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Behavioural Stimulation and Sensation-Seeking among prisoners: Applications to substance dependency.

Jane L. Ireland[a]

Pauline Higgins[b]

[a]Ashworth Research Centre (ARC), University of Central Lancashire, Preston, Lancashire, UK.

[b]HM Prison Service, Northwest, Lancashire, UK

Corresponding author; Jane L. Ireland, University of Central Lancashire, Preston, PR1 2HE, UK. E-mail: JLIreland1@uclan.ac.uk; TEL: 01772 894471

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dependence.

Abstract

Background: Sensation-seeking among prisoners with substance dependence difficulties
(drug and/or alcohol) was examined. This topic is under-researched in a prisoner sample.

Aims: To examine the association between sensation-seeking, other personality variables,
and substance dependency among prisoners. To examine if sensation-seeking can be refined.

Methods: Adult male prisoners (n = 200) completed self-report measures examining the
constructs of interest.

Results: Sensation-seeking comprised extraversion and openness to experience. It was more
appropriately described as Behavioural-Stimulation-and-Sensation-Seeking (BStim-SS).
BStim-SS related to drug and poly-substance dependency but not alcohol-only dependency.
Increased impulsivity was related to all substance use dependencies.

Conclusions and implications for practice: The BStim-SS presents as a valuable concept to
apply to forensic populations. It captures the need for behavioural *and* emotional stimulation
and lends support to Reward Discounting theory as valuable to apply across substance
dependency. Implications for practice include:

- A need to identify a broader concept of sensation-seeking for prisoner samples;

- The recognition of differences within substance dependent samples, with impulsivity
  presenting differently across drug and/or alcohol dependent groups;

- Recognition that concepts regularly applied to community samples need to be
  examined more specifically among forensic samples to ascertain validity.

Key Words: Sensation-seeking; Impulsivity; Substance dependence; Prisoners

Behavioural Stimulation and Sensation-Seeking among prisoners: Applications to substance dependence.

Sensation-seeking has been described as one of the most potent predictors of substance use (e.g. Donohew, Bardo, Zimmerman & Stelmack, 2004; Ersche, et al, 2010; Horvath et al, 2004). Sensation-seeking is described as a need to seek out varied, novel, complex, and intense situations, and a willingness to take risks for these experiences (Zuckerman, 2007). It is closely related to other personality constructs associated with substance use, such as *impulsivity* (e.g. Acton, 2003; ; Ersche, et al, 2010; Moeller et al 2002), *openness to experience* and *extraversion* (Grekin, Sher & Wood, 2006), with considerable cross-over across these constructs (Depue & Collins, 1999; Kelly et al, 2006; Sher & Trull, 1994; Zuckerman et al, 1993). For example, some researchers have suggested that extraversion is an indirect test of sensation-seeking (Sher & Trull, 1994), with impulsivity a reconceptualised 'adult' form of sensation-seeking (Clayton, Segress & Caudill, 2007). This poses the question as to whether these constructs are distinct, or if they are in fact best described as a single more unified personality concept of particular relevance to substance use. This is not an issue that research has addressed using statistical methods, certainly not within populations known to present with an elevated need for stimulation (e.g. prisoners). In addition, the association between sensation-seeking and substance use is not uniform, with some research indicating that although sensation-seeking may have a direct route to increasing involvement in substances, this may apply to alcohol and only indirectly to a use of drugs (Puente, Gutiérrez, Abellán & López, 2008).

The *theoretical* basis for considering sensation-seeking is clearly defined, with a number of theories independently discussing this as a factor promoting engagement in

substances. Across recent years the field has moved towards presenting 'new' models or frameworks with no mention or testing of founding theory (Puente, Gutiérrez, Abellán & López, 2008). This has resulted in the loss of examination of some earlier theories and a move towards more descriptive atheoretical papers. This is particularly common among non-community samples known to be at an increased risk for substance use difficulties, such as prisoners. Four theories that are particularly helpful in informing theory-driven predictions that could apply to sensation-seeking and substance dependency include the *Personality-Deficiency Theory* (e.g. Ausubel, 1980), *Multiple Models Theory* (e.g. Gorsuch & Butler, 1976), *Addiction to Pleasure Theory* (e.g. Bejerot, 1975) and *Reward-Discounting* (e.g. Smillie & Jackson, 2006).

