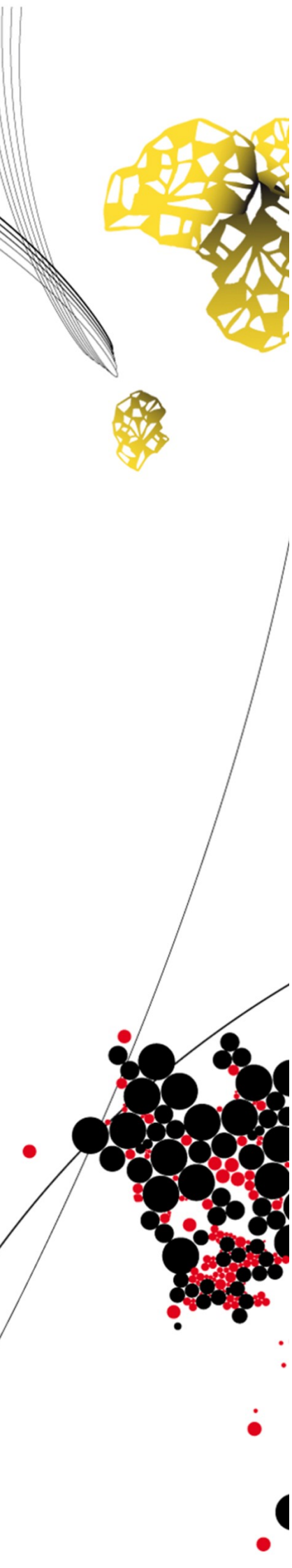

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Faculty of Behavioral, Management and Social Sciences

The Mediating Role of Manipulativeness in the Relationship Between the Dark Triad and Cognitive Enhancement Drug Use

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THE MEDIATING ROLE OF MANIPULATIVENESS IN THE RELATIONSHIP BETWEEN THE DARK TRIAD AND COGNITIVE ENHANCEMENT DRUG USE

Abstract

Cognitive enhancement drug (CED) use is on the rise in academic settings as well as in job situations. To date, no research has empirically identified the characteristics of cognitive enhancement drug users. The present research addresses the relationship between the Dark Triad personality traits – Machiavellianism, narcissism and psychopathy – and cognitive enhancement drug use and how manipulativeness plays a mediating role in this association. In a sample of 175 mostly German and Dutch university students ($Mean_{age}$: 20.8; female: 126, male: 28) the Short Dark Triad scale (SD3) and the manipulativeness subscale of the CAT-PD-SF have been used to measure the Dark Triad and manipulativeness. For examining the frequencies of CED use, a new questionnaire was designed. All three traits of the Dark Triad were found to be positively associated with cognitive enhancement drug use (Machiavellianism: b = .1, narcissism: b = .08, psychopathy: b = .08). However, manipulativeness could not sufficiently explain the relation between the Dark Triad and CED use. The finding that the Dark Triad personality traits and cognitive enhancement drug use are related contributes to the understanding of CED use in European academic institutions.

Keywords: Cognitive enhancement drug use, Dark Triad, manipulativeness, Machiavellianism, narcissism, psychopathy, nootropics, neuroenhancers, personality traits

Introduction

Cognitive enhancement drug use

Within the last years the use of *cognitive enhancement drugs*, also called smart pills, nootropics or neuroenhancers, has become a large topic of discussion. Cognitive enhancement drug (CED) use can be defined as the use of psychoactive drugs to enhance one's cognition, like memory, vigilance, attention or concentration by healthy individuals, thus people who are not prescribed to these drugs (Franke, Bagusat, Rust, Engel, & Lieb, 2014). To increase academic achievement or to be more resilient to longer working hours or shift-work more and more people make use of substances that enhance cognitive processes by promoting alertness, concentration or memory (Sahakian & Morein-Zamir, 2007). Especially in academic settings, like universities, but also in certain professions, the use of these cognition-enhancing substances is very prevalent (Franke et al., 2014; Sahakian, 2016). Research showed the prevalence rates of CED use among healthy individuals range from about 1 % up to more than 20 %, with differences between substances, settings and ways of surveying (Franke et al., 2014). Although in the US this phenomenon has constituted a problem more widely spread than in Europe, it is not to be neglected in European countries (Franke et al.). Among US university students the use of cognitive enhancement drugs is found to be very common. In European countries like Germany or Switzerland the prevalence rates are lower compared to the US, but still high enough to raise concern (Franke et al.). But next to university students, people who work long shifts or are expected to be concentrated over a long time, like surgeons, nurses or pilots, make up a big group amongst the users (Franke et al.). This gives the impression that CED use is not only a trend among young adults that stops when obtaining the degree, but is also happening in adult life in certain occupations. That is what makes this topic so important to address in research. Since student life appears to be where CED use begins, the research of this paper deals with the relation between cognitive enhancement drug use among university students and certain personality traits.

Regarding the various substances used for the purpose of cognitive enhancement a distinction can be made between three categories (Franke et al., 2014). The first category are over-the-counter drugs like coffee, energy drinks, caffeine in general, alcohol, cigarettes and legal Cannabis. These substances can be bought at the supermarket without much effort and are therefore very easy to obtain. Over-the-counter (OTC) drugs are probably the most used group of cognition-enhancing substances (Franke et al.). Caffeine, which is content of coffee

and many energy drinks, has an established place in many people's everyday life to help them start their day in the morning or to overcome fatigue in the afternoon. It has the effect of promoting alertness or vigilance (Zwyghuizen-Doorenbos, Roehrs, Lipschutz, Timms, & Roth, 1990). Energy drinks, containing for example taurine, have similar effects on cognition like coffee (Alford, Cox, & Wescott, 2001). Nicotine, which is a content of cigarettes, has been found to enhance cognition in terms of promoting attention and memory (Warburton, 1992). For alcohol the found effects on cognition showed that it supports memory of earlier learnt information by impairing the acquisition of potentially interfering new memories (Mueller, Lisman, & Spear, 1983). The acquisition of new information was found to be disrupted (Parker, Birnbaum, & Noble, 1976).

The second category, prescriptive drugs, contains drugs initially designed for the treatment of disorders like attention deficit hyperactivity disorder (ADHD) or sleep disorders. These are for example methylphenidate or better known under the brand name Ritalin, dexamphetamine or modafinil, that are being misused for cognitive enhancement. These drugs are prescription drugs that people can usually only obtain from their doctor if they have a certain disorder for which the substance is a treatment method. However, many of these patients sell their prescription drugs illegally to other people, who want to use it for cognitive enhancement (CBS News, 2010). Other ways to obtain these substances seem to also be illegally via the internet. Among the second group of substances, drugs initially used for treatment of disorders (prescriptive drugs), Modafinil, Armodafinil or Methylphenidate, Lisdexamphetamine and Dexamphetamine can be numbered. Substances as Modafinil and Armodafinil are used to treat narcolepsy, obstructive sleep apnoea and other sleep disorders, whereby they enhance wakefulness and alertness (Alcohol & Drug Foundation, 2018). These drugs are being misused for cognitive enhancement with the purpose of being able to work or study longer hours by preventing to become tired. Substances as Methylphenidate, Lisdexamphetamine or Dexamphetamine are commonly used to treat ADHD by affecting restlessness, impulsive behavior and inattentiveness (Alcohol & Drug Foundation). Therefore, it is not surprising that they are so popular for increasing concentration during long study sessions.

