Impulsivity
Clinical Aspects in Substance Use Disorders

MICHIEL CHRISTIAAN BOOG

Impulsivity
Clinical Aspects in Substance Use Disorders

Impulsiviteit: klinische aspecten in stoornissen in het gebruik van middelen

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Love is bigger than anything in its way

—

Bono

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General introduction

Since the 1950's, impulsivity is an intensively studied topic in research on personality and psychopathology (Loree, Lundahl, & Ledgerwood, 2015). Influential theories on impulsivity (for example those of Zuckerman (1971) and Cloninger (1987)) all link impulsivity to the abuse of substances, and substance use disorders (SUDs) are seen as a prominent clinical correlate of impulsivity (Verdejo-García, Lawrence, & Clark, 2008). In general, individuals suffering from SUDs are found to be more impulsive (Moeller & Dougherty, 2002).

SUDs are a widespread problem (Grant et al., 2017; Grant et al., 2004). Their consequences are often devastating, causing psychological, physical, social and financial problems (Rehm et al., 2009; Whiteford et al., 2013). Financial costs for society are immense: in a study in 2005, the annual costs of an individual suffering from alcohol dependence were estimated at about 11.000 euros; for opioid and cannabis these costs were about 18.000 euros (Andlin-Sobocki & Rehm, 2005). The total economic costs of excessive alcohol use in the US is estimated at $223.5 billion (Bouchery, Harwood, Sacks, Simon, & Brewer, 2011); the costs of drug abuse to US society are estimated at $151 billion (Miller & Hendrie, 2008).

In this general introduction, first a brief historical outline of theories and empirical research on impulsivity will be given, and the relevance for SUD will be indicated.

HISTORICAL OUTLINE

Psychoticism-Extraversion-Neuroticism

Impulsivity has been an important dimension in theories on personality since Eysenck's development of the Psychoticism-Extraversion-Neuroticism (P-E-N) theory of personality (Eysenck, 1947, 1982). In his theory, impulsivity is not regarded as a primary dimension of personality. Eysenck considered impulsivity to be a combination of high levels of Extraversion, Psychoticism and Neuroticism; the relationship with Psychoticism being the strongest (Eysenck & Eysenck, 1977).

The P-E-N-model has been used in studies on the personality of drug dependent individuals (Gossop & Eysenck, 1983; Lodhi & Thakur, 1993). Cross-sectional studies provide firm support regarding Psychoticism and Neuroticism (Eysenck, 1997): addicted individuals obtain higher scores on these dimensions. On the Extraversion scale, individuals with drug and alcohol use problems tend to score lower, although results are contradictory (see Francis, 1996 for a summary of the research on this topic). Whether there is a causal relationship between P, E and N on one side and SUD on the other, is largely unclear (Eysenck, 1997). Longitudinal studies give some insight in the nature of the relationship: in a study on adolescents, P and N predicted alcohol misuse twelve months later (George, Connor, Gullo, & Young, 2010). Sher, Bartholow, and Wood (2000) found P to be a predictor of SUD six years after initial assessment, although the predictive value was reduced when SUD diagnoses at baseline were taken into account.

Specific research into the relationship between impulsiveness and drug abuse using Eysenck's impulsivity questionnaire is sparse. There is some empirical evidence showing a positive association between substance use and abuse and Eysenck's impulsivity questionnaire (Soloff, Lynch, & Moss, 2000; Wills, Vaccaro, & McNamara, 1994).

Sensation Seeking

Zuckerman (1971) considers impulsivity as a more central aspect of personality. His theory on sensation seeking centers around the concept of impulsivity (Dawe & Loxton, 2004). Zuckerman's Sensation Seeking Scale was developed as an operationalization of the concept of 'optimal level of stimulation' (p. 139, Zuckerman, Eysenck, & Eysenck, 1978). This construct is formulated to explain the curvilinear relationship between emotional responses and the level of stimulation. Graphically, it depicts the rise of positive affect when arousal increases, leading to peak in emotional well-being, followed by decrease of positive affect with further increasing arousal. Sensation seeking is described as a need for varied, novel and complex sensations and experiences in order to maintain an optimal level of arousal (Zuckerman, Bone, Neary, Mangelsdorff, & Brustman, 1972).

The positive relationship between sensation seeking and use (Jaffe & Archer, 1987; Khavari, Humes, & Mabry, 1977; Newcomb & McGee, 1991; Zuckerman et al., 1972; Zuckerman, Buchsbaum, & Murphy, 1980), and abuse (Zuckerman & Cloninger, 1996) of substances is clearly demonstrated in cross-sectional studies. Heroin addicts had higher sensation seeking scores than non-addicts; sensation seeking was associated with age of first use, age of onset of abuse, and severity of symptoms in cocaine abusers; sensation seeking was related to the number of different types of drug used in abusers of all kind of drugs (high scorers used more different types of drug) (Ball, Caroll, & Rounsaville, 1994; Kaestner, Rosen, & Appel, 1977; Platt, 1975; Sutker, Archer, & Allain, 1978). Regarding the relationship between sensation seeking and SUD, far less prospective than cross-sectional research has been done. In a longitudinal study in middle school and high school, sensation seeking strongly predicted marijuana and alcohol use (Crawford, Pentz, Chou, Li, & Dwyer, 2003).

Novelty Seeking

Cloninger proposed a four-dimensional model of temperament (Cloninger, 1987; Cloninger, Svrakic, & Przybeck, 1993; Stallings, Hewitt, Cloninger, Heath, & Eaves, 1996), which includes the dimensions Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD) and Persistence (PS). Novelty Seeking has been regarded as a conceptualization of impulsivity (Helmus, Downey, Arfken, Henderson, & Schuster, 2001). It is defined as "a heritable tendency to respond strongly to novelty and cues for reward (or relief from punishment) that leads to exploratory activity in pursuit of rewards as well as avoidance of monotony and punishment" (Stallings et al., 1996, p. 128).

Cross-sectional research shows that NS is very clearly related to SUD (Le Bon et al., 2004; Martinotti, Cloninger, & Janiri, 2008; Van Ammers, Sellman, & Mulder, 1997). SUD patients were more novelty seeking and the severity of their problem covaried with scores on NS (Conway, Kane, Ball, Poling, & Rounsaville, 2003). Craving in opiate addicts who are detoxified is found to be associated with NS (Martinotti et al., 2008), and treatment outcome in SUD is predicted by NS (Helmus et al., 2001; Roll, Saules, Chudzynski, & Sodano, 2004) Little is known whether NS precedes (and perhaps causes) substance use. Masse and Tremblay (1997) found that NS in children (assessed by teachers, at age six and ten) predicted early onset of substance use in puberty. Further, Sher et al. (2000) found NS to have predictive value for the occurrence of SUD six years after baseline. However, when baseline SUD diagnoses were used as a covariate, prediction was diminished.

Behavioral Approach System

In his Reinforcement Sensitivity Theory, Gray (1993) stated that there are three emotional systems that excite behavior: the behavioral inhibition system (BIS), the behavioral approach system (BAS) and the fight-flight-freezing system (FFFS; Corr, 2004; Mardaga & Hansenne, 2007). Individuals differ in their sensitivity to stimuli associated with negative and positive reinforcement. BAS is activated by signals of reward or relief from punishment, BIS is responsible for inhibition of behavior, and the FFFS is activated by aversive signals and it is involved in escape behaviors. According to Gray, BAS is similar to (but not the same as) impulsivity. (Carver & White, 1994; Dawe, Gullo, & Loxton, 2004).

The biological basis of BAS is supposed to lay in variations in dopaminergic neurotransmission (Franken, Muris, & Georgieva, 2006; see for contradicting experimental results Stuettgen, Hennig, Reuter, & Netter, 2005). High BAS sensitive individuals exhibit higher levels of dopamine in the mesolimbic system (also known as the brain reward system), in response to (potential) rewarding stimuli. According to Gray (1993, in Franken et al., 2006), the state induced by dopamine release in the nucleus accumbens (a central part of the brain reward system) resembles the ecstatic state during alcohol and drug use. This effect might be experienced in smaller proportions when less extreme forms of reinforcement (than consequences of alcohol and drugs use) occur. Persons with very sensitive BAS are franticly looking for reinforcement. Therefore, it is not surprising that BAS functioning and the abuse of substances are interrelated, because addiction co-occurs with the vigorous pursuit of reinforcement. After all, it is known that all substances of abuse have strongly rewarding properties (Franken & Muris, 2006a).

The research conducted is in this area makes clear that craving for substances (Franken, 2002), use of substances (Franken & Muris, 2006a), abuse of substances (Johnson, Turner, & Iwata, 2003; Loxton & Dawe, 2001), and substance dependence (Franken et al., 2006) are related to high sensitive BAS functioning.

METHODS OF MEASURING IMPULSIVITY

Traditionally, personality traits as impulsivity are measured through self-reports. Gottesman and Gould (2003) suggest a distinction between phenotypes, genotypes and endophenotypes in measurement of disorders. Self-reports are seen as indicators of phenotypes (Goudriaan, Oosterlaan, De Beurs, & Van den Brink, 2008), which are 'observable characteristics of an organism' (Gottesman & Gould, 2003, p. 636). Self-reports possibly produce limited understanding of psychiatric disorders (because of limited construct validity of psychiatric disorders, state-effects, and flaws in introspection). Endophenotypes form the path between genes (genotypes) and behavior (phenotypes), and hold the potential for 'deconstruction' of pathology (Gottesman & Gould, 2003) and understanding the etiology of disorders. An

endophenotype is a mechanism that underlies a pathological phenomenon, and might be (for example) of neurophysiological, biochemical or neuropsychological nature.

Impulsivity, thus, can be investigated using questionnaires such as the NS scale taken from Cloninger's Temperament and Character Inventory (Cloninger, Przybeck, Svrakic, & Wetzel, 1994) or the BIS/BAS-scales (Carver & White, 1994) based on Gray's work. Further, when researching impulsivity, behavioral measures could be employed, such as the Stop Signal Task (Goudriaan et al., 2008), or the Iowa Gambling Task (Franken & Muris, 2005), computerized tests that assess different facets of the broad concept of impulsiveness, in an implicit way. Third, neurophysiological measures such as electroencephalography (EEG) can be used. EEG is a neurophysiological method for assessing, among other things, automatic error processing (cortical reactivity following errors made) (Franken, van Strien, Franzek, & van de Wetering, 2007; Littel et al., 2012). This error processing is reduced in impulsivity. Strikingly, a recent study found no relationship between this three levels (self-report, behavioral, and neurophysiological) of measurement in impulsivity (Bernoster, Groot, Wieser, Thurik, & Franken, in press).

Some studies suggest that endophenotypes have more predictive value for the course of mental disorders (Gottesman & Gould, 2003; Goudriaan et al., 2008; Marhe, Luijten, & Franken, 2013; Ooteman et al., 2005). In studying the course of SUD and impulsivity, it therefore seems appropriate to use endophenotypical measures, next to questionnaires. (Loree et al., 2015).

THE TWO-FACTOR MODEL OF IMPULSIVITY

Impulsivity clearly is a multi-faceted construct. Attempts have been made to organize different conceptualizations of impulsivity in a meaningful way (Dawe & Loxton, 2004; Franken & Muris, 2006b; Stevens et al., 2014). Dawe and colleagues (Dawe et al., 2004; Dawe & Loxton, 2004) formulated a promising theory on impulsivity, the two-factor model, that facilitates the integration of phenotypical and endophentoypical measures of impulsivity. They state that impulsivity can be split up in 'Rash Impulsiveness' and 'Reward Sensitivity'. Rash Impulsiveness is acting without premeditation, and is often referred to as disinhibition. Reward Sensitivity is a deliberate, well-considered pursuit of rewards. Metaphorically, high levels of reward sensitivity are like driving a car with a powerful engine that speeds towards a desired destination. Rash Impulsiveness, then, is a malfunctioning of the braking system of the car. Both phenomena bring danger of accidents (Gullo & Dawe, 2008). Reward Sensitivity is supposedly based on the functioning of the mesolimbic dopaminergic system, also known as the brain reward system (Bechara, 2005; Dawe & Loxton, 2004; Stevens et al., 2014) . Rash Impulsiveness is linked to the orbitofrontal cortex (Franken & Muris, 2006b), in which serotonine plays a crucial role (Evenden, 1999). There is evidence that the two impulsivity constructs (Reward Sensitivity and Rash Impulsiveness) are interconnected. Regarding biology, this notion is supported: the orbitofrontal cortex is connected to the dopaminergic pathways of the limbic system through complex feedback loops (Dawe et al., 2004). Empirical research on this two-factor model of impulsivity supports its validity (Franken & Muris, 2005, 2006b; Miller, Joseph, & Tudway, 2004), but the clinical value for SUD is largely unknown. Possibly, the two-factor model can be investigated using phenotypical and endophenotypical measures (Goudriaan et al., 2008).

The first part of the present thesis aims at contributing to the understanding of the two-factor model of impulsivity in SUD. Specifically, the clinical validity of the model and its predictive value for treatment retention are investigated.

The second part of this thesis focuses on psychotherapeutic possibilities for SUD. In this, special attention is given to two disorders that very frequently co-occur with SUD, and that are characterized by impulsivity: borderline personality disorder (BPD) and antisocial personality disorder (ASPD). Below, we elaborate on the second part of the thesis.

IMPULSIVITY HINDERS TREATMENT OF SUD

Treating substance disorder has proven to be difficult. Relapse and drop-out (which is related to nonrecovery, Vanderplasschen et al., 2013) are common (McLellan, Lewis, O'Brien, & Kleber, 2000; Stark, 1992). It is important to try to identify variables that predict the outcomes of the treatment of addiction. Understanding of the mechanisms contributing to treatment success will enable taking individual differences into account in conceptualizing treatment plans of patients (Dawe et al., 2004; Miller, 1991).

There is evidence for the predictive value of impulsivity in SUD treatment success. In a review, Loree et al. (2015) evaluated 35 studies on impulsivity as a predictor of SUD treatment outcome. Twenty-eight of these studies, using self-reports and behavioral measures of impulsivity, found that impulsivity predict abstinence and treatment attrition; high levels of impulsivity (self-reported an behavioral) were related to decreased abstinence and higher levels of attrition. In another review (Stevens et al., 2014), the relationship between neurocognitive measures of impulsivity and treatment outcome in addiction was evaluated. This review indicates that cognitive disinhibition, delay discounting and decision making (all three endophenotypical measures of impulsivity. Hypothetically, delay discounting and decision making are forms of Reward Sensitivity; cognitive disinhibition falls under Rash Impulsiveness) predict SUD treatment outcome (the relationship being negative). Strikingly, measures of motor disinhibition (another endophenotypical index of impulsivity, possibly a form of Rash Impulsiveness) were found to be unrelated to SUD treatment outcome.

DIFFICULTIES IN TREATMENT OF PATIENTS WITH SUD AND COMORBID BPD AND ASPD

Just as in SUD, impulsivity plays an important role in BPD and ASPD (Sebastian, Jacob, Lieb, & Tüscher, 2013; Swann, Lijffijt, Lane, Steinberg, & Moeller, 2009). These three disorders co-occur frequently, as might be expected. Prevalence rates of BPD and ASPD in SUD are both about 20% (Verheul, van den Brink, & Hartgers, 1995). Vice versa: 64% - 78% of BPD patients is believed to suffer from a SUD (Tomko, Trull, Wood, & Sher, 2014; Zanarini et al., 1998). About 50% of ASPD patients presumably has an alcohol dependence; approximately 25% of individuals suffering from ASPD is drug dependent (Trull, Jahng, Tomko, Wood, & Sher, 2010). Verheul, van den Bosch, and Ball (2009) describe possible explanatory models for the relationship between personality disorders and SUDs. One of these models assumes that

personality disorders precede (and cause) SUDs. Three developmental pathways are suggested in this model: an impulsivity pathway, a stress reactivity pathway, and a reward sensitivity pathway. Of these threes pathways, the impulsivity pathway is empirically the most supported (Verheul et al., 2009).

Personality disorders in SUD patients form a challenge in treatment. Experts advise an integral treatment of both disorders (Kienast & Foerster, 2008; van den Bosch & Verheul, 2007), but evidence based integrated treatment programs are largely lacking (van den Bosch & Verheul, 2007), and integrated treatment isn't regular practice in most treatment centers, at least not in the Netherlands. This advice of integrative treatment for SUDs and comorbid personality disorders is based on the fact that the outcomes of treatment solely focused on SUD are worse if there is a comorbid personality disorder (Verheul et al., 2009). The relationship between SUD, personality disorder and treatment outcome is however complex The combination of SUD and personality disorder is more predictive of relapse after treatment than one of these variables on its own (Pettinati, Pierce, Belden, & Meyers, 1999). Further, personality problems deteriorate the therapeutic alliance, with negative consequences for the treatment of SUDs (Gerstley et al., 1989; Verheul, van den Brink, & Hartgers, 1998). Contradictory to clinical impression, SUD patients suffering from comorbid personality disorders generally benefit from SUD treatment. Personality disorders are, nevertheless, associated with the severity of problems (in respect to substance use, comorbidity and legal offences) before and after treatment (Cacciola, Alterman, Rutherford, & Snider, 1995a; Cacciola, Rutherford, Alterman, McKay, & Snider, 1996; Verheul, Brink, Koeter, & Hartgers, 1999). SUD patients with comorbid personality disorder relapse sooner after treatment completion than patients without comorbid personality disorder (Thomas, Melchert, & Banken, 1999; Verheul et al., 1998). Verheul et al. (2009) suggest that SUD patients without personality disorder can benefit from treatment so profoundly, that they are no longer susceptible for relapses. On the other hand, SUD patients with comorbid personality disorder do admittedly benefit from treatment, but do not reach the level of 'immunity for relapse' easily.

TREATMENT OF SUD AND COMORBID BPD: SCHEMA THERAPY WITH HIGH IMPULSIVE PATIENTS

Ball (Ball, 1998, 2007; Ball, Cobb-Richardson, Connolly, Bujosa, & O'Neall, 2005; Ball, Maccarelli, LaPaglia, & Ostrowski, 2011) has investigated the effectivity of Schema Therapy (ST) for patients suffering from SUDs and personality disorders. ST is an evidence based form of psychotherapy, initially employed for BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009), but proven to be effective for various other personality disorders (Bamelis, Evers, Spinhoven, & Arntz, 2014; Bernstein et al., 2012; Weertman & Arntz, 2007) as well. It targets schema's: maladaptive patterns consisting of cognitions, emotions, physical reactions and memories tied to a certain theme, such as for instance mistrust, inferiority or social isolation (Young, Klosko, & Weishaar, 2003). ST integrates elements from other therapy methods like cognitive, behavioral, psychodynamic and gestalt therapy. Ball and colleagues conducted three controlled trials on ST in SUD patients (Ball, 2007; Ball et al., 2005; Ball et al., 2011), of whom most suffered of a co-morbid personality disorder. In the third study, Ball et al. (2011) explicitly doubt the further application of ST for patients with SUDs and personality disorders: "We question the added value of dual-focus therapies for the a range of co-occurring personality disorders and substance dependence relative to empirically supported therapies more narrowly targeting addiction symptoms" (page 10). Lee and Arntz (2013) express criticism on the methodology used in Ball's effectiveness studies. Central in this criticism is the observation that the ST was not delivered in the right dosage and key elements of ST were left out of the therapy.

The second part of this thesis is aimed at investigating the validity of schema theory for SUD patients with a comorbid personality disorder. Further, based on Ball's research and Lee and Arntz's criticism, a study into the effectiveness of ST for patients with alcohol dependence and BPD is conducted. Because of the lack of existing evidence for the effectiveness of ST for alcohol dependence and comorbid BPD, this study is a phase 1 study, and it is designed as a multiple baseline case series study.

OUTLINE

Part one

As described above, this thesis consist of two parts. In the first part the focus will be on different conceptualizations of impulsivity and mostly on the clinical validity of the two-factor model of impulsivity, as formulated by Dawe and Loxton (2004).

Chapter 2: The concepts of rash impulsiveness and reward sensitivity in substance use disorders. In this study, we investigate the validity of the two-factor model of impulsivity in SUD patients. Using self-reports and behavioral measures of impulsivity, we expect to find two impulsivity factors: rash impulsiveness and reward sensitivity.

Chapter 3: Rash impulsiveness and reward sensitivity as predictors of treatment outcome in male substance dependent patients. In a clinical sample of SUD patients, the predictive value of the two-factor model of impulsivity is studied. Hypothetically, rash impulsiveness and reward sensitivity predict treatment attrition and relapse into substance use.

Chapter 4: Cognitive inflexibility in gamblers is primarily present in reward-related decision making. In patients with gambling disorder, we investigate the nature of their cognitive inflexibility. Is this inflexibility reward-based, or is it general inflexibility (i.e. response perseveration)? We expect the cognitive inflexibility observed in gambling disorder to be related to problems in reward-based learning.

Part two

The second part of this thesis deals with the relevance of schema theory and ST for SUD and comorbid ASPD and especially BPD.

Chapter 5: Schema modes and personality disorder symptoms in alcohol dependent and cocaine dependent patients. In this study, we try to understand the relationship between personality disorders and SUDs by studying schema modes. We hypothesize that alcohol patients, cocaine patients and nonpatients differ regarding schema modes and personality disorder symptoms.

Chapter 6: Borderline personality disorder with versus without substance use disorder: differences in impulsivity and schema modes. In this study, the differences between BPD patients with SUD, BPD patients without SUD and nonpatients regarding impulsivity and schema modes are investigated. We expect the differences between the two patient groups to be limited. The differences between the patient groups on one hand and the nonpatients on the other are hypothesized to be substantial; patients scoring more dysfunctional than nonpatients.

Chapter 7: Schema Therapy for borderline personality disorder and alcohol dependence: a multiple baseline case series study. In a phase 1 study, using a multiple baseline design, the effectiveness of ST for BPD and alcohol dependence will be investigated. Treatment as usual will be applied in a baseline phase, followed by three ST phases, in which BPD and alcohol dependence are both targeted. We expect ST to be an effective therapy for this comorbidity.

This thesis will be concluded with a summary and a general discussion.

Chapter 8: General discussion

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The concepts of rash impulsiveness and reward sensitivity in substance use disorders

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ABSTRACT

According to recent theories of addiction, the commonly used term impulsivity comprises two factors: Rash Impulsiveness and Reward Sensitivity. The present study addresses the relevance and generalizability of this two-factor model in a clinical sample of substance use disorder patients. This was examined by examining both internal and external validity. In addition, a comparison was made between self-reported and behavioral measures reflecting Reward Sensitivity and Rash Impulsiveness. Results provide evidence for the existence of the two hypothesized impulsivity factors in a clinical sample of substance dependent patients. Meaningful relationships between the model and drug use characteristics have been found, providing further evidence for the validity of the two-factor model. Furthermore, it is suggested that behavioral and self-report measures of impulsivity represent different constructs.

INTRODUCTION

Impulsivity is believed to play an important role in the origin (McGue, Iacono, Legrand, Malone, & Elkins, 2001)Legrand, Malone, & Elkins, 2001 and development (Crews & Boettiger, 2009) of addiction. It is believed to be associated with different kinds of addictive behaviors (Walther, Morgenstern, & Hanewinkel, 2012). One influential theoretical account, the Reinforcement Sensitivity Theory (RST) of Gray, provides an explanation for the relationship between impulsivity –related concepts and the development of psychopathology (Gray, 1993). Gray's RST is based on the existence of three independent emotional systems in the central nervous system that regulate behavior: the behavioral inhibition system (BIS), the behavioral approach system (BAS) and the fight-flight-freezing system (FFFS) (Corr, 2004). The accent in research has mainly been on BIS and BAS (Stuettgen et al., 2005). When studying the link between personality and addiction within Gray's paradigm, BAS has proven itself as the variable of main interest. According to Gray, individuals differ in the extent to which they are sensitive towards stimuli associated with negative and positive reinforcement. BAS is activated by signals of reward or relief from punishment. Some authors suggest that BAS represents Gray's conceptualization of impulsivity (Carver & White, 1994; Dawe et al., 2004), but this suggestion is questionable (Rawlings & Dawe, 2008).

Studies show that sensitivity of the BAS is a useful concept to study the link between personality and addiction. High BAS sensitive persons are more attracted to stimuli associated with reward, are more prone to approach those stimuli, and experience more positive affect in situations in which they expect reward (Franken et al., 2006).

There have been several studies reporting on the relationship between substance use, substance dependence and BAS. In most cases, BAS is measured employing the Carver and White BIS/BAS scales (1994), which are widely used measures of Gray's reinforcement sensitivity theory. These scales measure BIS and three dimensions of BAS: Drive (the persistence to obtain goals), Fun Seeking (the willingness to seek out and spontaneously approach potentially rewarding experiences) and Reward Responsiveness (the anticipation of and positive response towards reward). Most of these studies were conducted in non-clinical samples (Franken & Muris, 2006a; Johnson et al., 2003; Loxton & Dawe, 2001). In a community based study (Johnson et al., 2003), alcohol and drug use problems were related only to BAS Fun seeking. Loxton and Dawe (2001) found BAS Drive and BAS Fun seeking to be related to alcohol misuse: in a group of two hundred senior high school girls, alcohol misuse was predicted by these BAS-scales. In the Franken and Muris study on substance use in college students (2006a), similar results were found: BAS Drive and BAS Fun Seeking correlated significantly with substance use.

The association between Gray's Reinforcement Sensitivity Theory and substance use behaviors in clinical samples has been investigated (Franken, 2002; Franken et al., 2006); these studies show that BAS is indeed associated with drug and alcohol dependence.

The above-mentioned studies provide indications that impulsivity-related constructs such as BAS are relevant to substance use. However, there is converging evidence that impulsivity is not a unitary construct (Aragues, Jurado, Quinto, & Rubio, 2011; Dougherty et al., 2009; Evenden, 1999; Pattij & Vanderschuren, 2008). Although addiction is closely associated with impulsivity, in addicted persons a striking discrepancy can be observed. On the one hand there is the breakdown of impulse control and on the other hand a 'great amount of planning and

effort which goes into obtaining the substance' (Evenden, 1999). This simultaneous presence of impulsive (non-planning) and deliberate behavior in substance use disorder, is explained in a theory postulated by Dawe and Loxton (Dawe et al., 2004; Dawe & Loxton, 2004).

Dawe and Loxton theorize that the broad concept of impulsivity consists of two factors. The first factor is seen 'as a tendency to act rashly and without consideration of consequences' (p. 345, Dawe & Loxton, 2004). This factor is called 'Rash Impulsiveness'. The other factor is a well-considered drive towards rewarding stimuli, which is called Reward Sensitivity. Dawe and colleagues (2004; 2004) theorize that Reward Sensitivity and Rash Impulsiveness both play a specific role in the development of substances use disorders. Individuals who are highly sensitive to rewards are more prone to start using drugs and their BAS-sensitivity likely increases the incentive salience of drugs, thus causing continuation of drug use. Further, it is more plausible that drug use will continue to exist in rash impulsive individuals, because of their problems with inhibition, in spite of negative consequences of prolonged drug dependence. Without an adequate inhibition system, the use of substances becomes compulsive.

Evidence for this two-factor theory has been found by several authors employing factor analysis (Dawe & Loxton, 2004; Franken & Muris, 2006b; Quilty & Oakman, 2004; Zelenski & Larsen, 1999). Factor analysis was used to examine the underlying structure of various variables representing impulsivity. These studies reveal that both BAS Drive and BAS Reward Responsiveness of the BIS/BAS scales load on one factor which can be defined as Reward Sensitivity. Rash Impulsiveness is reflected in Eysenck's Imp (impulsivity according to Eysenck; Zelenski & Larsen, 1999), Cloninger's Novelty Seeking (Caseras, Àvila, & Torrubia, 2003), Dickman's Dysfunctional Impulsivity (Franken & Muris, 2006b) and Zuckerman's Sensation Seeking Scale (Quilty & Oakman, 2004). Although BAS Fun seeking (BIS/BAS scales) loads on both Reward Sensitivity and Rash Impulsiveness, it seems more closely aligned with Rash Impulsiveness (Carver & White, 1994; Dawe et al., 2004; Franken & Muris, 2006b). The two-factor model is further validated in a study using structural equation modeling (Gullo, Ward, Dawe, Powell, & Jackson, 2011)2011.

More evidence for the validity of the above described two-factor model of impulsivity comes from behavioral and emotion research. In a gambling task (Franken & Muris, 2005) Reward Sensitivity was a predictor of decision making whereas Rash Impulsiveness was not. Further, Carver and White (1994) demonstrated that Reward Sensitivity (measured using the Drive and BAS Reward Responsiveness subscales of the BIS/BAS-scales) predicts the experience of positive affect in reaction to cues of impending reward (and not BAS Fun Seeking).

The present study investigated the validity of the two-factor model of impulsivity in a clinical sample of substance dependent inpatients, and thus we aimed to investigate whether the two-factor model could be generalized to a clinical sample of substance dependent patients and find out whether the two-factor model is clinically relevant. Most of the previous studies on the two-factor model included subjects from general population (Caseras et al., 2003; Franken & Muris, 2006b; Miller et al., 2004; Quilty & Oakman, 2004; Zelenski & Larsen, 1999). Although Dawe and Loxton (2004) hypothesize on the relationships between the two-factor model and substance abuse disorders, research on the two-factor model in this specific population is scarce. As far as we know, only one study found support for the two-factor model in a sample of treatment seeking substance abusers (Gullo, Dawe, Kambouropoulos, Staiger, & Jackson, 2010).