Personality-Deficiency Theory (PDT) proposes that sustained drug use is a consequence of an initial need for euphoria by an inadequate personality, which is then sustained by a need to continue use in order to avoid unpleasant abstinence symptoms. The need for a 'high' can result in drug users deliberately delaying gratification in order to achieve a greater sense of stimulation/euphoria (Ausubel, 1980). According to PDT, an increased sensation-seeking tendency, coupled with an increased drive for openness to experience and extraversion, should be apparent more among chronic than non-chronic or non-users. Chronic use in this instance incorporates dependency. Certainly, personality is argued to be related to sustained patterns of behaviour, as opposed to more occasional behaviours, thus fitting expectations of substance *dependency* as opposed to more casual or occasional substance abuse. Indeed, substance dependency has been associated clearly with personality (Freestone, Howard, Coid & Ullrich, 2013; Mehdizadeh Zare Anari & Hajhoseini, 2012), particularly within more specialized samples where presentations are complex. Such samples include forensic populations (Hopley & Brunell, 2012). The

association between maladaptive personality and dependency has been noted both for alcohol dependency only (Agrawa, Narayanan & Oltmanns, 2013), and for drug dependency (Hicks et al, 2013).

As noted, PDT suggests users have an ability to *delay* gratification in order to enhance an effect. This suggests that reduced impulsivity should be more apparent among chronic and polydrug users, since they should have an ability to delay gratification for a more enhanced reward of later [increased] euphoria. Thus you would expect increased sensation-seeking, openness to experience and extraversion to represent the over-riding contributing factors to their 'inadequate' personality as opposed to increased impulsivity. Nonetheless it has, conversely, been argued that sensation-seeking may promote impulsive behaviour which in turn increases the risk for drug but not alcohol use (Puente, Gutiérrez, Abellán & López, 2008), with further studies indicating elevated anxious-impulsive personality traits among drug-dependent users in comparison to healthy volunteers, with higher levels of sensation and reward-seeking personality in drug dependent groups than their siblings (Ersche et al, 2012). This has also posed a further question, namely whether or not impulsivity is really a distinct concept, or if it is simply part of a broader conceptualisation of sensation-seeking.

Addiction to Pleasure Theory (APT) seems to support PDT by adding to the importance of sensation-seeking as a crucial element. APT describes how it is biologically normal for a pleasure stimulation to continue once it has begun and to be positively reinforcing, thus encouraging sustained use (e.g. Bejerot, 1975). There are further reports that sensation-seeking has a heritable biological basis (Bardo et al, 2007; Puente, Gutiérrez, Abellán & López, 2008; Zuckerman, 2003). Thus not only should sensation-seeking be associated with drug use, but it should be associated more with those increased and sustained levels of drugs, including poly-drug users.

Multiple Models Theory (MMT) (e.g. Gorsuch & Butler, 1976) adds further to these models by describing one pathway particularly relevant to a forensic population, namely the 'nonsocialised' route. Via this route individuals low on conformity and responsibility continue their drug use as a result of drug availability and a sensation-seeking motivational drive. MMT describes how psychological dependence on a drug may be in part influenced by the 'rush' associated with drug intake, suggesting again how a need for sensation may represent a core feature. Impulsivity and sensation-seeking have certainly been shown to relate to a range of criminal behaviours (e.g. Horvath & Zuckerman, 1992; Lynam et al, 2000), highlighting the importance of examining these constructs and their association with substance use in a forensic population.