The third category are illicit drugs like ecstasy or methamphetamine that are mainly used for recreational purposes but that also enhance cognition (Franke et al., 2014). These drugs are neither purchasable at normal shops nor prescribed by the doctor and the possession

and use of them is illegal. The third group, illicit drugs, contains drugs like ecstasy (MDMA), methamphetamine ('speed') and illicit amphetamine. These drugs are more popular as recreational drugs that have a strong effect on the metabolism and therefore increase alertness and wakefulness (Logan, 2002). For example, people taking ecstasy for recreational use often experience an increased sense of well-being, emotional warmth, empathy, extroversion and enhanced sensory perception (National Institute on Drug Abuse, 2017). In terms of cognitive enhancement, the drug can facilitate staying awake longer, being more alert and increasing the mood.

However, many of the substances used for cognitive enhancement do not only have the positive effect of increasing alertness, memory or concentration, but also have harmful side effects. For illicit drugs like ecstasy or methamphetamine it is known that they have tremendous negative effects like hallucinations, anxiety and brain damage to name only a few and are highly addictive, which is why their usage and possession are prohibited (Drugfreeworld, 2018; National Institute on Drug Abuse, 2017). But also drugs that doctors prescribe to their patients like Ritalin or Modafinil have negative side effects that are not to be underestimated. Because, for example, Ritalin contains a form of amphetamine, the use of it can have similar side effects like they are known from methamphetamine or illicit amphetamine. For instance, it can also cause addiction and have influence on your brain structures (Alcohol and Drug Foundation, 2018). Even the consumption of caffeine, a 'daily stimulant', can have negative side effects if consumed in high amounts, like rapid heart rate, insomnia, digestive issues, addiction or high blood pressure (Spritzler, 2017).

Due to the positive but also remarkably negative effects of cognition enhancing drugs there are many discussions about the pros and cons of taking cognitive enhancement drugs (Cakic, 2009; Greely, Sahakian, Harris, Kessler, Gazzaniga, Campbell, & Farah, 2008; Sahakian, 2016; Sahakian & Morein-Zamir, 2007; Scheske & Schnall, 2012). Additional to the side effects listed above there is rising concern about ethical consequences. Students rated CED use as cheating behaviour, since the performance of CED users is improved by the use of substances (Cakic, 2009; Greely et al., 2008). Another point mentioned in discussions is that it creates an unfair 'playing ground' (Cakic, 2009; Scheske & Schnall, 2012). By taking cognitive enhancement drugs people want to improve their performance, attain better grades at examinations, become better than others and better compared to themselves before they used cognitive enhancement drugs. This makes it harder for people who are not making use of

cognitive enhancement drugs to compete with them, making it an unfair playing ground. Consequently, this might lead to increased pressure on peers and colleagues to also make use of cognitive enhancement drugs to remain competitive. CED use therefore does not only have consequences for the individual, like the side effects of the substance itself, but also for the people surrounding the user. Thinking one step further, if more and more people make use of cognitive enhancement drugs to remain competitive, it might in turn also lead to increased pressure by companies. By giving the impression that it is 'normal' to be able to work concentratedly for many hours, the expectations of the employers might rise. Some employers might even encourage the use of cognitive enhancement drugs to increase productivity. This, to think more globally, could lead to overworked employees and students and push society to its limits and even further (Sahakian & Morein-Zamir, 2007).

For the sole purpose of better achievement, the downsides of cognitive enhancement drug use seem to be quite high and there are also more common and less risky ways of improving performance. Examples for alternatives are improving the general lifestyle by increasing the engagement in sports, having sufficient sleep and consuming healthy, nutritious food. Although these methods are well-known and common, some people seem to prefer the use of drugs with, sometimes unknown, negative side effects. Unfortunately, not much information is available about the users themselves. Questions about the type of user and the motivation of use are still not adequately answered.

However, there are indications that special personality traits might be related to CED use. One suggestion is that it is individuals who are more prone to the socially less accepted ways of improving their achievement by manipulation or cheating, that preferably make use of cognitive enhancement drugs. This suggestion emerged due to different surveys indicating that cognitive enhancement has been rated as cheating or manipulation of the 'playing field' among university students (Cakic, 2009; Greely et al., 2008). Students stated that CED use gives the students making use an unfair advantage towards the ones not making use of these substances (Cakic, 2009; Greely et al., 2008). It appears to be a socially less accepted method of achievement improving. Socially less accepted methods like cheating or manipulating are found to be implemented by people with certain characteristics more often than by others. For instance, psychopathy has been found to be linked with cheating, not only in the social aspect but also in business and academic life, especially on examinations (Coyne & Thomas, 2008). Additionally, the two personality traits Machiavellianism and narcissism are shown to be

related with this type of behavior (Furnham, Richards, & Paulhus, 2013). People with these character traits seem to care less about creating an unfair situation for others to gain profit themselves. It therefore appears that socially-aversive personality traits like Machiavellianism, narcissism and subclinical psychopathy might be the link to cognitive enhancement drug use. One construct that combines these three intercorrelated socially-aversive personality traits is the *Dark Triad* (Paulhus & Williams, 2002).

The Dark Triad and Manipulativeness

The Dark Triad consists of three overlapping elements: Machiavellianism, narcissism and psychopathy. The first trait, Machiavellianism, contains the tendency to strive for achievement even at the expense of others or without regard to others (Furnham, Richards, & Paulhus, 2013). Other characteristics that describe a Machiavellian are exploitativeness, deception, social manipulation, low empathy and advocation of self-interest (Jakobwitz & Egan, 2006). The second trait in the triad is narcissism which is related to grandiosity, self-love, attention seeking, selfishness, strive for superiority and to being success-oriented (Jakobwitz & Egan, 2006; Shpancer, 2018). The third element of the dark triad, psychopathy, is associated with callousness, arrogance, impulsiveness, selfishness, remorselessness, social manipulation and strive for superiority (Furnham, Richards, & Paulhus, 2013). From the description of the three traits it is already noticeable that their elements are very similar.