However, in the abovementioned studies only self-report measures representing the two factors were used. In the current study, the issue of generalizability was addressed by performing a principal component analysis on the subscales of various questionnaires that have been related to Rash Impulsiveness in previous studies (Dickmans Impulsivity Inventory-dysfunctional impulsivity, Novelty seeking, Brief Sensation Seeking, BAS Fun Seeking) and Reward Sensitivity (BAS Reward Responsiveness, BAS Drive). In contrast to the previous studies, we related the resulting factors to behavioral measures tapping Rash Impulsiveness and Reward Sensitivity. In this way, we tried to find further evidence for the external validity of the two-factor model.

To investigate the clinical relevance of Reward Sensitivity and Rash Impulsiveness, relations to substance use variables were examined. Based on Dawe et al. (2004) and Pardo, Aguilar, Molinuevo, & Torrubia (2007) we hypothesize that Reward Sensitivity mediates substance use and that Rash Impulsiveness mediates the continuation of drug use (continuation despite negative consequences). According to the theory of Dawe and colleagues (Dawe et al., 2004), it is more likely that individuals who are highly reward sensitive will start using substances than less reward sensitive people. Because of their problems with inhibition, rash impulsive individuals are more likely to keep on using substances.

In the present study we used the Card Playing Task (CPT; Goudriaan et al., 2008) to measure Reward Sensitivity on a behavioral level and the Stop Signal Task (SST; Logan, Cowan, & Davis, 1984) as a behavioral measure of Rash Impulsiveness. The CPT investigates decision-making in conditions in which rewarding is unclear. It requires a "non-rash" decision-making under conflicting reward and punishment contingencies. Reward sensitive individuals tend to prefer the possibility of immediate smaller rewards at the expense of delayed bigger rewards. They behave in this way presumably because they are mainly driven by rewards (Goudriaan et al., 2008). Therefore, we use the CPT as a measure of Reward Sensitivity. The SST is a measure of disinhibition, which is the "rash" tendency to act upon acute impulses. Disinhibition has been regarded as the neuropsychological equivalent of impulsivity (Goudriaan et al., 2008). The most important measure of the SST is the Stop Signal Reaction Time (SSRT). The SSRT measures pre-potent response inhibition; it examines the latency of the inhibitory response. The lower the SSRT, the better the inhibitory control.

It was hypothesized that the two-factors of impulsivity, i.e. Reward Sensitivity and Rash Impulsiveness, were also present in a clinical population of substance dependent patients. Further, we expected that these two factors were relevantly associated with clinical variables. That is, we hypothesized that Reward Sensitivity would be associated with the age of first use of substances (onset) and that Rash Impulsiveness would be associated with the total number of years of frequent substance use (continuation). To further explore this matter, the link between Reward Sensitivity and continuation and the link between Rash Impulsiveness and onset was examined as well. Importantly, we hypothesized that there is a positive relation between behavioral and self-reported measures that tap into Reward Sensitivity and Rash Impulsiveness, respectively.

MATERIAL AND METHODS

Participants

A sample of 60 substance dependent inpatients of a large urban mental health care facility (Bouman Mental Health Care, Rotterdam, the Netherlands) volunteered in this study. All patients entering treatment during the study were asked to participate in the study. Seventy-nine patients agreed to participate. However, 4 patients could not be included because of their limited knowledge of Dutch language. Of those 75 participants, 13 were excluded, because they left the treatment facility before the baseline measurements. Of the 62 remaining patients, 2 patients aborted their participation during the study (administration of the tasks was too demanding). The mean age of the eventual sample was 41.7 years (*SD*= 10,8). The diagnosis of substance dependence was assessed according to DSM-IV-TR criteria (APA, 2000a) by independent clinicians at admission. The primary substance dependence diagnoses were: alcohol (56.7% of the patients), opioid (23.3%), cocaine (16.7%), cannabis (1.7%), and amphetamine (1.7%). Seventy percent of the sample had a second substance dependency diagnosis. Because of possible male-female differences (Wingerson et al., 1993) and a high proportion of males (80%) in the substance disorder treatment population in the Netherlands, we only included male inpatients. Individuals suffering from severe concomitant psychiatric disorders such as schizophrenia, mood disorders, acute psychotic disorders and neuropsychiatric disorders (as assessed by clinicians of the detoxification unit at admission) were not included. Besides substance dependence, 28.3% of our sample had a minimum of one psychiatric disorder, lifetime prevalence (anxiety disorder, mood disorder, psychotic disorders and/or ADHD). Some participants used methadone (21.7%), antidepressants (26.7%), antipsychotics (21.7%), and/or benzodiazepines (25%). Substance use characteristics are presented in Table 1.

Procedure

Patients were selected and asked to volunteer while staying at the detoxification unit. Patient selection took place during a period of 18 months. A short checklist was examined, to find out whether new patients would be suited to participate in the study (male, no severe concomitant psychiatric disorder). Potential participants were then informed about the procedure and when they were willing to take part, they signed an informed consent form. The study was approved by the Ethics Commission of the Erasmus University Medical Center.

After detoxification (mean number of days: 24.2; *SD*= 12.8), participants were transferred to the rehabilitation ward. Within a week after their admission to the rehabilitation ward participants were interviewed by one of the members of the research team, the behavioral tests were administered (by the research team) and questionnaires were filled in. Testing took between one and two hours. Participants received no incentive for their contribution.

Table 1. Summary statistics of use of any substance

Substance	Age (in years) of first frequent[a] use			Number of years frequent[a] use			Proportion variable of number of years frequent[a] use (years of use divided by age)		
	N	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Alcohol (any quantity)	52	20.5	7.7	52	18.3	12.4	52	.40	.21
Alcohol (<5 units/day)	49	24.1	10.4	49	15.5	11.1	49	.34	.20
Heroin	22	30.7	2.0	22	9.1	8.1	22	.20	.17
Methadone	18	36.4	11.8	18	5.3	6.1	18	.11	.12
Sedatives	20	30.6	7.7	20	2.8	2.9	20	.07	.07
Cocaine	32	25.8	9.5	32	8.0	6.3	32	.20	.15
Amphetamines	10	20.0	5.2	10	3.5	3.8	10	.11	.13
Cannabis	34	17.8	9.4	34	10.2	10.8	34	.26	.22
>1 substance a day	43	22.5	11.0	43	10.7	8.9	43	.26	.19

[a] *frequent: a minimum of three times a week*

Instruments

The BIS/BAS scales (Carver & White, 1994) are a self-report questionnaire designed to examine individual differences in sensitivity regarding stimuli associated with negative (Behavioural Inhibition System) and positive (Behavioural Approach System) reinforcement. The scales cluster into two primary scales: BIS and BAS. The BIS scale is unitary; the BAS scale can be split up in three subscales: Reward Responsiveness (BAS Reward Responsiveness;), Fun Seeking (BAS Fun), and Drive (BAS Drive). The Dutch version of the BIS/BAS scales has adequate reliability, with Cronbach's alpha ranging from .61 to .79. (Franken, Muris, & Rassin, 2005).

Novelty Seeking is a subscale of the Temperament and Character Inventory (TCI), developed by Cloninger and colleagues (Cloninger, 1987). In Cloninger's theory on personality, impulsivity is named Novelty Seeking (Cloninger, 1987). The Dutch version of the TCI has good psychometric properties (Duijsens & Spinhoven, 2006), with substantial proof of the validity and acceptable reliability (Cronbach's alpha of .74 for Novelty Seeking).

Zuckerman's Sensation Seeking Scale (Zuckerman et al., 1972) is described as a measure of the need for varied, novel and complex sensations and experiences to maintain an optimal level of arousal (Zuckerman et al., 1972). The Brief Sensation Seeking Scale (Hoyle, Stephenson, Palmgreen, Pugzles Lorch, & Donohew, 2002) has solid validity and reliability. Although the psychometrics of the Dutch version of the BSSS are unknown, the current study revealed a Cronbach's alpha of .75.

The Dickman Impulsivity Inventory (Dickman, 1990) is a self-report questionnaire representing two scales: Functional Impulsivity and Dysfunctional Impulsivity. Only the

Dysfunctional Impulsivity scale is used in this study as Franken and Muris (Franken & Muris, 2006b) showed that it is the most appropriate measure of Rash Impulsiveness. The Dutch version of the DII had good psychometric properties (Claes, Vertommen, & Braspenning, 2000). Cronbach's alpha coefficient of Dysfunctional Impulsivity is .84.

The SST is a behavioral test measuring disinhibition (Verbruggen, Logan, & Stevens, 2008). Four blocks of 64 trials are administered. The first block is used for training and the participant is instructed during this block by the researcher. The blocks consist of Go trials (75%) and Stop trials (25%). Go trials require the participant to press one of two buttons as fast as possible: the left button when a square is presented on a computer screen, the right button when a circle is presented. Stop trials are identical to Go trials apart from the fact that an auditory stop signal is presented, shortly after the visual presentation of the square or circle. This stop signal requires the participant to inhibit his response. The delay between the presentation of the visual stimulus and the stop signal is varied using a tracking algorithm, which makes sure that every participant is able to inhibit in approximately 50% of the trials. The Stop Signal Task is a rather uncomplicated cognitive task and therefore a rather pure measure of disinhibition (Goudriaan et al., 2008).

The Card Playing Task (CPT; Goudriaan et al., 2008) is included as a measure of Reward Sensitivity. In the CPT, a stack of cards is displayed on a computer screen. Participants can choose to open the first card from a closed deck or choose to quit the task. Number cards result in a loss of 50 eurocents, face cards result in the gain of 50 eurocents. When a participant chooses to play until the end of the task (without quitting), the task takes ten blocks of ten cards. This division in blocks is not apparent for the participant. Per block, the ratio of wins to losses changes (one win card is removed and one loss card is added). In each block the chance of losing therefore becomes bigger: in the first block nine out of ten cards are win cards, in the second block eight out of ten cards are win cards, and so on. The number of cards played is the dependent variable: Reward Sensitive individuals will play on even in the face of great losses.

The substance use variables are measured by means of the Dutch version of the Addiction Severity Index (ASI; Hendriks, Kaplan, van Limbeek, & Geerlings, 1989). This structured interview assesses the different types of drugs used, the first age of use, and the duration of use.

Data analysis

The scales selected to represent Reward Sensitivity and Rash Impulsiveness (Reward Responsiveness, Drive, Novelty Seeking, Brief Sensation Seeking Scale, Dickman Impulsivity Inventory –Dysfunctional Impulsivity, Fun seeking) were subjected to a principal components analysis (PCA) employing a Varimax rotation. An exploratory approach was preferred above a confirmatory approach since this is one of the first studies investigating the factor structure in a clinical population. The factors were extracted based on eigenvalues (eigenvalue >1). Then, to further investigate the clinical relevance of the two factors, correlations between the factor scores and ASI-substance use variables were determined (age of first use and number of years of frequent substance use). Non-parametric statistics (Spearman's rho) were employed because of the non-normal distribution of the substance use variables. Present age of the subjects is an obvious confounder for 'number of years of frequent substance use'. Therefore a proportion variable was computed, in which 'number of years of frequent use' was divided by present age. Thirdly, to compare questionnaire-based variables and behavioral measures, correlations between the Reward Sensitivity factor scores and number of cards played in the Card Playing Task were computed. The same was done for Rash Impulsiveness and the Stop Signal Reaction Time of the Stop Signal Test. Again, non-parametric correlations were applied because of the non-normal distribution of the data.

RESULTS

The PCA yielded two factors with eigenvalues larger than 1. The total amount of variance accounted for was 69%. In Table 2, the loadings of the 6 scales on the 2 factors are displayed.

Table 2. Results of the principal component analysis performed on various Reward Sensitivity and Rash Impulsiveness scales.

	Factor 1 Reward Sensitivity	Factor 2 Rash Impulsiveness
BAS Reward Responsiveness	.82	.17
BAS Drive	.84	.11
BAS Fun	.70	.55
DII Dysfunctional Impulsivity	.38	.66
BSSS	.35	.63
NS	-.03	.91

Factor loadings of >.50 are printed bold. BAS = Behavioural Approach System, DII = Dickman Impulsivity Inventory, BSSS = Brief Sensation Seeking Scale, NS = Novelty Seeking

The first component had an eigenvalue of 3.1 and accounted for 36% of the variance, and can be defined as representing Reward Sensitivity. BAS Reward Responsiveness, BAS Drive and BAS Fun all loaded substantially on the first factor (all loadings .70 and above). The second component can be labeled as Rash Impulsiveness and had an eigenvalue of 1.0 and accounted for 33% of the total variance explained. BAS Fun, Dickman Impulsivity Inventory - Dysfunctional Impulsivity, Brief Sensation Seeking Scale and Novelty Seeking loaded high (all factor loadings over .50) on this factor.

Correlations between the two emerging factors and ASI-substance use variables (age of first use and proportion of number of years of frequent use) are shown in Table 3.

As can be seen, Reward Sensitivity was associated with age of first frequent use of several substances: higher levels of Reward Sensitivity co-occur with younger age of first frequent use. In contrast, Rash Impulsiveness was linked to the proportion of number of years of frequent use of several substances. Rash Impulsiveness appeared not to be significantly correlated with years of frequent use of substances.

Table 3. Correlations between Reward Sensitivity and Rash Impulsiveness and substance use variables.

Age of first frequent use	Reward Sensitivity	Rash Impulsiveness
Alcohol (any quantity)	-.18	.06
Alcohol >5 units	-.26	-.06
Heroin	-.20	.04
Methadone	-.12	-.17
Sedatives	-.51[a]	-.39
Cocaine	-.41[a]	-.32
Amphetamines	-.67[a]	.03
Cannabis	-.23	-.08
More than one substance a day	-.31[a]	.01
Proportion[b] years of frequent use		
Alcohol (any quantity)	-.14	-.20
Alcohol >5 units	-.05	-.19
Heroin	-.23	-.07
Methadone	-.33	.04
Sedatives	.26	-.10
Cocaine	.02	-.33
Amphetamines	.49	.27
Cannabis	.30	.11
More than one substance a day	.07	-.19

[a] correlation is significant at the .05 level (2-tailed).
[b] years of frequent use is divided by age.

Further, the Reward Sensitivity factor correlated significantly with the number of cards played on the Card Playing Task (.36; $p<.01$). Higher levels of Reward Sensitivity were associated with a larger amount of cards played. However, no significant correlation was observed between Rash Impulsiveness and the SSRT on the Stop Signal Task.

DISCUSSION

The present study examined the structure of the broad concept of impulsivity in a clinical population of substance dependent patients. The major aim was to investigate the external validity of a two-factor model of impulsivity as proposed by Dawe and colleagues (Dawe et al., 2004), and to explore the clinical relevance of this theory for substance use disorders. Although some evidence has been found for the validity of the two-factor model in substance abuse disorders (Gullo et al., 2010), this is the first study that investigates this model in a clinical population of patients with substance use disorders, and moreover, includes behavioral tasks to further understand the two-factor model of impulsivity.

Principal component analysis performed on several questionnaires that were supposed to measure Reward Sensitivity and Rash Impulsiveness largely supported the hypothesized factor structure. Two factors emerged: Reward Sensitivity and Rash Impulsiveness. Conforming to expectations, Reward Responsiveness and BAS Drive loaded strongly on the Reward Sensitivity factor, and BSSS, NS and DII-dysfunctional impulsivity loaded clearly on the Rash Impulsiveness factor. The loading of these 'Rash Impulsiveness scales' on Reward Sensitivity were higher than expected when compared with the outcomes of the studies of Franken and Muris (Franken & Muris, 2006b) and Zelenski and Larsen (Zelenski & Larsen, 1999). It is important to note that both these two studies were performed in a sample of students, whereas the present study was performed in a substance dependent population. Arguably, a population of students is more homogeneous than a population of inpatient (multi-)substance dependent patients. Therefore, lower reliability indices, such as factor scores, can be expected. BAS Fun loaded on both factors, which is reported by several authors (Dawe & Loxton, 2004; Franken & Muris, 2006b; Zelenski & Larsen, 1999), although the present study is – to our knowledge - the only study in which BAS Fun loads somewhat higher on Reward Sensitivity (compare Franken & Muris, 2006b; Miller et al., 2004; Zelenski & Larsen, 1999). For future studies addressing the constructs of Reward Sensitivity and Rash Impulsiveness, it could be considered to exclude the BAS Fun scale as it does not seem to represent one of these constructs in a straightforward manner.

The significant negative correlations between Reward Sensitivity and 'age of first frequent use of a substance' largely support our hypotheses, based on the theory of Dawe and Loxton (2004) that individuals who are very sensitive to rewards are more likely to start using drugs earlier in their life as they are more strongly driven by the rewarding and/or novelty effects of substances. All of the associations were in the expected direction (for all substances, high Reward Sensitivity was linked to younger age of onset, although not all correlations were significant). It is important to stress that no causal inferences can be made from this correlational investigation. The present findings do not suggest that high levels of Reward Sensitivity results in the onset of substance use, but merely that they are associated with age of substance use onset. Longitudinal research is needed to address this issue. In contrast with earlier studies (Lyvers, Duff, & Hasking, 2011; Pardo et al., 2007) the correlation between Reward Sensitivity and age of first frequent use of alcohol did not reach significance. Hypothetically, this could be caused by the fact that we addressed frequent use of alcohol, while the aforementioned studies investigated any use of alcohol.

In contrast to our hypothesis, none of the associations between Rash Impulsiveness and 'total proportional number of years of frequent use of a substance' were significant. Judging from these results, it can be hypothesized that the role of Rash Impulsiveness in continuation of substance use is limited. On the other hand, the small variance of our sample (all quite severe dependent users) might have limited the ability to detect the relation between Rash Impulsiveness and 'total proportional number of years of frequent use of a substance'. In addition, no significant correlations were found between Reward Sensitivity and 'total proportional number of years of frequent use of a substance' and between Rash Impulsiveness and 'age of first frequent use of substance'.

The findings regarding the comparison between behavioral measures and the two factors reflecting Reward Sensitivity and Rash Impulsiveness, support the hypotheses also partly. The number of cards played in the Card Playing task was correlated with the Reward Sensitivity factor, indicating that they might tap the same construct. That is, patients reporting to be sensitive to rewards, have trouble stopping themselves to react to a previously rewarded response although they are obviously losing. The expected relationship between the Stop Signal Reaction Time of the SST and Rash Impulsiveness was not found. There appears to be no clear association between self-reported Rash Impulsiveness and behavioral disinhibition. This in line with the findings of Goudriaan and colleagues (2008) in their study in pathological gamblers. They found no significant correlations between questionnaires measuring impulsivity on the one hand and behavioral measures representing disinhibition on the other hand. Their suggestion that self-report measures and behavioral tasks in this matter do not represent the same constructs seems applicable as far as Rash Impulsiveness is concerned.

The study on hand has clear limitations. Only male patients were includes, so it is unclear whether the results can be generalized to female substance dependent patients. For example, Loxton and colleagues found gender effects in a study on the two factor model in problem gamblers (Loxton, Nguyen, Casey, & Dawe, 2008). Further, it is possible that a selection effect has occurred while composing the research sample because several patients refused participation. It is not known if this group of patients had specific characteristics, influencing the outcomes of the present study. The partial lack of confirmation of the hypotheses regarding the relationship between substance use variables and the two-factor model of impulsivity might also be a problem of statistical power. In future research the generalizability and validity of the two-factor model of impulsivity in clinical populations of substance abuse disorder should be further investigated by studying a larger sample which includes female patients.

It can be concluded that Reward Sensitivity and Rash Impulsiveness are distinct constructs in a clinical sample of inpatients with substance use disorders. Although further (longitudinal) studies are needed on the causal nature of the relationships between Reward Sensitivity, Rash Impulsiveness and clinical variables, the present study provides a first indication for the relevance of these two constructs in understanding substance use disorders. Future studies should further investigate the clinical value of these two constructs by addressing their predictive value for relapse. Ultimately, individual differences regarding Reward Sensitivity and Rash Impulsiveness might be valuable when making individual treatment plans.

3

Rash Impulsiveness and Reward Sensitivity as predictors of treatment outcome in male substance dependent patients

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ABSTRACT

Recent theories hypothesize that the impulsivity observed in addictive behaviors is a two-factor construct, consisting of Rash Impulsiveness and Reward Sensitivity. There is some evidence for this distinction, but it is unknown what the clinical relevance of this distinction is. The present study examines the predictive value of the two-factor model regarding drop-out from treatment and relapse into substance use in a clinical population of male substance dependent patients. Both behavioral and self-report measures of Rash Impulsiveness and Reward Sensitivity were measured during treatment while substance use relapse was measured after 90 days. Results indicate that treatment drop-out could be predicted by a behavioral index of Reward Sensitivity (Card Playing Task); self-reported Rash Impulsiveness only approached significance as predictor drop-out. In contrast, relapse could not be predicted in the present study. These findings might have implications for the early identification and treatment of patients at risk of treatment drop-out .

INTRODUCTION

Treatment drop-out and relapse are significant problems in the treatment of substance dependent patients. The prediction of treatment outcome, both treatment drop-out and relapse, is important in order to identify risk groups at the start of the treatment. Currently, most predictor studies examine demographic and substance use variables. Overall, substance use variables, such as severity of substance use, appear indeed to be a robust predictor of treatment outcome (see alsoAdamson, Sellman, & Frampton, 2009). There are some indications that personality traits predict treatment outcome, although the number of studies is quite limited and most studies are based on self-report. Identification of personality traits that are associated with higher treatment drop-out and relapse would make it possible to identify those patients with higher risk and could guide treatment plans of individual patients (Dawe et al., 2004; Miller, 1991).

Impulsivity is a personality trait that is particularly relevant for addictive behaviors (see for example: Le Bon et al., 2004; Miller, 1991). According to some recent theories (Dawe et al., 2004, Dawe & Loxton, 2004), impulsivity consists of two components: Rash Impulsiveness and Reward Sensitivity. This two-factor model explains the paradox that can be observed in substance use disorder patients: the absence of impulse control and a simultaneous 'great amount of planning and effort which goes into obtaining the substance' (Evenden, 1999). Rash Impulsiveness stands for 'a tendency to act rashly and without consideration of consequences' (p. 345, Dawe & Loxton, 2004). The other factor, Reward Sensitivity, is a deliberate drive towards rewards. Dawe and colleagues theorize that both factors play a distinctive role in the origin and continuation of substance use disorders. Support for this two-factor model comes from studies using factor analyses on data obtained from general population (Dawe & Loxton, 2004; Franken & Muris, 2006b; Quilty & Oakman, 2004; Zelenski & Larsen, 1999). Recently, evidence for the existence of these two factors of impulsivity has been found in a clinical sample of substance dependent inpatients (Boog, Goudriaan, van de Wetering, Deuss, & Franken, 2013).

Three studies are showing that Novelty Seeking predicts treatment attrition in substance dependent patients (Helmus et al., 2001; Kravitz, Fawcett, McGuire, Kravitz, & Whitney, 1999; Roll et al., 2004). However, one study does not find a relationship between Novelty Seeking and drop-out (Zoccali et al., 2007). Other studies use other measures of impulsivity such as Barratt's Impulsiveness Scale (Moeller et al., 2001) or the Sensation Seeking Scale (Patkar et al., 2004). These studies found similar results: impulsivity is associated with drop-out and poorer treatment outcome. The studies mentioned above indicate that facets of impulsivity can be predictors of treatment outcome. However, research into the predictive value of the two-factor model of impulsivity for addiction treatment outcome has not been done yet. In addition, behavioral measures of impulsivity are scarce in treatment prediction studies.

In behavioral terms, Rash Impulsiveness is referred to as disinhibition. According to Logan and colleagues (1984), disinhibition involves the inhibition of a pre-potent response. In a study of Passetti and colleagues in opiate dependence (Passetti, Clark, Mehta, Joyce, & King, 2008) behavioral measures of disinhibition did not predict treatment outcome. Further, in a tobacco smoking cessation program (Krishnan-Sarin et al., 2007), participants who failed to achieve

abstinence had worse performances on the Continuous Performance Task, a behavioral task measuring impulsivity.

Behavioral measures representing Reward Sensitivity require decision-making under conflicting reward and punishment contingencies. Reward Sensitivity is associated with a preference for immediate smaller rewards at the expense of delayed bigger rewards (Goudriaan et al., 2008). There is evidence that decision-making under conflicting contingencies is a predictor of treatment outcome and relapse in alcohol addiction (Bowden-Jones, McPhillips, Rogers, Hutton, & Joyce, 2005). In opiate addiction, similar results are found (Passetti et al., 2008; Passetti et al., 2011). In their 2008 study, Passetti and colleagues found that performance on tests of decision-making predicted abstinence of illicit drugs at three months in patients taking part in a community based treatment program (poor performance predicting relapse). In a subsequent study (2011) Passetti and colleagues refined their results: they found that this association between poor decision making and relapse only holds for outpatients. Regarding treatment of cocaine dependent individuals, Verdejo-Garcia et al. (2011) did not find evidence that Reward Sensitivity (measured with the Iowa Gambling Task) predicted treatment retention.

Noteworthy, Goudriaan and colleagues (2008) investigated relapse in abstinent pathological gamblers. These authors found both behavioral measures of Reward Sensitivity (Card Playing Task) and Rash Impulsiveness (Stop Signal Task) to be predictors of relapse in pathological gamblers. However, in a similar study Álvarez-Moya and colleagues (2011) found conflicting results: behavioral measures of Reward Sensitivity and Rash Impulsiveness did not predict relapse in pathological gambling.

In the present study we addressed the predictive value of the two-factor model of impulsivity in treatment outcome of substance dependent inpatients, using both self-report and behavioral measures of Reward Sensitivity and Rash Impulsiveness. It was hypothesized that higher levels of Rash Impulsiveness and Reward Sensitivity would be predictive of higher rates of treatment drop-out and higher levels of relapse at follow-up. Because of the absence of prior studies on this specific topic, it is not feasible to postulate very specific predictions regarding the nature of the presumed relationships. Therefore, the present study is more explorative regarding the exact relations between these constructs and treatment outcome. This is the first study investigating the predictive value of the two factor model of impulsivity on addiction treatment outcome. Importantly, it is the first study using both behavioral and self-report measures of impulsivity in this context.

METHOD

Participants

A sample of 58 consecutive included substance dependent inpatients of a large urban mental health care facility (Bouman Mental Health Care, Rotterdam, The Netherlands) volunteered in this study. From four patients no follow-up measures could be obtained. One of these four patients deceased during his stay at the clinic; the other three patients did not respond to repeated attempts to contact them. The mean age of the final sample (*N*=54) was 42.7 years (*SD*=10.5). The diagnosis of substance dependence was assessed according to DSM-IV-TR criteria (APA, 2000a) by experienced clinicians. The primary substance dependence diagnoses were: alcohol (59.3%), opioid (24.1%), cocaine (14.8%) and cannabis (1.9%). Sixty-nine percent of the sample had a secondary substance dependence diagnosis, 25.9% had a third substance dependence. Only male patients were included, to avoid possible gender effects (Wingerson et al., 1993). Individuals suffering from severe concomitant psychiatric disorders such as schizophrenia, mood disorders, acute psychotic disorders and neuropsychiatric disorders (as assessed by clinicians) were not included. Substance use characteristics are presented in Table 1. The age of first frequent use and the number of days of use in the last 30 days before admission to the clinic are indicated for several substances. The present sample is partly overlapping with the sample used in the psychometrical study of Boog et al. (2013).

Table 1. Summary statistics of substance use.

Substance	Age (in years) of first frequent[a] use			Number of days of use in last 30 days		
	N	Mean	*SD*	*N*	Mean	*SD*
Alcohol (<5 units/day)	46	24.6	10.5	41	22.3	10.0
Heroin	20	31.0	12.4	14	20.6	11.8
Methadone	17	36.5	12.2	16	23.1	10.6
Sedatives	18	30.4	8.1	9	18.3	14.1
Cocaine	27	26.7	10.0	26	14.8	11.2
Amphetamines	8	20.4	5.6)	4	1.8	.5
Cannabis	29	18.1	10.1	22	13.4	12.5
>1 substance a day	37	23.1	11.7	36	17.9	12.1

[a] *frequent: a minimum of three times a week*

Procedure

All male patients who were consecutively admitted to the detoxification unit were asked to volunteer. One hundred and forty patients were considered for inclusion, of these patients 33 did not meet the inclusion criteria (7 had neuropsychiatric disorders, 20 had other severe concomitant psychiatric disorders (mood, psychosis) and 6 patients had language difficulties), 31 refused participation and 18 left the facility before the first assessment was done. Participants were informed about the procedure and signed an informed consent form. The research plan was approved by the Ethics Commission of the Erasmus Medical Centre.

After detoxification (mean number of days: 24.4; *SD*=13.0), participants were transferred to the rehabilitation ward. Within a week after their admission to the rehabilitation ward an

interview was held, behavioral tests were administered, personality questionnaires were filled out and personal information was acquired. Subjects were followed for 90 days, starting at the date of their admission to the rehabilitation ward. Dates of discharge and reasons (i.e., drop out vs. planned) for discharge were filed. Effort was made by the treatment staff to motivate patients to adhere to the clinical program for a period of three months. Nevertheless, not all patients remained in the program during this period and sometimes, in consultation with the treatment staff, patients were stayed for a shorter or longer period of time than three months. Therefore, the duration of the stay at the clinic was not the same for each patient. At day 90, patients were contacted again by telephone. In this follow-up interview, participants were asked whether they had relapsed, on which date the relapse had occurred and how many of the last thirty days they had been using substances (all substances except tobacco).