Indeed alternative theories do place emphasis on a distinct role for impulsivity as a contributing factor in substance use. *Reward Discounting* theory (e.g. Smillie & Jackson, 2006), for example, describes a role for immediate gratification with substance use, assuming that individuals will discount future rewards and instead choose the immediate reward. This would point to users *failing* to delay their use of drugs in order to increase the eventual euphoria, and not to them increasing the delay. Indeed among alcohol users, Richards, Zhang, Mitchell and De Wit (1999) stated that the delayed reward often becomes less certain for the individual so they may feel more inclined to accept the smaller more immediate reward, which is more certain. Their research found that delay discounting was positively linked to increased levels of impulsivity. This was supported by Kirby and Petry (2004) who, examining heroin, cocaine and alcohol users, found cocaine and heroin users had higher levels of delay discounting (and therefore higher impulsivity) than controls. Other studies have also suggested an application to alcohol, with delay discounting (and thus impulsive

decision making) associated with alcohol misuse (Ortner, MacDonald and Olmstead 2003), although this research is not consistent.

The current study is interested in exploring sensation-seeking in a forensic (prisoner) sample and in determining its relationship to impulsivity, openness to experience and extraversion, focusing on application to alcohol *and* drug dependency (Puente, Gutiérrez, Abellán & López, 2008). It will do this by employing statistical methods that will examine the factorial construct of sensation-seeking. It makes the following predictions; 1.) Sensation-seeking will comprise components relating to impulsivity, openness to experience and extraversion; 2.) In accordance with PDT both increased sensation-seeking and decreased impulsivity will predict drug dependency; 3.) In accordance with PDT, APT and MMT, sensation-seeking should contribute more than impulsivity to models predicting dependent drug use; 4.) In accordance with RDT it is predicted that increased impulsivity should be predictive more of alcohol than other drug dependency.

Method

Participants

A total of 448 adult male prisoners were approached to take part from a Category B (medium to high security) prison. Two hundred questionnaires were returned completed, representing a 44.6% return rate. The average age of the sample was 36.10 (SD = 10.2).

Measures

Each participant completed the following measures:

Drug Abuse Screening Test (DAST-20: Gavin, Ross & Skinner, 1989) This consisted of 20 statements asking for information about drug use. The statements were answered in

relation to their drug use in the 12 months prior to custody. Participants were asked to indicate 'yes' or 'no' to each item. Each item scored to support drug abuse was rated as a 1. Examples of items included "Have you ever felt bad or guilty about your drug abuse" and "Have you lost friends because of your use of drugs". A score of six and above is used to indicate problematic drug use with two items specifically focused on assessing dependency in addition to abuse. This measure assesses problematic use, including dependency, and does not produce a 'diagnosis'.

Alcohol Use Disorder Identification Test (AUDIT: Babor, Higgins-Biddle, Saunders & Monteiro, 2001) This was developed by the World Health Organisation and consisted of ten statements, each rated on a scale of 0 to 5, with five indicating increased frequency and 0 reduced/no evidence. As with the DAST, questions focused on the 12 months prior to custody. Examples of items included "How often did you have six or more drinks on one occasion" and "How often did you fail to do what was normally expected of you because of your drinking". Participants can score a maximum of 40 on the AUDIT; 0 to 7 is indicative of low risk, 8 to 15 is risky or hazardous drinking, 16 to 19 high risk or harmful level and 20 or more high risk. Dependency is assessed separately with a score of 4 or more on the dependency items indicating possible dependency, with this considered as almost certain dependency if the overall AUDIT score is 20 or more. As for the DAST, this measure does not 'diagnose'.

Barratt Impulsivity Measure - Short Form (BIS-15: Spinella, 2007) This consisted of 15 statements, covering the three impulsivity factors of non-planning, motor impulsivity and attention impulsivity. Items were rated on a four-point Likert scale ranging from 1 (rarely/never) to 4 (almost always/always). Six items were reverse scored. Example items include "I act on impulse" and "I say things without thinking".