These three personality traits might be related to CED use. One reason for this suggestion is that people with high scores on the dark triad personality traits, especially psychopathy and narcissism, are found to be more risk-taking in the form of substance abuse (Stenason & Vernon, 2016). This leads to the assumption that people with these traits are also more likely to make substance (ab)use for cognitive enhancement. Moreover, the above stated description of personality traits is mostly in line with discussions and survey outcomes regarding cognitive enhancement drug use (Cakic, 2009; Greely et al., 2008). Cognitive enhancement was rated as manipulation of the “playing field”. From these discussions and surveys, it appeared that people who use cognitive enhancement drugs do so because they strive for better achievement although it is an unfair method (Cakic, 2009; Greely et al., 2008). The strive for superiority, manipulativeness and selfishness that are associated with people scoring high on dark triad personality traits might give these people the impulse to manipulate things in such that their strive for superiority is easier to realise without taking

response for the consequences it might have for others. In other words, people with high scores on the Dark Triad might tend to cheating behavior that benefits themselves without thinking of consequences for others. CED use, which is also to some parts illegal and therefore even more so ties in with unethicalness, can be seen as such kind of cheating behavior benefitting one's own goals. This gives rise to the assumption that the Dark Triad personality traits are related to CED use.

In 2012, Jones and Figueredo found *manipulation* and *callousness* to be the overlapping factors of the three Dark Triad personality traits, meaning that callousness and manipulativeness are what all three traits have most in common. This gives rise to the thought that one of these two factors explains the assumed positive relation between the three Dark Triad personality traits and CED use. Abovementioned survey outcomes and discussions further support this assumption. Cognitive enhancement drug use was here rated as cheating behaviour, as creating an unfair situation for others and as unethical (Cakic, 2009; Greely et al., 2008). This matches with the description of the core element manipulativeness. Although the concept of manipulativeness has not received much attention in research for clearly forming a definition, a review of several definitions has been made (Ackerman, 1995). Based on dictionary entries from different sources, manipulation or manipulativeness has been defined as influencing behavior, shrewdness, deviousness, behavior benefitting the manipulator and unethicalness (Ackerman). Additionally, it was characterized by inhibition of rational deliberation, falsification or omission of information, playing on nonrational impulses, deceptiveness, ulterior motives and getting someone to do something differently from what he is already doing. These characteristics correspond with some of the Dark Triad elements as well as with the survey ratings of CED use. It is therefore to assume that manipulativeness is the element of the Dark Triad personality traits that explains the positive association with CED use that all three DT traits have in common. This would mean that manipulativeness is presumably the mediating variable of this positive association (see Figure 1).

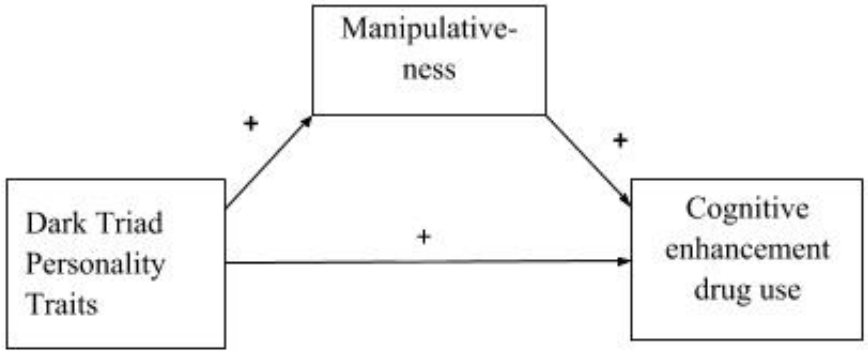

Figure 1. Proposed conceptual model describing the mediating role of manipulativeness in the effect of Dark Triad personality traits on CED use.

Current study

Based on the existing research and literature earlier discussed in this paper, the following research question was established: *'Are Dark Triad personality traits related to cognitive enhancement drug use and what is the role of manipulativeness?'*. In order to answer this question, six hypotheses, two per Dark Triad trait, will be examined.

$H1_a$: *There is a positive association between Machiavellianism and cognitive enhancement drug use.*

$H1_b$: *The positive association between Machiavellianism and cognitive enhancement drug use is mediated by manipulativeness*.

$H2_a$: *There is a positive association between narcissism and cognitive enhancement drug use.*

$H2_b$: *The positive association between narcissism and cognitive enhancement drug use is mediated by manipulativeness*.

$H3_a$: *There is a positive association between psychopathy and cognitive enhancement drug use.*

$H3_b$: *The positive association between psychopathy and cognitive enhancement drug use is mediated by manipulativeness*.

Method

Participants and Design

This correlational study comprised a purposive sample of 175 university students (M_{age}: 20.8; *Min*: 18; *Max*: 30), that are acquired via the SONA-rewardsystem of the University of Twente or via other proximities to the researcher like Facebook announcements or private messages. The sample consisted of 28 male and 126 female participants, one person indicated 'other' (see table 1). Participants who are non-students and are under the age of 18 were excluded from participating. Two participants answered with '8' and '1ß' on the age question. It was assumed that this was by accident, because ß looks very similar to an 8 and is near on the keyboard. Furthermore, '8' was probably an 18 because the participants were all students. Subsequently, the participants were kept in the dataset. However, for calculating the mean age and standard deviation these data were taken out.

Table 1.
Frequencies, Percentages and Means of the Demographic Variables

	Category	Frequency (%)
Gender	Male	28 (27.4)
	Female	126 (72)
	Other	1 (.6)
Nationality	Dutch	22 (12.6)
	German	132 (75.4)
	Other	21 (12)
Subject of study	Psychology	130 (74.3)
	Communication science	29 (16.6)
	Other[1]	16 (9.1)
Year of study	1	124 (70.9)
	2	17 (9.7)
	3	17 (9.7)
	4	10 (5.7)
	5	3 (1.7)
	6	1 (.6)
	More than 6	3 (1.7)
		Mean (SD)
Age[2]		20.8 (2.4)

Note. $n = 175$. [1]Other including agriculture, creative technology, different management studies, mathematics, social work, medicine, medical technology, German studies and biology. [2]$n = 173$.

Procedure

The research was approved by the BMS Ethics Committee of the University of Twente. The collection of data took place from the 11th of April until the 27th of April 2018. The participants were acquired via the SONA-system of the University of Twente or via

Facebook. The students who responded to the study about 'Cognitive enhancement drug use' were provided a web address leading to the established survey. At the beginning of the survey, participants received general information about the research purposes. After having read the information and consenting to participate anonymously, the students were asked to fill out the online questionnaire. The participants engaged voluntarily and agreed with the informed consent prior to participation. All participants were offered to receive more information and to have potential questions answered via e-mail. It took approximately 30 minutes to fill out the complete survey. After participation the students who took part via the SONA-rewardsystem of the University of Twente were rewarded with 1 creditpoint.