Instruments

The BIS/BAS scales (Carver & White, 1994) are self-report questionnaires developed to examine individual differences in sensitivity regarding stimuli associated with negative (Behavioral Inhibition System) and positive (Behavioral Approach System) reinforcement. The scales are made up of 24 items (of which four are filler items), clustering into two primary scales: BIS (seven items) and BAS (thirteen items). The BIS scale is one-dimensional; the BAS scale can be split up in three subscales: Reward Responsiveness (BAS Reward Responsiveness; five items), Fun Seeking (BAS Fun; four items), and Drive (BAS Drive; four items). The Dutch version of the BIS/BAS scales has adequate reliability, with Cronbach's alpha ranging from .61 to .79. (Franken et al., 2005). In order to reduce the number of variables, only the BAS Drive-scale was used, because it loaded highest on the Reward Sensitivity factor in a factor analytic study in a substance dependent sample (Boog et al., 2013), a finding that is supported in factor analysis conducted in a sample of normal subjects (Franken & Muris, 2006b). It seems therefore a good representation of the concept of Reward Sensitivity.

Novelty Seeking (NS) is a subscale of Cloninger's Temperament and Character Inventory (TCI) (Cloninger, 1987; Cloninger et al., 1993; Stallings et al., 1996). In Cloninger's theory on personality, impulsivity is named Novelty Seeking (Cloninger, 1987) which is defined as "a heritable tendency to respond strongly to novelty and cues for reward (or relief from punishment) that leads to exploratory activity in pursuit of rewards as well as avoidance of monotony and punishment (behavioral activation system)" (Stallings et al., 1996, p. 128). The Dutch version of the TCI has good psychometric properties (Duijsens & Spinhoven, 2006). In the present study NS is used as the measure of the concept of Rash Impulsiveness. This choice is made because NS had the highest factor loading in a factor analysis of several measures of Rash Impulsiveness in a substance dependent sample (Boog et al., 2013). This finding is supported in study in a normal population (Franken & Muris, 2006b).

The Stop Signal Task (SST) is a neurocognitive test measuring disinhibition (Verbruggen et al., 2008). The dependent variable produced by this test is the Stop Signal Reaction Time (SSRT). The SSRT measures pre-potent response inhibition; it examines the latency of the inhibitory response. The lower the SSRT, the better the inhibitory control. Four blocks of 64 trials are administered. The first block is used for training and the participant is instructed during this block by the researcher. The blocks consist of Go trials (75%) and Stop trials (25%). Go trials require the participant to press one of two buttons as fast as possible: the left button when a square is presented on a computer screen, the right button when a circle is presented. Stop trials are identical to Go trials apart from the fact that an auditory stop signal is presented, shortly after the visual presentation of the square or circle. This stop signal requires the participant to inhibit his response. The delay between the presentation of the visual stimulus and the stop signal is varied using a tracking algorithm, which makes sure that every participant is able to inhibit in approximately 50% of the trials. The Stop Signal Task is a rather pure measure of disinhibition (Goudriaan et al., 2008).

The Card Playing Task (CPT; Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2005; Goudriaan et al., 2008) was included as a measure of Reward Sensitivity. This test is an adapted version of the Card Playing Task (see studies above for details) as developed by Newman and coworkers (1987). In the present CPT, a stack of cards is displayed on a computer screen. Participants can choose to open the first card from a closed deck or choose to quit the task. Number cards result in a loss of 50 euro cents, face cards result in the gain of 50 euro cents. When a participant chooses to play until the end of the task (without quitting), the task takes ten blocks of ten cards. This division in blocks is not apparent for the participant. Per block, the ratio of wins to losses changes (one win card is removed and one loss card is added). In each block the chance of losing therefore becomes bigger: in the first block nine out of ten cards are win cards, in the second block eight out of ten cards are win cards, and so on. The number of cards played ('cards') is the dependent variable: Reward Sensitive individuals will play on even in the face of great losses (Goudriaan et al., 2005).

The severity of the substance use was measured by means of the Dutch version of the Addiction Severity Index (ASI; Hendriks et al., 1989). This structured interview assesses the different types of drugs used, the first age of frequent use and the number of days used in the 30 days prior to admission to the clinic. Because of the fact that users of all kinds of substances are included in this study, severity of substance use was measured by the highest number of days of use of any specific substance during the 30 days preceding admissions (ASI-variable; we labeled this "frequency of use". Mean (with standard deviation in parentheses) of frequency of use was 25.20 (8.08).

Two treatment outcome variables were assessed: treatment drop-out (dichotomous: yes/no) and relapse (continuous: number of days of substance use in the 30 days before the follow up). Drop-out was defined as discharge from the clinical facility that was not planned. Follow up took place after 90 days, counting from the day at which questionnaires and behavioral tasks were administered. Follow-up was executed through telephone interviews held by one of the members of the research team.

Data analysis

A logistic regression analysis and a standard hierarchical regression analysis were conducted to investigate the extent to which predictor variables were associated with drop-out and relapse, respectively.

BAS Drive (our self-reported measure of Reward Sensitivity), NS (our self-reported measure of Rash Impulsiveness), the number of cards played of Card Playing Task (our behavioral

measure of Reward Sensitivity) and SSRT of the Stop Signal Task (our behavioral measure of Rash Impulsiveness) were used as independent variables in the regression analysis.

Since substance use severity is known to be an important predictor of treatment outcome (Marhe, van de Wetering, & Franken, 2013), the frequency of recent substance use (last 30 days before admission) was entered in the first block of a hierarchical regression model. After controlling for this severity variable, the four independent variables mentioned above were entered to be able to determine their predictive value for treatment outcome over and above substance use related variable.

Because drop-out is a dichotomous variable, logistic regression was used in the prediction of drop-out. In prediction of relapse standard multiple regression was used. Because of the non-normal distribution of several of the variables, bootstrapping was applied. In this way we were able to check the robustness of the individual predictors. 95% confidence intervals (CI) for B-values were computed via bootstrapping using 1,000 resamples and were obtained as the 2.5th and the 97.5th percentiles of the resulting bootstrap sampling distribution (Efron & Tibshirani, 1993). SPSS 19 was used to carry out the bootstrapping procedure.

Analysis of tolerance values indicated that the validity of the model was not jeopardized by multi-collinearity (tolerance for all independent variables at least .85).

Additionally, we added the results of the bivariate statistics (independent samples t-tests and correlations) in table 2 and table 4 for description purposes. Note that the results and interpretation of the results are based in the regression analyses.

RESULTS

Table 2. T-test results comparing not dropping out with patients dropping out on various predictor variables.

	non-drop-out		drop-out			
	mean	*SD*	mean	*SD*	df	*t*
frequency of use	26.76	6.07	21.50	10.91	52	1.82
NS	12.18	3.36	14.12	3.42	52	-1.93
BAS Drive	11.39	2.48	12.87	2.22	52	-2.07[a]
Cards	27.34	29.76	53.25	36.12	52	-2.74[b]
SSRT	288.50	65.65	263.19	35.19	52	1.45

[a] significant at the .05 level (2-tailed), [b] significant at the .01 level (2-tailed), NS=Novelty Seeking, BAS= Behavioral Approach System, SSRT=Stop Signal Reaction Time

To examine treatment drop-out, a hierarchical logistic regression was performed. In the first block of the regression the possible confounder frequency of use was entered. Frequency of use explained a significant amount of the total variance of drop-out (Nagelkerke *R*-square = .11, model $\chi^2(1) = 4.51, p = .03$). The model correctly classified 74.1% of the cases. Next, predictors BAS Drive, NS, cards, and SSRT were entered in the model. This final model explained a substantial and significant amount of the total variance of drop-out (Nagelkerke *R*-square = .43, model $\chi^2(5) = 19.44$, $p < .002$). The overall accuracy of classification was 83.3%, with 62.5% correctly classified patients in the dropout group, and 92.1 % correctly classified patients in the non-dropout group. Cards was a significant predictor of treatment drop-out ($B = .03$; 95% CI, .01 to .14) and NS only approached significance ($B = .27$; 95% CI, -.02 to 1.10). The *B*-values indicate that playing more cards (i.e. higher behavioral Reward Sensitivity) and higher levels of self-reported NS are associated with an increased probability to drop-out of treatment.

Table 3. Hierarchical logistic regression for variables predicting drop-out (final model).

Predictors	*B*	*SE*	95% bootstrap CI for *B*	
			Lower	Upper
Frequency of use	-.06	.88	-.25	.04
NS	.21	9.22	-.20	1.18
BAS Drive	.27	10.35	-.02	1.10
Cards	.03	1.43	.01	.14
SSRT	-.004	.31	-.04	.02

NS=Novelty Seeking, BAS= Behavioral Approach System, SSRT=Stop Signal Reaction Time

Table 4. Correlations between relapse and various predictor variables and intercorrelations of predictor variables.

	relapse	frequency of use	NS	BAS drive	cards	SSRT
relapse						
frequency of use	-.12					
NS	-.15	-.19				
BAS drive	-.02	-.11	.15			
cards	-.10	-.03	-.13	.16		
SSRT	.09	.34[a]	-.23	-.10	-.03	

[a]correlation is significant at the .05 level (2-tailed), NS=Novelty Seeking, BAS= Behavioral Approach System, SSRT=Stop Signal Reaction Time

To examine relapse, standard hierarchical regression analysis was conducted, with frequency of use as possible confounder entered in the first block. Frequency of use explained 1.6% of the variance in relapse ($F(1, 52) = .82, p = .37$). When subsequently BAS Drive, NS, cards and SSRT were entered, the full model explained 11.1% of the variance (*R*-square) in relapse ($F(6, 47), 1.20, p = .32$), note that

this model is not significant. The four impulsivity variables explained an additional 9.6% of explained variance, but did not significantly contribute to the model over and above the substance use variable (*R*-squared change = .10, F_{change} (4, 48) = 1.29, p = .29). In the final model, only cards (behavioral Reward Sensitivity) approached significance (cards: B = -.07; 95% bootstrap CI, -.15 to .007).

Table 5. Hierarchical regression for variables predicting relapse (final model).

Predictors	ß	*B*	*SE*	95% bootstrap CI for *B*	
				Lower	Upper
frequency of use	-.19	-.23	.16	-.55	.06
BAS Drive	-.01	-.02	.60	-1.18	1.25
NS	-.17	-.47	.42	-1.26	.40
Cards	-.24	-.07	.04	-.15	.007
SSRT	.12	.02	.02	-.01	.06

NS=Novelty Seeking, BAS= Behavioral Approach System, SSRT=Stop Signal Reaction Time

DISCUSSION

In this study we investigated the predictive value of the two-factor model of impulsivity (i.e., Reward Sensitivity and Rash Impulsiveness) for treatment outcome in a sample of substance dependent patients. To our knowledge, this is the first study using both self-report and behavioral measures to examine this matter. In the present study impulsivity was used to predict treatment drop-out and relapse, making it possible to inspect the relationship between these three concepts.

Two hierarchical regression analyses were performed, using behavioral and self-report measures of Reward Sensitivity and Rash Impulsiveness as predictors. The first hierarchical regression analysis, using drop-out as criterion, supported the hypotheses partly. The number of cards played - a behavioral measure of Reward Sensitivity - significantly predicted treatment drop-out over and above severity of substance dependence. Novelty Seeking (self-reported Rash Impulsiveness) only approached significance. Higher levels of behavioral Reward Sensitivity and higher levels of self-reported Rash Impulsiveness (although this latter only approached significance) predicted higher levels of drop-out from treatment.

In the second regression analysis, after controlling for frequency of use, our predictor variables could not predict relapse. Although the behavioral measure of Reward Sensitivity (cards) approached significance, the overall model was not significant. Therefore, no support was found for the hypothesized predictive value of the two-factor model for relapse.

The present study shows an indication for the predictive value of self-reported Rash Impulsiveness for drop-out (again, this only approached significance). No straightforward evidence is found that self-reported Reward Sensitivity can predict treatment outcome. In previous studies, the value of self-reported Rash Impulsiveness in predicting treatment outcome has been demonstrated extensively (Helmus et al., 2001; Kravitz et al., 1999; Roll et al., 2004). In a study among non-patients, there are clear indications that self-reported Rash Impulsiveness is a stronger predictor of problematic substance use than self-reported Reward Sensitivity (Gullo et al., 2011).

The evidence found in the present study for the predictive value of behavioral Reward Sensitivity for treatment outcome (i.e. drop out) is supported by studies in alcohol dependence and opiate dependence (Bowden-Jones et al., 2005; Passetti et al., 2008; Passetti et al., 2011), but not in a study in cocaine dependence (Verdejo-Garciá et al., 2011). Note that all this studies used different treatment outcome measures; therefore a precise comparison is difficult to make. The lack of evidence found in the present study for the predictive value of behavioral Rash Impulsiveness is in concordance with the outcomes of a study in opiate dependency (Passetti et al., 2008). The present study is the first study combining behavioral measures of Reward Sensitivity and Rash Impulsiveness in a heterogeneous sample of inpatients addicted to various substances. The present study gives preliminary evidence for the notion that behavioral measures of Reward Sensitivity might be better predictors than self-reported measures. Interesting in this regard are the findings of Goudriaan and colleagues (Goudriaan et al., 2008). In their study on relapse in pathological gamblers, they found behavioral measures of Reward Sensitivity and Rash Impulsiveness to be predictors of relapse; self-reported Reward Sensitivity and Rash Impulsiveness were not predictive of relapse. They also suggest that behavioral measures might be better predictors of treatment outcome. The present study supports this finding with respect to Reward Sensitivity but does not with respect to Rash Impulsiveness. Strikingly, the outcomes of this study suggest that, in a model containing self-report and behavioral measures, a behavioral measure (cards) is a more relevant predictor than a self-report measure (Novelty Seeking). Clearly, more research is needed in this area (see also Marhe, Franken, & Luijten, in press).

All in all, the two-factor model of impulsivity seems to be a relevant tool to predict treatment attrition. Although treatment drop-out and relapse in substance use are clearly related (Ghodse et al., 2002; Wallace & Weeks, 2004), the two-factor model seems not to be capable of predicting relapse in inpatient substance dependent patients. In other words, the two-factor model has short-term predictive value (drop-out), but no longer-term predictive value (relapse in the 30 days before the follow-up). Hypothetically, through prolonged abstinence, the relevance of impulsivity for treatment outcome might decline.

Some limitations of this study should be noted. The sample consists of male subjects, making it unclear whether the results can be generalized to female substance dependent patients. Second, the sample size is relatively small, especially regarding the use of regression analyses. Third, there is a complicated relationship between drop-out and relapse. Some subjects were still in treatment at follow-up, while for others this was not the case. There is a presumed protective effect of being in treatment. This should be beared in mind when interpreting the present results. Furthermore, although the diagnoses in the present study were obtained by experienced clinicians, no consensus discussion or structured interviews took place. Finally, at follow-up, relapse was only measured through self-report.

Overall, our findings suggest that particularly behavioral Reward Sensitivity predicts drop-out from treatment in substance dependent inpatients. This has clear implications for treatment of substance dependent individuals who are treated in a clinical facility. When behavioral Reward Sensitivity is assessed at admission, high-risk patients can be identified. These high-risk patients may be indicated to receive specialized interventions such as training to cope with their impulsivity. Future research can be aimed at evaluation of the success of these interventions.

4

Cognitive inflexibility in gamblers is primarily present in reward-related decision making

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ABSTRACT

One hallmark of gambling disorder is the observation that gamblers have problems stopping their gambling behavior once it is initiated. On a neuropsychological level it has been hypothesized that this is the result of a cognitive inflexibility. The present study investigated cognitive inflexibility in patients with gambling disorder using a task involving cognitive inflexibility with a reward element (i.e., reversal learning) and a task measuring general cognitive inflexibility without such a component (i.e., response perseveration). For this purpose, scores of a reward-based reversal learning task (Probabilistic Reversal Learning Task) and the Wisconsin Card Sorting Task were compared between a group of treatment seeking patients with gambling disorder and a gender and age matched control group. The results show that pathological gamblers have impaired performance on the neurocognitive task measuring reward based cognitive inflexibility. However, no difference between the groups is observed regarding non-reward based cognitive inflexibility. This suggests that cognitive inflexibility in gambling disorder is the result of an aberrant reward-based learning, and not based on a more general problem with cognitive flexibility. The pattern of observed problems is suggestive of a dysfunction of the orbitofrontal cortex, the ventrolateral prefrontal cortex and the ventral regions of the striatum in gamblers. Relevance for the neurocognition of problematic gambling is discussed.

INTRODUCTION

A gambling disorder (GD) is characterized by a lack of self-regulation (APA, 2013; Goldstein, Volkow, Wang, Fowler, & Rajaram, 2001). Patients suffering from this disorder are not able to inhibit their urge to gamble, and are unable to shift their behavior (Goudriaan et al., 2008). Because of the similarities between GD and substance use disorders it is now generally seen as a non-substance related addictive disorder (APA, 2013). Further, there is clear connection between GD and obsessive compulsive disorder (Blaszczynski, 1999). A core feature of these both disorders is the inability to stop repetitive detrimental behavior.

One specific process related to the lack of self-regulation suggested to underlie GD is cognitive inflexibility associated with reward learning. More specifically, we refer to a tendency to hold on to behavior that has been profitable before, but no longer leads to gain (Klanker, Feenstra, & Denys, 2013). In patients with GD, this reward based cognitive inflexibility presumably can be observed as some kind of continuous gambling even in the face of increasing losses. Reward-based cognitive inflexibility can be studied using the principles of reversal learning, which is dependent on the capacity to perform flexible behavior when stimulus-reward contingencies alter (Clark, Cools, & Robbins, 2004; Franken, van Strien, Nijs, & Muris, 2008). For example, in a study using a reversal learning task, GD-patients performed worse than nonpatients (de Ruiter et al., 2008). Reward-based cognitive inflexibility, i.e. reversal learning, has been associated with the orbitofrontal cortex (Klanker et al., 2013), the ventral prefrontal cortex (Clark et al., 2004), the ventrolateral prefrontal cortex (de Ruiter et al., 2008) and is facilitated by dopaminergic activity in the ventral regions of the striatum (Clark et al., 2004; Klanker et al., 2013). The concept of reward based cognitive inflexibility is also closely related to the concept of reward sensitivity (Boog et al., 2013) and the concept of impaired decision making under conflicting contingencies (Goudriaan et al., 2008).

Another feature related to the lack of self-regulation is arguably a more general, non-reward based, cognitive inflexibility seen in GDs. This form of cognitive inflexibility is based on the functioning of different regions of the prefrontal cortex and the basal ganglia (Monchi, Petride, Petre, Worsley, & Dagher, 2001): the mid-dorsolateral prefrontal cortex, a cortical basal ganglia loop, the posterior prefrontal cortex, and the putamen. Klanker et al. (2013) stress the importance of the lateral prefrontal cortex in this form of cognitive inflexibility. Several studies show that GD-patients have non-reward based cognitive inflexibility and suffer from perseveration, mainly studied by using the Wisconsin Card Sorting Task (WCST; Goudriaan, Oosterlaan, De Beurs, & Van Den Brink, 2006; Odlaug, Chamberlain, Kim, Schreiber, & Grant, 2011; Regard, Knoch, Gütling, & Landis, 2003; Rugle & Melamed, 1993). Contradictory findings are however reported by Cavedini and colleagues (2002). They found no differences between nonpatients and GD patients on the Wisconsin Card Sorting Task and the Weigl's Sorting Test, another instrument to test cognitive flexibility. In a later study, Brand et al. (2005) found no deviations in non-reward based cognitive flexibility in GD as well.

Cognitive inflexibility with and without reward in GD are believed to be independent of each other (Cavedini et al., 2002). This idea is further supported by findings in substance dependent individuals (Bechara & Damasio, 2002). Cavedini and colleagues excluded a possible interference of non-reward based cognitive inflexibility in abnormal decision making

(i.e. reward based cognitive inflexibility) in the Iowa Gambling Task. In this task, subjects have to choose between possible short-term high gains, resulting in eventual losses, or short-term smaller gains, resulting in overall gain in the long run. In contrast, Brand et al. (2005) however suggested that there is a relationship between cognitive inflexibility with and without reward in GD. They used the Modified Card Sorting Test to investigate non-reward based cognitive inflexibility. The Game of Dice Task was applied to measure cognitive inflexibility with reward, a test in which the rules regarding gains and losses are explicit, contrary to the frequently used Iowa Gambling Task (in which these rules are implicit). In other words, in the Game of Dice Task subjects receive explicit instructions on their chances of winning and losing. Brand and colleagues found that GD was associated with cognitive inflexibility with reward, but not with inflexibility without reward. Importantly, they found a relationship between cognitive inflexibility with and without reward in GD.

In the present study, the relationship between cognitive inflexibility with and without reward in GD was further investigated. It remains unclear whether basic cognitive inflexibility might play a role in cognitive flexibility that is based on rewards. The present study intended to clarify the nature of the presumed relationship between GD, reward based cognitive inflexibility and non-reward based cognitive inflexibility. Possibly, the difficulties with stopping detrimental behavior observed in GD is more a general problem of cognitive flexibility (i.e. behavioral perseveration, as seen in obsessive compulsive disorders), and not only a reward-based decision making problem. It was hypothesized that GD patients have higher levels of cognitive inflexibility without reward, that GD-patients are more cognitive inflexible with reward and that cognitive inflexibility with and without reward are not related. Further, the relationships between self-reported symptoms related to cognitive inflexibility (i.e., obsessive compulsive disorder symptoms), psychological distress, and cognitive inflexibility with and without reward were studied. This was done in order to find out if cognitive inflexibility was related to OCD symptoms and psychological distress and to possibly obtain insight in which form of cognitive inflexibility is more related to and more relevant for the phenotypical manifestations of GD. Lastly, we studied the association between the cognitive inflexibility with and without reward in both GD and controls.

METHOD

Participants

Thirty-eight individuals (male and female) participated in this study: 19 patients diagnosed with GD and 19 nonpatients. The GD group consisted of outpatients of a large urban mental health care facility (Bouman Mental Health Care, Rotterdam, The Netherlands). The groups were matched regarding to gender and age. Characteristics of the two groups are presented in Table 1.

GD-patients suffering from severe concomitant psychiatric disorders such as psychotic disorders, bipolar disorders, autism spectrum disorders and neuropsychiatric disorders (as assessed by clinicians) and suffering from color blindness were not included. The nonpatients did not suffer from any psychiatric disorders or color blindness.

Table 1. Characteristics of subjects.

	GD group	Nonpatients
Gender	14 males, 5 females	16 males, 3 females
Age	*M*=42.1	*M*=38.8
	SD=13.35	*SD*=8.0
Level of education	1=26.3%	1=42.1%
	2=52.6%	2=52.6%
	3=15.8%	3=0%
	4=5.3%	4=5.3%
Years of education[a]	*M*=13.47	*M*=15.11
	SD=4.0	*SD*=2.47

Level of education: 1= high, 2= intermediate, 3= low, 4=no education
M=mean, SD=standard deviation

PROCEDURE

Individuals who were included in the GD group were all members of a standard group therapy for gambling disorder. Potential participants were informed about the procedure and when they were willing to take part, they signed an informed consent form. Matched controls were selected via convenience sampling. The study was approved by the Ethics Commission of the Reinier van Arkel Groep. After participants agreed to participate in the study, the behavioral tests were administered, questionnaires were filled out and personal information was acquired. The data collection took place in the treatment facility.

Instruments

The Probabilistic Reversal Learning Task (PRLT) was used as a measure of cognitive inflexibility (Clark et al., 2004; Franken et al., 2008). The PRLT measures reward based response perseveration. In this study, we used the version of the PRLT as described by Franken and colleagues (2008). During 100 trials, subjects had to choose between two stimuli (S+ and S-, easy discernable geometrical figures), presented on a computer screen. The S+ (advantageous) stimulus had the following properties: a reward-punishment ratio of 70:30, a reward range of 80-250 points, and a punishment range of 10-60 points. For the S- (disadvantageous) stimulus the reward-punishment ratio was 40:60, the reward range 30-60 points, and the punishment range 250-600 points. The continuous choice of S+ lead to overall gain, the continuous choice of S- resulted in overall loss. At onset, subjects did not know which geometrical figure resulted in overall gain and which in overall loss. They were supposed to learn this by trial and error. A reversal took place after five correct (S+) choices. Then the geometrical figure leading to the advantageous outcome became the geometrical figure leading to the disadvantageous outcome and vice versa. The total number of reversals (i.e. the

capacity to change strategy) was the outcome variable of interest (PRLT reversals).

The Wisconsin Card Sorting Test (WCST; Heaton, 1981) was used to investigate a more general, non-reward-based, cognitive inflexibility which is reflected in the number of response perseverations (Goudriaan et al., 2006). In this test, subjects have to sort cards in such a way that they match one of four stimulus cards, according to a concept that is unknown to the subject (form, color or number). Feedback is provided regarding the correctness of the response. After ten consecutive correct responses the sorting principle changes, and the subject has to change strategy. We used percentage of perseverative responses as variable in our analyses (WCST perseverations).

The Brief Symptom Inventory (Derogatis & Melisaratos, 1983) is a self-report measure, derived from the SCL-90-R (Derogatis, Rickels, & Rock, 1976). It is a brief psychological symptom scale. The Dutch version of the BSI has solid validity and reliability (De Beurs & Zitman, 2005), with a Cronbach's alpha of . 96. Although the BSI comprises nine subscales, the total score was used as index of current distress in this study.

The Padua Inventory (PI; Sanavio, 1988) is an obsessive compulsive disorder symptom questionnaire. In a sample of Dutch subjects, the validity and reliability of the PI were satisfactory (van Oppen, 1992), wih a Cronbach's alpha of .94. In the present study, the Padua Inventory-Revised (PI-R) was used (Anholt et al., 2009; Van Oppen, Hoekstra, & Emmelkamp, 1995). It has five subscales: Impulses, Washing, Checking, Rumination and Precision. Further, is yields a total score, indicating severity of OCD-symptoms. Some evidence exist for the construct validity of the PI-R. (Van Oppen et al., 1995).

The South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987; Stinchfield, 2002) is a short screening instrument for pathological gambling, based on DSM criteria. It has adequate psychometric qualities (Lesieur & Blume, 1987), with a Cronbach's alpha of .97. In the present study a Dutch version of the SOGS was used (Goudriaan, 2013). The SOGS was used as a measure of severity of GD.

Data analysis

Analyses were conducted to investigate possible differences between GD-patients and controls regarding age, education and gender. Education was operationalized as level of education and years of education. Level of education was divided in four categories: high (college/university), intermediate (high school), low (junior high school) and no secondary education. An independent–samples t-test was used to investigate age differences and years of education, a Fisher's exact test was used for gender (because both variables in this analysis were categorical, and because of small sample size). A Mann-Whitney U-test was executed to compare the two groups regarding level of education, because level of education is an ordinal variable. Further, independent-samples t-tests were used to compare the group of GD-patients with normal controls regarding scores on PRLT, WCST, PI-R and BSI. To compare both groups regarding scores on the SOGS, a Mann-Whitney U-test was employed, because of non-normality of the distribution of the values of this variable. In order to study relationships between BSI, PI-R, PRLT and WCST correlations between these variables were determined. These correlations were computed within the GD-group, in the control group and in the total group (GD-patients and nonpatients together). All tests were done two-tailed with an alpha level of .05.

RESULTS

Demographics

An independent-samples t-test was conducted to compare the age of patients with GD and controls. No significant difference was found in age between GD-patients (M = 42.05, SD = 13.35) and controls (M = 38.79, SD = 7.79): t (29.39) = .92, p = .37. Another independent-samples t-test was conducted to find out if the two groups differed regarding years of education. No significant difference was found in years of education between GD-patients (M = 13.47, SD = 4.01) and controls (M = 15.11, SD = 2.47): t (36) = -1.51, p = .14 (two-tailed). A significant difference between level of education of GD-patients and controls was however found (p=.025) using a Mann-Whitney U-test. Of the patients with GD, 26.3% had a low educational level versus 0% of the controls; 42.1% of the controls had a high educational level versus 15.8% in the control group. The control group had a higher level of education. For gender Fisher's exact test was employed. No significant differences in gender were found (p=.69).

Differences between groups regarding reward based cognitive inflexibility, non-reward based cognitive inflexibility, severity of OCD-symptoms, psychological distress and severity of GD

Mean scores (standard deviations) of all five measures (PRLT reversals, WCST perseverations, BSI, PI-R and SOGS) are displayed in table 2. To find out if level of education was a possible confounder, Spearman rank order correlations between level of education and the several dependent variables were calculated as a pre-test. No significant correlations were observed (correlation between educational level and WCST perseveration was .14, and between education and PRLT reversals was -.02.)

