



UNIVERSITÀ DEGLI STUDI DI PADOVA

Dipartimento di Psicologia Generale

Corso di Laurea Triennale in Scienze psicologiche cognitive e
psicobiologiche

Elaborato finale

The role of impulsivity in the relation between Dark Tetrad personality traits and paraphilic interest: an EEG study

Relatore:

Prof. Giuseppe Sartori

Correlatrice:

Prof.ssa Josanne van Dongen

Laureanda: Vanesa Ajazi

Matricola: 1220757

Anno accademico: 2021/2022

INDEX OF CONTENTS

Introduction	4
Methods	11
2.1 Participants	11
2.2 Measures	13
2.3 Procedure	16
2.4 Statistical Analyses	16
2.5 Data Management Plan	17
Results	17
3.1 Relation between Dark Tetrad and paraphilic interest	17
3.2 The role of impulsivity	19
Discussion	21
References	24

Introduction

A paraphilic interest is defined as a sexual interest in an atypical target (e.g., animals, children) or activity (e.g., being urinated, showing own genitals unexpectedly). When this interest becomes perennial, persistent, and necessary for sexual pleasure, it is considered a paraphilia (Dawson et al., 2014). According to the Diagnostic and Statistical Manual Disorder, Fourth Edition, Text Revision (DSM-IV-TR), paraphilias are defined as sexual disorders characterized by “recurrent, intense, sexually arousing fantasies, sexual urges or behaviours, generally involving (1) non-human objects, (2) the suffering or humiliation of oneself or one’s partner, or (3) children or other nonconsenting persons that occur over a period of six months”, which “cause clinically significant distress or impairment in social, occupational, or other important areas of functioning” (American Psychiatric Association, 2000).

However, the Diagnostic and Statistical Manual Disorder, Fifth Edition (DSM-5) now makes a distinction between paraphilias and paraphilic disorders in order to destigmatize the “anormal” and not normative sexual interests and behaviours from pathological ones. For this reason, a paraphilic disorder exists when “recurrent, intense sexually arousing fantasies, sexual urges, or behaviors currently cause distress or impairment to the individual or whose satisfaction has entailed personal harm, or risk of harm, to others generally involving non-human objects, the suffering or humiliation of oneself or one’s partner, children, or non-consenting persons” (American Psychiatric Association, 2013). In the DSM-5, the term paraphilia is now defined as “any intense and persistent sexual interest other than sexual interest in genital stimulation or preparatory fondling with phenotypically normal, physiologically mature, consenting human partners (American Psychiatric Association, 2013). Paraphilias, however, may be not necessarily classified as “intense and persistent”, but rather sexual interests, of no clinical significance, which are greater than nonparaphilic sexual interest (Sorrentino, 2016).

A total of eight Paraphilias are listed in the DSM-5: paedophilia, exhibitionism, voyeurism, sexual sadism, sexual masochism, frotteurism, fetishism, and transvestic fetishism.

Table 1 summarizes paraphilias listed in the DSM-IV and subsequent changes in DSM-5.

Table 1. *Summary of definitions of Paraphilias and Paraphilic disorders*

Paraphilias(DSM IV)	Paraphilic Disorder	Summary definitions
Paedophilia	Paedophilic Disorder	Sexual arousal involving having sexual intercourse with children and pubescent children
Exhibitionism	Exhibitionistic Disorder	Sexual arousal involving the exposure of one's genitals to an unsuspecting individual
Voyeurism	Voyeuristic Disorder	Sexual arousal involving the observation of an unsuspecting individual who is naked, undressing, or engaging in sexual activity
Sexual sadism	Sexual Sadism Disorder	Sexual arousal involving activities of inflicting harm and humiliation on another individual
Sexual masochism	Sexual Masochism Disorder	Sexual arousal involving activities of being humiliated, beaten, bound, or otherwise made to suffer
Frotteurism	Frotteuristic Disorder	Sexual arousal involving activities of touching and rubbing against an unsuspecting individual
Fetishism	Fetishist Disorder	Sexual arousal involving non-living objects such as shoes and undergarments
Transvestic fetishism	Transvestic Fetishism Disorder	Sexual arousal involving dressing in gender-stereotypical clothing or being another gender

Since paraphilic disorders and behaviors have been associated with criminogenic consequences, in particular sexual violence (Chan et al., 2015), it is important to distinguish between paraphilic interest in terms of fantasy and paraphilic interest in terms

of engagement and behaviour. It is important to define also which factors influence the development of a paraphilic fantasy in a paraphilic behaviour (Molen et al., 2022).

In general, one of the factors that has been linked with delinquency, as well as sexual violence, is self-control (Cheung & Cheung, 2010). Impulsivity, a fundamental aspect of sexual self-control, plays a key role on deciding to act or not on a paraphilic behaviour (Molen et al., 2022).

A distinction of two different forms of impulsivity has been made by Dickman (1990): functional impulsivity and dysfunctional impulsivity. The first one is associated with the idea of generation, enthusiasm, adventurousness, and the ability to make quick decisions, while the second one is related to erratic disorderliness, distraction, and inaccurate decision making (Dickman, 1990). Furthermore, impulsivity can be also described as “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions” (Moeller et al., 2001) and as “behaviors that are premature, risky, unplanned and inadequate to situation” (Daruna JH & Barnes, 1993).

If the functional impulsivity can lead to positive outcomes, the dysfunctional one is broadly used concerning sexual offences. However, the level of impulsivity differs between different sex offenders. Snoyman and Aicken (2011) found that sex offenders are significantly less impulsive than non-sex offenders. Recidivism rates can also be used to examine the differences in impulsivity (Perley-Robertson et al., 2019). For instance, Quinsey et al. (1995) found that rapists recidivated less than child molesters, suggesting that child molesters act with less impulsivity.

There are several measures used to investigate impulsivity, principally self-report measures, behavioral measures (Lodi-Smith et al., 2014), and neurophysiological measures, such as the electroencephalogram (EEG), which allows to detect fast and early brain responses due to its high-resolution time. Research shows that high impulsivity is linked with decreased behavioral inhibition in a Go/No-Go task. The task is a measure of response inhibition because individuals have to desist from doing an action (usually pressing a button) after precise stimuli in No-Go trials. In a German study, Schiffer and Vonlaufen, (2011) found that child sexual offenders were more impulsive in Go/No-Go task, not only compared to healthy controls, but also to no sexual offenders.

