MEDIATORS AND MODERATORS OF THE RELATIONSHIP BETWEEN TRAIT

URGENCY AND ALCOHOL USE

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By

Linda DINC

London, UK

Supervisor: Dr Andrew Cooper

London, UK

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DECLERATION

I certify that this thesis is a presentation of my original research work. Wherever contribution of others involved, every effort is made to indicate this clearly, with due reference to the literature.

The work was done under the supervision of Dr Andrew Cooper, at Goldsmith's University of London.

Linda DINC

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ABSTRACT

The studies in this thesis sought to further validate the role of impulsivity facets, in particular the urgency facets (rash actions in response to intense positive or negative emotions), as risk factors for different patterns of alcohol use and related problems. Previous research has supported the use of mood based dispositions to rash action in predicting a wide range of maladaptive behaviours. However, these studies have predominantly relied on correlational research designs, and there has been limited consideration of variables that may mediate or moderate links between the impulsivity facets and alcohol use. The first three studies described in the thesis employed correlational designs to examine whether urgency facets predict alcohol use and problems over and above other UPPS-P facets, and the mechanisms through which urgency leads to alcohol use and related problems (e.g. drinking motives, executive functions) among a group of college students (n=140, n= 386, n=62 respectively for study 1, study 2, and study 3). The following two studies used experimental designs to assess the effects of alcohol use on executive functions and behavioural risk taking as moderated by trait urgency (n= 82); and the potential moderating effects of high activation positive mood states on the relationship between positive urgency and beer consumption (n=110). Consistent with previous research, the first three studies revealed that urgency facets predicted alcohol use and problems beyond the other three facets of the UPPS-P. Additionally, the relationship between impulsivity facets and the three patterns of alcohol use was mediated through different drinking motives; while the relationship between negative urgency, sensation seeking, lack of perseverance and weekly total alcohol use was mediated by peer pressure motives, the relationship between negative urgency, sensation seeking and problem use was mediated by coping

and peer pressure motives, and the relationship between lack of perseverance, sensation seeking and binge use of alcohol was mediated by enhancement and peer pressure motives. Study 3 demonstrated that lack of perseverance, but not the urgency facets, moderated the effects of alcohol use on distractor interference. Study 4 showed that the acute effect of alcohol on prepotent response inhibition was moderated through sensation seeking; negative urgency was directly and positively related to prepotent response inhibition and risk taking, while positive urgency was negatively associated with distractor interference. Finally, study 5 found that positive urgency led to increases in beer consumption following high activation positive mood induction, as opposed to low activation and neutral mood conditions. Overall, the role of urgency showed incremental validity beyond previously identified risk factors. These findings, combined with prior cross-sectional and longitudinal field studies, provide strong support for the unique contribution of urgency in rash actions. Additionally, sensation seeking and lack of perseverance emerged as strong determinants of prepotent response inhibition and distractor interference, respectively, among college students who consume alcohol excessively. The studies in this thesis support the notion that impulsivity is a multi-faceted construct, and highlight the function of each facet in alcohol use and related problems, and the role of other contributing factors (e.g. drinking motives, executive functions, and positive mood) in this relationship.

Keywords: Impulsivity, Alcohol, Positive Affect, Executive Functions

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CHAPTER 1

Introduction

Excessive alcohol use is a problem that can cause substantial risk or harm to the individual. There are different forms of excessive alcohol use. These include daily high level drinking, repeated drinking episodes to intoxication, drinking that is causing physical and mental harm and drinking that result in the person becoming dependent or addicted to alcohol. Some of the problems excessive alcohol use cause are illness and distress to the individual, breakdown in relationships, trauma, prolonged disability and early death. Although it is a serious problem, the majority of excessive drinkers are undiagnosed.