Ten-Item Personality Inventory (TIPI: Gosling, Rentfrow & Swann, 2003) This consists of ten items relating to five factors of personality; extraversion, neuroticism, agreeableness, conscientiousness and openness. Items were measured on a seven-point Likert scale, ranging from 1 (disagree strongly) to 7 (agree strongly). Five items were reverse scored. Example items include, "[I am] extroverted, enthusiastic" and "[I am] open to new experiences, complex". For the purpose of the current study and its predictions, only the items relating to extraversion and openness to experience were analysed.

Brief Sensation Seeking Scale (BSSS: Hoyle et al, 2002) This BSSS consists of eight items covering subscales of thrill and adventure seeking, disinhibition, boredom susceptibility and experience seeking. Responses were rated on a five-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly). No items were reverse scored. Example items included "I would like to explore strange places" and "I like wild parties".

Procedure

Participants received a cover letter outlining the purpose of the research. Questionnaires were distributed during a period of 'lock up' which means that the cells were locked for a specific period of time, thus allowing participants to complete measures individually without interruption. All participants were given a debrief sheet following measure completion. All analyses were completed using SPSS.

Results

Extent of substance dependency

Across the sample, 57.5% (n = 115) were identified as drug [non-alcohol] dependent and 29% (n = 58) as alcohol dependent. Twenty percent of the sample (n = 41) were identified as poly-substance dependent, namely fell into both the alcohol and drug dependency group.

<u>Personality: Sensation-seeking, impulsivity, openness to experience and extraversion</u>

Mean scores on sensation-seeking, impulsivity, openness to experience and extraversion scores are shown in Table 1. Higher scores indicate increased evidence of the specific concept. Scores are indicated overall and across dependency users.

<<Insert Table 1 here>>

<u>Joint Factor Analysis: Sensation-seeking, impulsivity, openness to experience and extraversion</u>

Although there is a conceptual distinction between sensation-seeking, impulsivity, openness to experience and extraversion, we wanted to test if the variables were empirically separate using a joint factor analysis (Ferguson, 2001). Zero-order correlations were computed, with significant correlations between sensation-seeking and extraversion ($r = .18$, $p = .01$), and sensation-seeking and impulsivity ($r = .42$, $p = .001$). There was a significant correlation between extraversion and openness to experience ($r = .24$, $p = .001$), and no significant correlation between sensation-seeking and openness to experience ($r = .09$ns).

Factors were extracted using a principal components analysis[1] and rotated using direct oblimin [oblique] rotation. Four factors were extracted (see Table 2 and Table 3 for factor score totals). Only loadings above .40 are presented. The only items that did not load were 'Conventional, uncreative' (openness to experience) and 'I get restless when I spend too much time at home' (sensation-seeking).

<<Insert Table 2 here>>

<<Insert Table 3 here>>

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[1] The analysis was also repeated using Principle Axis Factoring to determine consistency. This again produced a four factor solution with the composition of the factors fitting with the Principal Component Analysis. The only noted difference was with the Sensation Seeking item "I would like to take off on a trip with no pre-planned routes or timetables" which failed to load on any factors.

The pattern matrix demonstrated mixed outcomes. Impulsivity loaded broadly onto two separate factors – 'Behavioural and cognitive impulsivity' and 'Lack of planning'. This indicated good separation from sensation-seeking, extraversion and openness to experience, which shared the remaining two factors – 'Openness to new places and unusual experiences' and 'Interest in stimulating and exciting experiences'. Since sensation-seeking, extraversion and openness to experience all loaded onto shared factors, this suggested little empirical separation between them. Indeed the description of the new 'sensation-seeking' factors suggested that the collective description of 'Behavioural-Stimulation-and-Sensation-Seeking (BStim-SS)' seemed more appropriate since it appeared less to do with a unitary focus on a bodily sensation (e.g. emotion) and extended to a need for behavioural stimulation, or to be engaged in an *activity* likely to promote a potential emotional sensation (e.g. fear).