Furthermore, two kinds of ERPs have been studying in Go/No-Go Task that show differences between Go-trials (pressing a button) and NoGo-trials (not response): N2 and P3. N2 is frontal negative displacement in a time range of about 200 to 300 ms after the stimulus, while P3 is a frontocentral positive diversion which peaks at 300-500 ms. These displacements can be seen mostly during No-Go trials and are therefore considered to reflect response inhibition (Nakata et al., 2004).

It has been demonstrated that individuals with high impulsivity have significantly reduced P3 and N2 amplitudes during a Go/No-Go Task (Chan et al., 2015; Ruchow et al., 2008). In particular, the Nogo-N2 and the Nogo-P3 have been found to be related to response inhibition condition (Fallgatter & Strik, 1999; Pfefferbaum et al., 1985). Some studies showed that the Nogo P3 amplitude was reduced in healthy subjects with high impulsivity scores, compared to those with low impulsivity scores (Ruchow et al., 2008; Shen et al., 2014). Similarly, a reduced Nogo P3 amplitude has been reported for individual with deficits in inhibitory control, such as patients with borderline personality disorder (Ruchow et al., 2008).

Despite studies above mentioned demonstrate that P3 and N2 are related to response inhibition, findings from other studies suggest that these ERPs are not more reduced in highly impulsive people. Rosburg et al. (2018) used the Go/No-Go task to investigate the difference in P3 and N2 between healthy individuals, contact child sexual offenders and non- contact child sexual offenders. They found the N2 and P3 amplitudes were the same in CSOs and healthy individual, suggesting unaltered response inhibition. Similarly, a reduced N2 amplitude was not found in juvenile inmates with impulsive aggression (Chan et al., 2015).

Behavioral and neurophysiological measures investigate response inhibition, one of the several aspects related to impulsivity. However, impulsivity is a notion that cannot be reduced only to one concept (Rosburg et al., 2018) and, in most of studies, it is assessed by standardized self-report questionnaires and not behavioral measure: this cause, at best, a modest correlation between these measures (Cross et al., 2011).

Recent studies proposed that personality traits can represent one of the factors of paraphilic interest (Bartels & Gannon, 2011), in particular those included in the so-called “Dark Triad” (Paulhus & Williams, 2002). The Dark Triad is composed by narcissism, Machiavellianism and psychopathy. In addition to these traits, which are dispositions to

amoral and antisocial behaviour, recent research has suggested that everyday sadism should also be added (Buckels et al., 2013; Chabrol et al., 2009). Infact, several studies demonstrated the overlap of this trait with the personality traits of the Dark Triad (Buckels et al., 2013; Chabrol et al., 2009; Mededović & Petrović, 2015; Paulhus, 2014). With the inclusion of sadism as an individual construct, the Dark Triad has been expanded and recalled “the Dark Tetrad “of personality. Despite these traits have common characteristics such as dishonesty and manipulation, they are distinctly separate from each other (Jonason & Krause, 2013). Psychopathy represents callousness, impulsiveness, and a lack of empathy (Hare & Neumann, 2009; Walker et al., 2017). Narcissism describes self-absorption and feelings of entitlement (Malesza & Ostaszewski, 2016). Machiavellianism is characterized by selfishness and the strategic manipulation of others for personal gain (Jonason & Krause, 2013). Finally, sadism indicates the pleasure by inflicting physical or emotional pain on other persons (Reidy et al., 2011) by control, punishing, and humiliating others (Myers et al., 2006).

In a study conducted by Dudeck et al. (2007), it has been found that 36.8% of the sexual offenders suffered from a narcissistic personality disorder versus 9.4% of the non-sexual offenders. Another study showed offenders with higher scores in psychopathy were significantly more likely to have a sadistic paraphilia than offenders with low and moderate psychopathy (Woodworth et al., 2013). Like psychopathy, sadism is linked with sex offending: convicted rapists have been reported to have sadistic motivation in 5% of cases (Groth, 1979) and, among criminals convicted of sexual homicide, 32% of them was diagnosed with sexual sadism disorder (Stefanska et al., 2019).

Dark Tetrad personality traits also correlate with various aspects of sexual behavior, characterized by the motivation to look for variety and novelty in sexual activities. These factors may lead to the development of paraphilias (Kafka, 2001, 2009). Dark Tetrad personality traits have been discovered to be related to sexual promiscuity (Burtäverde et al., 2021) and sexually deviant courtship behaviors, such as exhibitionism and voyeurism were found to be associated to elevated levels of narcissism (Lodi-Smith et al., 2014). In addition, psychopathy was the most strongly correlated with high sex drive and fantasies with exploratory, impersonal, and sadomasochistic themes (Baughman et al., 2014).

Impulsivity is another factor that correlates with Dark Tetrad personality trait and explains the tendency to preference for novelty and variety in sexual activities. The Dark

Triad is characterized by low conscientiousness (Jonason et al., 2010) and at least two traits of the Dark Triad – narcissism and psychopathy – are associated with high rates of impulsivity and risk-taking (Jonason et al., 2010). Psychopathy is primarily related to dysfunctional impulsivity, narcissism to the functional one, while Machiavellianism is not associated to any type of impulsivity (Crysel et al., 2013; Jones & Paulhus, 2011; Vazire & Funder, 2006; Woodworth & Porter, 2002). March et al. (2017) examined the relation between all four Dark Tetrad traits and impulsivity: they found that Machiavellianism, psychopathy, and sadism are positively correlated with dysfunctional impulsivity, and that psychopathy, if it is present in high or medium levels, moderates the relationship between dysfunctional impulsivity and trolling behaviours on online dating applications.

Most of studies of paraphilias or paraphilic interest have used a clinical population, or they have been conducted in a forensic setting; few studies have focused on a general population because of the idea that paraphilic interest is abnormal or deviant and present only in sexual pathologies. However, in most of the case, the paraphilic interest is not pathological, but just another type of expression of sexuality. For instance, recent studies demonstrated that paraphilic interest may be more usual than we think. Williams et al. (2009) used a sample of 88 non offenders to investigate which personality trait could predict sexual deviant fantasies and behaviour. They found that psychopathy highly correlated with paraphilic fantasies, in particular bondage and sadism. Furthermore, when the three traits of the Dark Triad were analysed simultaneously, psychopathy was found to be the strongest predictor. Williams et al. also found that individual with high scores in psychopathy were more likely to translate their paraphilic fantasies into behavior. Ahlers et al., (2011) found that 64% of male participants revealed at least a paraphilic interest and 44% of them reported a paraphilic behavior. Similarly, in a study conducted by Joyal and Carpentier (2016), almost half of the sample of Canadian adults reported at least one engagement in paraphilic behaviours.