Materials

The current study is part of a bigger survey about cognitive enhancement drug use. The Online Survey created using the programme Qualtrics consists of a general part with demographics and questions about cognitive enhancement drug use as well as a specific part. In the specific part various scales were integrated for different sub-studies such as the current study, including for example perceived stress, coping styles, the big five personality traits or peer pressure. The subscales used for the purpose of this particular study are the Short Dark Triad Test and a Manipulativeness Scale. Only the scales relevant for the current study will be discussed in detail.

Cognitive enhancement drug use. To assess CED use we created a questionnaire (see appendix). First, we asked whether cognitive enhancement drugs were used within the past year. When the participant answered that they used the substance, we asked about the frequency of use. The frequencies were examined using a four-point Likert-scale (0 = 0, 1 = 1-3 times, 2 = 4-10 times and 3 = more than 10 times). We differentiated between the three categories over-the-counter (OTC) drugs, prescriptive (PRES) drugs and illicit (ILL) drugs, as proposed by previous research (Franke et al., 2014). The drugs included in the over-the-counter category were Caffeinated drinks, Caffeine pills, Alcohol, Cigarettes, legal Cannabis and participants could fill in for other OTC drugs they used. In the prescriptive drugs category, the drugs Methylphenidate, Modafinil, Beta-Blocker, prescriptive Amphetamine, Fluoxetine, Piracetam, prescriptive Cannabis and 'other' was included. The drugs included in the category of illicit drugs were illicit Amphetamine, Cocaine, MDMA, Heroine, illicit Cannabis and 'other'. The different categories were introduced to the participants at the beginning of the survey and again prior to the questions. For some items within the OTC

category, namely alcohol use and legal cannabis use, the answer categories were set up for the use within a month. For the items regarding the consumption of caffeinated drinks and cigarette use the answer categories were set up for use within a week. This differentiation was made because substances like coffee or cigarettes are presumably being used more frequently than for example illicit drugs like heroine (Franke et al., 2014). For people who drink two cups of coffee every day, it would not be very accurate to only answer with 'more than 10 times within the last year', when it was more than 600 times within the last year. Therefore, we chose for these adjustments to get a more precise impression of the frequencies per substance. These adjustments were accounted for in the analyses by calculating the frequency of yearly use by respectively multiplying the answer categories by either 12 when asked for monthly use or by 52 when asked for weekly use. This means that for instance '1 = 1-3 times per month' was changed to '1 = 12-36 times per year'. The created scale showed an acceptable reliability with Cronbach's $\alpha = .74$.

The Dark Triad. To measure the Dark Triad personality traits the Short Dark Triad questionnaire (SD3) was used (Jones & Paulhus, 2013). The SD3 is a 27-item self-report scale that measures the Dark Triad construct consisting of three concepts, namely Machiavellianism, narcissism and psychopathy. The scale consists of three subscales to respectively examine Machiavellianism, narcissism and psychopathy with each 9 items (Jones & Paulhus). All items were presented in Likert-type format with anchors 1 (strongly disagree) to 5 (strongly agree) (Jones & Paulhus). The Machiavellianism subscale is developed to examine the personality trait Machiavellianism by detecting the presence of a lack of morality, a cynical worldview, manipulativeness, planning, coalition formation and reputation building (Jones & Paulhus). An example item for the Machiavellianism subscale is 'It's not wise to tell your secrets'.

The narcissism subscale is developed to measure narcissism by examining manipulation and callousness, such as for Machiavellianism, but also a grandiose identity and underlying insecurity (Jones & Paulhus, 2013). An example item for the narcissism subscale is 'I like to get acquainted with important people'.

The psychopathy subscale measures psychopathy by detecting deficits in affect and self-control (Jones & Paulhus, 2013). For the psychopathy subscale an example item is 'I insist on getting the respect I deserve'. The internal consistency of the three subscales was found to be acceptable (Cronbach's α: Machiavellianism = .75; narcissism = .76;

psychopathy = .70) (Birkás, Gács, & Csathó, 2016). The internal consistency found in the current study was questionable to acceptable (Cronbach's α: Machiavellianism = .63, narcissism = .74 and psychopathy = .59). The external validity was rated as good due to the fact that the subscales predicted corresponding informant-ratings (Jones & Paulhus, 2013). Also did the subscales perform well in both predictive and concurrent validity (Jones & Paulhus).

Manipulativeness. To assess the mediating variable manipulativeness the Manipulativeness subscale from the CAT-Personality Disorder Scales Static Form (CAT-PD-SF) was used (Simms, Goldberg, Roberts, Watson, Welte, & Rotterman, 2011). The subscale contains 6 items to assess the tendency to cheat, lie and behave in dishonest ways and the behavioral pattern of taking advantage of and exploiting others in order to achieve self-serving goals (Simms et al.). These items are statements like 'I cheat to get ahead', to which there is a five-point response format ranging from '1 = very untrue of me' to '5 = very true of me' (Simms et al.). The subscale has proven to have a good internal consistency for community samples as well as for patient samples (Simms et al.). This is congruent with the alpha found in the current study (.81).

Data Analysis

For conducting the analyses, the statistical program for social sciences SPSS was used. At first, descriptive statistics were analysed to get a global overview of the data: CED use total, including the means of all substances, the Dark Triad traits, manipulativeness. Before the main analyses, a reliability analysis for internal consistency (Cronbach's α) and a factor analysis were conducted. The factor analysis was executed to check whether the categories made for cognitive enhancement drug use are appropriate by looking at the quantity of factors within the scale. However, for the main analyses the total score for CED use was used. Next to that, correlations were analysed using Pearson's *r* to get a first overview of the associations between the variables of the main analyses.

Since previous findings showed that the independent variables are intercorrelated traits that can be combined into one construct, the three variables were examined on multicollinearity as another step before the main analysis (Jones & Paulhus, 2013). This was done by conducting regression analyses and including the variance inflator factor (VIF). A VIF > 5 or a tolerance < .2 would confirm multicollinearity between the variables. After that,

the same analysis was conducted including manipulativeness as another independent variable to check the multicollinearity between the DT traits and manipulativeness.

The analysis techniques used to examine the mediation will be regression analyses as proposed by Preacher and Hayes (2004). Their regression model PROCESS macros for SPSS was conducted for all three hypotheses. In this model the mediation effect of manipulativeness on the relation between the independent variables, which are the personality traits of the Dark Triad (H1: Machiavellianism, H2: Narcissism, H3: Psychopathy), and the dependent variable, which is the total score of CED use, were examined by the use of bootstrap confidence intervals. This process is convenient if the sample distribution is non-normal (Preacher & Hayes, 2004). If the analyses generated confidence intervals that do not include zero, the mediation effect of manipulativeness was statistically significant and therefore supported the $_b$-hypotheses.