Independent-samples t-tests (PI-R, BSI, PRLT reversals, WCST perseverations) and a Mann-Whitney U-test (SOGS) were conducted to compare the GD-group and the control group. As expected, GD-patients reported significantly higher scores on the SOGS (p< .001) than controls. Also, GD-patients had higher scores on the PI-R total score (t (26.32) = 2.90, p = .01). On only two subscales of Padua Inventory, patients with GD obtained significantly higher scores (Rumination and Precision). The two groups also differed regarding the BSI (t (18.48) = 3.76, p= .001), GD-patients obtaining higher scores. Further, on the PRLT, GD-patients reached a lower number of reversals (t (36) = -2.39, p = .022). No significant difference was found between the two groups regarding percentage of perseverative responses in the WCST (t (36) = 1.07, p = .29).

Table 2. Mean scores (SDs) of GD patients, nonpatients, and total group on PRLT reversals, WCST perseverations, BSI, PI-R and SOGS.

	GD-group	nonpatients	total group
PRLT reversals	4.1 (2.2)	5.9 (2.7)	5.0 (2.6)
WCST perseverations	18.9 (11.4)	12.5 (5.9)	15.7 (9.5)
BSI	1.1 (1.1)	.14 (.12)	.6 (.9)
PI-R	36.1 (23.2)	18.9 (11.5)	27.5 (20.1)
SOGS	8.3 (3.4)	.21 (.71)	4.2 (4.7)

Table 3. Correlations between several variables in the GD-group.

	PRLT reversals	WCST perseverations	PI-R	BSI
PRLT reversals		-.21	-.45[a]	-.52*
WCST perseverations			-.02	.14
PI-R				.78**
BSI				

*correlation is significant at the .05 level (2-tailed), **correlation is significant at the .01 level (2-tailed), [a]p = .054

Table 4. Correlations between several variables in the control group.

	PRLT reversals	WCST perseverations	PI-R	BSI
PRLT reversals		-.19	-.07	.01
WCST perseverations			-.25	.05
PI-R				.40
BSI				

Table 5. Correlations between several variables in the total group (GD and control).

	PRLT reversals	WCST perseverations	PI-R	BSI
PRLT reversals		-.24	-.39*	-.45**
WCST perseverations			.01	.19
PI-R				.78**
BSI				

*correlation is significant at the .05 level (2-tailed), **correlation is significant at the .001 level (2-tailed)

Correlations between reward based cognitive inflexibility, non-reward based cognitive inflexibility, psychological distress and severity of OCD-symptoms

Inspection of scatterplots regarding the respective relationships between the BSI, PI-R, WCST perseverations, and PRLT reversals did not reveal any outliers nor deviations from normality.

Correlations were computed between PI-R, BSI and PRLT reversals and WCST perseverations in the GD-group, the control group and the total group. Results can be found in Table 3, 4 and 5. In GD-patients, significant correlations were found between PRLT reversals and BSI (higher number of reversals associated with lower BSI-scores), and between BSI and PI-R (higher BSI-scores co-occur with higher PI-R-scores). The correlation between PRLT reversals and PI-R only approached significance. More reversals were linked to lower PI-R-scores. In the control group, no significant correlations appeared. In the total group, significant correlations were found between PRLT reversals and BSI (more reversals associated with lower BSI-scores), between PRLT reversals and PI-R (more reversals associated with lower PI-R-scores), and between BSI and PI-R (higher BSI-scores co-occurred with higher scores om PI-R).

DISCUSSION

The present study investigated the nature of the presumed relationship between GD and cognitive inflexibility. Significant differences were found between a group of patients suffering from GD and nonpatients (matched regarding age and gender). GD-patients reported higher levels of severity of gambling, higher levels of psychological distress and more obsessive compulsive symptoms. Further, they displayed more reward based cognitive inflexibility. No evidence was found that GD was related to non-reward based cognitive inflexibility, i.e., perseveration. In the GD-group, reward based and non-reward based cognitive inflexibility were not related. Reward based cognitive inflexibility was significantly related to level of psychological distress; more inflexible GD-patients reporting more symptoms. A near-significant correlation was found between reward based cognitive inflexibility and OCD-symptoms. Non-reward based cognitive inflexibility was not related to level of psychological distress or OCD-symptoms.

In the control group, no relationship was found between the two forms of cognitive inflexibility, and between cognitive inflexibility and symptoms. In the total group, however, significant relationship were found between reward based cognitive inflexibility on one side

and psychological distress an OCD-symptoms on the other. Non –reward based cognitive inflexibility was not related to level of psychological distress or OCD-symptoms. Once again, reward based and non-reward based cognitive inflexibility were not related.

The findings in the present study suggest that reward based cognitive inflexibility characterizes GD-patients in contrast to non-reward based cognitive inflexibility. GD-patients, in other words, do not seem to have problems with general flexibility in strategy and behavior, but do have difficulties with altering a response that is rewarded before, but no longer is (i.e. a dysfunctional focus on rewards). This is line with findings of several studies that suggest that GD is intertwined with reward based cognitive inflexibility (Brand et al., 2005; Cavedini et al., 2002; de Ruiter et al., 2008). The idea that GD is not related to general flexibility is supported by two studies (Brand et al., 2005; Cavedini et al., 2002), but is contradicted by results from other studies (Goudriaan et al., 2006; Odlaug et al., 2011; Regard et al., 2003; Rugle & Melamed, 1993). Also, the present study found indications that reward based and non-reward based cognitive inflexibility are not related in GD. Therefore, it seems that the reward-based cognitive inflexibility observed in GD is not the result of a more general, non-reward based tendency to perseverate. The results of different studies support these findings (Bechara & Damasio, 2002; Cavedini et al., 2002). Brandt et al. (2005) however suggest that non-reward based cognitive inflexibility in itself is not a characteristic of GD (which is supported by the findings of Cavedini et al. in 2002), but plays a role in reward based cognitive inflexibility, when the rules about winning and losing are explicit.

The present study gives preliminary evidence for the idea that reward based cognitive inflexibility is a more central feature of GD than non-reward based cognitive inflexibility. This conception is further supported by the finding that in the GD-group reward based inflexibility was related to level of psychological distress and nearly significantly related to level of OCD-symptoms; in the total group reward based cognitive inflexibility was related to psychological distress and OCD-symptoms. In other words, subjects who were inflexible when rewards were at stake, were more obsessive and compulsive and reported lower levels of psychological well-being. Cognitive inflexibility without reward was not related to OCD-symptoms and psychological distress. This is another indication that GD might be more a problem of reward based inflexibility than of a general tendency to perseverate. This stresses the importance of possible dysfunctioning of the orbitofrontal cortex, the ventrolateral prefrontal cortex and the ventral regions of the striatum in GD-patients (Clark et al., 2004; Klanker et al., 2013).

Some limitations of this study should be mentioned. Firstly, the size of the sample was relatively small. Further, the rules for winning and losing in the PRLT are implicit. That leaves open the possibility that non-reward based cognitive inflexibility plays a role in reward based cognitive inflexibility (see Brand et al., 2005)

In this study the relations between reward based and non-reward based cognitive inflexibility and GD were investigated. In the context of comparing non-reward based and reward based cognitive inflexibility in GD, the paradigm of reversal learning is used for the first time. It is likely that reward based cognitive inflexibility is a more central aspect of GD.

5

Schema modes and personality disorder symptoms in alcohol dependent and cocaine dependent patients

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ABSTRACT

Substance use disorders (SUDs) and personality disorders co-occur frequently. This relationship might be understood by studying schema modes (a key concept in Schema Therapy), that explain the dysfunctions characterizing personality disorder patients. In the present study, we compared the schema modes and personality disorder symptoms between alcohol dependent patients, cocaine dependent patients and nonpatients. We found indications that specific schema modes are specific for SUD patients. However, no differences between specific subtypes of SUD patients (alcohol vs. cocaine dependent patients) could be found regarding schema modes. Further, it is suggested that borderline personality disorder symptoms are highly relevant for SUD patients. A first step is made in understanding the relationship between schema modes and SUD, which may contribute to the understanding of the problematic behavior seen in patients with personality disorders and SUDs (and may possibly contribute to the improvement of the treatment of this group of patients).

INTRODUCTION

Substance abuse is a very common disorder (Kessler et al., 2005) worldwide, that is associated with great economic costs, and emotional, social and financial problems (e.g. Andlin-Sobocki & Rehm, 2005; Kessler, Foster, Saunders, & Stang, 1995). Recovering from substance abuse is associated with frequent relapses (Gossop, Stewart, Browne, & Marsden, 2002; Sinha, 2007) and treatment drop-out (Brorson, Ajo Arnevik, Rand-Hendriksen, & Duckert, 2013). Several reasons for this relapse and drop-out have been documented; one reason might be the profile of personality traits in substance use disorder (SUD) patients and the high comorbidity rates of personality disorders in patients with SUD (Trull, Sher, Minks-Brown, Durbin, & Burr, 2000; Walcott, Martin, & Hickling, 2013; Zimmerman, Rothschild, & Chelminski, 2005). Regarding basic dimensions of personality, a SUD profile is marked by high disinhibition / impulsivity scores, and low levels of conscientiousness and agreeableness (Conway et al., 2003; Kotov, Gamez, Schmidt, & Watson, 2010; Walton & Roberts, 2004). The personality trait of disinhibition has been found to be an important predictor of SUD, both in cross-sectional as well in prospective studies (Sher et al., 2000). Further, in a review of Verheul et al. (1995) it was concluded that about 44% of people abusing alcohol and about 70% of individuals abusing cocaine have personality disorders (in both patient and non-patient samples). Antisocial and borderline personality disorder (ASPD and BPD) are the most prevalent personality disorders (with prevalences of about 20%) (Verheul et al., 2009). These comorbid personality disorders hinder treatment, for example, treatment outcomes are worse than those of SUD patients without comorbidity (Compton, Cottler, Jacobs, Ben-Abdallah, & Spitznagel, 2003; Verheul et al., 2009). Furthermore, comorbid personality disorders are associated with impaired therapeutic relationships (Verheul et al., 1998) and higher chances of relapse after treatment (Thomas et al., 1999).

A promising and relative new treatment approach for personality disorders is Schema Therapy. This is an evidence-based form of psychotherapy for various personality disorders (Bamelis et al., 2014; Giesen-Bloo et al., 2006; Young et al., 2003) which has its roots in the schema theory of Young (Young et al., 2003). According to Young et al. (2003) schemas are "self-defeating emotional and cognitive patterns that begin early in our development and repeat through our life". Behavioral reactions are not included in the schema concept (Sempértegui, Karreman, Arntz, & Bekker, 2013). Schema *modes* are the combination of one or more activated schemas and the associated coping reaction. The concept of schema modes is developed in attempts to explain the 'flipping' (the frequent and abrupt changing in mood and behavior) seen in complex (mainly borderline personality disordered) patients (Lobbestael, van Vreeswijk, & Arntz, 2007; Sempértegui et al., 2013). Young et al. (2003) define a schema mode as "an enduring facet or part of the self that has not been fully integrated with other facets or parts of the self". Severe pathology comes with extreme forms of disintegration of these schema modes (Sempértegui et al., 2013), and individuals suffering from severe pathology have little control over the frequent flipping between different modes. Fourteen modes have been identified (Lobbestael, van Vreeswijk, Spinhoven, Schouten, & Arntz, 2010). Targeting these schema modes in therapy (instead of the more stable schemas) is indicated in treatment of severely disturbed patients (Arntz & Jacob, 2012; Lobbestael et al., 2007). Promising therapeutic results have been reported in borderline patients using the schema modes approach (Giesen-Bloo et al., 2006; Nadort et al., 2009).

The schema theory and therapy seems also a relevant perspective for the treatment of SUD patients. For example, it has been found that high scores on the Young Schema Questionnaire (YSQ) are associated with substance use problems in both clinical (Ball & Cecero, 2001; Brotchie, Meyer, Copello, Kidney, & Waller, 2004; Roper, Dickson, Tinwell, Booth, & McGuire, 2010; Shorey, Anderson, & Stuart, 2014; Shorey, Stuart, & Anderson, 2013, 2014) and non-clinical samples (Bakhshi Bojed & Nikmanesh, 2013). Strikingly, only in one of these studies, personality disorders have been taken into account (Shorey, Anderson, et al., 2014). This is remarkable, because the schema concept stems from theories on treatment of personality disorders. Therefore, it might well be the case that the relevance of schemas for SUD lies in the high level of co-occurrence of personality disorders and SUDs.

We are not aware of studies addressing the presence of schema *modes* in SUDs. In contrast, there is some research conducted on the applicability of Schema Therapy in SUD (Ball et al., 1998) by evaluating the effectiveness of Dual Focus Schema Therapy (DFST; Ball, 1998). DFST is an adapted form of Schema Therapy, that is specifically designed to address SUDs and personality disorders together. These studies come to contradictory findings regarding the effectiveness of DFST. Ball et al. (Ball et al., 2005) find a positive effect of DFST on therapy utilization in patients with personality disorders and SUDs, and Ball (Ball, 2007) concludes that DFST is more effective in reducing substance use and establishing a therapeutic alliance than 12 Step Facilitation Therapy in opioid patients with personality disorders. However, in a third trial (Ball et al., 2011), no evidence was found for the effectiveness of DFST. One of the issues of the latter study as, discussed by Lee and Arntz (2013), is that the researchers only focused on schemas but did not target schema modes, which would arguably had been more effective.

The present study aims to identify schema modes that are specific for alcohol dependent and cocaine dependent individuals. This way the relevance of schema modes for SUD can possibly be revealed further which might inform current schema-based treatments for SUD. Because of the complex pathology of patients with SUDs and personality disorders, and the preference of targeting schema modes instead of schemas in SUD therapy, schema modes are the main interest in this study. Since schema modes and SUDs both have a clear behavioral component (substance use is often seen as a coping mechanism in schema theory), investigating schema modes (instead of schemas) becomes even more legitimate. As far as we know, this is the first study that examines the relationship between schema modes and SUDs.

Although the relevance of the concept of schema modes in SUD patients seems evident, the theoretical underpinnings are in its infancy. A conceptual starting point can be found in a model postulated by Kersten (2012). Kersten suggests that SUDs originate from the schema modes "Self-Aggrandizer" (see Table 1 for different schema modes; the names of different schema modes are chosen in such a way that they are appealing and intuitive to patients. For definitions of different schema modes, see Van Vreeswijk, Broersen, and Nadort (2012)),"Bully and Attack", "Detached Protector", "Detached Self Soother", "Vulnerable Child", "Angry Child", "Impulsive Child" and "Punitive Parent". Kersten suggests that "Detached Protector" and "Detached Self Soother" are characteristic for alcohol dependent individuals and that the schema modes "Self-Aggrandizer" and "Bully and Attack" are related to cocaine abuse. Because of the explorative nature of the present study, we do not focus exclusively on these hypothesized differences between cocaine and alcohol dependent patients. Hence, we hypothesize that SUD patients have higher scores on the schema modes "Detached Protector", "Detached Self Soother", "Self-Aggrandizer", "Bully and Attack", "Vulnerable Child", "Angry Child", "Impulsive Child" and "Punitive Parent" as compared to controls.

Table 1[1]**.** Schema modes.

Vulnerable Child
Angry Child
Enraged Child
Impulsive Child
Undisciplined Child
Happy Child
Compliant Surrender
Detached Protector
Detached Self-Soother
Self-Aggrandizer
Bully and Attack
Punitive Parent
Demanding Parent
Healthy Adult

[1] From *The Wiley- Blackwell Handbook of Schema Therapy: theory, research, and practice* (p. 33-34), by M.F. van Vreeswijk, J. Broersen, and M. Nadort, 2012, Chicester: John Wiley & Sons. Copyright 2012 by John Wiley & Sons. Reprinted with permission.

To further study the relevance of the above mentioned schema modes for cocaine and alcohol dependent patients, the relationship between the severity of substance dependence and these schema modes is investigated.

Lastly, we will also investigate personality disorders, in order to characterize our sample, and to compare the three groups regarding personality disorders. We will focus on borderline personality disorder and antisocial personality disorder (because these are the most prevalent personality disorders in SUD and because of the focus on these personality disorders in Kersten's model). Based on prior research (Verheul et al., 1995), we expect a higher prevalence of personality disorders symptoms in SUD patients as compared to controls.

METHOD

Participants

One hundred and fifty-nine individuals participated in this study. The sample consisted of three groups: alcohol dependent patients, cocaine dependent patients and nonpatients. Participants were recruited in outpatient facilities of two mental health care services (Bouman Mental Health Care and Ready for Change, Rotterdam, the Netherlands). Recruitment of nonpatients was conducted through convenience sampling. Characteristics of the groups are displayed in Table 2. Patients diagnosed with concomitant axis I diagnoses (according to DSM-IV-TR criteria; APA, 2000b) were not included, also regarding concomitant SUD diagnoses (alcohol dependent patients were excluded in case of a concomitant SUD; cocaine dependent patients were excluded too if a concomitant SUD was diagnosed). Nonpatients did not suffer from any Axis I disorder whatsoever. Sufficient knowledge of Dutch language was required for inclusion.

Table 2. Characteristics of subjects.

	Alcohol dependent group	Cocaine dependent group	Nonpatients
Gender	39 males, 17 females	41 males, 6 females	34 males, 22 females
Age	*M* = 47.39 *SD* = 9.42	*M* = 39.79 *SD* = 8.0	*M* = 43.43 *SD* = 14.31
Level of education[a]	1=33.9% 2=26.8% 3=39.3%	1=25.5% 2=44.7% 3=29.8%	1=8.9% 2=25.0% 3=66.1%
Any personality disorder	42.9%	63.8%	17.9%
Two personality disorders with highest mean score (dimensional)[b]	Antisocial (*M* = 2.61, *SD* = 2.81) Borderline (*M* = 2.5, *SD* = 2.30)	Borderline (*M* = 4.04, *SD* = 2.11) Antisocial (*M* = 3.57, *SD* = 4.12)	Obsessive-compulsive (*M* = 1.52, *SD* = 1.49) Paranoid (*M* = 1.04, *SD* = 1.45)
Two most prevalent personality disorder (categorical)[c]	Antisocial (21.4%) Borderline (16.1%)	Paranoid (38.3%) Borderline (34%)	Paranoid (7.1%) Borderline (5.4%)

[a] Level of education: 1= low (Elementary to Middle school), 2= intermediate (High school), 3= high (College or University),
[b] number of PD criteria met, [c] individuals with a specific personality disorder, M=mean, SD=standard deviation

Procedure

Patients were recruited after a standard intake procedure. Recruitment was based on diagnoses assessed during intake procedure (by independent psychiatrists and clinical psychologists according to DSM-IV-TR criteria) (APA, 2000b). Nonpatients were recruited using convenience sampling via the network of the researchers. One of the members of the research team approached potential participants and asked them to volunteer, if they met criteria for inclusion. In the two patient groups, collection of data took place after a period of at least three weeks of abstinence of all substances. Data collection took place in a single session. A member of the research team assessed demographic characteristics, executed an interview and administered two questionnaires. All participants who participated in the study provided informed consent.

Measures

The Screening Questionnaire Personality Disorders (Vragenlijst Kenmerken Persoonlijkheid (VKP); Duijsens, Eurelings-Bontekoe, & Diekstra, 1996) measures (criteria of) personality disorders according to the DSM-IV-TR. The VKP is a self-report instrument that consists of 197 items, clustered in 12 DSM-IV-TR scales. The items are phrases like 'I trust most people' or 'I have good friends'; respondents are asked to state whether they agree with a particular statement. Two dependent variables are generated: a dimensional score (the sum score of the criteria met per personality disorder), and a diagnosis (a score above threshold concerning a specific personality disorder). In this study, the dimensional score is regarded as main outcome, because of the loss of information in generating a categorical diagnostic variable. The psychometric qualities of the VKP are reasonable (Duijsens et al., 1996). The reliability of the VKP-scales is questionable to acceptable (Cronbach's vary between .59 to .78; average .66).

The Schema Mode Inventory (SMI; Lobbestael et al., 2010) is a self-report instrument that is used for schema mode assessment. The SMI is composed of 14 scales, representing 14 schema modes. The SMI has acceptable internal consistency (Cronbach's from .79 to .96), adequate test-retest reliability, and moderate construct validity.

The severity of substance abuse was measured by means of the Addiction Severity Index (ASI), section III (alcohol and drugs use) (Hendriks et al., 1989). The ASI is a structured interview that assesses, amongst others, the types of drugs used, number of years of use, and age of onset of use. Psychometric qualities of the ASI are acceptable (Hendriks et al., 1989). The ASI was administered in all three groups (it was applied in the control group as well, to check once more no SUD patients were included in this group). Two ASI variables were used: age of first frequent use and proportion of years of frequent use (years of frequent use divided by age).

Data analysis

In order to investigate whether the cocaine dependent, the alcohol dependent and the healthy control groups differed in respect to level of education, a Chi-square test for independence was conducted. To investigate possible differences between the three groups regarding gender, Fisher's exact test was used (because of unequal distribution between cells). Age differences between the three groups were evaluated using a one-way analysis of variance.

The differences in prevalence between the three groups concerning BPD and ASPD (the two most prevalent personality disorders) were regarded by means of an analysis of covariance (ANCOVA), with demographic variables as covariates.

To examine whether the alcohol group, the cocaine group and the healthy control group differed regarding schema modes, ANCOVA's were executed, with demographic variables as covariates. Finally, the relationships between specific schema modes and severity of addiction were investigated by means of correlational analyses.

RESULTS

Demographic characteristics

A Chi-square test for independence made clear that there was a significant association between group (cocaine, alcohol and controls) and level of education; the effect size was medium, χ^2 (4) = 19.87, p= .001, Cramer's V = .25. The control group had the highest level of education.

A Fisher's exact test was conducted regarding gender. The groups differed significantly regarding gender (p = .008): the cocaine group had the lowest (12.7%) proportion of women, the control group the highest (39.3%) proportion of women.

A one-way ANOVA pointed out that the alcohol group, cocaine group, and control group differed significantly in age: F (2, 156) = 6.08, p = .003. Post-hoc comparisons (Tukey HSD) made clear that the mean age for alcohol patients (47.39 years) was significantly higher than the mean age of cocaine patients (39.79 years). The control group did not differ significantly in age (43.43 years) from either alcohol or cocaine patients.

Personality disorders

Significant differences between the three groups were found concerning BPD and ASPD dimensional scores: ANCOVA's (with gender, age and level of education as covariates. ANCOVA's were followed by pairwise comparisons based on estimated means) showed that the cocaine dependent patients had a higher BPD dimensional score than alcohol dependent patients and controls; alcohol dependent patients had a higher BPD score than normal controls as well (F (2, 153) = 24.29, p = .001, partial eta squared = .24, a large effect size according to Cohen (1988a). Cocaine dependent and alcohol dependent patients didn't differ in ASPD dimensional scores; both patient groups however had significant higher ASPD dimensional scores than nonpatients (F (2, 153) = 7.02, p = .001, eta squared = .08 (moderate effect size).

As an additional robustness check, non-parametric correlations were computed between level of education and BPD and ASPD dimensional scores in the patient group (cocaine dependent and alcohol dependent patients together) and in the control group. In the patient group, a significant correlation was found between level of education and BPD dimensional score, r_s = -.37, p = .005, with high level of education associated with lower BPD dimensional scores. No further significant correlations were found.

Schema modes

ANCOVA's were conducted to compare the differences between the alcohol dependent patients, cocaine dependent patients and controls regarding the schema modes "Detached Self-Soother", "Detached Protector", "Self-Aggrandizer", "Bully and Attack", "Vulnerable child", "Angry Child', "Impulsive Child", and "Punitive Parent". In each ANCOVA age, gender and level of education were used as covariates. Because of the relatively great number of comparisons, Bonferroni adjustment was employed. Alpha levels of .00625 per test (.05/8) were used.

Table 3. Table 3. ANCOVA's Schema modes (N = 159).

	F (df)	P	partial eta squared	pairwise comparison
"Detached Self-Soother"	10.68* (2, 153)	≤.001	.12 (medium effect size)	cocaine/alcohol > control
"Detached Protector"	3.92 (2, 153)	.02	.05 (small)	cocaine > control
"Self-Aggrandizer"	.56 (2, 153)	.57	.01	-
"Bully and Attack"	1.71 (2, 153)	.18	.02	-
"Vulnerable child"	9.99* (2, 153)	≤.001	.12 (medium)	cocaine/alcohol > control
"Angry Child"	7.27* (2, 153)	≤.001	.09 (medium)	cocaine > control
"Impulsive Child"	8.51* (2, 153)	≤.001	.10 (medium)	cocaine/alcohol > control
"Punitive Parent"	11.05* (2, 153)	≤.001	.13 (medium)	cocaine/alcohol > control

* *significant after Bonferroni adjustment*

Again, additional non-parametric correlations were computed between level of education and the aforementioned schema modes in the patient group (cocaine dependent and alcohol dependent patients together) and the control group. In the control group, a significant correlation was found between level of education and the schema mode "Self-Aggrandizer", r_s = .37, p = .005, with high level of education associated with high "Self-Aggrandizer" scores. No further significant correlations were found in this respect.

Finally, correlations were computed between substance use variables and the above mentioned schema modes ("Detached Self Soother", "Detached Protector", " Self-Aggrandizer", "Bully and Attack", "Vulnerable Child", "Impulsive Child", "Angry Child" and "Punitive Parent"). Because of the relatively great number of comparisons, Bonferroni correction was applied. Alpha levels of .00625 per test (.05/8) were used. Significant positive associations were observed between schema modes "Vulnerable child" and "Angry child" and "proportion of frequent use of alcohol > 5 units" in alcohol dependent patients.

Table 4. Correlations between schema modes and substance use variables in alcohol dependent patients (n = 56).

	Age of first frequent use of alcohol >5 units	Proportion[a] years of frequent use of alcohol >5 units
"Detached Protector"	-.10	.25
"Detached Self-Soother"	-.13	.19
"Self-Aggrandizer"	-.29	.11
"Bully and Attack"	-.17	.01
"Vulnerable child"	-.25	.43[b]
"Angry Child"	-.36	.44[b]
"Impulsive Child"	-.09	.10
"Punitive Parent"	-.14	.33

[a] *years of frequent use is divided by age* , [b] *significant after Bonferroni adjustment*

Table 5. Correlations between schema modes and substance use variables in cocaine dependent patients (n = 47).

	Age of first frequent use of cocaine	Proportion[a] years of frequent use of cocaine
"Detached Protector"	.16	-.09
"Detached Self-Soother"	.02	.05
"Self-Aggrandizer"	-.12	.12
"Bully and Attack"	.00	.03
"Vulnerable child"	-.01	-.10
"Angry Child"	-.03	-.01
"Impulsive Child"	.15	-.07
"Punitive Parent"	.11	-.18

[a] *years of frequent use is divided by age* , [b] *significant after Bonferroni adjustment*

DISCUSSION

In the present study, the differences between alcohol dependent patients, cocaine dependent patients and healthy individuals were examined regarding specific schema modes.

The three groups differed in scores on "Detached Self-Soother", "Vulnerable Child", "Angry Child", "Impulsive Child", and "Punitive Parent" (medium effect sizes). Except for the mode "Angry Child", both cocaine patients and alcohol patients obtained higher scores than controls on these schema modes. For the "Angry Child" schema mode, only cocaine patients had higher scores than controls. No differences between cocaine patients and alcohol patients were found in any of the investigated schema modes.

The findings of the present study partly support the hypotheses based on Kersten's model (2012), which suggests eight schema modes to be characteristic for SUD patients. Differences were found between SUD patients and nonpatients on the schema modes "Detached Self-Soother", "Vulnerable Child", "Angry Child", "Impulsive Child", and "Punitive Parent". However, contrary to expectations based on Kersten's model, no differences were found between SUD patients and controls on "Detached Protector", "Self-Aggrandizer" and "Bully and Attack". Further, Kersten (2012) suggests the existence of schema modes that would be typical for cocaine dependent patients and alcohol dependent patients. However, the present data do not support this hypothesis, but rather suggest that these schema modes are relevant for substance use disorders in general.

Having said this, the present data provided some putative clues for some more substance-specific subtypes. Interestingly, positive relationships between the schema modes "Vulnerable Child" and "Angry Child" and severity of substance abuse were found in the alcohol group (but not in the cocaine group), which suggests that these modes might be especially relevant for alcohol dependent patients.

Concerning the general prevalence of personality disorders in alcohol and cocaine patients, the present study shows a largely comparable prevalence to the Verheul (1995) study. More specific, the prevalence of ASPD and BPD diagnoses -the two most prevalent personality disorders for SUD- in the current study was very similar to prevalence figures found in earlier research (Verheul et al., 1995), suggesting that our patient sample was representative in terms of personality disorders. An exception could be the relative high prevalence of paranoid personality disorder in our cocaine patients. In our study, the three groups differed from each other concerning the prevalence of ASPD and BPD. In addition, alcohol and cocaine patients had higher ASPD dimensional scores than normal controls; cocaine patients had higher scores on BPD than alcohol patients (and normal controls), who, in their turn, had higher BPD scores than controls. Remarkably, especially the difference in BPD criteria met was considerable (large effect size; Cohen, 1988).

The present study has some limitations and strengths that should be mentioned. First, patients suffering from concomitant axis I diagnoses were to be excluded. These axis I diagnoses were established during the intake procedure. At that moment, patients sobriety was probably incipient, and a clear view on some concomitant axis I diagnoses might have been obscured by the pharmacological effects of substance use. However, concomitant axis I diagnoses seem to recover with recovering of SUD (Verheul et al., 2000). It therefore seems unlikely that a great number of patients suffering from concomitant axis I disorders were accidentally included in the present study. A second limitation lies in the absence of formal diagnostic investigation of nonpatients.