Since some paraphilic interests, such as paedophilia, biastophilia or sexual sadism may violate social norms and law, is necessary to understand them in a general population in order to prevent risks of sexual crimes and recidivism in them (Chan, 2021). Studying paraphilic interest in a non-clinical population can bring benefits not only from a criminal justice point of view, but also from a personal and interpersonal health perspective:

breaking the taboos may help individual to discover their sexuality and to ask for professional help in case of sexual problems without any stigma.

Similarly, when people think about personality traits such as sadism, narcissism, psychopathy and Machiavellianism, they have the tendency to consider these dark traits as something belonging just to clinical and forensic population. Most of the studies are conducted by considering these aspects only in their categorial dimension (Baughman et al., 2014; Figueredo et al., 2015). However, since these traits of personality are present in a continuum, they should be studied in general population and not only in the forensic or clinical ones, where these traits are extremely and pathological present. Studying these aspects in a non-clinical population can help to discover the real nature of human personality (Jonason & Dinić, 2021).

Starting from these assumptions, this study was interested in studying the Dark Tetrad traits and paraphilic interests in a general population of students. Therefore, the study had the goal to examine whether a relationship exists between the Dark Tetrad personality traits and paraphilic interest. Furthermore, since impulsivity has been related to both the Dark Tetrad and paraphilia in offenders, we examined the role of impulsivity in this relationship, by using electrophysiological ERP-measure.

Therefore, based on literature, two research questions have been formulated for the current study. The first one is: “Which is the relationship between paraphilic interest, in terms of engagement, and Dark Tetrad personality traits?”, while the second is: “Which is the role of impulsivity in this relationship?”. Corresponding with these research questions, five hypotheses have been proposed.

For the first research question, three hypotheses have been postulated:

1. There is a positive association between Dark Tetrad personality traits and engagement in paraphilic activities.
2. Psychopathy and sadism are the most highly predictors of engagement in paraphilic activities.
3. Psychopathy is correlated mostly with masochist, fetishist and sadist activities.

Lastly, corresponding with the second research question, two hypotheses have been formulated:

1. P3 and N2 have a reduced amplitude in those scoring high on Dark Tetrad and paraphilic interest.
2. Impulsivity, measured by ERPs, moderates the relation between Dark Tetrad personality traits and paraphilic interest.

The study was conducted at Erasmus Behaviour Lab under the supervision of Dr. Josanne van Dongen, associate professor of the Forensic and Legal Psychology program master of Erasmus University of Rotterdam.

Methods

2.1 Participants

A sample of 52 students ($M = 20.98$ years, $SD = 2.53$, range = 18–27) participated in this study. Most of the participants in this study were females (62%, $n=32$), with the remaining males (34%; $n=18$) and non-binary (4%; $n=2$). The sample was collected from the Erasmus University of Rotterdam, most of the students were Psychology students; they received course credits in exchange for participating in the study. Sociodemographic characteristics of participants are presented in Table 2.

Participants were excluded if they were suffering from a physical or mental illness and had hearing or visual impairments which can not be corrected using aids. Two participants were excluded because of too many artifacts in the data in the No-Go condition, resulting in a sample of 50 participants.

Ethical approval was obtained from the Research Ethics Review Committees of the Erasmus School of Social and Behavioural Sciences.

Table 2. *Sociodemographic characteristics of participants*

		Frequency	Percent (%)
Sexual orientation	Heterosexual	38	73%
	Homosexual	6	12%
	Bisexual	7	13%
	Asexual	1	2%
Country of residence	The Netherlands	46	92%
	Germany	1	2%
	Spain	1	2%
	Vietnam	1	2%
	Japan	1	2%
Relationship status	Single	21	40%
	Dating	3	6%
	In a relationship	28	54%
Highest level of education	High school diploma	24	46%
	College/university, no degree	18	34%
	Associate's degree	1	2%
	Bachelor's degree	7	14%
	Master's degree	2	4%
Employment	Employed part-time	11	21%
	Unemployed	1	2%
	Student	39	75%
	Student and part- time worker	1	2%
			2%
Ethnicity	White		75%
	Hispanic		4%
	Black or African American		2%
	Asian		7%
	Middle North Africa		2%
	Mixed		10%

2.2 Measures

Self-report measures

Participants completes the self-report measures on Qualtrics.

Dark Tetrad traits were measure using the *Short Dark Tetrad* (Paulhus et al., 2021). It contains 28 items, seven for each of the four traits of Machiavellianism (e.g., “Avoid direct conflict with others because they may be useful in the future.”, “Whatever it takes, you must get the important people on your side.”), subclinical Narcissism (e.g., “I have some exceptional qualities.”, “I have a unique talent for persuading people.”), subclinical Psychopathy (e.g., “People often say I’m out of control.” “I tend to fight against authorities and their rules.”), and Sadism (e.g., “Some people deserve to suffer.”, “Just for kicks, I’ve said mean things on social media.”). For each item participants had to rate their agreement on a five-point scale: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

Dickman's Impulsivity Inventory (DII) was administered to measure impulsivity (Dickman, 1990). This is a 23-item self-report measure and it consists of two scales: one of 11 items for functional impulsivity (e.g., “Most of the time, I can put my thoughts into words very rapidly.”, “People have admired me because I can think quickly.”), and the second one of 12 item for dysfunctional impulsivity (e.g., “I will often say whatever comes into my head without thinking first.”, “I often get into trouble because I don’t think before I act.”). The DII uses a dichotomous response format for each item (True=1 False=2).

The *Marlowe-Crowne Social Desirability Scale (MCSDS)* in its 13-items short version was used to identify social desirability responses (e.g., “I am always courteous, even to people who are disagreeable”, “No matter who I’m talking to, I’m always a good listener”) and to provide validity evidence for other scale scores used in this study (Cross et al., 2011). The MCSDS has a dichotomous response format for each item (True=1 , False=2).