Results

Descriptive statistics

The descriptive statistics for cognitive enhancement drug use, the Dark Triad personality traits and manipulativeness can be found in table 2. The calculated mean for CED use lies at *M*(SD) = .14(.17) on a four-point Likert scale (0 = no use to 3 = more than 10 times). To the answer whether they had ever made use of CED, 77.7% of the participants stated ‘yes’. For more detailed information on the descriptive statistics of CED use see the outcomes per substance (see table A). A factor analysis of the CED use scale indicated six factors. It was found that the substances cocaine, illicit amphetamine, MDMA, prescriptive amphetamine, legal Cannabis, illicit Cannabis, Cigarettes, Methylphenidate (e.g. Ritalin) and ‘other’ over-the-counter drugs loaded on one factor. A second factor included caffeinated drinks, alcohol and caffeine pills. Piracetam and Modafinil loaded on a third factor. ‘Other’ illicit and prescriptive drug use loaded on the fourth factor. Fluoxetine and prescriptive Cannabis respectively loaded on the fifth and sixth factor. The means of the Dark Triad personality traits are comparable to the outcomes of a norm group of undergraduate students (n = 387), that scored around 2.4 and 3.1 in average on the three subscales (Paulhus, 2013). The mean of the manipulativeness scale shows that most participants scored below 2 on a five-point Likert scale (1 to 5). Additionally,

Pearson's *r* correlations between all variables have been calculated (See table 2). The correlations between the Dark Triad traits and the cognitive enhancement categories showed, if at all significant, weak positive relationships. The correlations between manipulativeness and cognitive enhancement were similarly weak. However, the relationships found between manipulativeness and the Dark Triad traits were significant moderate positive relationships.

Table 2.
Descriptive statistics and correlations between CED use, the Dark Triad and manipulativeness

	Mean (SD)	*Min*	*Max*	CED use	Machiav[1]	Narcissism	Psychopathy
CED use total	.14 (.17)	.00	.75	-			
Machiav[1]	2.67 (.57)	1.22	4.33	.341**	-		
Narcissism	2.51 (.65)	1.11	4.11	.294**	.673**	-	
Psychopathy	2.74 (.56)	1.22	4.44	.266**	.628**	.660**	-
Manipulativeness	1.89 (.60)	1.00	3.83	.288**	.535**	.632**	.548**

Note. n = 175. *p < .05, **p < .01. Pearson's *r* was calculated to examine the correlations between the variables. [1] = Machiavellianism.

Mediation analysis

Since the Dark Triad traits showed high intercorrelations in previous studies as well as in the current study, it was in doubt whether the three traits are distinctive enough to be integrated into separate mediation analyses. For this reason, before conducting the analyses to answer the research question, regression analyses have been made to test the multicollinearity of the three Dark Triad traits and manipulativeness. A regression analysis of Machiavellianism, narcissism and psychopathy on CED use showed that Machiavellianism was the only significant predictor of CED use if combined with the other traits. The test on multicollinearity showed did not confirm multicollinearity between the three DT traits, $VIF_{machiav}$= 2.1 $tolerance_{machiav}$= .49, $VIF_{narciss}$= 2.2 $tolerance_{narciss}$= .45, VIF_{psycho}= 2.0 $tolerance_{psycho}$= .50. In the same regression analysis but including manipulativeness as another independent variable, manipulativeness indicated a higher regression coefficient than narcissism and psychopathy. Multicollinearity could not be confirmed since all four variables had tolerance above .2 and a VIF below 5. Neither between the DT traits nor between the DT traits and manipulativeness could multicollinearity be confirmed, meaning that all four variables can be handled as distinctive.

In order to assess whether there is a positive association between Machiavellianism and cognitive enhancement drug use and whether this relationship is mediated by manipulativeness, multiple linear regression analyses based on Preacher and Hayes' (2004) PROCESS macro for SPSS were conducted. The results are presented in Figure 2. The direct effect of the independent variable Machiavellianism on the dependent variable cognitive enhancement drug use showed that Machiavellianism is a significant predictor of CED use, $b = .1$, $t(173) = 4.77$, $p < .001$. The effect of Machiavellianism on the mediator manipulativeness was also found to be significant, $b = .64$, $t(173) = 8.34$, $p < .001$. The effect of the mediator, controlling for the independent variable Machiavellianism, was not significant, $b = .04$, $t(173) = 8.34$, $p = .08$. When controlling for the mediator, the independent variable Machiavellianism was found to be a significant predictor of CED use, $b = .08$, $t(173) = 3.12$, $p < .005$. The analysis for the indirect effect of Machiavellianism on CED use through manipulativeness showed that the effect size is not significantly greater than zero and that zero falls within the bootstrap confidence interval, *effect size*: .024, *95% CI*: [-.011; 059]. Therefore, the positive association between Machiavellianism and cognitive enhancement drug use is not mediated by manipulativeness and hypothesis 1_b must be rejected. $H1_a$ was confirmed.

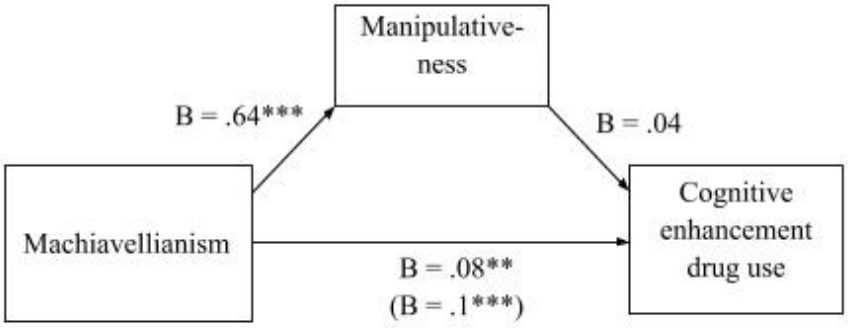

Figure 2. Mediation model of Machiavellianism as independent variable and cognitive enhancement as dependent variable with manipulativeness as mediator (H1). The value within brackets depicts the direct effect of the DT trait on CED use. *$p <$ .001; **$p < .01$; ***$p < .001$

To examine whether there is a positive association between narcissism and cognitive enhancement drug use and whether this association is mediated by manipulativeness, again regression analyses based on Preacher and Hayes' (2004) PROCESS macro for SPSS were

conducted. The results are presented in Figure 3. The total effect of the independent variable narcissism on the dependent variable cognitive enhancement drug use was found to be significant, $b = .08$, $t(173) = 4.05$, $p < .001$. The effect of narcissism on the mediator was also significant, $b = .66$, $t(173) = 10.72$, $p < .001$. Controlling for the independent variable, the mediator manipulativeness was not a significant predictor of CED use, $b = .04$, $t(173) = 1.81$, $p = .07$. The regression of the independent variable narcissism on CED use was significant when controlling for the mediator, $b = .05$, $t(173) = 2.02$, $p < .05$. The indirect effect was also not significantly greater than zero, *effect size*: .029, *95% CI*: [-.009; 067]. Hypothesis 2_a was confirmed, but hypothesis 2_b will be rejected because no mediation effect of manipulativeness could be found on the positive association between narcissism and cognitive enhancement drug use.