Nonpatients were asked whether they were suffering from any psychiatric disorder (and were excluded on affirmation), and their substance abuse was examined through administration of the ASI. But the existence of DSM-IV-TR diagnoses was not formally confirmed. Third, personality disorders were established by a self-report measure, whereas semi-structured interviews are the preferred method for assessing personality disorders (McDermut, Zimmerman, Oldham, Skodol, & Bender, 2005). Fourth, we acknowledge that background variables such as educational level were not perfectly matched between the groups and additional analyses showed that educational level was in some occasions related to schema modes and personality disorder symptoms. Although we controlled for these variables in the analyses, future studies should include larger and better matched samples.

Concluding, SUD patients have higher scores on specific schema modes than nonpatients, and these schema modes might be helpful in discriminating SUD patients from healthy individuals and understanding the psychological dynamics of substance abuse. For now, schema modes seem of limited value in differentiating between cocaine and alcohol dependent patients, because no differences were found on schema modes between cocaine dependent and alcohol dependent patients. In clinical practice, it seems important to assess every individual patient and develop a treatment plan that matches that particular patient (irrespective of preferred substance of abuse). The effect size of the difference on the BPD scores was large: BPD symptoms seem to be highly characteristic for SUD patients. Future research is needed to find out what the relative value is of the assessment of BPD symptoms and schema modes. Do these two concepts have unique value in understanding SUD patients, and especially in treating their problems? For now, considering research done on SUD and personality, there is far more and stronger evidence for the relevance of basic personality traits (conscientiousness, agreeableness, disinhibition, e.g. Conway et al., 2003; Kotov et al., 2010) and personality disorders (Zimmerman et al., 2005) in characterizing SUD patients. Further research should make clear whether addressing schema modes in therapy for SUD patients might be a valuable addition to current therapy practice. This use of schema modes might be clinically relevant, because the schema mode concept and Schema Therapy bring clear tools for therapists in working with complex pathology.

6

Borderline personality disorder with versus without substance use disorder: differences in impulsivity and schema modes

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ABSTRACT

Substance use disorders (SUD) and Borderline Personality Disorder (BPD) are highly co-morbid. In the present study, an attempt was made to understand the differences between BPD and BPD with co-morbid SUD (BPD+SUD), by studying impulsivity and schema modes. BPD patients, BPD patients with alcohol dependency (BPD+SUD) and nonpatients (NP) were compared regarding behavioral impulsivity (motor impulsivity, risk taking, delay discounting), self-reported impulsivity, and schema modes. The two patient groups had higher scores on self-reported impulsivity and displayed greater delay discounting than the NP group. Further, BPD and BPD+SUD groups were different from the NP group regarding all schema modes investigated. No differences were found on any of the dependent variables between the two patient groups. It is suggested that BPD patients might be not very different with regard to impulsivity and schema modes from BPD+SUD patients.

INTRODUCTION

Substance use disorder (SUD) and borderline personality disorder (BPD) co-occur frequently, with percentages of BPD in SUD patients ranging from 7% - 27% (Trull et al., 2000; Verheul et al., 1995) while 64% - 78% of BPD patients is believed to suffer from SUD (Lieb, Zanarini, Schmahl, Linehan, & Bohus, 2004; Tomko et al., 2014; Zanarini et al., 1998). These high comorbidity rates warrant research into the (dis)similarities between these two disorders.

An explanation of the strong relationship between BPD and SUD might be found in the role that impulsivity plays in both disorders (Trull et al., 2000). Research on the relationship between impulsivity and SUD shows that there is a strong association: SUD patients are more impulsive (e.g. De Wit, 2009; Perry & Carroll, 2008), and impulsivity is a predictor of treatment outcome in SUD treatment (Boog et al., 2014; Patkar et al., 2004). Further, impulsivity is a symptom of BPD according to DSM-IV-TR (APA, 2000b), and is considered a core aspect of BPD (Coffey et al., 2011). Attempts to cluster the nine BPD symptoms resulted in four- (Lieb et al., 2004) and three-factor solutions (Skodol, Gunderson, et al., 2002); in both models impulsivity was one of the factors. Because of the shared role of impulsivity, Zanarini (1993) even suggests that BPD and SUD may be placed in the same domain of psychopathology: impulse control disorders. Hypothetically, the co-morbidity of two disorders characterized by impulsivity (BPD and SUD) is related to increased levels of impulsivity, making BPD patients with co-morbid SUD even more impulsive than BPD patients without SUD. This notion is supported by some studies (Coffey et al., 2011; Wilson, Fertuck, Kwitel, Stanley, & Stanley, 2006a).

There are several studies addressing the differences between BPD and BPD+SUD patients regarding impulsivity. Impulsivity is seen as a multifaceted concept (Coffey et al., 2011; Franken & Muris, 2006b; Stevens et al., 2014), that can be studied at phenotypical and endophenotypical level (Gottesman & Gould, 2003). Phenotypes comprise self-reports, endophenotypes include neurocognitive (behavioral) measures (Goudriaan et al., 2008; Stevens et al., 2014). There is some evidence for preferring the use of endophenotypes over phenotypes in researching impulsivity, due to predictive validity (Boog et al., 2014; Goudriaan et al., 2008; Marhe, Luijten, et al., 2013). At endophenotypical level, impulsivity can be operationalized at least in three ways (Coffey et al., 2011; Franken & Muris, 2006b): as rash, motor disinhibition (Logan et al., 1984), as a preference for smaller immediate rewards over delayed, bigger rewards (delay discounting; Petry, 2001), and thirdly as a tendency towards possible immediate rewards, when reward and punishment contingencies are unclear (Franken & Muris, 2005), also seen as risk taking (Stevens et al., 2014). Various studies (Lee, Bagge, Schumacher, & Coffey, 2010; van den Bosch, Verheul, & Brink, 2001) found no differences in self-reported impulsivity between BPD vs. BPD+SUD patients. These finding were replicated and extended by Maraz et al. (2016): they found no differences between BPD and BPD+SUD on self-reported and behavioral (delay discounting) impulsivity. In other studies BPD+SUD patients obtained higher (self-reported) impulsivity scores than BPD patients (Coffey et al., 2011; Links, Heslegrave, Mitton, Reekum, & Patrick, 1995; Wilson, Fertuck, Kwitel, Stanley, & Stanley, 2006b). Especially, the findings of Coffey et al. (2011) are notable in respect to the present study: BPD+SUD patients

obtained higher scores on self-reported impulsivity than BPD patients, who, in their turn, had higher scores than controls. BPD+SUD and BPD patients performed worse than controls on a task measuring behavioral inhibition, but did not differ from each other in this respect. No differences in risk taking were found between the three groups. Lastly, Coffey et al. (2011) found BPD+SUD patients to prefer smaller, immediate rewards over delayed, bigger rewards compared to controls. No differences in delay discounting were found between BPD+SUD vs. BPD and BPD vs. controls. Briefly worded: Coffey et al. (2011) found differences between BPD versus BPD+SUD in self-reported impulsivity, but not in behavioral measures of impulsivity.

An interesting, less documented, perspective in studying personality and the differences between SUD and BPD is formed by schemas and schema modes, as defined by Young et al. (2003). Schemas and schema modes might give a supplementary, less fundamental, and more clinically oriented perspective on the unpredictable, erratic behavior of BPD and SUD patients. Schemas are dysfunctional themes or patterns, consisting of cognitions, emotions, bodily sensations and memories, and are often closely tied to early childhood adverse events (Young et al., 2003). Schemas serve as 'templates' (Nysæter & Nordahl, 2008) for perception of everyday experiences. For example: a childhood that lacks emotional reliability might lead to the development of a 'mistrust schema'. This schema causes a tendency to interpret social situations as hostile and to distrust others. Schema modes are the combination of a schema (or more than one schema) that is active at a given moment, and a specific coping reaction to this schema activation (Lobbestael et al., 2007; Sempértegui et al., 2013); a schema mode therefore is similar to a state. Both schemas and schema modes play an important role in Schema Therapy, an evidence based form of psychotherapy for BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009). Including schemas and schema modes, next to impulsivity, in the investigation of BPD and SUD, might in the long run help improving the treatment of patients with SUD and BPD. Studying impulsivity helps understanding the nature and development of SUD and BPD and the fundamental (dis)similarities between both disorders; Schema Therapy might eventually offer an holistic treatment approach and therapeutic tools.

A preference for applying schema modes (over schemas) in BPD and SUD is suggested because of the high number of schemas found in BPD patients (schema modes make therapy models more parsimonious; Lobbestael et al., 2007), the frequent 'mode flipping' in BPD patients (Sempértegui et al., 2013; mode flipping might hypothetically be seen as the psychotherapeutic labelling of impulsivity), and the relevance of schema modes for SUD (Boog, Hest, Drescher, Verschuur, & Franken, 2018). Young suggests that the schemas "Abandonment/instability", "Mistrust/abuse", "Emotional deprivation", "Failure" and "Subjugation" are related to BPD (Young et al., 2003), but empirical studies have not shown a straightforward 'schema profile' for BPD patients (Sempértegui et al., 2013). Further, as far as schema modes, the "Vulnerable Child", "Angry Child", "Impulsive Child", "Punitive Parent" and "Detached Protector" (see Table 1 for definitions of specific schema modes) modes are identified as being highly active in BPD, whereas lower scores on the "Healthy Adult" mode have also been linked to BPD (Arntz, Klokman, & Sieswerda, 2005; Lobbestael, Arntz, & Sieswerda, 2005; Lobbestael, Van Vreeswijk, & Arntz, 2008; Sempértegui et al., 2013).

Table 1[2]**.** Schema modes investigated in the present study.

Child modes	
Vulnerable Child	The patient believes that nobody will fulfill his needs and that everyone eventually abandons him. He mistrusts others and believes that they will abuse him. He feels worthless and expects rejection. He is ashamed of himself and he often feels excluded. He behaves like a small, vulnerable child that clings to the therapist for help, because he feels lonely and believes there is danger everywhere.
Angry Child	The patient feels intensely angry, enraged, and impatient because his core needs are not being met. He can also feel abandoned, humiliated, or betrayed. He expresses his anger in extreme manifestations, both verbal and nonverbal, just like a small child who has an outburst of anger.
Impulsive Child	The patient wants to satisfy his (non-core) desires in a selfish and uncontrolled manner. He cannot control his feelings and impulses and he becomes enraged and infuriated when his (non-core) desires or impulses are not met. He often behaves like a spoiled child.
Undisciplined Child	The patient had no tolerance for frustration and cannot force himself to finish routine or boring tasks. He cannot bear dissatisfaction or discomfort (pain, conflict, or overexertion) and he behaves like a spoiled child.
Maladaptive coping modes	
Detached Protector	The patient cuts off strong feelings because he believes that such feelings are dangerous and can get out of hand. He withdraws from social contacts and tries to cut off his feelings (sometimes this leads to dissociation). The patient feels empty, bored, and depersonalized. He may adopt a cynical or pessimistic attitude to keep others at arm's length.
Detached Self-Soother	The patient seeks distraction in order not to feel negative emotions. He achieves this by soothing behaviour (e.g. sleeping or substance abuse) or by self-stimulating activities (being fanatical or occupied with work, the internet, sport or sex).
Maladaptive parent modes	
Punitive Parent	The patient is aggressive, intolerant, impatient, and unforgiving toward himself. He is always self-critical and feels guilty. He is ashamed of his mistakes and believes he had to be punished severely for them. This mode is a reflection of what (one of) the parents or other educators used to say to the patient in order to belittle or punish him.
Healthy Mode	
Healthy Adult	The patient has positive and neutralized thoughts and feelings about himself. He does things that are good for him and this leads to healthy relationships and activities. The Healthy Adult mode isn't maladaptive.

[2] From *The Wiley- Blackwell Handbook of Schema Therapy: theory, research, and practice* (p. 33-34), by M.F. van Vreeswijk, J. Broersen, and M. Nadort, 2012, Chicester: John Wiley & Sons. Copyright 2012 by John Wiley & Sons. Reprinted with permission.

Research into schemas in SUD patients has been conducted mainly in patients whose personality disorder status was unknown (Brotchie et al., 2004; Roper et al., 2010; Shorey et al., 2013; Shorey, Stuart, et al., 2014); in two studies personality disorders were taken into account (Ball & Cecero, 2001; Shorey, Anderson, et al., 2014). Overall, SUD patients obtained higher scores than nonpatients on a variety of schemas. Especially, the schemas "Mistrust/abuse", "Abandonment/instability" and "Dependence" seem to be characteristic for SUD patients, although definite conclusions cannot be drawn because of the heterogeneity of the different study samples and the high number of schemas on which SUD patients and controls differed. In only one study (Boog et al., 2018), the relevance of schema modes for SUD was evaluated; in this study the relationships between schema modes, BPD and SUD were not explicitly discussed. More dysfunctional scores on schema modes "Detached Self-Soother", "Vulnerable Child", "Angry Child", "Impulsive Child", and "Punitive Parent" were obtained by SUD patients as compared to nonpatients.

To our knowledge, regarding schema modes, studies on comparisons between BPD vs. BPD+SUD patients have not been performed yet. Therefore, in the present study, we investigated the differences between three groups of individuals: patients with BPD, patients with BPD and alcohol dependence (according to the DSM-IV; BPD+SUD), and nonpatients (NP). Only patients whose main SUD diagnosis was an alcohol dependency were included in the BPD+SUD group, in order to prevent confounding due to dependencies on different substances. Alcohol use disorder is believed to be the most prevalent SUD in BPD (Kienast, Stoffers, Bermpohl, & Lieb, 2014; Trull et al., 2010; Zanarini et al., 1998). The three groups were compared regarding impulsivity and schema modes, in order to gain more insight into the differences between BPD and SUD and the co-occurrence of these disorders. Possibly, this might help improving treatment interventions of especially patients suffering from both disorders, who have been suggested to have more severe pathology than patients with BPD or SUD only (Heath, Laporte, Paris, Hamdullahpur, & Gill, 2017; Links et al., 1995), or than BPD patients with other comorbidities (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2004b). Moreover, specific treatment interventions for BPD+SUD patients are scarce (Lee, Cameron, & Jenner, 2015; Pennay et al., 2011), and prognosis for patients with BPD+SUD is worse than for patients with just a BPD (Kienast et al., 2014; Skodol, Siever, et al., 2002). (Arntz, Stupar-Rutenfrans, Bloo, van Dyck, and Spinhoven (2015) however, found that substance abuse was not predictive of discontinuation nor recovery in psychotherapy for BPD). Schemas were not addressed in the present study; we focused on schema modes. This was done because schema modes seem to form a more fruitful approach in understanding the relationship between SUD and BPD (Boog et al., 2018; Lobbestael et al., 2007; Sempértegui et al., 2013). We hypothesized that BPD patients (with and without SUD) would obtain higher scores on measures of self-reported and behavioral impulsivity than NP (the schema mode "Impulsive Child" was used as measure of self-reported impulsivity). Based on prior research, it was expected that BPD+SUD patients would score higher on self-reported impulsivity than BPD patients, but that no differences would be found regarding behavioral indices of impulsivity between these two groups of patients. Further, we limited our scope to eight schema modes. The "Vulnerable Child", "Angry Child", "Impulsive Child", "Punitive Parent", "Detached Protector", and "Healthy Adult" schema modes were studied because of their relevance for BPD (Arntz et al., 2005), as described above. Next to these six schema modes, we investigated the "Detached Self-Soother" and "Undisciplined Child" schema modes, because of their face validity for SUD (see Table 1 for definitions of schema modes). Regarding differences in schema modes, we expected that patients (both groups) would be rating more dysfunctional than NP. Furthermore, we expected BPD+SUD patients to obtain higher scores than BPD patients on the "Undisciplined Child" and "Detached Self-Soother" schema modes, because of the possible relationship of these schema modes to SUD. Regarding the other schema modes, no differences between the two patient groups were expected (apart from the hypothesized difference on the "Impulsive child" schema mode).

METHOD

Participants

A sample of 71 individuals volunteered to participate: 25 individuals diagnosed with BPD according to DSM-IV (APA, 2000b), 22 individuals with BPD and alcohol dependence according to DSM-IV criteria, and 24 individuals without a mental disorder (see Table 2 for characteristics of participants). For all participants, inclusion criteria were Dutch literacy, and IQ above 80. Regarding the BPD group exclusion reasons were ADHD (because of ADHD being characterized by impulsivity and therefore potentially obscuring the associations investigated in this study), psychotic disorders (except short, reactive psychotic episodes, as seen in BPD), bipolar disorder, and SUD. For the BPD+SUD group ADHD, psychotic disorder (except short, reactive psychotic episodes, as seen in BPD), bipolar disorder and non-alcohol SUD that was the principal SUD, were reasons for exclusion. A power analysis indicated that with N=71 80% power was achieved to detect a large effect (f = 0.34) between the three groups at alpha = .05, and a (large) effect of f = 0.44 at Bonferroni corrected alpha level of .00625. For the comparisons between the patient groups power was 80% to detect large effect sizes of f = 0.42 (alpha = .05) respectively f = 0.54 (alpha = .00625).

Table 2. Characteristics of subjects.

	BPD[b]	BPD+SUD[c]	NP[d]
Gender	22 females, 3 males	17 females, 5 males	14 females, 10 males
Age	*M* = 35.88 *SD* = 9.51	*M* = 34.82 *SD* = 6.37	*M* = 33.67 *SD* = 7.37
Level of education[a]	1 = 24% 2 = 56% 3 = 20%	1 = 36.4% 2 = 45.5% 3 = 18.2%	1 = 16.7% 2 = 54.2% 3 = 29.2%
BPDSI[b] score	*M* = 30.16 *SD* = 6.91	*M* = 31.28 *SD* = 6.72	*M* = 1.62 *SD* = 1.48

[a] level of education: 1= low (Elementary to Middle school), 2= intermediate (High school), 3= high (College or University),
[b] BPD=Borderline Personality Disorder, [c] SUD=Substance Use Disorder, [d] NP=nonpatients

The administration of behavioral tests suffered from some challenges (regarding the functioning of the laptops used, but also with regard to the understanding of the instructions by the participants) and therefore not all participants completed all behavioral tests. Of the 25 BPD participants, 2 did not complete the Stop Signal Task (SST), for 1 other participant the Card Playing Task (CPT) was missing and 1 individual did not complete any (SST, CPT, Delay Discounting Task; DDT) behavioural test. The DDT outcomes of two individuals (1 of the BPD group and 1 of the BPD+SUD group) were excluded, because of non-systematic responding, as defined by Johnson and Bickel (2008). No data were missing for the NP group.

Procedure

Patients were recruited at Antes, a mental healthcare institute in Rotterdam, the Netherlands. The study protocol was approved by the authorized Ethical Committee. Patients were solicited through internal announcements. Once a potential participant had given permission to be contacted, he/she was approached by a member of the research team. Information was given to the patient and a preliminary inclusion screening was performed. Subsequently, patients were asked to participate; informed consent concluded the inclusion. Nonpatients were recruited through convenience sampling. From controls informed consent was obtained as well. Finally, tests, questionnaires and interviews were administered, usually in two sessions.

The participants in the BPD+SUD groups were recruited in the context of a broader (therapy) study. They were recruited at the SUD departments of Antes during 2.5 years. Their engagement in the present study comprised a participation in a research psychotherapy trajectory of at least one year.

The patients in the BPD group were not recruited in the context of a therapy study. They were recruited in departments of Antes specializing in the treatment of personality disorders. These patients were referred for a treatment for an (alleged) personality disorder, most of them even for a specialized BPD program.

Nonpatients were recruited through the networks of the first two authors, taking into account the demographics of the two patients groups (matching regarding sex, age and level of education was pursued).

Measures

The MINI-International Neuropsychiatric Interview-PLUS (M.I.N.I.; Sheehan et al., 1997; Sheehan et al., 1998) is a short, structured interview for DSM-IV diagnoses. Its sensitivity and specificity are generally good; concurrent validity, test-retest reliability, and interrater reliability are good as well (Lecrubier et al., 1997; Sheehan et al., 1997; Sheehan et al., 1998).

The Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders Axis II disorders (SCID II; Gibbon, Spitzer, Williams, Benjamin, & First, 1997) is a semi-structured interview for the assessment of personality disorders according to the DSM-IV. It has excellent inter-rater reliability (Lobbestael, Leurgans, & Arntz, 2011), and good test-retest reliability (Zanarini & Frankenburg, 2001; Zanarini et al., 2000).

The Schema Mode Inventory is a questionnaire investigating schema modes. It has adequate psychometrical qualities (Lobbestael et al., 2010). In the present study, extra attention was given to the 'Impulsive Child' scale, as is was seen a phenotypical measure of impulsivity. Only eight schema modes were used (see Table 1).

The Borderline Personality Disorder Severity Index (BPDSI) is a semi-structured interview (Arntz & Giesen-Bloo, 1999). It is a valid and reliable (Arntz et al., 2003; Giesen-Bloo, Wachters, Schouten, & Arntz, 2010) instrument that investigates the frequency and severity of BPD symptoms in a period of three months. A score of 15 is seen as the cut-off between patients with BPD and non-patients (Arntz et al., 2003).

The SST is a behavioral, neuropsychological test that measures motor disinhibition (Verbruggen & Logan, 2008; Verbruggen et al., 2008). The most important outcome variable is the Stop Signal Reaction Time (SSRT). The SST examines the capacity to inhibit a reaction that has already been set in (see for a mor detailed description of the SST: Boog et al., 2014)

The CPT is a neurocognitive instrument that tests reward sensitivity (Goudriaan et al., 2005, 2008). It is a gambling task, in which high reward sensitive individuals show a preference for smaller, immediate rewards over long-term, larger rewards. The number of cards played ('cards') is the dependent variable: high reward sensitive individuals will play on even when they lose substantially (Goudriaan et al., 2005). In the CPT, the decision-making is done while rewarding is unclear (Boog et al., 2013; see this reference for more details about the CPT). High scores on the CPT come with a tendency to take risks (Stevens et al., 2014).

The DDT (Stevens, Verdejo-García, Roeyers, Goudriaan, & Vanderplasschen, 2015) is a behavioral impulsivity task that, like the CPT, measures the preference for smaller, immediate rewards relative to delayed, larger rewards (Stevens et al., 2014). Delay discounting is the phenomenon that the value of rewards tends to diminish as a function of time (Wittmann, Leland, & Paulus, 2007), which is augmented in SUD (Amlung, Vedelago, Acker, Balodis, & MacKillop, 2017). However, contrary to the CPT, in the DDT, participants are aware of the contingencies. In six blocks of eight trials per block, they are asked to state their preference for a smaller, immediate financial reward versus a delayed financial reward. With help of a fixed value per block of the delayed rewards and a fixed number of days per block between the immediate an delayed reward, and a computerized adaption in the value of the immediate reward (based on the responses of the subject), an 'indifference point' is determined for each block (Stevens et al., 2015). The indifference point (determined for each of the six blocks) is the value of the immediate reward that is equally preferred to the delayed reward. The indifference points are plotted for every delay of the six blocks, which results in a curve. The dependent variable is the area under the curve (AUC; Schmaal, Goudriaan, van der Meer, van den Brink, & Veltman, 2012). A smaller AUC (and a corresponding steeper delay discounting function) represents higher impulsivity.

Data analysis

To find out whether the BPD, BPD+SUD and NP groups differed regarding gender and level of education, Chi-square tests for independence were applied. To compare the three groups in respect to age, a one-way analysis of variance (ANOVA) was used.

In order to examine differences regarding indices of impulsivity and schema modes one-way ANOVA's were conducted. If considerable differences regarding demographic variables were found, one-way analysis of covariance (ANCOVA) was applied.

RESULTS

Demographic characteristics

Demographics and BPDSI scores are presented in Table 2. A one-way ANOVA pointed out that the BPD group, the BPD+SUD group and the NP group did not differ in age: F (2, 68) = .48, p = .62. Chi-square tests for independence showed that the three groups were not significantly different from each other regarding level of education (χ^2 (4) = 2.79, p = .59), nor gender (χ^2 (2) = 5.81, p = .06). However, because of the considerable differences regarding gender between the three groups, gender was added to the analyses (regarding impulsivity and schema modes) as covariate.

Impulsivity

A one-way ANCOVA (with gender as covariate) showed significant differences between the two patients groups on the on hand, and the NP group on the other regarding the schema mode "Impulsive child" (see *3.3* for more details). No significant difference in the scores on this schema mode between the BPD and the BPD+SUD group were found.

In order to compare the three groups concerning behavioural measures of impulsivity, one-way ANCOVA's (with gender as covariate) were used. No significant differences were found in the SSRT (SST), nor regarding Cards (CPT). A significant difference at the p<.05 level was found in AUC (DDT): BPD and BPD+SUD patients obtaining lower scores than NP (large effect size). BPD and BPD+SUD patients did not differ from each other in AUC.

Table 3. ANCOVA's behavioral measures impulsivity.

	Mean (*SD*)	*F* (df)	*p*	partial eta squared	pairwise comparison
AUC (DDT)[a]	-NP[d]: .61 (.21) -BPD[e]: .36 (.21) :BPD[f]+SUD: .34 (.19)	11.04 (2, 64)	≤.001	.26 (large effect size)	NP > BPD/BP-D+SUD
SSRT (SST)[b]	-NP: 236 (34) -BPD: 247 (44) -BPD+SUD: 238 (48)	.27 (2, 64)	.76	.008	-
Cards (CPT)[c]	-NP: 33.21 (17.31) -BPD: 36.65 (25.93) -BPD+SUD: 44.91 (31.12)	1.29 (2, 65)	.28	.038	-

[a] *AUC (DDT) = area under the curve in the Delay Discounting Test,* [b] *SSRT (SST)=stop signal reaction time in the Stop Signal Test,* [c] *Cards (CPT)=the number of cards played in the Card Playing Test,* [d] *NP=nonpatients,* [e] *BPD=Borderline Personality Disorder,* [f] *SUD=Substance Use disorder*

Schema modes

One-way ANCOVA's (with gender as covariate) were used to investigate possible differences regarding schema modes. To avoid Type 1 errors, we used a Bonferroni adjustment to the alpha levels: the alpha levels were set at .00625 per test (.05/8). The two patient groups differed significantly from NP on the schema modes "Vulnerable child", "Angry child", "Impulsive child", "Undisciplined Child" "Punitive parent", "Detached protector", "Detached Self-Soother" and "Healthy adult" (post-hoc comparisons indicated that the two patient groups obtained higher scores on "Vulnerable child", "Angry child", "Impulsive child", "Undisciplined Child", "Punitive parent", "Detached protector", and Detached Self-Soother" than NP; NP obtained a higher score on the "Healthy adult" mode than the patient groups). All effect sizes (partial eta squared) were large (according to Cohen, 1988b). No significant differences in schema modes between BPD and BPD+SUD groups were found.

Table 4. ANCOVA's schema modes.

	Mean (SD)	*F* (df)	*p*	partial eta squared	pairwise comparison
"Vulnerable child"	-NP[a]: 1.16 (.20) -BPD[b]: 3.55 (.99) -BPD+SUD[c]: 3.65 (.78)	88.77 (2, 67)	≤.001	.73 (large effect size)	BPD/BPD +SUD > NP
"Angry child"	-NP: 1.68 (.59) -BPD: 3.49 (.87) -BPD+SUD: 3.43 (.74)	46.78 (2, 67)	≤.001	.58 (large)	BPD/BPD +SUD > NP
"Impulsive child"	-NP: 1.70 (.56) -BPD: 3.04 (.77) -BPD+SUD: 3.48 (.95)	40.30 (2, 67)	≤.001	.55 (large)	BPD/BPD +SUD > NP
"Undisciplined Child"	-NP: 1.88 (.62) -BPD: 2.93 (.99) -BPD+SUD: 3.41 (.77)	23.16 (2, 67)	≤.001	.41 (large)	BPD/BPD +SUD> NP
"Punitive parent"	-NP: 1.30 (.25) -BPD: 2.97 (1.10) -BPD+SUD: 3.04 (.85)	31.06 (2, 67)	≤.001	.48 (large)	BPD/BPD +SUD> NP
"Detached protector"	-NP: 1.27 (.23) -BPD: 2.91 (.97) -BPD+SUD: 2.95 (.74)	44.67 (2, 67)	≤.001	.57 (large)	BPD/BPD +SUD > NP
"Detached Self-Soother"	-NP: 1.62 (.42) -BPD: 3.58 (1.12) -BPD+SUD: 3.89 (.88)	51.56 (2, 67)	≤.001	.61 (large)	BPD/BPD +SUD > NP
"Healthy adult"	-NP: 4.92 (.43) -BPD: 3.38 (.69) -BPD+SUD: 3.22 (.51)	66.65 (2, 67)	≤.001	.67 (large)	NP > BPD/BPD +SUD

[a]*NP=nonpatients,* [b]*BPD=Borderline Personality Disorder,* [c]*SUD=Substance Use disorder*

Pairwise contrasts (Table 5) showed that the effect sizes of the differences between BPD and BPD+SUD patients regarding schema modes "Impulsive child" and "Undisciplined child" were substantial (although non significant). BPD+SUD patients had higher scores on these two schema modes than BPD patients.