The *Paraphilias Scale* (Seto et al., 2020) was used to evaluate the participants’ interest in paraphilic activities and their engagement with those activities. First, participants had to rate the 40 items regarding their sexual interest, on a 7-point scale (-3=very repulsive, -

2= somewhat repulsive, -1=mildly repulsive, 0=indifferent, +1=mildly arousing, +2=somewhat arousing, +3=very arousing). Of the 40 items, 38 referred to 13 subtypes of paraphilic interest. These subtypes are: voyeurism (e.g., “You are watching unsuspecting stranger while they undress.”), exhibitionism (e.g., “You are exposing your genitals to a stranger who is not expecting it.”), scatologia (e.g., “ You are making obscene phone calls to someone who is not expecting it.”), fetishism (e.g., “You are touching an object like shoes, gloves, or plush toys.”), frotteurism (e.g., “You are touching or rubbing a stranger who is not expecting it.”), sadism (“You are spanking, beating, or whipping someone.”), masochism (e.g., “You are having your breathing restricted during sexual activity.”), biastophilia (e.g., “You are seeing someone unconscious or unable to move.”), urophilia (e.g., “You are urinating on someone.”), scatophilia (e.g., “You are being defecated on by someone”), pedohebephilia (e.g., “You are having sex with a girl below the age of 12.”), Eroticized gender (e.g., “You are imagining yourself as someone of the opposite sex.”), and zoophilia (e.g., “You are having sex with an animal.”) Participants then had to rate the same 38 items in terms of their actual engagement on a 5-point scale: (1=never, 2=once or twice ever, 3=once a year or more on average, 4 = once a month or more on average, and 5= once a week or more on average). The other two items are used as control items as they were referred to interest in adult males and females.

Psychometric properties for all scales are shown in Table 3. The Cronbach’s α of Short Dark Tetrad scale was .88 (>.80) which indicates high internal consistency. The Cronbach’s α of Dickman's Impulsivity Inventory and The Cronbach’s α of Marlowe-Crowne Social Desirability were respectively .19 and .06 which indicate that these scales have an unacceptable internal consistency. Lastly, The Cronbach’s α of Paraphilias Scale was .84 (>.80) which indicates high internal consistency.

Table 3. *Psychometric properties for scales*

Scale	<i>M</i>	<i>SD</i>	Range	Cronbach’s α
Short Dark Tetrad	2,69	.42	2-4	.88
DII	1,57	.13	1-2	.19
MCSDS	1,44	.52	1-2	.06
Paraphilias Scale	1,88	.19	1-3	.84

DII= Dickman's Impulsivity Inventory , MCSDS= Marlowe-Crowne Social Desirability Scale

Go/No-Go Task

Participants had to complete one behavioural task: the Go/No-Go. The Go/No-Go task consisted of 400 trials (of which 125 were No-Go trials). In each trial, a vowel (A, E, I, O, or U) was shown. When the vowel was different from the previously shown vowel, participants had to press the space button as fast as possible, indicating a “Go”. If the vowel was the same of the previous one, participants had to indicate a ‘No-Go’ by not pressing any button. Vowels were shown for 200 ms, and between vowels the screen was black for a time between 1020 and 1220 ms. Vowels were presented in white on a black background.

EEG-recording

Brain activity was measured using EEG. A Biosemi Active-Two amplifier system was used to recorder EEG during the Go/No-Go Task. A total of thirty-two active Ag/AgCl electrodes were mounted in an elastic cap and placed on the scalp in base on the 10–20 International System, with two extra electrodes at FCz and CPz. Additional electrodes were attached to the right and left mastoids as references; for recording a horizontal electrooculogram recording the outer canthi of both eyes (for recording a horizontal electrooculogram), and the infraorbital and supraorbital region of the left eye (for recording a vertical electrooculogram). Brain Vision Analyzer 2.0 (Brain Products, Munich, Germany) was used to transform offline the recorded raw EEG signals. Data were referenced to the computed mastoids. In addition, all signals were filtered with a band pass of 0.10–30 Hz. The Gratton et al. (1983) algorithm was used for ocular corrections. Topographical interpolation (Soong et al., 1993) was employed to calculate new values for bad channels, with a maximum of 200 channels per participant (data were excluded if more than half bad channels had to be interpolated). The data from the Go/No-Go task were segmented into epochs of 1200 ms: from 200 ms before to 1000 ms after stimulus presentation for both Go (marked with “399”) and No-Go (marked with “101”) trials. The pre-stimulus period (200 ms) served as a baseline. Epochs including a signal that exceeded $\pm 75 \mu\text{V}$ were excluded. The ERPs of interest for the study in the Go/No-Go task were the N2 (representing response inhibition) and the P3 (representing more elaborate appraisal of the stimuli). The N2 was defined as the difference between the mean amplitude on No-Go trials vs. Go trials within the 175–250 ms time interval,

averaged across Cz. The P3 difference wave for the Go/No-Go task was defined as the difference between the mean amplitude on No-Go trials vs. Go trials within the 300–500ms time interval, again averaged across Cz.

2.3 Procedure

Participants signed up for the study on the website of Erasmus University of Rotterdam. Then, they were contacted to schedule the EEG session. Once in the lab, participants first had to fill out the survey. They had to read the participants' informed consent where they were told about the research proposal and that their responses would be kept confidential. After the consent form, they were asked to make a note of the participant number in order to be able to save their EEG and Go/No-Go data; then the questionnaire was administered. They completed the survey in private without any interruption. After the survey they were accompanied to the room for the Resting state Task and then Go/No-Go task. The EEG session, including filling the survey, the Resting State Task and the Go/No-Go Task took approximately two hours.

2.4 Statistical Analyses

All data processing and statistical analyses from self-report questionnaire and electrophysiological measures were done in IBM SPSS Statistics 25. Firstly, data descriptive statistics were retrieved. To assess the associations between Dark Tetrad personality traits and paraphilic interest, Pearson correlations were performed. This step allows to determine whether the relationship is linear and to perceive the relationships between our variables, but not yet to confirm our second hypothesis, according to which psychopathy and sadism traits predict paraphilic interest. To be able to do so, a hierarchical regression analysis was executed: at step 1 sadism was put as control and at step 2, psychopathy was added as predictor of engagement in paraphilic activities. To check if psychopathy is correlated mostly with fetishist, masochist and sadistic activities, Pearson correlation was performed. To assess the possible moderating effect of impulsivity, we use PROCESS in SPSS, while Pearson correlation was used to assess the relation of P3 and N2 with paraphilic interest and Dark Tetrad personality traits. Before all these analyses, all necessary assumption were checked. Firstly, we checked for outliers and mistakes in data of the sample: due to excessive artifacts in P3 and N2 of two participants, these individuals were removed from the analyses. For all analyses, the assumption of linearity was checked by creating a Q-Q plot. Then, a boxplot was creating to check normality. The independence of residual errors was assessed using Durbin-