The Alcohol Use Disorder Identification Test (AUDIT) was developed by the World Health organisation (WHO) to identify persons with hazardous (or risky) and harmful patterns of alcohol use. According to the AUDIT, hazardous drinking is a pattern of alcohol use that increases the risk of harmful consequences for the drinker or others. Harmful drinking refers to alcohol use that results in negative consequences for physical and mental health (Babor, Cambell, Room & Saunders, 1994). The AUDIT is also used for identification of alcohol dependence and some specific consequences of harmful drinking. Alcohol dependence is defined as a cluster of behavioural, cognitive and physiological phenomena that may develop after repeated alcohol use (Babor et al., 1994). Alcohol dependence includes a strong desire to consume alcohol, continuous use despite harmful consequences, prioritising drinking over other activities and obligations, impaired control over its use, increased tolerance to alcohol, and physical withdrawal when it is not consumed. Alcohol related problems include a wide variety of diseases, disorders and injuries, social, legal and financial problems (Anderson, Cramona, Patton, Turner & Wallace, 1993; Edwards et al., 1994). It is a major cause of liver cirrhosis,

pancreatitis, hypertension, gastritis, diabetes. Some forms of stroke and mental health problems such as depression are also likely to be aggrevated by alcohol consumption (Anderson et al., 1993).

University students and young adults in the UK are at heightened risk for problems associated with alcohol use due to their hazardous patterns of alcohol consumption (Webb, Ashton, Kelly, & Kamali, 1996; Wicki, Kuntsche, & Gmel, 2010; Heather et al., 2011; Gill, 2002). Episodic drinking, which refers to consumption of 6 or more units of alcohol in one drinking session, and heavy alcohol use are the leading causes of injury and death among university student drinkers and young adults. Hazardous consumption is associated with implications for the individual, educational and wider society (Ham & Hope, 2003). The adverse consequences of high volume consumption for college students include academic failure, risky sexual behaviour (Zapolski, Cyders, & Smith, 2009), involvement in criminal acts, and jeopardising future job prospects (Dietze et al., 2013; Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). Alcohol consumption at excessive levels has been reported to be a source of various other problems such as traffic violations (Zador, Howard, Rauch, Ahlin, & Duncan, 2011), alcohol related violence (McMurran, 2012), complex multifaceted deterioration of body movement (Modig, Fransson, Magnusson, & Patel, 2012) and other global health problems (Lam & Chim, 2010).

There is an abundance of studies demonstrating higher prevalence of alcohol use among college students as compared to their non-college peers (Cleveland, Mallett, White, Turrisi, & Favero, 2013; Kypri, Cronin, & Wright, 2005; Johnston, O'Malley, & Bachman, 2001) indicating concerns for public health given the negative social and health consequences associated with high-volume consumption (McGee & Kypri, 2004; Reboussin, Song, & Wolfson, 2012). A review of 18 published studies measuring

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drinking behaviour of undergraduate students in the UK over a period of 25 years concluded that 43 % of females and 52% of males reported drinking over the safe limit of 21 units per week for men and 14 units per week for women (Gill, 2002). These figures were 37% for men and 33% for women in 16-24 year olds. Moreover, among a sample of 3075 students, 15% reported hazardous drinking behaviour (36 units or more for women and 51 units or more for men); 28% of student drinkers declared binge use of alcohol (6 or more units in a drinking episode; 1 unit of alcohol was counted as either 1 glass of wine, 1 measure of spirit (25ml) or half a pint of beer) (Webb et al., 1996). More recent survey data on alcohol use disorders and hazardous drinking in university students in England showed similar results. A cross-sectional survey in a sample of 770 undergraduate students from seven universities across England revealed that 61 % of the sample (65 % of men and 58 % of women) scored highly (8 or more) on the Alcohol Disorder Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). Among these, 40 % endorsed criteria for hazardous drinking, 11% endorsed criteria for harmful drinking and 10 % endorsed criteria for potential dependence (Heather et al., 2011).

The pattern of alcohol use in university students as they progress through university was also investigated. In a longitudinal study including 5895 UK undergraduate students it was found that students reported consuming significantly more units of alcohol per week at Year 1 than at Years 2 or 3 of their degree. Male students reported higher alcohol intake than their female peers. The study also demonstrated that students who reported high-volumes of alcohol use were more likely to report a negative impact of alcohol on their studies, finances and physical health (Bewick et al., 2008).