DISCUSSION

Are BPD patients who suffer from a comorbid SUD different from 'regular' BPD patients, further than their pervasive usage of substances? In the present study, an attempt has been made to answer this question regarding impulsivity and schema modes.

As for impulsivity, BPD+SUD patients did not obtain significantly different "Impulsive Child" scores from BPD patients (although, in line with the hypothesis, BPD+SUD patients scored higher than BPD patients, with a medium effect size). Both patient groups scored higher

Table 5. Pairwise contrasts between BPD [a]+SUD [b] and BPD patients.

	Estimated means (Standard error)	*t*	*p*	Estimated Cohen's *d*
"Vulnerable child"	-BPD: 3.60 (.15) -BPD+SUD: 3.67 (.16)	.30	.76	.09
"Angry child"	-BPD: 3.53 (.15) -BPD+SUD: 3.44 (.16)	-.45	.65	-.14
"Impulsive child"	-BPD: 3.12 (.15) -BPD+SUD: 3.50 (.16)	1.74	.087	.52 (medium effect size)
"Undisciplined Child"	BPD: 2.98 (.16) BPD+SUD: 3.42 (.17)	1.89	.063	.57 (medium effect size)
"Punitive parent"	-BPD: 2.96 (.17) -BPD+SUD: 3.04 (.18)	.31	.75	.09
"Detached protector"	-BPD: 2.95 (.14) -BPD+SUD: 2.96 (.15)	.03	.97	.01
"Detached Self-Soother"	-BPD: 3.64 (.17) -BPD+SUD: 3.90 (.18)	1.04	.30	.31 (small effect size)
"Healthy adult"	-BPD: 3.36 (.11) -BPD+SUD: 3.22 (.12)	-.84	.40	-.25 (small effect size)

[a]*BPD=Borderline Personality Disorder,* [b] *SUD=Substance Use Disorder*

than NP. On two behavioral measures of impulsivity (rash, behavioral motor disinhibition, and a tendency towards possible immediate rewards, when reward and punishment contingencies are unclear (risk taking), no differences were found between the three groups. In delay discounting, the two patient groups obtained lower scores than the NP group (indicating that the patients were more impulsive), but BPD and BPD+SUD patients did not differ from each other. The effect size in this analysis was large, indicating that the difference in mean scores was substantial.

The findings regarding impulsivity in our study correspond partly to our hypotheses. As expected, self-reported impulsivity levels in the two patient groups were higher than in the NP group. Differences were hypothesized regarding self-reported impulsivity between BPD and BPD+SUD patients (although prior research in this matter is not univocal (Coffey et al., 2011; Lee et al., 2010)). No significant differences were found in self-reported impulsivity in the present study between BPD and BPD+SUD. Possibly, this was a consequence of restricted statistical power (the effect was in the hypothesized direction and not unsubstantial). In line with our hypotheses, behavioral indices of impulsivity did not yield differences in scores between BPD and BPD+SUD patients. However, two measures of impulsivity (CPT and SST) did not differ between any of the three groups, suggesting that BPD patients (with and without SUD) do not differ from controls regarding risk taking nor motor impulsivity. In delay discounting, meaningful differences between BPD patients (BPD and BPD+SUD) and nonpatients were found, suggesting that patients tend to favor immediate rewards over future rewards. In other

words, rewards rapidly lose their subjective value for BPD and BPD+SUD patients, when the delivery of these rewards is postponed.

Our findings regarding behavioral impulsivity are in concordance with a study comparing BPD patients with NP (Barker et al., 2015), in which no differences were found between these two groups on motor impulsivity. Further, in the Barker et al. study, BPD patients showed greater delay discounting than NP. Coffey et al. (2011) compared BPD patients, BPD+SUD patients and nonpatients. Contrary to the present study, they found motor impulsivity to be a characteristic of BPD and BPD+SUD patients. In line with our findings, no differences in risk taking were found between the three groups. Coffey et al. (2011) concluded delay discounting to be a variable that distinguished BPD+SUD patients from NP (a finding that is supported by findings of Maraz et al., 2016). The results of the present study support the conclusion of Coffey et al. (2011) that BPD patients and BPD+SUD patients do not differ on behavioral indices of impulsivity. Based on the present study and prior research (Coffey et al., 2011; see also: Maraz et al., 2016), although findings are mixed, delay discounting might be the impulsivity variable that most strongly differentiates BPD and BPD+SUD patients from NP.

As far as schema modes concerns, the outcomes of the present study match the hypotheses based on prior research (among others Arntz et al., 2005). Significant differences in the typical modes that are related to BPD, i.e., "Vulnerable child", "Angry child", "Impulsive child", "Punitive parent', "Detached protector", and "Healthy adult", were found between the two patient groups on one hand and individuals without psychopathology on the other. As expected, patients scored more dysfunctional on all the modes under investigation. Regarding schema modes that were expected to be related to SUD ("Detached Self-Soother" and "Undisciplined Child"), the two patients groups had higher scores than the NP group too. But, contradicting our hypotheses, BPD+SUD patients did not obtain higher scores than BPD patients on these two schema modes. The difference however between BPD and BPD+SUD concerning the "Undisciplined child" was substantial (although not significant), with BPD+SUD patients scoring higher than BPD patients. A similar phenomenon showed up regarding the "Impulsive child" schema mode (BPD+SUD patients obtaining higher scores than BPD patients). Failure to reach significance regarding the comparison between BPD and BPD+SUD patients on these two schema modes might be a consequence of insufficient statistical power, and a larger sample size would have led to significant differences.

Regarding the differences between the two patients groups on one hand and NP on the other, effect sizes were large, which means that all eight schema modes appear to be meaningful variables for BPD patients with and without SUD. The specific profile as found in BPD patients in prior research (high scores on "Vulnerable child", "Angry child", "Impulsive child", "Punitive parent", "Detached protector" modes and a lowered "Healthy adult" score; Sempértegui et al., 2013) was found in the present study in BPD patients as well as in BPD+SUD patients. Moreover, possibly the schema modes "Undisciplined Child" and "Impulsive Child" are additionally characteristic of BPD+SUD patients.

As far as the limited number of variables that we investigated, we find evidence that the differences between the personalities of BPD+SUD and BPD patients are limited. For clinical practice, our findings therefore might suggest that the advancements regarding treatment of BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009) might be valid for BPD+SUD patients as well (as suggested by van den Bosch et al., 2001). Indeed, comorbid SUD was not an exclusion criterion in these studies on ST for BPD – only when clinical detox was deemed necessary, the patient was excluded. Specialized treatment programs for personality disorders are often not accessible for patients with comorbid SUD (van den Bosch et al., 2001), at least in the Netherlands. Although further research is needed, this study suggests that the underlying personalities of BPD and BPD+SUD might not be very different, and perhaps the psychotherapeutic approach should not be that different either. Perhaps evidence based psychotherapeutic approaches for BPD should be supplemented with specialized SUD interventions, and therapists should become familiar with topics specific for SUD treatment (such as urine tests, intoxication and knowledge of addictive substances).

A shortcoming in the present study is the difference in recruitment between the groups of BPD patients and BPD+SUD patients. The BPD+SUD patients were solicited in the context of a therapy study: their refusal in the present study was a refusal of the therapy study. The BPD group was recruited just for the present study. It is unclear whether a sampling bias has occurred because of this. Further, many more SUD patients were denied participation because they met an exclusion criteria (predominantly because a BPD could not be diagnosed) than patients who were considered for inclusion in the BPD group. This was likely due to two reasons: the very specific treatment referral of the BPD group for psychotherapy for their (borderline) personality disorder and the obscurity in symptoms in SUD patients who have recently become abstinent of alcohol. Possibly, health care professionals confuse the emotional instability of patients going through withdrawal with BPD symptoms. Third, due to limited sample size, the present study suffers from restricted power. Only large effects (Cohen's d = .83 for uncorrected p-level respectively d = 1.05 for Bonferroni corrected p-level) could be detected with 80% power between the two patient groups. Although including a sample with BPD patients and especially BPD+SUD patients is challenging, this is a shortcoming of the present study.

Future research should address these limitations, and is also needed to further broaden the scope of these findings. Can these findings be extended to other personality disorders and other SUD? And is it really so that BPD+SUD patients can benefit from psychotherapy?

All in all, the outcomes of the present study suggest a pronounced profile of schema modes in BPD and BPD+SUD patients, but limited differences between these two patients groups regarding schema modes. Regarding self-report, BPD and BPD+SUD were more impulsive than NP. On behavioral level, BPD and BPD+SUD patients showed more delay discounting, but they did not exhibit higher levels of risk taking, and had no higher levels of motor impulsivity. BPD and BPD+SUD patients did not differ on any impulsivity variable, although higher levels of self-reported impulsivity might exist (BPD+SUD patients being more impulsive). Future studies should further unravel whether fundamental differences between BPD and BPD+SUD patients do exist. Secondly, given the possibly limited differences between the groups, future studies should clarify whether BPD+SUD patients need a different treatment approach than BPD patients without SUD.

7

Schema Therapy for borderline personality disorder and alcohol dependence: a multiple baseline case series study

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ABSTRACT

This study tested the effectiveness of Schema Therapy (ST) for borderline personality disorder (BPD) and comorbid alcohol dependence (AD). Twenty patients participated in a case series study with multiple baseline. The baseline phase consisted of treatment as usual. It was followed by a case conceptualization phase, an experiential techniques phase and a behavioral change phase. Patients showed significant decrease of BPD and AD symptoms; change was mainly accomplished in the experiential techniques phase, with medium to large effect sizes. Three months after termination of therapy, 68% of the patients had remitted from BPD, and the number of drinking days decreased clearly. This study shows that, although treatment is challenging in this group of patients, meaningful change can be obtained in patients with BPD and AD using ST.

INTRODUCTION

Borderline personality disorder (BPD) and substance use disorder (SUD) constitute a prevalent psychiatric comorbidity (Köck & Walter, 2018; Trull et al., 2000). Prevalence rates of SUD in BPD as high as 64-78% have been found (Tomko, Trull, Wood, & Sher, 2014; Zanarini et al., 1998) and alcohol use disorder is the most common SUD in individuals with BPD (Gianoli, Jane, O'Brien, & Ralevski, 2012), with life-time prevalence around 47-52% (Barth, 2007; Guy, Newton-Howes, Ford, Williman, & Foulds, 2018). Conversely, the prevalence of BPD in people with alcohol use disorder is also substantial, with a median over studies of 21% (Verheul et al., 1995)

Prognosis of BPD is poorer for those having a comorbid SUD (Skodol, Siever, et al., 2002; Zanarini et al., 2004b). BPD patients with comorbid SUD are believed to have more psychiatric symptom severity in general and more social problems than patients suffering from only one of these two disorders (Heath et al., 2017; Links et al., 1995). Comorbid SUDs give a worse prognosis for BPD than other psychiatric comorbidity (Kienast et al., 2014; Zanarini et al., 2004b) and suffering from alcohol dependence (AD) doubles the suicide rate in BPD patients compared with BPD patients without SUD (Stone, 1993).

Three studies investigating the impact of SUD on BPD treatment are known to the authors. In a randomized controlled trial (RCT) on Dialectical Behavior Therapy (DBT) for BPD patients, Verheul et al. (2003) did not find differences in effectiveness of treatment between patients with and without comorbid SUD. In this study, DBT was more effective than treatment as usual (TAU) for BPD patients with and without SUD in reducing severe BPD symptoms. However, DBT was no more efficacious than TAU in reducing SUD. Both DBT and TAU were not able to target SUD effectively (Gregory et al., 2008; van den Bosch, Verheul, Schippers, & van den Brink, 2002). In a naturalistic follow-up study, alcohol abuse predicted poorer outcome of time-limited cognitive analytic psychotherapy for BPD patients (Ryle & Golynkina, 2000). However, this finding was not replicated in a study on prediction of treatment outcome in Schema Therapy (ST) and Transference Focused Psychotherapy for BPD (Arntz et al., 2015)

Further, BPD hinders the treatment of SUD: in 495 heroin users enrolled in a SUD treatment program, BPD was related to more treatment episodes, poorer global mental health, more depression, overdose, needle sharing and suicide attempts (Darke, Ross, Williamson, & Teesson, 2005). This is line with findings on the effect of personality disorders in general on SUD treatment: SUD treatment outcomes of patients suffering from SUD and personality disorders are worse than those of patients only diagnosed with a SUD (Thomas et al., 1999; Verheul et al., 2009).

It has been suggested that personality disorders and SUD should be treated in an integrated way, because treatments focusing on only SUD or personality disorder yield limited results (Fridell & Hesse, 2006; van den Bosch & Verheul, 2007; Zanarini et al., 2004b). Several studies have been conducted into the effectivity of such a dual (targeting SUD and personality disorders) focus treatment approach. Four psychotherapeutic methods have been investigated: Dynamic Deconstructive Psychotherapy (DDP; Gregory et al., 2008; Gregory, DeLucia-Deranja, & Mogle, 2010), Dialectical Behavior Therapy-SUD (DBT-S; Linehan, Comtois, Murray, & et al., 2006), Mentalization-Based Treatment (Philips, Wennberg, Konradsson, & Franck, 2018)

and Dual Focus Schema Therapy (Ball & Young, 2000).

DDP was tested vs TAU in a small clinical trial in patients with BPD and AD. No significant differences were found between the two treatment conditions on outcome variables, but patients in the DDP group (and not in TAU) improved significantly throughout the treatment regarding parasuicidal behavior, alcohol misuse and care needed (Gianoli et al., 2012; Gregory et al., 2008).

In a randomized controlled study into the effectiveness of MBT for BPD and SUD, SUD treatment alone was compared with SUD treatment in combination with MBT (Philips et al., 2018). No significant differences were found between the two conditions on any outcome variable, possibly due to inadequate treatment adherence by the MBT therapists, high attrition of patients (48%) and low attendance at therapy sessions.

Evidence is found for the effectivity of DBT-S in reducing substance abuse, but DBT-S did not appear to be more effective in lowering the level of psychopathology or reducing inpatient treatment than TAU (Gianoli et al., 2012; Linehan et al., 2002; Linehan et al., 1999; Verheul et al., 2009).

Ball developed DFST (1998; Ball & Young, 2000). DFST is an adapted form of ST, targeting a broad range of PDs (among them BPD) and SUD. It has been investigated in several therapy outcome studies (Ball, 2007; Ball et al., 2005; Ball et al., 2011). Although therapy outcomes were initially promising (Ball, 2007), further results (Ball, 2005, 2007; Ball et al., 2011) suggest that DFST is not an effective therapy for patients with SUD and PD. Lee and Arntz (2013), however, express criticism on the methodology of the Ball et al. (2011) study. Among other things, they state that because of high early drop-out rates (almost 60%, most patients dropped out before session 13), most patients did not receive the core ingredients of DFST. Further, the dosage of DFST (24 sessions) is judged as insufficient.

Because of the positive outcomes of ST for especially BPD patients (Giesen-Bloo et al., 2006; Nadort et al., 2009) and the explanatory power of schema theory for problematic substance use (Boog et al., 2019; Boog et al., 2018), the present study was dedicated to investigate whether ST might be an effective therapy for patients with BPD and AD. Taking the studies of Ball and the criticism of Lee and Arntz as a starting point, we designed a phase 1 trial. Using a case series design, we investigated the effectiveness of individual ST that targeted both BPD and AD. We confined the scope of our study to BPD and AD to create a rather homogeneous sample, and because of the high prevalence of this comorbidity and the clear effectiveness of ST for BPD.

METHODS

Participants

Twenty individuals participated. Inclusion criteria were a main diagnosis of BPD, BPDSI-IV score higher than 20, AD as main SUD diagnosis (both diagnoses according to DSM-IV-TR criteria; APA, 2000b), Dutch literacy, and IQ above 80. Exclusion criteria were ADHD (because of symptom overlap between BPD and ADHD), psychotic disorders (except short, reactive psychotic episodes, as seen in BPD), neurocognitive disorders, and bipolar disorder. Further comorbid axis I and axis II disorders were allowed, as was medication use. Table 1 shows relevant characteristics of participants at baseline.

Table 1. Characteristics of subject at baseline.

Variable		Mean (*SD*)/Number (%)
Age (in years)		34.35 (6.41)
Gender	Female	15 (75%)
	Male	5 (25%)
Level of education[a]	Low	7 (35%)
	Intermediate	8 (40%)
	High	5 (25%)
Vocational status	Employed	5 (25%)
	Student	1 (5%)
	Disability	7 (35%)
	Welfare	5 (25%)
	Stay-at-home mother	2 (10%)
Marital status	Married/living together	7 (35%)
	LAT	2 (10%)
	Single	11 (55%)
Current Axis I diagnosis beside alcohol dependence	None	0 (0%)
	Other SUD	11 (55%)
	Depression/dysthymia	11 (55%)
	Panic disorder	4 (20%)
	Social anxiety	6 (30%)
	Generalized anxiety	7 (35%)
	Obsessive compulsive disorder	3 (15%)
	Post-traumatic stress disorder	5 (25%)
Number of PD criteria met beside BPD		13.4 (8.34)
Psychotropic medication	Anti-depressants	12 (60%)
	Mood stabilizers	2 (10%)
	Antipsychotics	8 (40%)
	Benzodiazepines	6 (30%)
	Other	6 (30%)
	No medication	4 (20%)

[a]*Level of education: 1= low (elementary to middle school), 2= intermediate (high school), 3= high (college or university)*

Procedure

Patients were recruited at a large mental health care institute (Antes), specialized in addiction treatment. Potential participants were offered a first, short appointment with a member of the research team, in order to provide information on the research. When patients agreed to participate, informed consent was obtained. Participants then underwent a full psychological assessment (performed by an independent psychologist), in order to establish axis I and axis II diagnoses with the MINI and the SCID-II. For this full psychological assessment, a six week period of abstinence of abusive substances was required. This demand was made to make

sure that symptoms of (personality) disorders could not be better explained as consequences of substance use. For inclusion, patients had to meet BPD criteria in the six week period of abstinence prior to administration. In addition, conform SCID II instructions, they had to meet BPD criteria in the last five years. BPD symptoms only occurring in episodes of substance abuse were not considered. When patients met all criteria for inclusion, additional measures were completed, and therapy was started.

Before every therapy sessions, an assessment was performed by a research assistant. Also, a nurse performed a urine test before or after every therapy session.

Three months after the end of the therapy, a new full psychological assessment was performed by the same psychologists who had done the first psychological assessment.

All therapy sessions were videotaped for supervision of therapists and to enable the check of treatment integrity .

Design

We used a non-concurrent multiple random baseline design (Carr, 2005; Kazdin, 2011). This design made it possible to control for time and nonspecific effects. The baseline phase varied from 5 to 14 sessions of TAU, with 2 patients randomly allocated to each of the 10 lengths. It was followed by phase II: 10 sessions in which a case conceptualization was made. This phase assessed nonspecific effects of attention on and exploration of personality problems.. In phase III experiential techniques were applied for 45 sessions. Phase IV consisted of 15 sessions, in which behavioral change was targeted. Phase II, III and IV formed the actual ST, and together consisted of 70 sessions for every patient. A week after the last therapy session, an assessment took place, which was followed by a three month period of no therapy. After this period a last full psychological follow-up assessment took place.

The study protocol was approved by the ethics review board of the department of clinical psychology of the University of Amsterdam. The study was registered in the Dutch trial registry (NTR, number NTR5218). Patients received compensation (15 euros) for three of the assessments in the study: at start, at the end of the therapy and three months after the last session of the therapy (follow-up).

We are not familiar with ways to perform power analysis for this design in order to estimate the desired sample size. Based on prior research into the effectiveness of ST in BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009), a large effect size can be expected. As an indication, a power analysis for paired *t*-test suggests that with a sample size of 20, the study will have 90% power to detect a large effect (Cohen's d ≥.80; alpha=.05, two-tailed).

Assessments

primary outcomes

A borderline personality disorder checklist (Borderline Personality Disorder Checklist Short Form; BPD-CL-SF) was constructed for the present study, in order to evaluate BPD symptoms time-effectively and frequently. This instrument was derived from the BPD Checklist (Giesen-Bloo & Arntz, 2005). The BPD-CL-SF is 10-item instrument covering the last three days including today. Each of the nine BPD criteria is rated on a 10-point scale ("In the last three days (including today), how much did you suffer from…?"), in which DSM-IV BPD criterion 9 is queried by two questions (one on dissociation and the other on paranoid ideation). Cronbach's α in our sample was .84. The BPD-CL-SF was administered at start, every session, at the end of the therapy and at follow-up).

The BPDSI-one week version (BPDSI-W; Arntz & Giesen-Bloo, 2009) is an adapted version of the BPDSI (Arntz & Giesen-Bloo, 1999), that is suitable for frequent administration. The questions of the BPDSI-one week version are identical to those of the BPDSI. The BPDSI-one week version, however, covers the last week. On an eight point scale specific BPD symptoms are scored (0=did not occur in the last week, 1=occurred one day in the last week, 7=occurred daily in the last week). In the present sample, the internal consistency of the sum score (Cronbach's α) was .66 (administration: start, every fifth session, end, follow-up).

Further, patients were asked if, in the last two days and today, they had drunk alcohol any alcohol (Alc) and five or more units of alcohol per day (Alc≥5)), used illicit drugs or unprescribed medication (Drugs; administration: start, every session, end, follow-up).

A visual analogue scale on craving (VAS craving) for alcohol was administered (see for example Myrick et al., 2004), comprising the day before yesterday, yesterday and today (administration: start, every session, end, follow-up).

other assessments

Urine samples were collected, and were subsequently analyzed in a clinical chemical laboratory. From every sample, urinary creatinine content (in order to detect dilution) and ethyl glucuronide level were determined (Bergström, Helander, & Jones, 2003). Ethyl glucuronide is a metabolite of ethanol (alcohol) in urine, and is detectable in urine for a longer period of time than ethanol (Dahl, Stephanson, Beck, & Helander, 2002) (ethyl glucuronide is detectable up to 80 hours; Wurst, Kempter, Metzger, Seidl, & Alt, 2000). Diluted samples were excluded from further data-analysis. For every patient suffering from a comorbid SUD (next to AD), every fourth urine sample was analysed regarding the concerning substance (tetrahydrocannabinol, amphetamines, cocaine, or benzodiazepines; administration: start, every session, end, follow-up).

Assessment of axis I diagnoses was done by means of the MINI-International Neuropsychiatric Interview-PLUS (M.I.N.I.; Sheehan et al., 1997; Sheehan et al., 1998) a structured interview for DSM-IV diagnoses. It has good sensitivity, specificity, concurrent validity, test-retest reliability, and interrater reliability (Lecrubier et al., 1997; Sheehan et al., 1997; Sheehan et al., 1998) (administration: start, follow-up).

Axis II personality disorders were examined using the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders Axis II disorders (SCID II; Gibbon et al., 1997). The SCID II is a semi-structured interview for the assessment of personality disorders. Its inter-rater reliability is outstanding (Lobbestael et al., 2011), test-retest reliability is good (Weertman, Arntz, Dreessen, Velzen, & Vertommen, 2003; Zanarini

& Frankenburg, 2001; Zanarini et al., 2000) (administration: start, follow-up).

In the first psychological assessment the Borderline Personality Disorder Severity Index-IV was administered (Arntz & Giesen-Bloo, 1999; Giesen-Bloo et al., 2010). It is a semi-structured interview, covering the last three months, with excellent psychometric qualities (Arntz et al., 2003; Giesen-Bloo et al., 2010). It was employed to confirm the SCID-II diagnosis of BPD (score > 20). Participants required a score of 20 or higher for inclusion (Giesen-Bloo et al., 2010); a score of 15 forms the cut-off between patients with BPD and non-patients (Arntz et al., 2003) (administration: start).

The Addiction Severity Index (ASI; Hendriks et al., 1989; McLellan et al., 1992) is a structured interview designed to evaluate the nature and the severity of substance use and comorbid problems. The psychometric qualities of the Dutch ASI are deemed satisfactory (Hendriks et al., 1989) (administration: start, follow-up).

The happiness item is a single question on happiness in the last months preceding assessment (Veenhoven, 2019). On a seven point Likert scale respondents are asked to rate their happiness from completely unhappy (1) to completely happy (7). The happiness item has good reliability and validity (Abdel-Khalek, 2006). It has been shown to be able to detect change in BPD patients in ST (Dickhaut & Arntz, 2014) (administration: start, end, follow-up).

The World Health Organisation Quality Of Life-BREF (WHOQOL-BREF; TheWhoqolGroup, 1998) is an abbreviated version of the WHOQOL, a questionnaire measuring quality of life in the two weeks prior to assessment. It has good psychometric qualities (TheWhoqolGroup, 1998; Trompenaars, Masthoff, Heck, Hodiamont, & Vries, 2005) (administration: start, end, follow-up).

Treatment protocol

Conform prior studies (Giesen-Bloo et al., 2006; Nadort et al., 2009), therapy was individual; every therapy session lasted 45-50 minutes. Sessions took place twice a week.

In phase I, TAU was employed. This comprised cognitive, motivational and self-control techniques, aimed at lasting abstinence from abusive substances. (based on de Wildt, 2002; de Wildt, Merkx, Vedel, & Schippers, 2011)

A case conceptualization was made in phase II, based on the symptoms, biography, outcomes of the Young Schema Inventory and the Schema Mode Inventory, and therapeutic interaction.

In phase III, in every session, imagery rescripting or chairwork was done. Imagery rescripting and chairwork are core aspects of ST and are intended to change schemas, through experiential learning. A predefined sequence was installed: two sessions of imagery rescripting were followed by two sessions of chairwork and so on.

Phase IV was intended to change behaviour. Based on specific goals, patients and therapists tried to improve quality of life by changing behavior. This was done through skill training, involving significant others, and making a relapse management plan. Phase IV was partly focused on enduring abstinence. Interventions stemming from Community Reinforcement Approach (an evidence based treatment approach for SUD; Meyers, Roozen, & Smith, 2011) were integrated in this phase.

In phases II, III, and IV, therapists applied a schematherapeutic stance, in which techniques such as limited reparenting, empathic confrontation and limit setting play an important role. Abstinence from substances was an important goal in all phases.

Therapists and treatment integrity

Five therapists initially contributed to the research project. They all had basic ST training prior to the project. The therapists received five days of training by an expert during the project. Two therapists left the research team early, thereupon a new therapist joined the therapists team. The final four therapists were psychologists with master's degrees, and all had post-master certifications.

The trainer provided expert supervision once every three weeks. Once every two weeks, the therapists met for peer supervision.

Statistical analysis

(Generalized) Linear Mixed Models analyses were performed using SPSS, in order to compare the means and linear change of primary outcomes in the case conceptualization phase, the experiential phase and the behavioral phase versus the TAU (baseline) phase (in line with Arntz, Sofi, & van Breukelen, 2013; and Renner, Arntz, Peeters, Lobbestael, & Huibers, 2016). Because of a very fast decline in reported symptoms, the first repeated measurements of every patient regarding some instruments were removed. This was done upon visual inspection of the scatter plot of the primary and secondary outcomes; the measurements before a clear scree were removed. This initial fast decline of symptoms was deemed a nonspecific artefact of highly frequent reporting them, as described by Renner et al. (2016) and Longwell and Truax (2005). The first five measurements of the BPD-CL-SF and the VAS craving were removed (administered twice a week), just as the first measurement of the BPDSI-W (administered every fifth session). The first self-report measurements of alcohol and drug use did not show a similar fast decline and were therefore not removed. Hypothetically, the absence of this artefact in self-reported use of substance was caused by the cross-checking of substance use by means of urinalysis. Data of the patient who dropped-out (see 3.1: Patient accrual) were included in the analyses.

The fixed part of the model comprised 1) dummy variables for the case conceptualization, experiential, and behavioral phases (and follow-up regarding the BPDSI-W), in order to contrast these with the TAU phase, and 2) linear time covariates, for each phase. These time covariates were centred within each phase, and represented the change in scores during a phase (time by phase interaction). Time as expressed in sessions. The random model part consisted of a random intercept, in order to control for differences between individuals at baseline. Further, the random part included AR1 for the within-subject covariance structure (the covariance structure best fitting the data was identified by comparing different structures (ARMA1, AR1) regarding -2 log likelihood). Random slopes were not included, since they led to a reduced fit of the model. Because of positive skewness of the probability distribution regarding the BPD-check, VAS craving and substance use self-report variables, a negative binomial distribution was

applied for these variables.

The analysis was started by entering all the predictors. Then, the non-significant centred time variables were deleted in backward fashion .

In order to assess effect size, Cohen's *d* was established for every phase as compared with baseline (TAU). Cohen's *d* was calculated as the B of every phase divided by the standard deviation estimated by the residual outcome variance. This residual outcome variance is the square root of a subject-specific variance, which consists of a between subject variance (the variance random intercept of the outcome mean per patient for every phase) + a within subject variance (residual variance/number of measurements per phase): Cohen's *d* = B / SD, with SD = √ (VAR(random intercept) + AR1 diagonal / #measurements).