The separation of impulsivity from the reformulated sensation-seeking factors was further supported by factor correlations. The largest correlation was between the two impulsivity factors (Factor 1: Behavioural and cognitive impulsivity and Factor 3: Lack of planning; r = .40), and between the two mixed personality and sensation-seeking factors (Factor 2: Openness to new places and unusual experiences; and Factor 4: Interest in stimulating and exciting experiences; r = -.17). This indicated further division between impulsivity and the personality and sensation-seeking factors.

Predicting chronic substance use using reformulated impulsivity and sensation-seeking factors

The predictors of dependent substance use were explored using the two impulsivity factors and the two BStim-SS factors (see Table 3). This was explored separately with regards to alcohol dependency, drug dependency and poly-substance dependency (defined here as a dependency on both alcohol and drugs). Three logistic regressions were completed

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with the dichotomous variable[2] in each representing the dependency group. The continuous predictors were factors one to four. The enter method was utilised.

Regression one: Drug dependency. The model correctly classified 70.5% of the sample (Goodness of fit 187.12; Model χ^2 = 54.9, p = .0001, n = 190). Drug dependency was predicted by increased Factor 2 Impulsivity 'absence of planning' (Exp (B) =.84, R = -.21, p = .0003: CI = .77 - .92) and increased Factor 2 of BStim-SS 'interest in stimulating and exciting experiences' (Exp (B) =.85, R = -.18, p = .001; CI = .77 - .94).

Regression two: Alcohol dependency. The overall model correctly classified 73.2% of the sample (Goodness of fit 194.80; Model χ^2 = 26.2, p = .0001, n = 190). Alcohol dependency was predicted by increased Factor 1 Impulsivity 'behavioural and cognitive impulsivity' (Exp (B) = .89, R = -.17, p = .0003: CI = .84 - .96). No other factors were significant.

Regression three: Poly-substance dependency. The overall model correctly classified 82.1% of the sample (Goodness of fit 193.16; Model χ^2 = 38.3, p = .0001, n = 190). Such dependency was predicted by increased Factor 1 Impulsivity 'behavioural and cognitive impulsivity' (Exp (B) = 1.11, R = .16, p = .007: CI = 1.02 – 1.20) and increased Factor 2 of BStim-SS 'interesting in stimulating experiences' (Exp (B) = 1.24, R = .23, p = .0004: CI = 1.10 – 1.41). No other factors were significant.

Discussion

The study suggested a potential review of the concept of sensation-seeking in a forensic sample, suggesting the concept may be distinct in part from impulsivity and focused on behavioural as well as emotion-focused stimulation. Behavioural-Stimulation-and-Sensation-Seeking (BStim-SS) was thus proposed, with this relating differently across

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[2] With each group (e.g. alcohol, drug and poly-dependency) compared to the remaining sample.

alcohol and other drug dependency. BStim-SS was a broader concept of sensation-seeking (Grekin et al, 2006), as applied to prisoners. Regarding the prediction that sensation-seeking would comprise components relating to impulsivity, openness to experience and extraversion, this was thus only partially supported. Specifically, impulsivity was distinct from sensation-seeking, thus failing to support any suggestion that impulsivity was intrinsically related to this concept (e.g. Acton, 2003; Depue & Collins, 1999; Kelly et al, 2006; Moeller et al 2002; Sher & Trull, 1994; Zuckerman et al, 1993) and/or was an adult-form of sensation-seeking (Clayton, Segress & Caudill, 2007). Thus, in samples where there are known to be increased levels of sensation-seeking *and* impulsivity (e.g. Horvath & Zuckerman, 1992; Lynam et al, 2000), such as prisoners, it appears these variables can be reliably distinguished.