Watson test. For multiple regression analyses, the assumption of homoscedasticity was checked by creating a scatterplot of residual and predicted values. Finally, multicollinearity was assessed by analysing Pearson correlations, ensuring no correlations higher than .80

2.5 Data Management Plan

During the entire study personal and sensitive data were saved and pseudonymized for privacy reasons at a secured server of the Erasmus University. All data were coded and archived at Erasmus University throughout the whole study period and archived for 15 years

Results

3.1 Relation between Dark Tetrad and paraphilic interest

As can be seen in Table 4, there is a statistically significant and strong positive correlation between Dark Tetrad personality traits and paraphilic interest, measured by both arousal and engagement ($r(50) = .59, p < .001$). A statistically significant and moderate positive correlation was also found between Dark Tetrad personality traits and engagement in paraphilic activities ($r(50) = .48, p < .001$). This result confirms our first hypothesis, according to which there is a positive correlation between Dark Tetrad personality traits and engagement in paraphilic activities. In addition, significant and strong positive correlation was found between Dark Tetrad personality traits and arousal ($r(50) = .59, p < .001$). Finally, considering each trait separately, results shows that the most correlated to engagement and arousal are psychopathy ($r(50) = .45, p = .001$) and sadism ($r(50) = .63, p < .001$).

Table 4. Pearson correlations between the SD4 scale and Paraphilias Scale

Short Dark Tetrad	Paraphilias Scale		
	Total	Arousal	Engagement
Machiavellianism	.33*, $p=.019$	.35*, $p=.013$	.21, $p=.135$
Narcissism	.32*, $p=.024$	.31*, $p=.027$	.27, $p=.057$
Psychopathy	.45**, $p=.001$	.39**, $p=.005$	.51**, $p<.001$
Sadism	.63**, $p<.001$	.66**, $p<.001$	.43**, $p=.002$
SD4 total	.59**, $p<.001$	.59**, $p<.001$	.48**, $p<.001$

** significant at the 0.01 level ($p<0.01$) * significant at the 0.05 level ($p<0.05$).

Table 5 shows the results of the hierarchical regression analysis, performed to assess which trait is the most predictor of engagement in paraphilic activities. At Step 1, sadism significantly predicted engagement in paraphilic activities ($R^2=.17$, $F(50)=10.46$, $p=.002$) and it explained 17% of the variance of the model. Adding psychopathy at Step 2, the model was able to predict 30% of engagement in paraphilic interest.

Psychopathy has been found to significantly predict engagement ($R^2=.12$, $F(49)=8.66$, $p=.005$). These results, confirm our second hypothesis according to which psychopathy and sadism predict engagement in paraphilic activities.

Lastly, Pearson correlation was performed to see which paraphilic activities are most correlated to psychopathy: psychopathy trait showed a significant and moderate positive correlation with engagement in fetish ($r(50) = .31$, $p=.026$), masochist ($r(50) = .41$, $p=.003$) and sadist activities ($r(50) = .50$, $p<.001$). This result confirms our hypothesis which states that psychopathy is correlated mostly with fetish, masochist and sadist activities.

Table 5. Results from hierarchical regression analysis

Predictors	β	t	R	R^2	ΔR^2
Step 1			.416	.173	.173
Sadism	.134	3,23			
Step 2			.545	.297	.124
Psychopathy	.159	2,94			

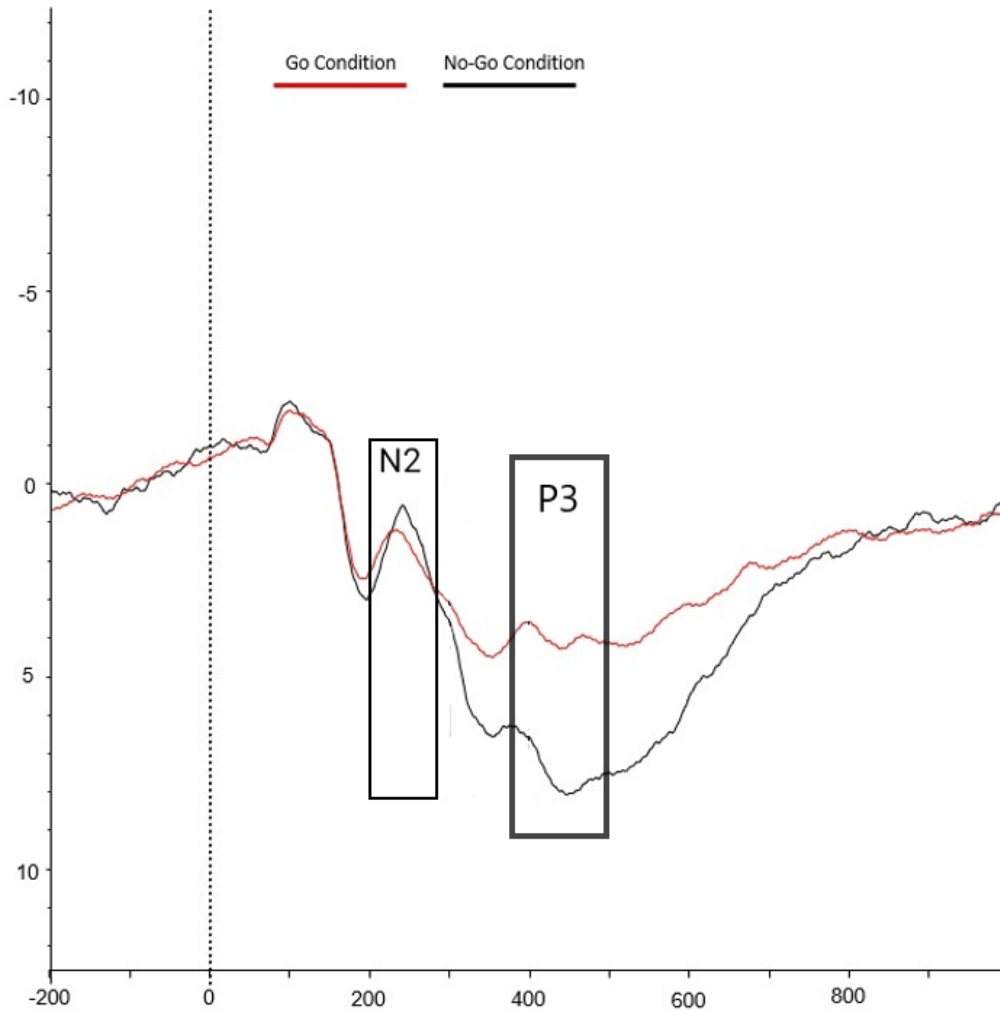
3.2 The role of impulsivity

Firstly, we checked for a possible correlation between the two measures of impulsivity used in this study (ERPs and Dickman Impulsivity Scale): no significant correlation was found between these measures. We did not consider the results from Dickman Impulsivity Scale because of its low reliability assessed with Cronbach' alpha.