RESULTS

Patient accrual

Patient flow is displayed in Figure 1. Of 143 patients referred to the study, 55 patients were not interested in participation. Another 37 patients turned out not to be eligible for enrollment in a brief screening, mainly because there were clearly no signs of BPD or AD. Fifty-one patients underwent a full psychological assessment, of whom 31 were excluded. In most cases they didn't reach a full BPD diagnosis. One patient was pushed out in phase I of the study (TAU) because she wouldn't meet basic requirements (she refused to cooperate in urine testing and psychological assessments). The data of this patient were not included in the analyses. Another patient dropped out of ST in phase III, apparently due to BPD symptoms and possibly following relapse in substance abuse. This patient was lost to assessments as well. This patient's data were included in the analyses.

Primary outcomes

Mixed regression analysis (Table 2 and Figure 2a) of the BPDSI-W revealed the main effects of phases III, IV and follow-up to be significant (the change halfway respective phases compared to baseline). No significant effect for phase II was found. A significant time by phase effect was found in phase III, indicating a linear decrease in BPDSI-W scores in phase III. The effect sizes as compared to baseline were small for phase II, large for phase III (very large at the end of phase III), and very large for phase 4 and follow-up.

Figure 1. Patient flow in the case series study.

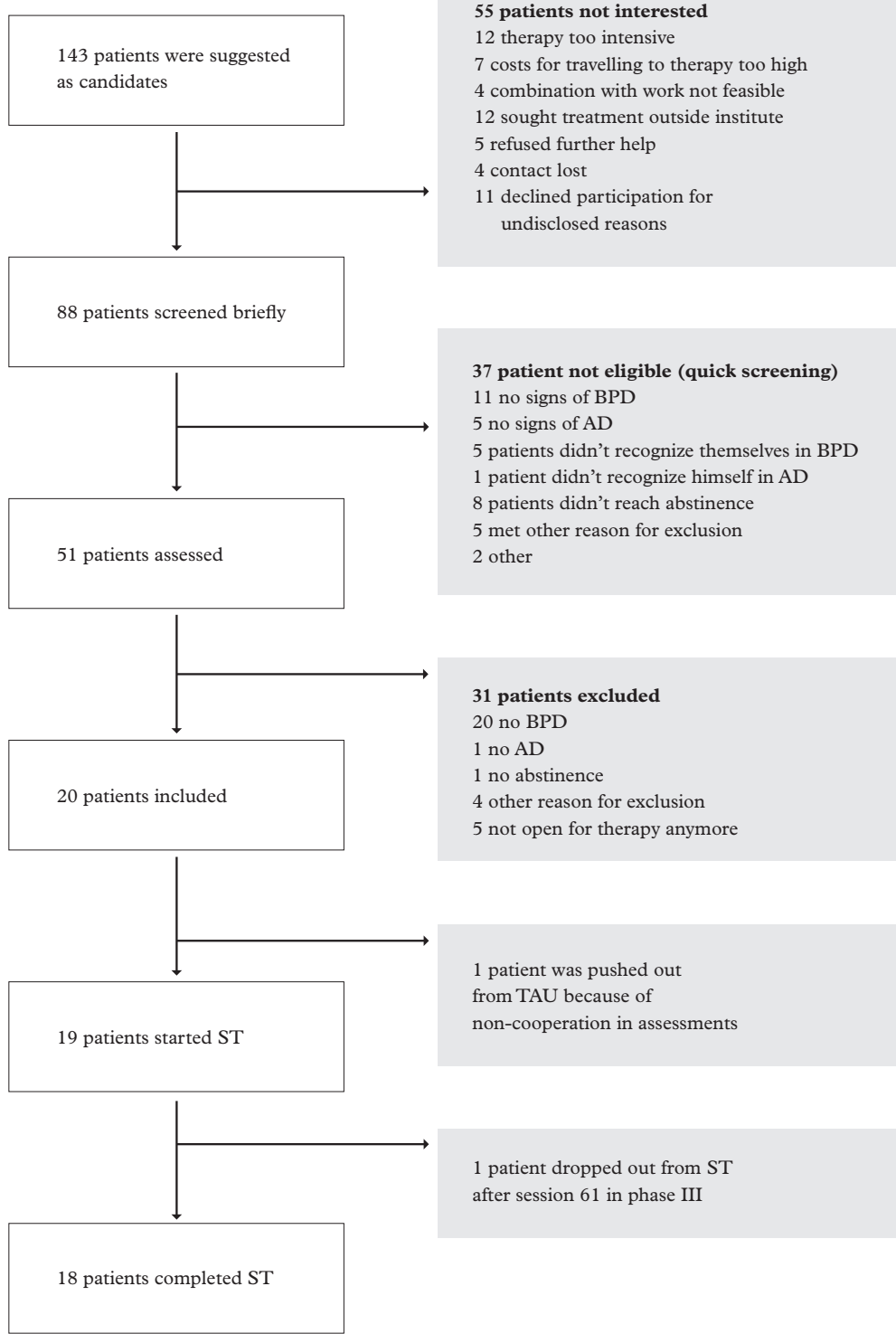
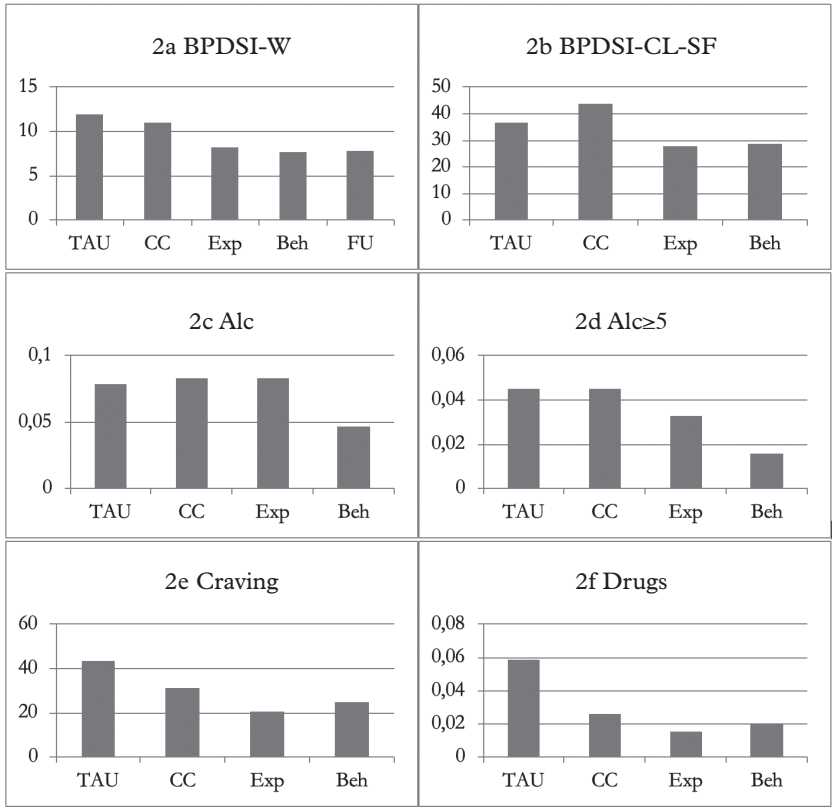


Figure 2. Estimated means per phase.



Note. In case of significant slopes within a phase, the mean at the end of the phase is depicted.
2a Mean BPDSI-W (Borderline Personality Disorder Severity Index-one week version) score per phase.
2b Mean BPDSI-CL-SF (Borderline Personality Disorder Severity Index Checklist Short Form) score per phase.
2c Mean Alc (use of any alcohol, last two days and today) score per phase.
2d Mean Alc≥5 (use of alcohol, five or more units a day, last two days and today) score per phase.
2e Mean Craving (VAS scale craving for alcohol last two days and today) score per phase.
2f Mean Drugs (use of drugs, last two days and today) score per phase.

▸ **Table 2.**

Note. Time is expressed in sessions and centered within phase.
[a]*BPDSI-W=Borderline Personality Disorder Severity Index-one week version*
[b]*BPD-CL-SF=Borderline Personality Disorder Checklist Short Form*
[c]*a negative binomial distribution with a log-link was employed (using Generalized Linear Mixed Models), the beta's are in the transformed dimension.*
[d]*Alc=drinking of alcohol in the last two days and today*
[e]*Alc≥5=drinking of five or more units of alcohol per day in the last two days and today*
[f]*Craving=craving for alcohol in the last two days and today*
[g]*Drugs=use of drugs or unprescribed medication in the last two days and today*
[h]*Effect size based on end of phase*
[i]*Estimated mean at end of phase*

Table 2. Mixed regression analyses of primary outcomes of ST for BPD patients and alcohol dependence.

	Parameter	B	95% CI (B)	Estimated mean	95% CI estimated mean	*t*	df	*p*	*d*
BPDSI -W[a]	Intercept	11.99	10.34 to 13.63	11.99	10.34 to 13.63				
	II: Case conceptualization	-1.03	-2.60 to .54	10.96	9.93 to 11.45	-1.29	298.39	.197	.42
	III: Experiential	-2.59	-4.06 to -1.12	9.4	7.93 to 10.87	-3.50	107.89	.001	1.06/1.48[h]
	IV: Behavioral change	-4.33	-6.28 to -2.39	7.66	5.71 to 9.6	-4.50	44.16	<.001	1.77
	V: Follow-up	-4.22	-6.85 to -1.60	7.77	5.14 to 10.39		37.22	.002	1.72
	Time within Experiential	-.26	-.50 to -.01	8.23[i]		-2.09	125.74	.038	
BPD-CL-SF[bc]	Intercept	3.29	2.96 to 3.61	36.74	29.36 to 46.94				
	II: Case conceptualization	.017	-.17 to .20	37.20	29.93 to 47.11	.18	.334	.86	.03/.76[h]
	III: Experiential	-.19	-.36 to -.02	32.16	26.51 to 39.74	-2.15	334	.03	.31/.57[h]
	IV: Behavioral change	-.36	-.56 to -.17	28.62	23.70 to 35.29	-3.66	334	<.001	.60
	Time within case conceptualization	.044	.01 to .08	43.89[i]		2.37	772	.02	
	Time within Experiential	-.01	-.01 to .00	27.78[i]		-2.64	279	.01	
Alc[c,d]	Intercept	-2.54	-3.36 to -1.7	.079	.04 to .18				
	II: Case conceptualization	.05	-.46 to .55	.083	.04 to .19	.17	1495	.86	.03
	III: Experiential	.05	-.34 to .44	.083	.04 to .18	.23	1495	.82	.03
	IV: Behavioral change	-.52	-1.02 to -.02	.047	.02 to .11	-2.02	1495	.04	.32
Alc≥5[c,e]	Intercept	-3.09	-4.00 to -2.19	.045	.018 to .112				
	II: Case conceptualization	.00	-.57 to .57	.045	.018 to .113	.00	500	.99	.001
	III: Experiential	-.30	-.76 to .15	.033	.014 to. .078	-1.32	500	.19	.18
	IV: Behavioral change	-1.07	-1.72 to -.41	.016	.006 to . 042	-3.17	500	.002	.63
Craving[f,c]	Intercept	3.77	3.30 to 4.24	43.28	27.01 to 69.34				
	II: Case conceptualization	-.34	-.67 to .01	30.97	19.87 to 48.27	-1.93	1399	.054	.38
	III: Experiential	-.48	-.77 to -.18	26.89	18.03 to 40.09	-3.18	1399	.002	.55/.86[h]
	IV: Behavioral change	-.56	-.89 to -.22	24.85	16.18 to 38.18	-3.26	1399	.001	.65
	Time within experiential	-.012	-.02 to -.004	20.66[i]		-2.81	1399	.005	
Drugs[g]	Intercept	-2.84	-3.96 to -1.71	.059	.02 to .18				
	II: Case conceptualization	-.83	-1.52 to -.14	.026	.01 to .08	-2.36	1495	.018	.41
	III: Experiential	-1.39	-1.96 to -.82	.015	.01 to .04	-4.81	1495	<.001	.68
	IV: Behavioral change	-1.06	-1.75 to -.38	.020	.01 to .07	-3.05	1495	.002	.52

Regarding the BPD-CL-SF (Table 2 and Figure 2b), the main effect of phase II was non-significant, although the slope in phase II was significant, indicating a significant increase in BPD-CL-SF scores in phase II. The main effects of phase III and IV were significant, as was the time by phase effect for phase III, indicating a decrease in BPD-CL-SF scores. Effect sizes were marginal (phase II, although the effect size at the end of phase II was medium, indicating a clear increase in score in this phase), small (phase III, although the effect size at the end of phase III was medium), and medium (phase IV).

In the mixed regression analysis of Alc (Table 2 and Figure 2c), only phase IV had a significant main effect. The effect size of phase IV versus baseline was small. Analysis of Alc≥5 (Table 2 and Figure 2d) led to similar results: a significant main effect for phase IV. The effect size was in this case, however, medium.

Regarding VAS craving (Table 2 and Figure 2e), the effects of phases III and IV were significant. The slope in phase III was significant, showing a decrease in craving in phase III. The effect sizes for phases III and IV were medium; the effect size based at the end of phase III was large.

All three phases had a significant effect on Drugs (Table 2 and Figure 2f). The effect size of the reduction in use of drugs from baseline to phase II was small; from baseline to phases III and IV the effect sizes were medium.

Other assessments

In Table 3 the outcomes of other assessments are presented. All these assessments took place at the start of the therapy, some at the end of therapy and all at three months follow-up. Of the 19 patients who underwent ST, 13 did not meet 5 criteria needed for a BPD diagnosis (remission) at follow-up. The average number of BPD criteria decreased. The number of drinking days (ASI) decreased too from start to follow-up, especially drinking 5 or more units of alcoholic drinks. An incline in WHOQOL-BREF scores was observed for all domains, indicating improvement in quality of life. However, scores regarding physical well-being and environment went down at follow-up (but not below baseline). Patients happiness score (on a 1 – 7 scale) improved: from 2.9 at start (very unhappy – rather unhappy) to 3.7 at the end of therapy (rather unhappy – not unhappy/not happy), and finally to 4.1 (not unhappy/not happy – rather happy).

Further, the outcomes of the self-reported use of any quantity of alcohol (Alc: (χ^2 (6) = 662.23, p <.001, Cramer's V = .48), the use of 5 or more units of alcohol (Alc≥5: χ^2 (6) = 391.52, p<.001, Cramer's V = .37) and the use of drugs (Drugs: χ^2 (6) = 63.20, p < .001, Cramer's V = .36) were significantly associated with the outcomes of urine tests (all 3 effect sizes large).

Table 3. Other assessments of ST for BPD patients and alcohol dependence.

	Start	End	3 month follow-up
# patients with BPD	19	-	6
Mean (SD) # BPD criteria met	6.9 (1.3)	-	2.6 (2.1)
Mean (SD) # drinking days last month	17.3 (13.2)	-	6.2 (7.4)
Mean (SD) # drinking days ≥ 5 units last month	16.4 (13.4)	-	1.8 (3.0)
Mean (SD) WHOQOL-BREF			
- physical	11.0 (2.5)	12.5 (2.0)	11.9 (2.9)
- psychological	9.1 (1.7)	10.8 (2.6)	10.9 (2.9)
- social	9.8 (2.4)	10.2 (3.2)	11.4 (3.9)
- environment	13.0 (2.0)	13.6 (2.3)	13.4 (2.2)
- general	10.7 (3.1)	11.4 (3.1)	12.1 (3.1)
Mean (SD) Happiness item[a]	2.9 (.8)	3.7 (1.2)	4.1 (1.4)

[a]*mean (SD) in Dutch general population in 2013: 5.46 (.74) (Veenhoven, 2019)*

DISCUSSION

BPD hinders the treatment of SUD. Although integrated treatment of both disorders is recommended, evidence base treatment programs are scarce. Therefore, we studied ST as a treatment for BPD and AD, using a multiple baseline case series design. Mixed regression showed significant effects of experiential techniques (phase III) and behavioral change techniques (phase IV) on BPD symptoms. The improvement regarding BPD symptoms appeared to have taken place within phase III. Formulating a case conceptualization (phase II) did not improve BPD symptoms; one of the instruments used (BPD-CL-SF) even suggests a deterioration in the phase II. The outcomes regarding the effect sizes of ST on BPD symptoms are somewhat contradictory: the BPD-CL-SF suggests a medium effect size, comparing the end of the therapy with baseline. The BPDSI-W suggests a very large effect size, reached at the end of phase III, and maintained until follow-up at three months after the therapy. Regarding the SUD variables, we found a significant effect of ST on use of alcohol and drugs and craving for alcohol, with mainly medium effect sizes. Significant change was reached in different phases for different variables (but for all variables a significant main effect of phase IV was found). Effect size regarding heavy drinking (5 or more units daily) was larger than for any drinking. All in all, most of the change in BPD and SUD symptoms seems to have occurred in phase III.

Further, 13 out of 19 (68%) patients reached remission from BPD at follow-up. The number of drinking days in the last month decreased from 17.3 to 6.2 and the number of days drinking heavily in the last month went from 16.4 to 1.8. Arguably, heavy drinking is a more relevant variable in SUD patients, because it represents loss of control over drinking. Based on pre-therapy versus follow-up comparison, and in concordance with outcomes of the mixed regression analyses (see above), ST seemed to have a larger effect on heavy drinking than on any drinking.

Drop-out in the present study was low (5.3%). In psychotherapy research in patients with SUD and personality disorders, drop-out rates of for example 48% (Philips et al., 2018) and 58% (Ball et al., 2011) are found. Low attrition is a an attribute of ST (Bamelis et al., 2014; Giesen-Bloo et al., 2006), probably caused by the emphasize put on building a strong therapeutic relationship in ST (Young et al., 2003) early in therapy (Spinhoven, Giesen-Bloo, van Dyck, Kooiman, & Arntz, 2007).

In the present study, an unexpected decrease in BPD symptoms and craving was observed in the baseline (TAU) phase. Thereupon, the first measurements were removed from analysis. Although we can't be sure that the decrease was not a true improvement in symptoms, it seems more likely that a measurement artefact occurred. Longwell and Truax (2005) demonstrate this artefact through experimentally investigating the re-test effect of the Beck Depression Inventory. In their study, frequent administration with short time intervals between assessment caused significant decrease in scores. This decrease was not witnessed in individuals who were tested less frequently. Through investigation of the nature of the changes (by relating the Beck Depression Inventory to other measures), it was concluded that the changes observed were unlikely to be the consequence of a true change. In their study, Longwell and Truax (2005) found this artefactual decrease in scores through the fifth administration, after which stabilization occurred. Renner et al. (2016) encountered this artefact in their case series study on ST for chronic depression. Moreover, stability regarding the dependent variable in the baseline phase of a case series design study is deemed an important requirement (Nock, Michel, & Photos, 2007; Smith, 2012).

Regarding the discrepancy between the effect sizes of the change in BPD-W and BPD-CL-SF, a clear limitation of the present study is faced. Both these repeated measures of BPD were not validated, and were constructed for the present study. We needed measures of BPD that were suitable for highly frequent administration. Both instruments were derived from validated instruments (BPDSI and BPD Checklist). The BPDSI-W and BPD-CL-SF were both administered by a trained and supervised research assistant. In the administration of the BPDSI-W, the assistants were trained to persistently explore the answers given by the patients. In contrast, in the administration of the BPD-CL-SF, the first answer given by the patient was registered and no further questions were posed.

Further limitations should be kept in mind while the results of this study are interpreted. First, a small percentage of the patients considered for participation was eventually included. This appeared to be mostly due to overestimation of BPD in SUD patients who are quitting their use of substances. Comparable ratios of assessment for eligibility vs. inclusion were found in prior research on psychotherapy for SUD and personality disorders (Ball et al., 2011; Gregory et al., 2008; Philips et al., 2018). Second, we did not include a control group. Although a multiple baseline TAU phase and an explorative case conceptualization phase were included to control for time and general therapeutic factors, we cannot be sure that the effects found are caused by ST. Third, all participants were clean before the start of TAU, in order to enable a psychological assessment. We believe that sobriety is needed to differentiate between personality disorders and SUD, and that being as clean as possible during therapy is important to increase psychotherapeutic outcome. It is however possible that a sampling bias occurred, caused by this procedure.

Strengths of this study include the use of independent research assistants, supervised by an independent psychologist. Independent psychologists executed axis I and II assessments; they were supervised by an independent psychologist regarding follow-up assessments. Validity of the BPD diagnoses was further enhanced by administration of the BPDSI at inclusion. Further, the sample size was large for this type of design. A final strength of the present study was the use of urinalyses to cross-check the self-report of use of substances. There was a strong association between self-report and urinalysis, indicating that patients were open about relapses.

Our study is the first controlled study that offers preliminary support of the effectiveness on both SUD and personality disorder of a dual focused psychotherapy. Effect sizes were smaller (except for the BPDSI-W) than found in prior studies on ST for BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009), that showed very large effect sizes. However, the treatment duration and the number of ST sessions was considerably smaller than in previous studies of ST for BPD. The medium effect sizes regarding SUD variables might also be caused by the fact that patients were already abstinent by the start of the therapy limiting the possibility to detect large changes. Benefits of ST might be especially observed in prolonged abstinence, as personality disorders generally don't prevent sobriety in SUD patients (Cacciola, Alterman, Rutherford, & Snider, 1995b; Cacciola et al., 1996; Verheul et al., 1999). However, continued abstinence in SUD patients with comorbid personality disorders is regarded challenging (Verheul et al., 2009). Further, the accomplishment of medium effect sizes might be a good first step when targeting pathology that is regarded as very severe (Ryle & Golynkina, 2000; Zanarini, Frankenburg, Hennen, Reich, & Silk, 2004a). Perhaps, ST should be provided for a longer period of time than in the present study, in order to obtain larger effects. In a substantial number of cases in the present therapy, therapists and patients deemed the therapy (80 sessions on average, of which 70 ST sessions) as too short.

As to the working mechanisms of ST in the population under investigation, we found indications for the importance of experiential techniques in the reduction of symptoms. This is in accordance with theories on ST: persistent experiential worked is regarded as crucial. Regarding the case conceptualization, no reduction in symptoms was found – there were even indications of deterioration. This deterioration is in line with Schema theory (getting cognitive insight in your pathology might increase emotional pain and therefore symptom increase might occur), and it is in line with previous research (Weertman & Arntz, 2007). It contradicts that treatment effects were due to nonspecific factors like attention and exploration. This finding however does not imply that formulating a case conceptualization can be skipped: it is regarded crucial for further ST. Strikingly, the improvements achieved

in therapy seem to have been maintained until follow-up. This follow-up was preceded by three months of no support of any health care professional.

Future research should further address the effectivity of ST for BPD and alcohol dependence more rigorously, applying a randomized controlled trial. In addition, research is needed to find out whether ST is effective for other SUD and other personality disorders. Finally, there is the issue of dosage: it is important to find out whether longer periods of ST and more sessions yield better outcomes for BPD patients with comorbid SUD.

8

Summary and General Discussion

In this dissertation, clinical aspects of impulsivity in substance use disorders (SUDs) were studied. Previous research shows that impulsivity is strongly associated with SUD (Perry & Carroll, 2008; Sher, Bartholow, & Wood, 2000). The concept of impulsivity has a central role in theories on the origins and course of SUD (Crews & Boettiger, 2009; De Wit, 2009). Impulsivity is believed to be an important factor in two major problems in SUD treatment: relapse and treatment attrition (Brorson, Ajo Arnevik, Rand-Hendriksen, & Duckert, 2013; Loree, Lundahl, & Ledgerwood, 2015; McLellan, Lewis, O'Brien, & Kleber, 2000).

The present dissertation consists of two parts. The research described in the first part is relatively basic research investigating the role of impulsivity in addictive behavior. It covers research into the two-factor model of impulsivity and different measures of impulsivity in SUD. The second part is more directly relevant for clinical practice and addresses the relevance of Schema Therapy (ST) for SUD and comorbid personality disorders. ST is an evidence based form of psychotherapy for various personality disorders (Bamelis, Evers, Spinhoven, & Arntz, 2014; Giesen-Bloo et al., 2006; Nadort et al., 2009; Weertman & Arntz, 2007). Potentially, it offers a framework for psychological treatment of impulsive individuals such as borderline and SUD patients. In the second part of this dissertation, we first focused on a specific element of ST: schema modes. These are states that explain the quick changes of mood and behavior seen in patients with personality disorders. In the final study of this dissertation, the treatment possibilities for SUD patients with comorbid borderline personality disorder (BPD; who allegedly are even more impulsive than patients with only SUD or BPD) were studied, applying ST.

Lastly, a summary of the outcomes of all the studies will be presented, followed by a general discussion of the main findings of this dissertation, the (clinical) implications, and directions for future research.

SUMMARY

Part I

In the General Introduction (Chapter 1), a brief history of the concept of impulsivity, and its relationship with SUD was discussed. Different measures of impulsivity (self-report, behavioral) were presented and a theoretical conceptualization of impulsivity and its association with SUD was introduced: the two-factor model of impulsivity. ST was suggested as a treatment approach for patients who are highly impulsive: patients with SUD and co-morbid borderline personality disorder (BPD).

In Chapter 2, the validity of the two-factor model of impulsivity was investigated in a clinical sample of SUD patients. The outcomes of this study partly supported the validity of the two-factor model. The two expected factors were found: Reward Sensitivity and Rash Impulsiveness. Reward Sensitivity was associated with young age of first frequent use of illicit substances, supporting the external validity of the two-factor model. Rash Impulsiveness was, in contrast to our hypothesis, not related to the number of years of frequent use of substances. Self-report and behavioral measures of Reward Sensitivity were related; those of Rash Impulsiveness were not. This suggests that, as far as Rash Impulsiveness is concerned, self-report and behavioral indices

represent different constructs.

In Chapter 3, the validity of the two-factor model of impulsivity was further studied, by examining its predictive value in SUD treatment. Self-report measures of Reward Sensitivity and Rash Impulsiveness did not predict relapse into substance use nor treatment attrition. A behavioral test, suggested to be a measure of Reward Sensitivity (the Card Playing Task, also described as representing risk taking) predicted treatment drop-out. A potential behavioral index of Rash Impulsiveness (the Stop Signal Test, also regarded as a measure of disinhibition) could not predict drop-out. Both behavioral test were not predictive of relapse.

In Chapter 4, perseveration – arguably a cognitive facet of impulsivity - in gambling disorder was investigated. Gambling disorder is regarded as a non-substance addictive disorder, and it comes with problems stopping repetitive behaviour. In this study, gamblers showed cognitive inflexibility, but only if a reward element was involved. This suggests that the pathological perseverance observed in gambling disorder is related to deviations in reward based learning (similar to increased levels of Reward Sensitivity), and not to general cognitive inflexibility.

Part II

In Chapter 5, schema modes in SUD patients were investigated. Schema modes were hypothesized to be relevant for SUD, because of the significance of schema modes for personality disorders, and high co-morbidity of personality disorders in SUD. We found specific schema modes to be related to SUD. No specific schema mode profile for different SUDs (alcohol versus cocaine) was found. Further, we found BPD symptoms to be highly characteristic of SUD patients.

Since SUD and BPD co-occur frequently, Chapter 6 addresses the differences between BPD and BPD+SUD, focusing on impulsivity and schema modes. No differences were found between the two patient groups regarding any of the dependent variables (self-reported impulsivity, behavioral impulsivity, schema modes). Both patient groups (BPD and BPD+SUD) obtained higher scores than nonpatients on self-reported impulsivity, delay discounting (a preference for immediate rewards over future rewards) and all schema modes under investigation. The outcomes of the study suggest that the differences between BPD and BPD+SUD patients (at least as it concerns impulsivity and schema modes) are limited.

In Chapter 7, the effectiveness of ST was investigated in a case series design study with multiple baseline. Nineteen patients with alcohol dependence and BPD as main diagnoses underwent ST, in four phases: a treatment as usual (TAU) phase, a case conceptualization phase, an experiential techniques phase and a behavioral change phase. Symptoms of BPD and alcohol dependence decreased significantly, with change taking place mainly in the experiential techniques phase (third phase). At follow-up, 68% of the sample had remitted from their BPD diagnosis. These outcomes suggest that ST can be helpful in reducing both BPD and SUD symptoms.

DISCUSSION

Impulsivity

Self-reported impulsivity and the two-factor model

Dawe, Loxton and Gullo (2004; 2004; 2014) postulate the two-factor model of impulsivity. This model is suggested to be highly relevant for SUD (Dawe et al., 2007). It states that impulsivity consists of two factors: Reward Sensitivity and Rash Impulsiveness. Reward Sensitivity is a drive for reward, that comes with planning and effort, without considering detrimental future consequences; Rash Impulsiveness is defined as acting without forethought. The functioning of two distinct brain systems constitutes the biological basis of the two-factor model. Reward Sensitivity is hypothetically associated with the functioning of the mesolimbic dopaminergic system (also known as the brain reward system) (Dawe et al., 2004; Robinson & Berridge, 2003). The brain reward system of individuals with high levels of Reward Sensitivity releases higher levels of dopamine when the individual is confronted with rewards. More importantly, the brain reward systems of high reward sensitive individuals sensitizes more quickly with repeated substance use, leading to stronger reactions to substance use, and changes in attention (Franken, 2003; Franken, Hendriks, Stam, & Van den Brink, 2004). The functioning of the orbitofrontal cortex is believed to underpin Rash Impulsiveness (Franken & Muris, 2006). The orbitofrontal cortex is linked to disinhibition; low levels of cortical serotonin are associated with impulsivity (Evenden, 1999).