Despite the detrimental effects of alcohol use on various aspects of life, few college students seek treatment for alcohol use problems (Blanco et al., 2008; Knight et al., 2002), suggesting a need for identification of risk factors that predispose individuals to alcohol use and associated problems. Personality traits and psychological vulnerabilities have been specified as factors that place young adults at heightened risk for problems associated with alcohol (National Institute on Alcohol Abuse and Alcoholism, 2006).

The personality trait of impulsivity is one of the major predisposing risk factors that leads young people to consume alcohol. Impulsivity is conceptualised as a personality trait that predisposes one to actions characterised by the inability to inhibit an inappropriate action, the tendency to act with little or no forethought, the propensity to act rashly in response to extreme positive or negative emotions, and a lack of planning and insensitivity to negative consequences (Dawe & Loxton; Reynolds, Ortengren, Richards, & Wit., 2006; Dom, Wilde, Hulstijn, & Sabbe, 2007; Dickman, 1990; Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007). There is an extensive literature linking impulsivity to alcohol use and alcohol problems (e.g. Dick et al., 2010; Verdejo-Garcia, Lawrence & Clark, 2008; Congdon & Canli, 2005; Zapolski, Cyders, & Smith, 2009; Adams, Kaiser, Lynam, Charnigo, & Milich, 2012). Studies have shown that heavy alcohol use can trigger impulsive behaviour (Goldstein & Volkow, 2002). For example, Marczinki, Abroms, Van selst, and Fillmore (2005) reported impairments in behavioural response inhibition in a group administered alcohol, relative to a placebo group.

Impulsivity as measured in prospective studies has also been shown to predict the development of alcohol use disorders (Clark, Vanyukov & Crnelius, 2002). The trait has been shown to predict excessive alcohol use, alcohol dependence, risky

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sexual behaviour, risk taking and gambling in college student samples (Zapolski et al., 2009; Cyders, Flory, Rainer, & Smith, 2009; Cyders, Zapolski, Comb, Settles, Fillmore, & Smith, 2010; Adams et al., 2012). Although impulsivity is clearly a robust risk factor that contributes to alcohol use and dependence, there are inconsistencies among previous studies that have examined the role of this trait in alcohol use and alcohol problems, and inconsistencies among self-report measures and behavioural task indices that have been used to measure it. (e.g. Dave & Loxton, 2004; Coskunpinar & Cyders, 2010; Curcio & George, 2011; Adams et al., 2012). Therefore, it seems that impulsivity is a multi-faceted concept with each facet assessing a different aspect of the trait and these facets may be differentially involved in risk for addiction. Most of these studies have been conducted among college students in the US. The literature lacks studies investigating the relationships between facets of impulsivity and alcohol use patterns among university students in the UK. Students have been the prime sample of interest for impulsivity and addiction studies due to early onset being an important risk factor for the development of addiction (e.g. Cyders et al., 2010; Zapolski et al. 2009).

This thesis focuses on the relationship between trait impulsivity and alcohol use and alcohol-related problems among university students. Impulsivity as a distal predictor of alcohol use, as well as the more proximal mechanisms through which impulsivity affects different patterns of alcohol consumption, will be examined. When examining impulsivity, the focus will be on emotion based dispositions to rash actions; positive and negative urgency. Positive urgency, which refers to impulsive actions in response to positive emotional states, and negative urgency, which refers to rash actions in response to negative emotional states, have been investigated in alcohol use and other risky/maladaptive behaviours. However, the mechanisms through which urgency facets relate to risky alcohol use and substance abuse have not been as widely researched. In

order to explore the way impulsivity influences drinking behaviour, it is critical to understand the multi-faceted nature of the trait, as well as the associations between these facet and substance use.

The next section provides background on several theories of personality, which serve as the foundation for understanding the major impulsivity measures and the UPPS model; this UPPS model will be used as the primary framework for considering impulsivity in this thesis.

Major Theories of Personality

The major theories of personality that encompass impulsivity can be distinguished into two broad approaches, biologically-based and biosocial models. Eysenck's Personality Theory (Eysenck, 1993), Cloninger's Tridimensional Personality Model (Cloninger, Svrakic, & Przybeck, 1993), Gray's Reinforcement Sensitivity Theory (Gray, 1987) and Zuckerman's Sensation Seeking Model (Zuckerman, 1991, 1995) are arguably the most influential biologically based personality models. Table 1 represents the major personality theories and the self-report measures developed based on these theories. Most of these measures comprise different facets of trait impulsivity. Impulsivity is associated with factors such as disinhibition, sensation seeking, approach motivation, urgency, reward seeking and drive. Table 1 includes self-report measures of impulsivity, such as Eysenck Impulsivity Scales, which is one of the earliest self-report measures of the trait.