Furthermore, BStim-SS did not predict substance dependency consistently whereas impulsivity did. Increased impulsivity predicted drug, alcohol and poly (drug and alcohol) dependency, whereas increased BStim-SS predicted drug and poly-drug dependency only, but not sole alcohol dependency. This suggests that a sensation-seeking component, however formulated, is driving *drug* dependency but not unilateral alcohol dependency. However, only one BStim-SS factor appeared relevant and that was an 'interest in stimulating and exciting experiences'. The BStim-SS factor 'openness to new experiences' was not a predictor. This latter factor is focused more on the sensation of experiences rather than a desire to be stimulated by engaging in highly-stimulating and risky activities, which was more consistent with the former BStim-SS factor. It was expected in accordance with Personality Deficiency Theory (PDT) that dependent drug users would be more sensitive to a drive for stimulation/ sensation (Ausubel, 1980), which would lend some understanding to this finding.

Collectively, however, these results are not wholly in keeping with the specific predictions made. For example, the prediction that increased sensation-seeking and decreased impulsivity should be predictive of drug dependency was supported regarding a single component of BStim-SS, but not in the direction predicted for impulsivity. This is not therefore wholly consistent with PDT (Ausubel, 1980) although it is in keeping with studies that have focused specifically on drug users (e.g. Ersche et al, 2012). There is consistency in that it does appear, as noted, that drug (not alcohol) users are driven by a need to be stimulated as a result of an inadequate personality, but inconsistent with research which suggested that alcohol and not drug dependency should be predicted by sensation-seeking components (Puente, Gutiérrez, Abellán & López, 2008). The current study found the opposite, unless the dependency represented *combined* alcohol and drug dependency.

This suggests that for alcohol only dependency, there are other factors of importance, such as impulsivity. Indeed, contrary to the predictions made in relation to PDT, it was not decreased levels of impulsivity that were important but increased levels. This suggests that those dependent on substances are not presenting with the skills that would allow them to *delay* engagement in use for the purpose of gratification (Ausubel, 1980). Furthermore, regarding impulsivity, there were differences in the specific element of impulsivity which predicted substance dependency. For drug dependency alone it was the 'absence of planning' factor, whereas for alcohol and poly-drug dependency it was the 'behavioural and cognitive impulsivity' element.

Regarding the separate contribution of sensation-seeking and impulsivity to the models, impulsivity was the first predictor regarding alcohol and drug dependency, but there was no real difference in the statistical contribution of the predictor (i.e. impulsivity factor versus sensation-seeking factor). There was, nonetheless, with regards to poly-dependency,

where a sensation-seeking component contributed more to the model than impulsivity, a suggestion that the sensation-seeking component of 'interest in stimulating and exciting experiences' was the main contributing predictor. The prediction that sensation-seeking should contribute more to models predicting dependent drug use than impulsivity was thus supported only in relation to poly-substance dependency. This suggests it is the combination of alcohol *and* drug dependency which is important, further suggesting that Personality-Deficiency Theory, Addiction to Pleasure Theory (APT) and Multiple Models Theory (MMT) are supported with regards to poly-substance dependency. Put simply, it is argued therefore that poly-drug dependency is related to inadequate personality (PDT), may have a biological pleasure stimulation component potentially driving its use (APT: Bardo et al, 2007; Bejerot, 1975; Puente, Gutiérrez, Abellán & López, 2008; Zuckerman, 2003), and represent a need for sensation among those likely to fall in the non-socialised route (MMT), such as forensic populations.

Collectively therefore the predictions overall appear supported more for a BStim-SS component, and more in relation to poly-substance dependency. Thus there is support in relation to this for PDT, APT and MMT in relation to a need to be stimulated or exposed to sensation. These models are not, however, able to explain the role indicated for impulsivity. Indeed, the finding of increased impulsivity representing a key element is consistent more with Reward Discounting Theory (RDT, Smillie & Jackson, 2006). It was predicted, in accordance with RDT, that increased impulsivity should be predictive more of alcohol than other drug dependency. The results indicated that increased impulsivity was predictive of alcohol, drug and poly-substance dependency, suggesting that RDT was applicable across all substances, and not just alcohol.