Figure 1 depicts the grand-averaged P3 and N2 amplitudes elicited in the Go/No-Go Task conditions. P3 and N2 amplitudes were greater in the No-Go condition than for a Go condition with respectively peaks at 250 ms and 450 ms. N2 did not show the maximum amplitude in the CZ site, while P3 showed it.

In accordance with our hypothesis, we expected that P3 and N2 amplitude would negatively associate with Dark Tetrad personality traits and paraphilic interest, meaning that people who have lower levels of response inhibition would score high on Dark Tetrad and paraphilic interest. We found that P3 and N2 negatively correlated with engagement in paraphilic activities, but this correlation was weak and not statistically significant. There was no significant correlation between psychopathy trait and these two ERPs, while sadism showed a moderate negative correlation with P3 ($r(50) = -.30, p=.032$).

Figure 1: Grand averaged N2 and P3 of Go and No-Go conditions at Cz site; Go condition is depicted by a red line, No-Go condition is depicted by a black line.



Lastly, to assess the moderation role of impulsivity between Dark Tetrad and paraphilic interest, PROCESS was performed. We considered sadism and psychopathy as independent variables, engagement as the dependent one and P3 and N2 as moderators. However, contrary to our hypothesis, we did not find any significant interaction and moderation effects between our variables.

Discussion

The aims of the current study were to assess which kind of relation exists between Dark Tetrad personality traits and paraphilic interest and to identify which is the role of impulsivity in this relation.

Corresponding with the first aim, the results are in line with our hypotheses, and they contribute a clearer understanding of the relation between Dark Tetrad traits and paraphilic interest. The study identified a positive correlation between Dark Tetrad personality traits and engagement in paraphilic activities ($r(50) = .48, p < .001$). This result supports the theories according to which personality traits correlate with paraphilias (Bartels & Gannon, 2011). Furthermore, in accordance with past research, which identified psychopathy and sadism as the traits most related to engagement in paraphilic activities (Ahlers et al., 2011; Baughman et al., 2014; Joyal & Carpentier, 2016; Stefanska et al., 2019), our study assessed that these two traits are the most predictors of engagement in paraphilic activities. In particular, psychopathy has been found as most correlated to fetish ($r(50) = .31, p = .026$), masochist ($r(50) = .41, p = .003$) and sadist activities ($r(50) = .50, p < .001$), as previous research suggested (Williams et al., 2009).

Corresponding to the second aim, we did not find significant results. Firstly, we did not find an association between the two measures of impulsivity used in this study (ERPs and Dickman Impulsivity Scale): this is in line with the ideas that response inhibition, measured by ERPs, does not totally cover the huge meaning of impulsivity that is assessed with standardized questionnaire (Cross et al., 2011). As a whole, we found that individuals had larger P3 amplitudes during No-Go trials than during Go trials, suggesting that the task in our study was valid. In accordance with previous studies (Chan et al., 2015; Ruchow et al., 2008; Shen et al., 2014), we expected that P3 and N2 amplitudes, markers of response inhibition, would be reduced in those individuals with high scores in Dark Tetrad and paraphilic interest. In other words, we expected that P3 and N2 amplitudes would be negatively associated to Dark Tetrad and paraphilic interest. The study found negative correlations between psychopathy and P3 and N2, but they were not statistically significant, while sadism showed a moderate negative correlation with P3 ($r(50) = -.30, p = .032$). Negative, but not significant correlations were also found between N2, P3 and engagement in paraphilic activities. These results suggest that response inhibition has an aversive relation with Dark Tetrad traits and paraphilic interest and that

the inclusion of more participants could lead to the likelihood of a statistically significant negative association between these three variables. Since impulsivity has been frequently associated with paraphilias (Quinsey et al., 1995; Snoyman & Aicken, 2011) and Dark Tetrad personality traits (Jonason et al., 2010), we hypothesized that impulsivity could play a role of moderator between these two variables. However, the moderation analysis did not show any significant interaction or moderation effect of impulsivity, suggesting that the relation between Dark Tetrad and paraphilic interest is not dependent by the level of impulsivity.

However, finding of the current study must be interpreted with discretions due to some limitations. The first limitation regards the sample of the study. The sample was relatively homogeneous: most of participants were Dutch, heterosexual and undergraduate psychology students. The sample cannot be considered representative of a general population. More heterogeneous sample with individuals from different communities and ethnicity must be used to improve the strength of the study. Furthermore, another limitation regards the size of the simple: due to the small size of our sample, the statistical power of the study could be doubtful. It is important to have enough big sample, especially in EEG studies (Moser et al., 2015), in order to reduce the chances of finding non-significant results and increase those that are genuinely true (Forstmeier et al., 2017).

Regarding EEG data and results concerning the role of impulsivity, some limitations can be highlighted. Firstly, the setting of the laboratory does not allow the individuals to show the same behavioral responses as in the real life: individuals might show better cognitive control than in real life. Furthermore, the Go/No-Go Task presented neutral stimuli without any sexual arousal: this does not allow to assess if individuals would have the same response inhibition in front of stimuli with sexual arousal. Lastly, we could not analyse behavioural measures from Go/No-Go Task. In particular, the number of incorrect No-Go trials, the number of times participants had two incorrect trials in a row and a lower average response time on the correct Go trials and incorrect No-Go trials are measures of impulsivity. Using these behavioral measures would help to find significant results from Go/No-Task and EEG and infer better regarding the role of response inhibition in the relation between Dark Tetrad and paraphilic interest.

Despite these limitations, the current study, together with results from previous research, support the relation between Dark Tetrad personality traits and engagement in paraphilic

activities. Further investigation must be made regarding the role of impulsivity, measured by ERPs, in this relation. Therefore, in the future studies, a bigger sample should be used and behavioral measures from Go/No-Go must be measured. Furthermore, sexual stimuli instead of neutral ones can lead to assess a better relation between response inhibition and paraphilic interest.