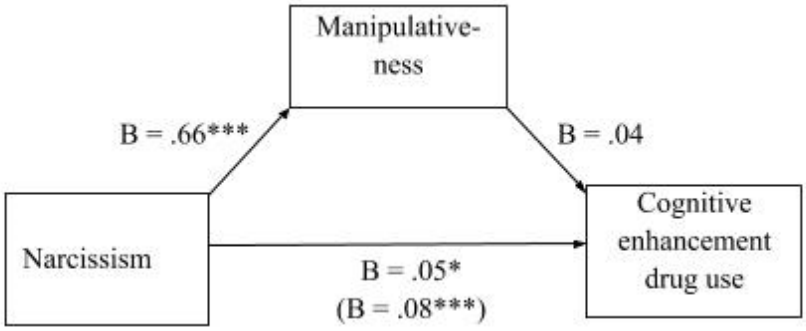

Figure 3. Mediation model of narcissism as independent variable and cognitive enhancement as dependent variable with manipulativeness as mediator (H2). The value within brackets depicts the direct effect of the DT trait on CED use. *$p <$ .001; **$p < .01$; ***$p < .001$

In order to measure whether there is a positive association between psychopathy and CED use and whether this positive association is mediated by manipulativeness, the same regression analysis techniques have been used as for the first two hypotheses. The results are presented in Figure 4. The total effect of the independent variable psychopathy on CED use was significant, $b = .08$, $t(173) = 3.63$, $p < .001$. Likewise was the effect of psychopathy on the mediator significant, $b = .66$, $t(173) = 8.63$, $p < .001$. A significant effect could be found in the regression of the mediator manipulativeness on CED use, when controlling for psychopathy, $b = .05$, $t(173) = 2.34$, $p < .05$. The regression of psychopathy, controlling for

the mediator, on the dependent variable CED use was insignificant, $b = .05$, $t(173) = 1.79$, $p = .076$. The bootstrap confidence interval includes zero, *95% CI*: [-.006; 071] and the indirect effect is also not significantly greater than zero, *effect size*: .034. Therefore, there is no significant mediation effect of manipulativeness on the positive association between psychopathy and cognitive enhancement drug use. Consequently, hypothesis 3_a was confirmed and hypothesis 3_b will be rejected.

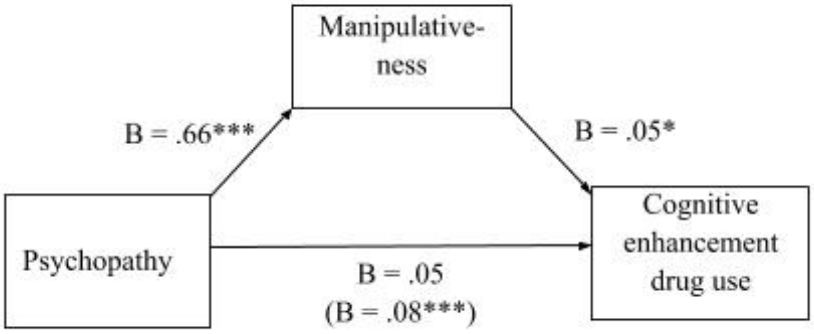

Figure 4. Mediation model of psychopathy as independent variable and cognitive enhancement as dependent variable with manipulativeness as mediator (H3). The value within brackets depicts the direct effect of the DT trait on CED use. *$p <$ .001; **$p < .01$; ***$p < .001$

Discussion

The current study addressed the question of how the Dark Triad personality traits are associated with cognitive enhancement drug use and whether manipulativeness is a mediating factor in this relationship. The most salient findings are that Machiavellians, as well as narcissists and psychopaths appear to be more likely users of cognitive enhancement drugs, but that manipulativeness is not a mediating factor in these associations. Below these findings are discussed in more detail.

Overview of the variables

It was found that the cognitive enhancement drug use within the past year was quite low in the current sample. Nevertheless, 77.7 % of the participants stated to have used CED at least once in their lifetime, which is on the other hand a quite high rate. In previous studies, lifetime

prevalence rates of over-the-counter drugs, prescriptive drugs and illicit drugs were highest for coffee with 66.8 % and lowest for prescriptive drugs with 1.29 % in a sample of German university students (Franke et al., 2014). In the present study, the participants also used coffee most and prescriptive drugs the least (See table A).

The mean scores of the Dark Triad traits were found to be comparable to outcomes of three previous studies with sample sizes ranging between 230 and 489 participants (Jones & Paulhus, 2013). One aspect that slightly differed was that participants of the current study scored highest on psychopathy, whereas in three previous studies the scores on psychopathy were the lowest and on Machiavellianism the highest (Jones & Paulhus, 2013). This means that the participants of the present sample were in average more psychopathic than Machiavellian.

For the variable manipulativeness it was found that the participants scored rather low, because the participants indicated more often that the statements regarding manipulative behavior would not apply to their own behavior. This means that the students of this sample made less use of manipulative methods in everyday life, like taking advantage of others or deceiving people.

Hypotheses testing

Consistent with the expectation, there was a relation found between Machiavellianism and cognitive enhancement drug use. This means that people who were more Machiavellian, were more likely to be CED users. Against the prediction, this relation was not explained by manipulativeness. Although a relation between Machiavellianism and manipulativeness could be found, this relation did not explain the relation between Machiavellianism and CED use.

As predicted, also narcissism was related with cognitive enhancement drug use, meaning that narcissists appeared to be more likely to make use of cognitive enhancement drugs. However, manipulativeness did also not explain this relation. Narcissism and manipulativeness did show a relation, but manipulativeness could not sufficiently explain the relationship between narcissism and CED use.

In line with the expectations, psychopathy and CED use were related. This means that people who were more psychopathic, were more likely to make use of cognitive enhancement

drugs. Although psychopathy and manipulativeness were also related, manipulativeness could not explain the relation between psychopathy and CED use.

Based on previous studies, which revealed that cognitive enhancement was often rated as a manipulation of the playing field, as cheating behavior and as a means to provide the user with an unfair advantage towards other non-users, one suggestion has been made (Cakic, 2009; Greely et al., 2008). The suggestion was that people, who do not care about creating an unfair situation for their own benefit, and people making use of socially-adverse methods to strive for superiority, are more likely to be CED users. Furthermore, it was manifested that for example striving for achievement even at the expense of others is a behavior associated with the Dark Triad personality traits (Furnham, Richards, & Paulhus, 2013). The outcomes of this study confirmed that people whose personality traits correspond with this type of behavior are more likely to make use of cognitive enhancement substances.