RDT argues that individuals do discount future rewards by accepting the option that is immediately before them. RDT would suggest that users *fail* to delay their use of drugs in order to increase the eventual euphoria. Interestingly drug dependency was predicted by the impulsivity component 'absence of planning' which is very supportive of an RDT formulation, whereas alcohol and poly-substance dependency was predicted by more *global* impulsivity challenges in the form of increased 'behavioural and cognitive impulsivity'. Collectively this suggest difficulties in impulsivity across alcohol (Ortner, MacDonald and Olmstead 2003; Richards, Zhang, Mitchell and De Wit, 1999) as well as drug dependency (Kirby and Petry, 2004), pointing to the potential value of behavioural theory (i.e. RDT) in explaining difficulties.

The current study is not, however, without its limitations. First, the sample was self-selecting and thus the extent to which it is representative of a substance dependent prisoner group is unknown. Second, this is a sensitive topic and honesty in reporting cannot be assured, even with the promise of anonymity. This is particular the case in closely monitored environments, such as prisons, where participants may fear repercussions for acknowledging even historical substance use challenges. Related to this, the use of self-report can lead to under and over-reporting, acknowledging therefore the potential difficulties in ascertaining the veracity of self-report. Third, the study utilised measures of differing length. Although the shorter versions of measures were selected to aid completion within this population, this could have influenced the results since it would have unavoidably led to the selection of smaller numbers of variables for each construct. This is an issue that will be returned to when discussing directions for future research.

Even accounting for the limitations, the results nevertheless suggest a role both for BStim-SS and impulsivity, indicating differences across dependency types. Alcohol only

dependency does not appear driven by BStim-SS but by increased global impulsivity, whereas drug only dependency is characterised by an increased need for sensation and increased impulsivity (specifically planning ability). Combined dependencies, in the form of alcohol and drugs, appear motivated both by BStim-SS and global impulsivity challenges. The results identify a need to recognise differences across dependencies, and the importance of acknowledging poly-substance dependency for which personality-deficiencies may be greater and more global. To illustrate, the current results suggest that working with individuals presenting with drug and not alcohol dependency should represent a marker for focusing on their ability to plan effectively, whereas for alcohol only dependency and combined alcohol and drug dependency the focus should be on more global impulsivity deficits, namely behavioural and cognitive.

The results also highlight the importance of revisiting concepts, such as sensation-seeking, and examining their application to a range of samples as opposed to assuming convergence. A future study could focus on the structure of constructs proposed here, by examining their replication using confirmatory factor analysis which includes a wider range of items. The study further highlights value in combining a range of theoretical approaches to developing an understanding of the processes potentially involved in substance use. An examination of the attitudes supportive of substance use and how these may relate to explaining the role of personality (Puente, Gutiérrez, Abellán & López, 2008) would be one such useful avenue to explore, and one which would allow for an enhanced examination of theory in this important area of study.

In overall conclusion, the study suggests there should be a review of how sensation-seeking, impulsivity and other related personality factors relate to substance dependency in complex populations, such as prisoners. It suggests that however sensation-seeking is

defined within such a population, its association may be greatest with dependency difficulties involving drug but not sole alcohol use, whereas alcohol dependency in such populations appears related more to increased impulsivity. The study also indicates the value of existing theory in explaining the association between personality and poly-substance dependency but nevertheless suggests a review of theory to explain unitary alcohol or drug dependency within forensic populations.

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Table 1.