Table 1

Leading Personality Theories and Impulsivity Related Measures

Theory	Measure	Description of Subscales
Zuckerman and Link (1968)	Sensation Seeking Scales	Thrill- and adventure-seeking Experience-seeking Disinhibition Boredom susceptibility
Eysenck, Pearson, Easting, and Allsopp (1985)	Eysenck Impulsivity Inventory (I7)	Impulsiveness Venturesomeness Empathy
Gray (1982) Carver and White (1994, BAS scales)	BIS/BAS Scale	Drive (BAS) Fun seeking (BAS) Reward Responsiveness(BAS) BIS
Cloninger (1987)	Tridimentional Personality Questionnaire (TPQ)	Novelty seeking Reward dependence Harm avoidance
Dickman (1990)	Dickman Impulsivity Inventory (DII)	Functional Impulsivity Dysfunctional Impulsivity
Patton, Stanford, and Barratt (1994)	Barratt Impulsivity Scale (BIS-11)	**1st order factors** Attention, self Motor Self-control Cognitive complexity Perseverance Cognitive instability **2nd order factors** Motor Impulsiveness Attentional Impulsiveness Non-planning impulsiveness
Lynam, Smith, Whiteside, and Cyders (2006)	UPPS-P Scale	Negative Urgency (lack of) Perseverance (lack of) Premeditation Sensation seeking Positive Urgency

Eysenck's personality theory. Eysenck's (Eysenck, 1967; H.J. Eysenck & Eysenck, 1985) three factor personality model has arguably been the most influential trait model in understanding personality. The model was based on three personality dimensions, Extraversion-Introversion (E), Neuroticism-Stability (N) and Psychoticism- Conformity (P), and is measured using the Eysenck Personality Questionnaire (EPQ). In this model, Extraversion reflected positive emotionality, while Neuroticism was associated with negative emotionality; these dimensions were linked to two distinct biological brain systems. The first was proposed to be connected with the reticular activating system, while the latter was associated with the limbic system. Eysenck explained that individual differences in introversion and extraversion stem from differences in the response thresholds of the ascending reticular activating system (ARAS), which affects the sensitivity of cortical arousal systems. It was theorised that introverts have lower response thresholds of the ARAS and therefore they are more aroused at rest, which leaves little need for extra stimulation from the environment. Extroverts, on the other hand, are under stimulated and seek extra arousal from the environment to reach an optimum level (Eysenck, Pearson, Easting, & Allsopp, 1985). The trait Neuroticism in this model was explained by individual differences in the arousal of the limbic system. Higher levels of arousal reflected a particularly responsive limbic system to stress or threat, which causes emotional instability due to hyperarousal. Impulsivity was initially incorporated as a lower order factor of extraversion in this theory.

In a revised version of the theory, Eysenck propounded that impulsivity arises from chronic under arousal of the cortical system, which leads to poor functioning of the reticular activating system (Eysenck, 1993). In his new model, Eysenck found that items which reflected impulsivity were related to different personality factors on the EPQ, both Psychoticism and Extraversion. A two factor model of impulsivity was

constructed in a new questionnaire, the I-5. The questionnaire comprised two subscales, Impulsivity and Venturesomeness. Impulsivity consisted of items tapping rash actions and acting without consideration of the consequences, while Venturesomeness contained items related to sensation seeking and risk taking, reflecting a multidimentional model of impulsivity.

