impulsivity explains the correlations found in this study, we investigated the associations (including regression analyses to test if the dark triad would explain additional variance in IUD over/next to impulsivity) between unspecified IUD, specific forms of IUD, impulsivity, and the dark triad. To not overload the manuscript and because the impulsivity questionnaire was only assessed in Study II and showed rather low reliabilities in some (sub)scales, these results are presented in the Supplementary Material. To sum these results up, for unspecified IUD, the traits Machiavellianism and psychopathy explain a significant part of the variance over/ next to impulsivity. However, for the specific forms of IUD, no consistent pattern could be observed.

In conclusion, the associations found between the dark triad traits and unspecified IUD are similar in males and females and across two independent samples. In detail, the traits Machiavellianism and psychopathy are positively related to tendencies toward unspecified IUD. Taking a closer look at associations between specific forms of IUD and the dark triad requires the inclusion of gender as an important variable to get the full picture and future studies will need to replicate these first findings. However, there is clear indication that different specific forms of IUD show different associations with personality variables/profiles.

Authors' contribution: CS and CM planned the design of this study. RS, BL, and MB gave helpful advice to improve the design. CS, RS, and BL conducted the data collections for the present studies. CS wrote the manuscript and conducted the statistical analyses. RS checked the analyses independently. All authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analyses. All authors agreed on the final version of the manuscript and agreed submission.

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