The results, showing that manipulativeness is in none of the three cases the mediating variable between the Dark Triad traits and CED use, are in contrast with previous findings. Previous findings were that manipulativeness is closely related with the Dark Triad and that CED use was rated as manipulative behavior (Cakic, 2009; Greely et al., 2008; Jones & Figueredo, 2012). Since the Dark Triad was found to be positively associated with manipulativeness and manipulativeness was also correlated with CED use, the question is why manipulativeness did not show to be the mediator between the Dark Triad and CED use. One explanation would be that manipulativeness and the Dark Triad have a common factor which predicts CED use. This common factor is probably sufficiently present in the Dark Triad that the factor within manipulativeness could not add anything to the relation between the Dark Triad and CED use. Therefore, it probably could not be found as a mediator in this association.

Strengths and limitations of the current study

One strength of the current study is its pioneer status. This study is the first to have addressed the relation between the Dark Triad personality traits and cognitive enhancement drug use with manipulativeness as mediator. It was hereby possible to uncover that the positive relationship between the Dark Triad and cognitive enhancement drug use does exist. Additionally, it was found that manipulativeness is not the component of the Dark Triad which explains this relation. These findings add important knowledge to this topic, namely

that the more a person has of the Dark Triad trait characteristics, the more they are likely to use cognitive enhancement drugs. Similarly important is the information that manipulativeness was not found as mediator. This information can be used to further examine the relation between the Dark Triad traits and CED use by considering that manipulativeness is not what explains this association, but that a different construct might do so.

Another strong point of this study is that students were addressed for the participation. Since students are the population in which cognitive enhancement drug use is most prevalent, it is important to examine the relations of their CED use with possible predicting factors, like in this case the Dark Triad personality traits and manipulativeness.

Anyhow, the current study is also facing some limitations. One limitation that might have affected the reliability of the CED use scale was the adjustment of some items in this scale. Regarding the frequencies of CED use, some answers were based on the use within the last week or last month, but most were based on the last 12 months. For caffeinated drinks, cigarettes, alcohol and legal cannabis the frequency of use was asked per week or per month. This was done to get a more precise understanding of CED use per substance. However, the answer categories of the adjusted items had to be multiplied to compare the frequencies of use within a year. It is therefore not clear how representative the outcomes were after multiplying them. Nevertheless, it was more important to us to get precise answers for the substances that are usually used a lot more frequently than others.

Furthermore, a factor analysis for the CED use scale showed that not all substances measured the same factor. It was indeed found that there are six distinctive factors that are measured with this scale. It appears that the distinction into three categories that has been made based on earlier research was not appropriate for measuring the different factors of CED use (Franke et al., 2014). This distribution of the substances on six distinctive factors is a surprising finding. For instance, we did not expect cigarettes in the same group with several illicit drugs, since it is used by many people on a daily basis, it is easy to obtain and has less severe side effects. It is possible that the integration of the different factors into one scale has led to the suppression of relationships with the other variables.

Another point is that social desirability is a factor that might have influenced the participants' reaction to the scales (King & Bruner, 2000). This means that the participants probably had the tendency to present themselves in a favourable way regarding social norms.

Most people probably would not want other people to know whether they use cognitive enhancement drugs, whether they have 'dark' personality traits or whether they are manipulative. In the manipulativeness scale, for instance, it was asked for answers on items like: 'Have exploited others for my own gain'. This is something most people would not want others to know if it applies to oneself. Though the scales were designed in an anonymous way, some people might have answered dishonestly, which would eventually have been a threat to the validity of this research. The dishonesty might have been provoked due to the fact that the questionnaires asked for direct estimates of oneself. An alternative would have been to use a different method of examining the different concepts instead of asking directly for the answers. One recommendation for future research with, for example, the manipulativeness concept would be to make indirect tests. This might, for instance, happen by presenting a case by showing animated videos to the participant. The videos would show a person in different situations, in which a decision would have to be made for either behaving socially or acting in a way that would match with manipulative behavior. In between different video sections the participant would be asked questions to this case like 'What should the person in this video do in this certain situation to get the best possible outcome?' and answer options could be among others the items of the manipulativeness scale. This proposed alternative design might have prevented the effect of social desirability. However, it was not possible to implement this alternative in the setting of the present study due to its incorporation within a bigger study and the limited time for conducting the research.

Regarding the representativeness of the addressed population, this study is facing another weak point. Since it was decided to examine the variables in the context of the population of students, it is not representative that mainly psychology and communication science students participated in this study. Furthermore, the sample consisted of mainly first-year students, resulting in less information about students that are studying in higher years.

Suggestion for further research and implications

Since the present study revealed important information about the users of cognitive enhancement drugs, there are some suggestions for further research. One important direction in which research should go is to examine whether the Dark Triad is otherwise associated with the six different factors that a factor analysis revealed for CED use. This means that the categories made in previous studies, namely over-the-counter, prescriptive and illicit drugs, are not correct and should therefore not be used for examining CED use (Franke et al., 2014).

In future studies, a scale should be developed that distinguishes between the six found factors. Additionally, for analysing associations with other constructs, mean scores should be calculated per factor-category. This would prevent the suppression of relations with other variables.

The next important step in research would be to examine whether something else mediates the found positive relation between the Dark Triad personality traits and CED use. The Dark Triad personality traits were discovered to be related with certain coping styles (Birkás, Gács, & Csathó, 2016). Machiavellianism and psychopathy were found to be associated with emotional coping strategies, whereas narcissism was related with task-oriented and emotionally controlled coping. Next to that, research showed a relation between cognitive enhancement drug use and certain coping styles (Riddell, Jensen & Carter, 2017). Coping styles that were positively related with CED use were emotion-focused coping, meaning strategies that aim at controlling emotions associated with the stressor. Furthermore, dysfunctional coping styles and avoidant coping strategies were associated with CED use (Riddell, Jensen & Carter, 2017). This leads to the idea that coping styles might be related to personality traits like the Dark Triad, and that certain coping styles associated with the DT subsequently predict the use of cognitive enhancement drugs. More specifically, the previous findings indicate that especially emotional or emotion-focused coping styles should be taken into account when examining the relation between the Dark Triad personality traits and cognitive enhancement drug use.