Gray's Reinforcement Sensitivity Theory. Gray (1970, 1987) developed the foundation for one of the most prominent biologically-based models of personality. Similarly to Eysenck, Gray proposed three systems in the brain that underpin observed personality traits (Gray, 1981): the Behavioural Approach System (BAS), the Behavioural Inhibition System (BIS) and the Fight Flight System (FFS). The BAS is associated with response and sensitivity to rewards; it causes the organism to be close to potential rewards, thus motivates it to seek for positive experiences and rewards. The BAS is activated when individuals are motivated to approach rewards. Gray proposed that individuals with high BAS activity are impulsive. They have higher dopamine levels and higher activity in the lateral hypothalamus and septal area in the brain (Gray, 1987). In contrast to the BAS, the BIS causes the organism to be alert; it is sensitive to negative experiences and punishment. The BIS motivates individuals to avoid dangerous stimuli and potential punishment. It corresponds to the brain area called the septo-hippocampal system. The prefrontal cortex sends information to the septo-hippocampus; this information is then sent to other brain regions such as median raphe, serotonergic fibres and noradrenergic fibres (Gray, 1994). The third system, the FFS, is thought to modulate responses to unconditioned negative stimuli resulting in fear and rapid escape or defensive aggression.

Gray and McNaughton (2000) revised the Reinforcement Sensitivity Theory (RST); in this revised system, BAS modulates all responses, not only conditioned but

also unconditioned responses, to rewarding stimuli. The third system was renamed the Fight Flight Freeze System (FFFS) in this model. The conceptualisation of the FFS was changed to include sensitivity to both conditioned and unconditioned aversive stimuli and activates undirected fight, flight or freezing behaviour, with an experience of fear or anger. In this revision, flight and freezing are considered as similar responses to threat that depend on whether escape is possible. Finally, the BIS was still considered as central to anxiety but in the revised system, it is conceptualised to be activated by goal conflict stimuli. Unlike the previous model, BIS is not conceptualised as a punishment system but rather associated with a conflict detection and resolution system that inhibits the ongoing behaviour until engagement of the BAS or FFFS is considered most appropriate. The failure to distinguish between fear (FFFS) and anxiety (BIS) has been the major confounding factor in existing measures of the BIS.

Zuckerman's personality model. Zuckerman (1990, 1994, 1996) based his sensation seeking theory on a model influenced by genetic, biological, psychophysiological and social factors, which affect behaviours, attitudes and preferences. In his influential model, Zuckerman (1994) defined sensation seeking as a trait that refers to seeking of novel and exciting experiences, and the willingness to engage in physical, legal and financial risks for the sake of these experiences. This definition is not totally independent of the other general impulsivity models. Based on this definition, two self-report questionnaires that focus on the characteristics of trait sensation seeking were developed: the Sensation Seeking Scale (SSS-V; Zuckerman, S. Eysenck, & Eysenck, 1978) and the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). SSS-V is an operational measure of trait sensation seeking that encompasses four different dimensions: thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility. Each

dimension of the scale reliably measures different characteristics of the sensation seeking construct (Brocke, Beauducel, & Tasche, 1999; Zuckerman, 1994; Roberti, Storch, & Bravata, 2003).

The ZKPQ was developed as an alternative five factor model of personality and comprises five sub-dimensions that measure different aspects of personality. These factors are sociability, neurotiscm-anxiety, impulsive sensation seeking, aggression-hostility and activity (Zuckerman et al., 1993). Roberti et al. (2003) reported strong convergent validity of impulsive sensation seeking facet of ZKPQ with general measures of sensation seeking. Both self-report instruments, the SSS-V and the ZKPQ, were shown to reliably predict behavioural expressions of sensation seeking and other personality aspects such as preferences, experiences, thoughts and behaviours (Zuckerman, 1994).

Cloninger's tri-dimensional personality model. Cloninger (1987, 1991), in a psychobiological model, integrated neurophysiological and genetic factors that underlie behavioural tendencies, adaptive interaction and learning styles in three personality dimensions in a comprehensive and testable scheme. The constructed measure for the assessment of three dimensions, novelty seeking, harm avoidance and reward dependence, was called the Tridimensional Personality Questionnaire (TPQ). Cloninger (1987) linked each dimension to overactivity or understimulation of neurotransmitter system. In the three dimensional personality model, Cloninger (1986) showed correlations between novelty seeking and low basal dopaminergic activity, harm avoidance and high serotonergic activity and reward dependence and low basal noradrenergic activity. He claimed that the extreme variants of the genetic temperament traits may predispose individuals to develop personality disorders, and individuals with

antisocial personality disorder would feature high novelty seeking, low harm avoidance and low reward dependence.