Furthermore, this study encourages to examine Dark Tetrad traits and paraphilic interest in general population. It is important to destigmatize Dark Tetrad traits and to consider them as dimensional constructs that are present in everyone (Baughman et al., 2014; Figueredo et al., 2015). Studying these traits only in forensic population leads to examine just the pathological aspects of them. Similarly, since most of the time paraphilic interest is not pathological, but a different expression of sexuality, it should be studied more in a non-clinical population in order to demonstrate that a not habitual sexual activity does not necessarily mean “deviant” or “abnormal”. Breaking the taboo of sexuality can contribute to increase the number of requests for professional sex consulting, which can be effectual in case of sex problems and personal distress caused by them. Furthermore, from a criminal justice point of view, it is important to study paraphilic interest in general population in order to prevent the risk of sexual crimes (Chan, 2021).

References

- American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.).
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Ahlers, C. J., Schaefer, G. A., Mundt, I. A., Roll, S., Englert, H., Willich, S. N., & Beier, K. M. (2011). How unusual are the contents of paraphilias? Paraphilia-associated sexual arousal patterns in a community-based sample of men. *The journal of sexual medicine*, 8(5), 1362–1370.
- Baughman, H. M., Jonason, P. K., Veselka, L., Vernon, P. A. (2014). Four shades of sexual fantasies linked to the dark triad. *Personality and Individual Differences*, 67, 47-51.
- Bartels, R. M., & Gannon, T. A. (2011). Understanding the sexual fantasies of sex offenders and their correlates. *Aggression and Violent Behavior*, 16(6), 551–561.
- Buckels, E. E., Jones, D. N., & Paulhus, D. L. (2013). Behavioral confirmation of everyday sadism. *Psychological Science*, 24, 2201-2209.
- Burtăverde, V., Jonason, P. K., Ene, C., & Istrate, M. (2021). On being “dark” and promiscuous: The Dark Triad traits, mate value, disgust, and sociosexuality. *Personality and Individual Differences*, 168, 110255.
- Chabrol, H., Van Leeuwen, N., Rodgers, R., & Séjourné, N. (2009). Contributions of psychopathic, narcissistic, Machiavellian, and sadistic personality traits to juvenile delinquency. *Personality and Individual Differences*, 47, 734-739.
- Chan, H. C., Beauregard, E., & Myers, W. C. (2015). Single-victim and serial sexual homicide offenders: Differences in crime, paraphilias, and personality traits. *Criminal Behavior and Mental Health*, 25(1), 66–78.
- Chan, H. C. (2021). Paraphilic Interests: The Role of Psychosocial Factors in a Sample of Young Adults in Hong Kong. *Sexuality Research and Social Policy*, 19(1), 159–178.

- Cheung, N. W. T., & Cheung, Y. W. (2010). Strain, self-control, and gender differences in delinquency among Chinese adolescents: Extending general strain theory. *Sociological Perspectives*, 53(3), 321–345.
- Cross, C. P., Copping, L. T., & Campbell, A. (2011). Sex differences in impulsivity: A meta-analysis. *Psychological Bulletin*, 137(1), 97–130.
- Crysel, L. C., Crosier, B. S., & Webster, G. D. (2013). The dark triad and risk behavior. *Personality and Individual Differences*, 54, 35-40.
- Daruna JH, Barnes P. A neurodevelopmental view of impulsivity. (1993). The impulsive client: theory, research and treatment., ed. J.J.L. McCown WG, Shure MB. Washington DC: *American Psychological Association*.
- Dickman, S. J. (1990). Functional and dysfunctional impulsivity: Personality and cognitive correlates. *Journal of Personality and Social Psychology*, 58(1), 95–102.
- Dawson, S. J., Bannerman, B. A., & Lalumière, M. L. (2014). Paraphilic Interests. *Sexual Abuse*, 28(1), 20–45.
- Dudeck, M., Spitzer, C., Stopsack, M., Freyberger, H. J., & Barnow, S. (2007). Forensic inpatient male sexual offenders: The impact of personality disorder and childhood sexual abuse. *Journal of Forensic Psychiatry & Psychology*, 18(4), 494-506.
- Fallgatter, A. J., & Strik, W. K. (1999). The NoGo-anteriorization as a neurophysiological standard-index for cognitive response control. *International Journal of Psychophysiology*, 32(3), 233–238.
- Figueredo, A. J., Gladden, P. R., Sisco, M. M., Patch, E. A., & Jones, D. N. (2015). The unholy trinity: The dark triad, sexual coercion, and Brunswik-Symmetry. *Evolutionary Psychology*, 13(2), 435-454.
- Forstmeier, W., Wagenmakers, E. J., & Parker, T. H. (2017). Detecting and avoiding likely false-positive findings—a practical guide. *Biological Reviews*, 92(4), 1941- 1968.
- Gratton, G., Coles, M. G., & Donchin, E. (1983). A new method for off-line removal of ocular artifact. *Electroencephalography and clinical neurophysiology*, 55(4), 468–484.
- Groth, N. A. (1979). *Men Who Rape: The Psychology of the Offender* (First Edition). Basic Books.

- Hare, R. D., & Neumann, C. S. (2009). Psychopathy: assessment and forensic implications. *Canadian journal of psychiatry. Revue canadienne de psychiatrie*, 54(12), 791–802.
- Jonason, P.K., & Dinić, B. (2021). Passing the torch: Second-generation research on the Dark Triad/Tetrad traits. *Primenjena Psihologija*, 14, 397–405.
- Jonason, P. K., & Krause, L. (2013). The emotional deficits associated with the Dark Triad traits: Cognitive empathy, affective empathy, and alexithymia. *Personality and Individual Differences*, 55(5), 532-537.
- Jonason, P. K., Li, N. P., & Teicher, E. A. (2010). Who is James Bond? The Dark Triad as an agentic social style. *Individual Differences Research*, 8(2), 111–120.
- Jones, D. N., & Paulhus, D. L. (2011). The role of impulsivity in the Dark Triad of personality. *Personality and Individual Differences*, 51(5), 679–682.
- Joyal, C. C., & Carpentier, J. (2016). The Prevalence of Paraphilic Interests and Behaviors in the General Population: A Provincial Survey. *The Journal of Sex Research*, 54(2), 161–171.
- Lodi-Smith, J., Shepard, K., & Wagner, S. (2014). Personality and sexually deviant behaviour. *Personality and Individual Differences*, 70, 39-44.
- Kafka, M. P. (2001). The paraphilia-related disorders: A proposal for a unified classification of nonparaphilic hypersexuality disorders. *Sexual Addiction & Compulsivity*, 8, 227-239.
- Kafka, M. P. (2009). Hypersexual disorder: A proposed diagnosis for DSM-V. *Archives of Sexual Behavior*, 39, 377-400.
- Malesza, M., & Ostaszewski, P. (2016). Dark side of impulsivity – associations between the dark triad, self-report and behavioral measures of impulsivity. *Personality and Individual Differences*, 88, 197-201.
- March, E., Grieve, R., Marrington, J., & Jonason, P. K. (2017). Trolling on Tinder® (and other dating apps): Examining the role of the Dark Tetrad and impulsivity. *Personality and Individual Differences*, 110, 139–143.