The finding of the present study, that the Dark Triad personality traits are positively related to the use of cognitive enhancement drugs, contributes to the refinement of current understandings of cognitive enhancement drug use in European Countries. By providing academic institutions with more knowledge about the topic of cognitive enhancement, a contribution can be made to the development of intervention or prevention measures for schools or workplaces. This is an essential step to prevent societies from becoming overworked 24/7 societies with exhausted employees and overly competitive students (Sahakian & Morein-Zamir, 2007).

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Tables

Table A.
Cognitive enhancement drug use including the individual substances (*n= 175*)

Category	Substance	Times per year	Frequency (%)
OTC	Caffeine pills	0	153 (87.4)
		1-3	11 (6.3)
		4-10	9 (5.1)
		more than 10	2 (1.1)
	Caffeinated drinks	0	72 (41.1)
		52-156[1]	40 (22.9)
		208-520[1]	43 (24.6)
		more than 520[1]	20 (11.4)
	Cigarettes	0	141 (80.6)
		52-156[1]	8 (4.6)
		208-520[1]	5 (2.9)
		more than 520[1]	21 (12)
	Alcohol	0	139 (79.4)
		12-36[2]	24 (13.7)
		48-120[2]	11 (6.3)
		more than 120[2]	1 (.6)
	Cannabis	0	148 (84.6)
		12-36[2]	15 (8.6)

		48-120[2]	4 (2.3)
		more than 120[2]	8 (4.6)
	Other	0	170 (97.1)
		1-3	3 (1.7)
		4-10	2 (1.1)
		more than 10	-
PRES	Methylphenidate	0	170 (97.1)
		1-3	3 (1.7)
		4-10	1 (.6)
		more than 10	1 (.6)
	Modafinil	0	174 (99.4)
		1-3	1 (.6)
		4-10	-
		more than 10	-
	β-Blocker	0	175 (100)
		1-3	-
		4-10	-
		more than 10	-
	Amphetamine	0	171 (97.7)
		1-3	3 (1.7)
		4-10	1 (.6)
		more than 10	-
	Fluoxetine	0	174 (99.4)
		1-3	1 (.6)
		4-10	-
		more than 10	-
	Piracetam	0	173 (98.9)
		1-3	1 (.6)
		4-10	1 (.6)
		more than 10	-
	Cannabis	0	171 (97.7)
		1-3	2 (1.1)
		4-10	1 (.6)
		more than 10	1 (.6)
	Other	0	172 (98.3)
		1-3	1 (.6)
		4-10	2 (1.1)
		more than 10	-
ILL	Amphetamine	0	168 (96)
		1-3	5 (2.9)
		4-10	2 (1.1)
		more than 10	-
	Cocaine	0	170 (97.1)
		1-3	4 (2.3)
		4-10	1 (.6)
		more than 10	-
	Methylenedioxymethamphetamine/ MDMA	0	168 (96)
		1-3	4 (2.3)
		4-10	3 (1.7)
		more than 10	-

Cannabis	0	160 (91.4)
	1-3	5 (2.9)
	4-10	2 (1.1)
	more than 10	8 (4.6)
Heroine	0	175 (100)
	1-3	-
	4-10	-
	more than 10	-
Other	0	173 (98.9)
	1-3	-
	4-10	1 (.6)
	more than 10	1 (.6)

Note. [1]initial answers multiplied by 52 for comparison per year. [2]initial answers multiplied by 12 for comparison per year.

Appendix

Cognitive Enhancement Drug use Scale.

First of all, we would like to give you a definition of cognitive enhancement drugs. Cognitive enhancement drugs are psychoactive drugs that are used to increase one's cognitive performance. This includes improving memory, vigilance, attention and concentration within healthy individuals, who have no prescription for these drugs. Regarding the various substances used for this purpose a distinction can be made between three categories:

1) **Over-the-counter drugs** like coffee or energy drinks. These substances can be bought at the supermarket without much effort and are therefore very easy to obtain.
2) **Prescription drugs** initially designed for the treatment of disorders like ADHD or sleep disorders that are being misused for cognitive enhancement. Examples are Methylphenidate (e.g. Ritalin) or Modafinil.
3) **Illicit drugs** like ecstasy or methamphetamine that are mainly used for recreational purposes but also enhance cognition.

Have you ever made use of a substance (one mentioned above or another) to increase your cognitive performance?

Options:
Yes O
No O

(If yes -> next, if no -> end of block)

What **Over-the-counter drugs (**like coffee or energy drinks. These substances can be bought at the supermarket without much effort and are therefore very easy to obtain) did you make use of for cognitive enhancement?

O Caffeine pills
O Caffeinated drinks (e.g. coffee, energy drinks)
O Cigarettes, Nicotine
O Alcohol
O Cannabis/Marijuana (legally bought)
O Other
O None

If selected -> frequency

How often did you make use of **Caffeine pills** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Caffeinated drinks (e.g. coffee, energy drinks)** to enhance your cognitive performance in the last week?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Cigarettes/Nicotine** to enhance your cognitive performance in the last week?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Alcohol** to enhance your cognitive performance in the last month?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Cannabis/Marijuana (legally bought)** to enhance your cognitive performance in the last month?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **the substance you referred to in the "others" category** in order to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

What **Prescription drugs** (initially designed for the treatment of disorders like ADHD or sleep disorders that are being misused for cognitive enhancement) did you make use of for cognitive enhancement?

O Methylphenidate (e.g. Ritalin, Concerta)
O Modafinil (e.g. Provigil)
O β-Blocker (e.g. Beloc)
O Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)
O Fluoxetine (e.g. Prozac)
O Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine)
O Cannabis/Marijuana (medical, prescribed by a doctor)
O Other
O None

If selected -> frequency

How often did you make use of **Methylphenidate (e.g. Ritalin, Concerta)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Methylphenidate (e.g. Ritalin, Concerta)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Modafinil (e.g. Provigil)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **β-Blocker (e.g. Beloc)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Fluoxetine (e.g. Prozac)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine)** to enhance your cognitive performance in the past 12 months?

How often did you make use of **Cannabis/Marijuana (medical, prescribed by a doctor)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **the substance you referred to in the "others" category** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

What **Illicit drugs** (like ecstasy or methamphetamine that are mainly used for recreational purposes but also enhance cognition) did you make use of for cognitive enhancement?

O Amphetamine (e.g. Speed/Pep)
O Cocaine
O Methylenedioxymethamphetamine/MDMA (Ecstasy)

O Cannabis/Marijuana (illicitly bought)
O Heroine
O Other
O None

If selected -> frequency

How often did you make use of **Amphetamine (e.g. Speed/Pep)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Cocaine** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Methylenedioxymethamphetamine/MDMA (Ecstasy)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Cannabis/Marijuana (illicitly bought)** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **Heroine** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times

How often did you make use of **the substance you referred to in the "others" category** to enhance your cognitive performance in the past 12 months?

O 0
O 1-3 times
O 4-10 times
O more than 10 times