Impulsivity as a Narrow Personality Trait

Impulsivity as a narrow personality trait has been reliably indexed by self-report measures of the trait. Barratt (1993) proposed a comprehensive model of impulsivity by integrating physiological, psychosocial and behavioural aspects in his theory. His research integrated self-report measures, behavioural task approach and brain-cognition-behaviour studies with animals. Based on this research the Barratt Impulsiveness Scale was developed (BIS; Patton et al., 1995). In this self-report impulsivity measure, Patton et al. specified three higher- order factors that measure different aspects of impulsivity: attentional impulsiveness, which reflects cognitive instability and the inability to focus on a task at hand; motor impulsiveness which refers to the actions done with little or no forethought and perseverance; and non-planning impulsiveness which measures self-control.

Dickman (1990) defined two factors: functional and dysfunctional impulsivity. Dickman asked whether the reasons that make people act with little forethought and inaccurately, when this style of responding causes difficulties, are the same reasons that make them act rashly when this response style leads to optimal results (Zadravec, Bucik, & Gregor, 2005; Claes et al., 1999). In Dickman's theory, functional impulsivity corresponds to responding impulsively when this causes optimal results, while dysfunctional impulsivity refers to the tendency to act with little forethought when this act is a source of difficulty.

Despite the efforts to place impulsivity in more comprehensive personality models, none of the frameworks propounded by previous personality theories that have

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attempted to integrate impulsivity in their models have gained universal acceptance. Whiteside and Lynam (2001) argued that the lack of consensus among these theories is perhaps due to the various dimensions defined and the disagreement among these theories in terms of the number and content of dimensions that characterised impulsivity. In an effort to bring clarification to the dimensions of impulsivity proposed in major personality models such as Eysenck's (1985) personality theory, Zuckerman's (1990) Sensation Seeking Model, Gray's (1987) RST and McCrae and Costa's (1990) Five Factor personality model (FFM), Whiteside and Lynam used a wide range of measures in a factor analytic study to identify the common impulsivity dimensions embedded in these personality theories. The development of the UPPS-P impulsivity model is fully described in the following sections. The next section describes the NEO-PI personality model, which was used as a framework for structuring the diversity of impulsivity conceptions in other personality theories and measures during the development of the UPPS-P.

NEO-PI-R personality model. NEO-PI-R model of personality (Costa & McCrae, 1992) is based on the FFM (McCrae &Costa, 1990), one of the leading personality theories, which describes individuals in terms of five fundamental personality domains. NEO-PI-R defines six facets to each personality trait defined in the FFM. The original model (FFM) was developed in a factor analytic study where participants were administered adjectives and were instructed to rate each adjective on how much it applied to them. In the FFM, three different domains, Neuroticism, Extraversion and Openness, have been shown to capture some aspects of impulsivity (Whiteside & Lynam, 2001).

Costa and McCrae, in their revised personality model (NEO-PI-R), proposed that the Impulsivity facet of Neuroticism domain and Self-discipline facet of the

Conscientiousness domain reliably measure low and high self-control respectively. The authors described individuals high on the Impulsiveness facet as excitable, moody and irritable, while those who were low on Self-control facet were described as disorganised, lazy and not thorough. The other two facets that tap into impulsiveness were identified to be the Excitement Seeking facet of Extraversion and the Deliberation facet of the Conscientiousness. High scorers on Excitement Seeking subscale were described as daring, adventurous and pleasure seekers, whereas low scorers on the Deliberation scale were described as careless, hasty, impatient and impulsive. While Excitement Seeking has been thought to resemble Zuckerman's SSS (Zuckerman, 1994) and Eysenck and Eysenck's Venturesomeness Scale (S.B.G. Eysenck & Eysenck, 1977), the Deliberation facet of Conscientiousness has been considered to show similarities to Barratt's non-planning impulsiveness facet (BIS, Patton et al., 1995). Whiteside and Lynam proposed that the conceptualisation of impulsivity within the FFM can be considered to bring a structure to the impulsivity construct. The following section will focus in particular on the UPPS-P model of impulsivity, which will be used as the primary framework for considering impulsivity in this thesis.