Rash Impulsiveness and Reward Sensitivity are both hypothesized to have a specific role in the origin and course of SUD. Dawe and colleagues (2004; 2004) expect that individuals who are highly sensitive to rewards are more likely to be attracted to highly rewarding stimuli such as drugs and alcohol. These individuals are therefore more prone to start using substances. Further, because of problems with inhibition, rash impulsive individuals are more likely to continue using substances, despite the adverse consequences of prolonged use.

Research has supported the empirical validity of the two-factor model mostly in student samples (Caseras, Àvila, & Torrubia, 2003; Franken & Muris, 2006; Miller, Joseph, & Tudway, 2004; Quilty & Oakman, 2004; Zelenski & Larsen, 1999). Its value in SUD patients has been investigated scarcely (Gullo, Dawe, Kambouropoulos, Staiger, & Jackson, 2010). In Chapters 2 and 3 of this dissertation, the investigation of the clinical validity of the two-factor model in SUD was described. In a sample of 60 patients with various SUD, the results of a principal components analysis on various impulsivity questionnaires supported the notion of two underlying factors: Rash Impulsiveness and Reward Sensitivity. In this study, the theory regarding the role of Rash Impulsiveness and Reward Sensitivity in the origin and development of SUD was partly supported. Reward Sensitivity was related to early onset of substance abuse, supporting the idea that high reward sensitive individuals will start using substances at younger ages (although no conclusion on causality can be made, because correlational analyses were used). Rash Impulsiveness was, however, not related to the continuation of substance abuse. Further, we examined the predictive value of the two-factor model. In a sample of SUD patients, treatment outcome could not be predicted by Rash Impulsiveness nor Reward Sensitivity. All in

all, this dissertation supports the idea that Rash Impulsiveness and Reward Sensitivity underlie the broad concept of impulsivity and that these factors might help to classify the different conceptualizations of impulsivity. Rash Impulsiveness was found to be unrelated to prolonged abuse of substances. Hypothetically, this could be a methodological problem: 'years of frequent use of a substance' is a rather indirect operationalization of continuation of usage of substances. Longitudinal research is needed to clarify this matter. If this lack of correlation between Rash Impulsiveness and continuation of substance abuse is not a methodological issue, the role of Rash Impulsiveness in prolonged substance abuse should be reconsidered. Further, why both Rash Impulsiveness and Reward Sensitivity did not predict treatment outcome is unclear. Possibly, self-report measures of impulsivity are less suitable for treatment prediction. Perhaps behavioral measures of impulsivity are better predictors of actual behavior than self-reported impulsivity.

Behavioral impulsivity

Impulsivity is traditionally measured through means of self-report (e.g. Cloninger, Przybeck, Svrakic, & Wetzel, 1994), but in recent years behavioral, neurocognitive tests have become more topical. Behavioral tests produce endophenotypical variables, that hold the promise of generating more insight into the nature of psychopathology. Potentially, endophenotypes are less biased than self-reports by poor self-reflection and limited construct validity (Gottesman & Gould, 2003). Several authors suggest that endophenotypes are better predictors of treatment outcome when studying impulsivity (Goudriaan, Oosterlaan, De Beurs, & Van den Brink, 2008; Marhe, Luijten, & Franken, 2013). Possibly, the two-factor model of impulsivity might be studied by behavioral tests that represent Rash Impulsiveness and Reward Sensitivity (Goudriaan et al., 2008). In Chapters 2 and 3, we investigated the performance of SUD patients on the Stop Signal Task (SST), which measures behavioral, motor disinhibition. The SST measures an individual's ability to inhibit a response that has already been started and it might be the behavioral equivalent of Rash Impulsiveness. Likewise, the Card Playing Task (CPT) was investigated, a test that measures the tendency to continue gambling, even when one's losing. In the CPT, reward contingencies are unclear, and it involves risk taking. The CPT might be regarded as representing the concept of Reward Sensitivity. A significant correlation between Reward Sensitivity and the CPT was found; between rash Impulsiveness and the SST no relationship was found. The CPT proved to be a predictor of drop-out of SUD treatment, whereas the SST did not predict drop-out. Relapse was predicted by neither of the behavioral measures of impulsivity.

Several studies suggest that self-reports and behavioral tests do not tap the same constructs (Bari & Robbins, 2013; Bernoster, Groot, Wieser, Thurik, & Franken, in press; Goudriaan et al., 2008). Partially, the outcomes as described in Chapter 2 support this notion: Rash Impulsiveness and behavioral (motor) disinhibition (as measured with the SST) were not associated. Our outcomes do, however, suggest that, concerning Reward Sensitivity, self-report and behavioral measure are related concepts: Reward Sensitivity and the CPT were significantly correlated.

In a review on behavioral tests as predictors of outcomes of treatment in SUD, Stevens et al. (2014) find disinhibition to be unrelated to treatment outcome, in contrast to other forms of behavioral impulsivity (like delay discounting and risk taking). These researchers suggest that the fact that many behavioral tests of disinhibition (like the SST used in the present dissertation) lack 'affectively challenging conditions' (p.67), might explain the absence of predictive validity. Disinhibition might become more ecological valid when inhibition interacts with attention-grabbing (substance related) stimuli. The importance of affect in impulsivity-related behavioral tests might explain the predictive superiority for treatment drop-out of the CPT over the SST in the present dissertation.

Support for the idea that behavioral tests that have an affective component are more valid than tests that use neutral stimuli, comes from research on gambling disorder in this dissertation. Pathological gambling is characterized by problems in stopping, which is described as cognitive inflexibility. In Chapter 4 of this dissertation, gamblers were found to suffer from cognitive inflexibility, when performing a test which required decisions that were related to rewards (these decisions, in other words, had an affective component). However, the gamblers showed no signs of non-reward based (general) cognitive inflexibility, in a test with neutral stimuli. This suggests that in pathological gambling (a disorder that is similar to SUD (Goudriaan et al., 2008), the continuation of damaging behavior is related to making decision in an affective context. Thus, unstoppable gambling (just as problematic substance use) might be not mere perseverance, but emotion-laden perseverance.

Impulsivity, SUD and BPD

In addition to SUD, BPD is one of the disorders in which impulsivity plays an important role. Not surprisingly, SUD and BPD are highly comorbid (Sebastian, Jacob, Lieb, & Tüscher, 2013). In Chapter 6, in order to investigate the (dis)similarities between BPD and BPD+SUD, we compared BPD patients, BPD+SUD patients and nonpatients on self-reported and behavioral impulsivity. Next to the SST and the CPT, we investigated an additional behavioral index of impulsivity: delay discounting. This is the tendency to regard rewards as less valuable, when their provision is postponed. This tendency is increased in SUD patients (Reynolds, 2006; Stevens, Verdejo-García, Roeyers, Goudriaan, & Vanderplasschen, 2015) and BPD patients (Barker et al., 2015).

As expected, BPD and BPD+SUD patients displayed higher levels of self-reported impulsivity than nonpatients (large effect size); no significant differences on self-reported impulsivity were found between the two patient groups. Regarding the CPT and SST, we found no differences between BPD patients, BPD+SUD patients and nonpatients. Applying the Delay Discounting Test (DDT), a large, significant difference was found between nonpatients on one hand and BPD and BPD+SUD patients on the other; the BPD and BPD+SUD groups showing more delay discounting (and thus being more impulsive) than nonpatients. No differences on the DDT were found between BPD and BPD+SUD patients. Previous studies largely support our findings that BPD and BPD+SUD patients do not differ on any measure of impulsivity (Barker et al., 2015; Coffey, Schumacher, Baschnagel, Hawk, & Holloman, 2011; Lee, Bagge, Schumacher, & Coffey, 2010; Maraz et al., 2016; van den Bosch, Verheul, & Brink, 2001).

And although not univocal, previous studies also support the idea that delay discounting is the behavioral variable of main interest when comparing BPD and BPD+SUD versus nonpatients (Barker et al., 2015; Coffey et al., 2011; Maraz et al., 2016). The finding that the SST did not discriminate the three groups, is possibly in line with Stevens et al. (2014)'s aforementioned theory on the importance of an affective component in the (predictive) validity of behavioral tests of impulsivity, because the SST misses this emotional component. The lack of discriminative validity of the SST in this study is, however, in contrast with the common finding that inhibitory failure is a key component in SUD. Possibly, BPD patients (with and without SUD) constitute a distinct group, in which emotionality plays a very important role. For BPD patients, impulsivity is possibly more associated with (regulation of) affect, as suggested in studies of Barker et al. (2015), Stamates, Linden-Carmichael, Preonas, and Lau-Barraco (2018) and Sebastian et al. (2013). Barker et al. (2015) found, in a sample of BPD patients and nonpatiens, childhood trauma to be a predictor of delay discounting (the BPD patients reporting more childhood trauma and showing more delay discounting). Stamates et al. (2018) suggest, based on a study in heavy alcohol drinkers, that impulsivity is fluctuating within individuals, and that the relationship between impulsivity and drinking is moderated by affect. Taken together, these result might point in the direction of the idea that an emotional component in behavioral tests of impulsivity is very relevant, particularly for BPD patients, because of the high prevalence of childhood trauma in BPD (Lieb, Zanarini, Schmahl, Linehan, & Bohus, 2004) and affective instability of BPD patients (Koenigsberg et al., 2002). Perhaps non-emotional behavioral impulsivity (as measured by the SST) is less relevant for BPD patients (with and without SUD). Whether behavioral, motor impulsivity is especially characteristic for SUD, could have been more clear if we would have included a SUD patient group (without BPD) in our study, next to BPD patients, BPD+SUD patients and nonpatients. This omission is a clear limitation of our study.

Why BPD patients, BPD+SUD patients and nonpatients did not differ regarding their scores on the CPT, is unclear. It is in line with findings of Coffey et al. (2011), who did not find differences between BPD, BPD+SUD and nonpatients in risk taking. Barker et al. (2015) suggest that impulsivity in BPD patients lies mainly in their preference for immediate rewards, because of their avoidance of future (more uncertain) rewards. They choose immediate rewards (even if these are small) because they don't trust 'the future'. This idea would also explain why BPD patients in our study did not have elevated CPT scores: a distrust of the future.

Schema theory

Schema modes

SUD treatment is very challenging, and relapse common (McLellan et al., 2000). High comorbidity of personality disorders (Verheul, 2001) might explain the persistence of SUDs, making them more rigid and difficult to treat effectively. In Chapters 5 and 6, we studied the relevance of schema modes for SUD. Schema modes stem from ST, and evidence based form of psychotherapy for personality disorders. In their Schema theory, Young, Klosko, and Weishaar (2003) postulate schemas and schema modes. Schemas are repetitive, emotional and cognitive patterns, that drive perception. Schema modes are the combination of one or more active schemas, and a characteristic reaction to this activation of schemas. In a comparison between alcohol dependent, cocaine dependent and nonpatients, we found specific schema modes to be characteristic of SUD patients. Contradicting our hypotheses, we found no differences regarding any schema mode between cocaine patients versus alcohol patients (Chapter 5). Together, these findings suggests that schema modes may help in understanding the dynamics in the personalities of SUD patients and their psychological treatment. However, schema modes do not seem to be helpful in characterizing groups of SUD patients using different substances. Also, in our study, BPD criteria were found to be very relevant; discriminating strongly between cocaine patients, alcohol patients and nonpatients. Cocaine and alcohol patients had clearly more BPD symptoms than nonpatients.

Further, in Chapter 6, we investigated the differences regarding schema modes between BPD patients, BPD+SUD patients and nonpatients. BPD and BPD+SUD patients scored more dysfunctional than nonpatients on all schema modes under investigation. The two patient groups did not differ significantly on any schema mode. This suggests that, at least regarding schema modes, that differences between BPD patients with and without SUD are limited. This might have consequences for psychotherapeutic treatment of BPD+SUD patients. Because of limited treatment success when focusing on only one disorder integrated treatment is recommended (Köck & Walter, 2018; van den Bosch & Verheul, 2007), but dual focused treatment programs are scarce (van den Bosch et al., 2001). If differences between BPD and BPD+SUD patients are limited, perhaps the relatively novel, successful treatment approaches for BPD might be applicable for BPD+SUD patients as well.

Schema Therapy

SUD and personality disorders co-occur frequently (Guy, Newton-Howes, Ford, Williman, & Foulds, 2018; Verheul, 2001). Although personality disorders hinder treatment (Verheul, van den Bosch, & Ball, 2009) and, as mentioned above, integrated treatment of both disorders is recommended (Kienast & Foerster, 2008; Köck & Walter, 2018), treatment programs for SUD and comorbid personality disorder are scarce (van den Bosch & Verheul, 2007). Up to now, various psychotherapeutic treatments for personality disorders (mainly BPD) and SUD have been investigated (Ball, Maccarelli, LaPaglia, & Ostrowski, 2011; Gregory, DeLucia-Deranja, & Mogle, 2010; Linehan et al., 2002; Philips, Wennberg, Konradsson, & Franck, 2018), with limited evidence for effectivity.

In Chapter 7 of this dissertation, in a phase 1 study, we studied the effectiveness of ST for BPD and alcohol dependence. Using different methodological strategies than in prior studies on dual focused ST (DFST; Ball, 2005, 2007; Ball et al., 2011), we executed a case series study. In our study, we found a significant decline of BPD and SUD symptomatology, with medium to large effect sizes. There was a clear decrease in number of drinking days (especially heavy drinking), and 68% of the patients remitted from BPD. The effect sizes found were smaller than in previous studies on ST for BPD (Giesen-Bloo et al., 2006; Nadort et al., 2009), but this

might be due to the considerably smaller number of therapy sessions in our study. Although our study has clear limitations (e.g. some instruments were not validated, the lack of a control group, the possibility of a sampling bias), it possibly is a new step in the development of new treatment options for patients with SUD and personality disorders. It seems that the outcomes of the present study are more favourable than the outcomes of prior studies on effectivity of DFST and other forms of psychotherapy (Mentalization Based Treatment, Dialectical Behavior Treatment, Dynamic Deconstructive Psychotherapy) for SUDs and personality disorders. When comparing the outcomes of prior studies on DFST for personality disorders and SUDs (Ball, 2007; Ball, Cobb-Richardson, Connolly, Bujosa, & O'Neall, 2005; Ball et al., 2011) with our outcomes, the critcism of Lee and Arntz (2013) on the 2011 study by Ball and colleagues might be helpful. Lee and Arntz formulate six limitations of the study of Ball et al. (2011). Lee and Arntz state that the large attrition, mostly early in treatment, compromised the assumptions underlying the statistical analysis used. Further, because of high early drop-out rates, most patients had not received the core ingredients of DFST. Moreover, the dosage of DFST (24 sessions) is judged as insufficient. Fourth, Lee and Arntz (2013) argue, vital parts of Schema therapy are missing in DFST (schema modes, an important adaptation to ST, are not applied). Fifth, all participants had been referred for treatment 'with external pressure' (p. 3) because of legal violations, in other words: they did not participate of their free will. And last, 37% of the sample could not be diagnosed with a personality disorder, whereas DFST is explicitly designed for SUD and personality disorder. In designing our study, we took all these comments into account, and none of these shortcoming is applicable to our study. We had low drop-out, at least 75 therapy sessions, we used schema modes, all patients decided freely whether to participate or not, and all patients had a personality disorder diagnosis. Taken together, these methodological differences between the study of Ball et al and our study might explain the superior outcomes of our study. The reasons why our study yielded better coutcomes than studies on other forms of psychotherapy for SUD and personality disorders (Gregory et al., 2008; Linehan et al., 2002; Philips et al., 2018) are more unclear, but speculatively they might be found in the nature of ST (especially the low drop-out observed in ST (Bamelis et al., 2014) – drop-out is a enormous problem in SUD and personality disorder treatment (Brorson et al., 2013)) and in the team of therapists in our research (well trained and highly cohesive). Only one patient (5.3%) in our study dropped-out. This remarkable low attrition is hypothetically due to the strong therapeutic relationship that was actively built by the therapists. This was done by showing authentic, warm en persistent interest (based on specific schemas) in their patients.

Clinical Implications

Several clinical implications can be distilled from the discussion above. First, it seems useful to use behavioral tests of impulsivity instead of self-reports when trying to predict treatment outcome in SUD. Although more research is needed, self-reports and behavioral tests do not seem to measure the same constructs. Further, behavioral tests seems better predictors of treatment outcomes. Second, it is recommended to use behavioral test with an 'affective component' when investigating impulsivity in SUD. In SUD patients, these tests have shown to be better predictors of treatment outcome. If a comorbid BPD is diagnosed, consider using the Delay Discounting Test in particular, because of the presumed preference for instant rewards and the relevance of affect in BPD. Third, personality disorders (especially BPD) are highly comorbid and highly discriminative for SUD patients. Personality disorder hinder treatment of SUD. Therefore, it seems wise to consider standard screening on personality disorders in SUD treatment. Fourth, schema modes appear not to differentiate between SUD groups that use different substances and, therefore, profiling different groups based on substance of use regarding schema modes seems unhelpful. In clinical practice, making individual treatment plans using schema modes seems more appropriate. When treating individual SUD patients, mapping their schema modes should be preceded by assessing a possible personality disorder. For it appears that personality disorder symptoms (especially BPD symptoms) are highly characteristic for SUD patients and, additionally, ST is an evidence based therapy for personality disorders (and not for SUD). Fifth, ST for BPD and SUD appears not to be entirely different from regular ST for BPD. But when performing ST with patients with SUD and BPD, one should constantly have two foci: substance abuse and dysfunctional personality patterns. Knowledge and experience regarding both foci is essential.

Recommendations for future research

Most studies in the present dissertation (except the studies in Chapter 5 and 7) suffer from limited sample size. Obtaining large sample sizes in SUD populations is hard, due to relapse, drop-out, impulsivity, and perhaps shame (Luoma, Kohlenberg, Hayes, & Fletcher, 2012) that patients feel about these issues. However, attempts should be made to support the findings of the present dissertation in larger samples in future research.

Regarding the two-factor model of impulsivity and its relationship to the onset and course of SUD, longitudinal research is needed.

Given the central role of impulsivity in SUD, direct treatment of impulsivity appears to be important. Preliminary evidence exists for the merits of contingency management in high impulsive SUD patients (Tomko, Bountress, & Gray, 2016). Promising results are obtained in studies using novel forms of cognitive training directed at reducing the negative influence of impulsivity on SUD (Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Because of the possible importance of affect and 'distrust of the future' in impulsivity (especially in SUD patients with comorbid BPD), it seems indicated to address these factors when trying to diminish impulsivity. ST is a method that targets affective instability and 'distrust of the future', and might possibly decrease impulsivity through these means. Research is needed to further investigate ways to influence impulsivity in SUD.

Stevens et al. (2014) suggest trying to establish a threshold of impulsivity above which SUD treatment becomes endangered. By identifying some sort of impulsivity cut-off score, individual treatment plans can take into account the level of impulsivity established at the start of an individual SUD treatment. Treatment modalities targeted at impulsivity might be added to the treatments of high impulsive patients. Future research might be directed at identifying a high risk group.

As far as impulsivity in BPD+SUD patients, hypotheses are put forward about the importance of affect and trauma in impulsivity (affective instability and childhood trauma being predictive of impulsivity). Further studying the relationship between these three variables, might help understanding impulsive behavior in BPD+SUD patients. ST might be an intervention that could help lowering impulsivity, by treating affective instability and childhood trauma.

The outcomes of the study presented in Chapter 6 suggest that, at least regarding impulsivity and schema modes, the fundamental differences between BPD patients and BPD+SUD patients are limited. More research is needed to find out whether BPD and BPD patients differ fundamentally, further than the abuse of substances.

The effectiveness of ST for SUD and personality disorders is in its infancy. Further research is needed, using a larger sample, to find out whether ST is effective for this group of patients. Further, it seems important to find out whether there are patient characteristics that make ST more or less effective. Also, study into the dosage of ST is important. Therapists collaborating in the ST study as described in Chapter 7, deemed the therapy dosage as provided (on average 80 sessions) for some patients as insufficient. They suggested that for these patients, 120 sessions would have been more appropriate.

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Nederlandse samenvatting *(Summary in Dutch)*

In dit proefschrift zijn klinische aspecten van impulsiviteit in stoornissen in het gebruik van middelen (SGM) onderzocht. Eerder onderzoek heeft aangetoond dat impulsiviteit sterk gerelateerd is aan SGM (Perry & Carroll, 2008; Sher et al., 2000). Het concept impulsiviteit heeft een centrale rol in theorieën over de oorsprong en het verloop van SGM (Crews & Boettiger, 2009; De Wit, 2009). Impulsiviteit wordt verondersteld een belangrijke factor te zijn in twee grote problemen in de behandeling van SGM: terugval in gebruik en uitval uit behandeling (Brorson et al., 2013; Loree et al., 2015; McLellan et al., 2000).

Het huidige proefschrift bestaat uit twee gedeeltes. Het onderzoek in het eerste gedeelte is tamelijk fundamenteel van aard. Dit onderzoek bekijkt de rol van impulsiviteit in verslavingsgedrag. Specifieker: het twee-factoren model van impulsiviteit en verschillende maten van impulsiviteit in SGM worden onderzocht. Het tweede gedeelte is meer direct relevant voor de klinische praktijk. Het richt zich op de relevantie van Schematherapie (ST) voor SGM en co-morbide persoonlijkheidsstoornissen. ST is een bewezen effectieve vorm van psychotherapie voor verschillende persoonlijkheidsstoornissen (Bamelis et al., 2014; Giesen-Bloo et al., 2006; Nadort et al., 2009; Weertman & Arntz, 2007). Mogelijk biedt ST een kader voor de psychologische behandeling van impulsieve patiënten, zoals patiënten met een SGM en een borderline-persoonlijkheidsstoornis (BPS). In het tweede gedeelte van dit proefschrift richtten we ons eerst op een specifiek onderdeel van ST: schemamodi. Dit zijn toestanden ('buien') die de snelle veranderingen in stemming en gedrag verklaren, die zo kenmerkend zijn voor patiënten met persoonlijkheidsstoornissen. In de laatste studie van dit proefschrift bestudeerden we de effectiviteit van ST voor patiënten met een SGM en een co-morbide BPS (patiënten die mogelijk nog impulsiever zijn dan patiënten met slechts een van deze beide stoornissen).

Hieronder wordt een samenvatting van de Algemene inleiding en van de belangrijkste uitkomsten van alle studies uit dit proefschrift gegeven.

DEEL I

In de Algemene Inleiding (Hoofdstuk 1) werd in het kort de geschiedenis van het concept impulsiviteit geschetst en haar relatie tot SGM. Verschillende maten van impulsiviteit (zelfrapportage, gedragsmatige) passeerden de revue. Een theorie over impulsiviteit en SGM werd geïntroduceerd: het twee-factoren model van impulsiviteit. We suggereerden dat ST een passende behandeling zou kunnen zijn voor patiënten die erg impulsief zijn: patiënten met een SGM en een co-morbide BPS.

In hoofdstuk 2 werd de validiteit van het twee-factoren model van impulsiviteit onderzocht in een klinische steekproef van SGM-patiënten. De uitkomsten van deze studie ondersteunden de validiteit van het model gedeeltelijk. De twee verwachte factoren werden gevonden: Beloningsgevoeligheid en Ondoordachte impulsiviteit. Beloningsgevoeligheid bleek geassocieerd te zijn met jonge leeftijd van het eerste frequente gebruik van verslavende middelen, hetgeen de externe validiteit van het twee-factoren model ondersteunt. Contrasterend met onze hypotheses bleek Ondoordachte impulsiviteit niet gecorreleerd met het aantal jaren van frequent middelengebruik. Zelfrapportage- en gedragsmaten van Beloningsgevoeligheid waren gerelateerd; zelfrapportage- en gedragsmaten van Ondoordachte impulsiviteit waren dit niet. Dit suggereert dat wat betreft Ondoordachte impulsiviteit zelfrapportage-instrumenten en gedragsmaten verschillende constructen representeren.

In Hoofdstuk 3 werd de validiteit van het twee-factoren model van impulsiviteit nader bekeken, door middel van het onderzoeken van de predictieve validiteit van het model in SGM-behandeling. Zelfrapportage-instrumenten van Beloningsgevoeligheid en Ondoordachte impulsiviteit voorspelden noch terugval in middelengebruik noch uitval uit behandeling. De Card Playing Task, die een mogelijke gedragsmaat van Beloningsgevoeligheid is (ook wel beschreven als een maat voor risico nemen), voorspelde uitval uit behandeling wél. Een gedragsmaat die mogelijkerwijs Ondoordachte impulsiviteit representeert (de Stop Signal Test, ook wel gezien als een instrument om gebrekkige inhibitie te meten) voorspelde uitval uit behandeling niet. Beide gedragsmaten waren niet voorspellend voor terugval.

In Hoofdstuk 4 werd perseveratie (wellicht een cognitief facet van impulsiviteit) in een gokstoornis onderzocht. Een gokstoornis wordt gezien als een niet-middelengerelateerde verslaving; de stoornis gaat samen met problemen in het stoppen van repetitief gedrag. In deze studie vertoonden gokkers cognitieve inflexibiliteit, maar alleen wanneer er sprake was van een beloning. Dit suggereert dat de perseveratie zoals die wordt waargenomen in een gokstoornis gerelateerd is aan afwijkingen in beloningsgerelateerd leren (vergelijkbaar met verhoogde Beloningsgevoeligheid) en niet aan algemene cognitieve inflexibiliteit.

DEEL II

In Hoofdstuk 5 werden schemamodi in SGM-patiënten onderzocht. We hypothetiseerden dan schemamodi relevant waren voor SGM, vanwege de betekenis die schemamodi hebben voor persoonlijkheidsstoornissen en de grote co-morbiditeit van persoonlijkheidsstoornissen en SGM. Specifieke schemamodi bleken gerelateerd aan SGM. We vonden geen specifiek schemamodusprofiel voor verschillende SGM (alcohol versus cocaïne). Verder maakten de resultaten duidelijk dat BPS-symptomen erg karakteriserend zijn voor SGM-patiënten.

Omdat SGM en BPS vaak samen optreden, richtte Hoofdstuk 6 zich op de verschillen tussen BPS en BPS+SGM, en dan met name wat betreft impulsiviteit en schemamodi. Geen enkel verschil werd gevonden tussen de twee patiëntengroepen betreffende de afhankelijke variabelen (zelfgerapporteerde impulsiviteit, impulsiviteit gemeten met een gedragsmaat en schemamodi). Beide patiëntengroepen (BPS en BPS+SGM) haalden hogere scores dan niet-patiënten wat betreft zelfgerapporteerde impulsiviteit, *delay discounting* (een

voorkeur voor onmiddellijke beloningen ten koste van toekomstige beloningen) en alle schemamodi die werden onderzocht. De uitkomsten van deze studie suggereren dat de verschillen tussen BPS- en BPS+SGM-patiënten minimaal zijn, tenminste: als we ons beperken tot impulsiviteit en schemamodi.

In Hoofdstuk 7 werd de effectiviteit van ST onderzocht in een *case series design study* met *multiple baseline*. Negentien patienten met een alcoholafhankelijkheid en BPS als hoofddiagnoses ondergingen ST, in vier fases. Ten eerste een *treatment as usual*-fase, daarna een casusconceptualisatiefase, ten derde een fase waren in experiëntiële technieken werden ingezet en ten slotte een gedagsveranderingsfase. BPS- en alcoholafhankelijkheidsymptomen verminderen significant; de verandering had vooral plaats in de experiëntiële (derde) fase. Bij de follow-up voldeed 68% van de steekproef niet meer aan de criteria van BPS. Deze uitkomsten suggereren dat ST behulpzaam kan zijn in het verminderen van zowel BPS- als SGM-symptomen.

Curriculum Vitae

Michiel Boog was born on July 26th, 1979, in Heerjansdam, the Netherlands. He completed secondary education (gymnasium) at Comenius in Capelle aan den IJssel. Subsequently, he studied clinical and health psychology (minor: sport psychology) at Leiden University, obtaining a Master's degree in 2002. After working at Leiden University for a short period of time, he got employed at BoumanGGZ, a healthcare organization in Rotterdam, specializing in treatment of addiction. At BoumanGGZ, Michiel worked at outpatient and inpatient facilities, and he completed two post-master training programs (gezondheidszorgpsycholoog, klinisch psycholoog). He is a certified clinical psychologist and psychotherapist. Although he worked at G-kracht (a treatment centre specializing in personality disorders) as a therapist for five years and as teacher at Rino Groep in post-master psychology courses, he has remained working at BoumanGGZ (now Antes, a part of Parnassia Groep). Through the years, in close collaboration with colleague therapists, Michiel specialized in psychotherapy for patients with substance use disorders and personality disorders. During his post master training, he was supervised by Professor Ingmar Franken. This supervision resulted in a PhD trajectory at Erasmus University Rotterdam (starting in 2012), supported by Antes (especially Dr. Ben v.d. Wetering). During the second half of the PhD trajectory, focusing on Schema Therapy, a collaboration with Professor Arnoud Arntz was started. Arnoud Arntz co-supervised the second part of the present dissertation.

Michiel guest-lectured at Erasmus University, reviewed empirical articles for international journals, and presented at national and international congresses. In 2019, a specialized treatment facility for patients with substance use disorders and comorbid personality disorders was started at Antes, influenced by the research described in this dissertation. In this facility, a group of healthcare professionals (of whom Michiel is one) will try to improve the treatment of patients with substance use disorders and personality disorders.

Publications

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