Sensation-seeking, impulsivity, openness to experience and extraversion

Sample	Sensation-seeking	Impulsivity	Openness to experience	Extraversion
	Mean (*SD/n*)[a]	Mean (*SD/n*) [a]	Mean (*SD/n*) [a]	Mean (*SD/n*) [a]
Overall sample	25.3 (6.5/199)	33.9 (8.8/198)	10.3 (2.4/191)	8.0 (2.4/191)
Drug dependent[b]	27.7 (6.1/115)	37.1 (8.1/114)	10.3 (2.4/113)	8.2 (2.2/113)
Alcohol dependent	27.5 (6.6/58)	38.2 (9.4/57)	10.0 (2.7/57)	7.9 (2.5/57)
Poly substance dependent[c]	29.2 (6.2/41)	39.5 (8.8/41)	10 (2.65/41)	8.3 (5.5/41)
Reliability	$\alpha=.77$	$\alpha=.87$	[d]	[d]

Note:

[a]SD = Standard Deviation, n = number of participants

[b]Not including alcohol.

[c]Combined alcohol and drug dependency at the same time.

[d]Comprised of two items and thus alpha cannot be reliability computed.

Table 2

Factor analysis across sensation-seeking, impulsivity, openness to experience and extraversion measures.

Factor 1: Behavioural and cognitive impulsivity (25.9% variance)	Original scale	Loading
I find it difficult to sit still when attending talks, lectures or places like the cinema	BIS (12)	.78
I am easily bored solving thought problems	BIS (15)	.77
I don't pay attention	BIS (14)	.72
I am restless at lectures or talks	BIS (11)	.67
I say things without thinking	BIS (4)	.59
I act on impulse	BIS (1)	.57
I buy things on impulse	BIS (5)	.48
I act on the spur of the moment	BIS (2)	.45
I do things without thinking	BIS (3)	.42

Factor 2: Openness to new places and unusual experiences (11.8% variance)	Original scale	Loading
I would like to explore strange places	BSSS (1)	.67
Open to new experiences, complex	TIPI (5)	.60
I would like to take off on a trip with no pre-planned routes or timetables.	BSSS (5)	.54
I like to do frightening things	BSSS (3)	.50
Extroverted, enthusiastic	TIPI (1)	.48
I prefer friends who are excitingly unpredictable.	BSSS (6)	.41

Factor 3: Absence of planning (7.1% variance)	Original scale	Loading
I plan for the future*	BIS (7)	-.91
I save regularly*	BIS (8)	-.78
I plan tasks carefully*	BIS (9)	-.77
I plan for job security*	BIS (6)	-.75
I am a careful thinker*	BIS (10)	-.62
I concentrate easily*	BIS (13)	-.51
Factor 4: Interest in stimulating and exciting experiences (5.03% variance)	**Original scale**	**Loading**
Reserved, quiet*	TIPI (6)	-.74
I would like to try bungee jumping	BSSS (7)	.67
I would love to have new and exciting experiences, even if they are illegal	BSSS (8)	.50
I like wild parties	BSSS (4)	.48

*The opposite of the statement relates to the factor.

Table 3.

Factor scores across reformulation sensation-seeking and impulsivity

Sample	IMPULSIVITY 1 Behavioural & cognitive impulsivity	IMPULSIVITY 2 Absence of planning	SENSATION 1 Openness to new places & unusual experiences	SENSATION 2 Interest in stimulating and exciting experiences
	Mean (*SD/n*) [a]	Mean (*SD/n*) [a]	Mean (*SD/n*) [a]	Mean (*SD/n*) [a]
Overall sample	18.3 (5.6/198)	15.4 (4.6/198)	22.9 (4.9/191)	12.7 (4.3/191)
Drug dependent[b]	19.8 (5.8/114)	17.1 (3.8/114)	23.5 (4.8/113)	14.1 (3.8/113)
Alcohol dependent	21.2 (6.5/57)	16.9 (4.4/57)	23.4 (4.7/57)	14.2 (4.7/57)
Poly substance dependent[c]	21.9 (6.7/41)	17.4 (4.0/41)	23.8 (4.6/41)	15.6 (4.0/41)
Reliability	α=.85	α=.85	α=.65	α=.64

Note:

[a]SD = Standard Deviation, n = number of participants

[b]Not including alcohol dependency.

[c]Combined alcohol and drug dependency at the same time.