The UPPS-P model of impulsivity. A number of studies have implicated different psychological dimensions involved in trait impulsivity (Dick et al., 2010; Enticott, Ogloff, & Bradshaw, 2006; Reynolds, Ortengren, Richards, & de Wit, 2006). In an effort to limit the number of factors characterized by impulsivity, Whiteside and Lynam (2001) administered a number of commonly used self-report impulsivity measures to 437 college students. The more specific aim was to examine whether the dimensions of the FFM of personality fits in the various conceptions of impulsivity previously defined in the literature and the extent to which the FFM brings structure to the diverse conceptualisation of the trait and provides a useful framework for

impulsivity research. The Emotionality, Activity, Sociability and Impulsivity Temperament Scale (EASI-III; Bus & Plomin, 1975), Dickman Functional and Dysfunctional Impulsivity Scale (DII; Dickman, 1990), the BIS-11, the I-7; the Personality Research Form Impulsivity Scale (PRF; Jackson, 1984), the Multidimensional Personality Questionnaire Control Scale (MPQ; Tellegen, 1982), Temperament and Character Inventory (TCI; Cloninger,1991), the SSS and revised version of the NEO-PI-R were employed in the study. In addition to these measures the authors created additional 14 items that tap into impulsivity dimension of these measures. Example additional items created include '*I only act rashly when I am upset',* and *'When I feel bad I will often do things I later regret in order to make myself feel better now'*.

Four factors were derived from these questionnaire measures following a factor analysis: 1- Urgency, the tendency to act rashly when in negative moods; 2-Perseverance, the ability to focus on a task to the end; 3-Premeditation, planning and taking account of the consequences before engaging in a task; 4-Sensation seeking, pursuing activities that are exciting and to be open to new experiences. These factors formed the basis for a new questionnaire called the UPPS. Convergent validity was tested by semi-structured interviews confirming the distinct function of each facet of the new scale (Smith et al., 2007). The scale has since been revised and the urgency facet has been further disaggregated into two subscales referred to as negative and positive urgency (Cyders et al., 2007). Cyders et al. suggested that there are individual differences in the tendency to act impulsively in response to positive emotions. The authors hypothesised that rash actions in response to positive mood are related to the rash actions in response to negative mood, and both reflect underlying dysregulation in response to extreme mood states.

Cyders et al. (2007) proposed an additional content-valid 14 item scale to measure the propensity to act rashly in response to positive emotions. This new scale was called the Positive Urgency Measure (PUM). An example item for this scale was '*I am surprised at the things I do while in a great mood*'. The PUM was reported to be content valid and unidimensional. The scale represented a distinct factor from those represented by subscales of the BAS and also from those represented by the revised version of the four factor UPPS (UPPS-R; Whiteside & Lynam, 2001). Thus, the new scale, the UPPS-P, broke down the concept of impulsivity into five subscales: positive urgency, negative urgency, lack of perseverance, lack of premeditation and sensation seeking. Since its development the UPPS-P scales has been linked to various risky and maladaptive behaviours, however the role of positive urgency in substance abuse and risky behaviours has not been widely researched. The role of each facet of the UPPS-P in substance abuse, alcohol addiction, and other maladaptive behaviours will be discussed in the following sections. The next section will focus on the facets of other impulsivity measures in relation to substance addiction and problem behaviours.

As noted above, Impulsivity is a multifaceted construct with a strong relevance to addiction. Previous studies have focused on the definitions and assessment of different subtypes of trait impulsivity and have related these to the causes and consequences of alcohol use, related problems and disorders (Potenza & de Wit, 2010; Henges & Marczinski, 2012; Leeman, Patock-Peckham, & Potenza, 2012; Nery et al., 2012; Capone &Wood, 2009; Dolan, Bechara & Nathan, 2008; Curcio & George, 2011; Moreno et al., 2012). The next section will provide a brief summary of how existing sub-traits of impulsivity have been related to alcohol use, before turning to look more specifically at research undertaken with the UPPS-P.