- Mededović, J., & Petrović, B. (2015). The dark tetrad: Structural properties and location in the personality space. *Journal of Individual Differences*, 36(4), 228-236.
- Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *The American journal of psychiatry*, 158(11), 1783–1793.
- Molen, L. V., Ronis, S. T., & Benoit, A. A. (2022). Paraphilic Interests Versus Behaviors: Factors that Distinguish Individuals Who Act on Paraphilic Interests From Individuals Who Refrain. *Sexual Abuse*.
- Moser, J. S., Durbin, C. E., Patrick, C. J., & Schmidt, N. B. (2015). Combining neural and behavioral indicators in the assessment of internalizing psychopathology in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, 44(2), 329–340.
- Myers, W. C., Burket, R. C., & Husted, D. S. (2006). Sadistic personality disorder and comorbid mental illness in adolescent psychiatric inpatients. *Journal of the American Academy of Psychiatry and the Law*, 34(1), 61–71.
- Nakata, H., Inui, K., Wasaka, T., Tamura, Y., Kida, T., & Kakigi, R. (2004). Effects of ISI and stimulus probability on event-related go/nogo potentials after somatosensory stimulation. *Experimental Brain Research*, 162(3), 293–299.
- Paulhus, D. L., Buckels, E. E., Trapnell, P. D., & Jones, D. N. (2021). Screening for dark personalities: The Short Dark Tetrad (SD4). *European Journal of Psychological Assessment*, 37(3), 208–222.
- Paulhus, D. L., & Williams, K. M. (2002). The Dark Triad of personality: Narcissism, Machiavellianism, and psychopathy. *Journal of Research in Personality*, 36(6), 556–563.
- Paulhus, D. L. (2014). Toward a taxonomy of dark personalities. *Current Directions in Psychological Science*, 23, 421-426.
- Perley-Robertson, B., Helmus, L.M., Derkzen, D.M., & Serin, R.C. (2019). Do Sex Offenders Against Adults , Sex Offenders Against Children , and Non-sex Offenders Differ in Impulsivity?
- Pfefferbaum, A., Ford, J. M., Weller, B. J., & Kopell, B. S. (1985). ERPs to response production and inhibition. *Electroencephalography and Clinical Neurophysiology*, 60(5), 423–434.

- Quinsey, V. L., Rice, M. E., & Harris, G. T. (1995). Actuarial prediction of sexual recidivism. *Journal of Interpersonal Violence*, 10, 85-105
- Reidy, D. E., Zeichner, A., & Seibert, L. A. (2011). Unprovoked Aggression: Effects of Psychopathic Traits and Sadism. *Journal of Personality*, 79(1), 75–100.
- Rosburg, T., Deuring, G., Boillat, C., Lemoine, P., Falkenstein, M., Graf, M., & Mager, R. (2018). Inhibition and attentional control in pedophilic child sexual offenders – An event-related potential study. *Clinical Neurophysiology*, 129(9), 1990–1998.
- Ruchsow, M., Groen, G., Kiefer, M., Hermle, L., Spitzer, M., & Falkenstein, M. (2008). Impulsiveness and ERP components in a Go/Nogo task. *Journal of Neural Transmission*, 115(6), 909–915.
- Seto, M. C., Curry, S., Dawson, S. J., Bradford, J. M. W., & Chivers, M. L. (2020). Concordance of Paraphilic Interests and Behaviors. *The Journal of Sex Research*, 58(4), 424–437.
- Schiffer, B., & Vonlaufen, C. (2011). Executive Dysfunctions in Pedophilic and Nonpedophilic Child Molesters. *The Journal of Sexual Medicine*, 8(7), 1975–1984.
- Shen, I. H., Lee, D. S., & Chen, C. L. (2014). The role of trait impulsivity in response inhibition: Event-related potentials in a stop-signal task. *International Journal of Psychophysiology*, 91(2), 80–87.
- Snoyman, P., & Aicken, B. (2011). Self-reported impulsivity in male offenders with low cognitive ability in New South Wales prisons. *Psychology, Crime & Law*, 17, 151-164.
- Soong, A. C., Lind, J. C., Shaw, G. R., & Koles, Z. J. (1993). Systematic comparisons of interpolation techniques in topographic brain mapping. *Electroencephalography and clinical neurophysiology*, 87(4), 185–195.
- Sorrentino, R. (2016, November 28). DSM-5 and Paraphilias: What Psychiatrists Need to Know. *PsychiatricTimes*. <https://www.psychiatrictimes.com/view/dsm-5-and-paraphilias-what-psychiatrists-need-know>
- Stefanska, E. B., Nitschke, J., Carter, A. J., & Mokros, A. (2019). Sadism among sexual homicide offenders: Validation of the Sexual Sadism Scale. *Psychological Assessment*, 31(1), 132–137.

Vazire, S., & Funder, D. C. (2006). Impulsivity and the Self-Defeating Behavior of Narcissists. *Personality and Social Psychology Review*, 10(2), 154–165.

Walker, B.R., Jackson, C.J. *Moral Emotions and Corporate Psychopathy: A Review*. *J Bus Ethics* 141, 797–810 (2017).

Williams, K. M., Cooper, B. S., Howell, T. M., Yuille, J. C., & Paulhus, D. L. (2009). Inferring sexually deviant behavior from corresponding fantasies: The role of personality and pornography consumption. *Criminal Justice and Behavior*, 36(2), 198–222.

Woodworth, M., & Porter, S. (2002). In cold blood: Characteristics of criminal homicides as a function of psychopathy. *Journal of Abnormal Psychology*, 111(3), 436–445.

Woodworth, M., Freimuth, T., Hutton, E. L., Carpenter, T., Agar, A. D., & Logan, M. (2013). High-risk sexual offenders: An examination of sexual fantasy, sexual paraphilia, psychopathy, and offence characteristics. *International Journal of Law and Psychiatry*, 36, 144-156.