Impulsivity and Alcohol Use

Previous research indicates that sensation seeking is one of the major personality variables related to substance use (Zuckerman, 1994). Both the SSS-V and the ZKPQ have been widely used in studies of alcohol use. D'Alessio, Baiocco, and Laghi (2006) assessed students' attitudes towards alcohol consumption in a survey study. One thousand undergraduate students were categorised as non-drinkers, social, heavy or binge drinkers. Participants were asked to complete a self-report alcohol scale, the SSS-V and the Positive Drinking Expectancy Scale. It was found that the percentage of binge drinking among university students was 32.9 %. Non-drinkers, social, heavy and binge drinkers differed on alcohol use variables, in their expectancies about alcohol and in sensation seeking dimensions. Heavy drinkers were found to score significantly higher than binge and social drinkers on boredom susceptibility and thrill and adventure seeking facets of the SSS-V; they have also reported higher positive expectancies about alcohol use.

Schepis et al. (2008) evaluated whether impulsive sensation seeking as measured by the Impulsive Sensation Seeking Scale (ImpSS) of the ZKPQ mediated the relationship between parental alcohol problems and offspring alcohol and tobacco use. ImpSS scores were found to be elevated among heavy and binge drinkers in the past month. Furthermore, the ImpSS scores showed increase with high frequency of past month alcohol use. Also, parental alcohol use was found to increase the likelihood of past month drinking, binge use of alcohol and tobacco use. However, ImpSS was not found to significantly mediate the relationship between parental alcohol problems and offspring alcohol or tobacco use, indicating that impulsive sensation seeking and parental alcohol problems are two factors that independently contribute to alcohol use.

Cross-sectional and longitudinal studies using the EPQ and the TPQ have demonstrated the critical role of impulsivity in substance abuse. Sher, Bartholow, and Wood (2000) cross-sectionally and prospectively investigated the predictive utility of both the EPQ and the TPQ for substance use disorder (SUD) diagnoses. Participants completed EPQ and TPQ and were assessed with structural diagnostic interviews at baseline and 6 years later. Both scales were found to show cross-sectional and prospective associations with SUDs. Although the two systems differentially predicted specific diagnosis, in both systems the dimensions marking broad impulsivity, sensation seeking or behavioural disinhibition were the strongest predictors prospectively. More specifically, Psychoticism predicted alcohol dependence but not tobacco or drug abuse or dependence. Extraversion and Neuroticism were not found to predict any substance use disorders.

Although theoretical support exists for BIS and BAS risk pathways to addictive behaviours, the role of the BAS has received much more empirical support. Franken, Muris, and Georgieva (2006) associated high BAS with increased risk for alcohol and illicit drug abuse. The study examined the differences in scores on the BIS/BAS scales between clinically diagnosed drug addicts, alcohol dependent participants and a healthy control group. Drug addicts were found to have higher levels of BAS/Drive and BAS/Fun seeking as compared to alcohol and control groups. O'Connor and Colder (2005) provided support for the association between BAS and alcohol use among college students. Sensitivity to reward, sensitivity to punishment and reasons for drinking were examined in a sample of 533 first year college students to identify patterns of alcohol use and related problems. The study found that sensitivity to reward was only associated with problematic drinking patterns and enhancement, coping and social motives for alcohol use mediated this relationship. O'Connor, Stewart, and Watt

(2009) investigated the unique influence of the BAS factors, Reward Responsiveness, Drive and Fun Seeking, and the BIS, on college student's drinking, smoking and gambling behaviours. The study found that Fun Seeking posed a risk for increases in drinking and smoking behaviours.

Franken and Muris (2006) examined whether Gray's BIS and BAS personality characteristics were associated with drug and alcohol use in a college student sample. The study demonstrated that college students' drug and alcohol use was positively correlated with the BAS and, to some extent, negatively with the BIS personality characteristics. The most substantial correlations were reported between BAS/ Fun Seeking and the number of illegal substances one had used, the quantity of alcohol use and frequency of binge drinking. Hamilton, Sinha, and Potenza (2012) investigated the relative levels of impulsivity, approach and inhibition in a community sample of 466 hazardous and non-hazardous drinkers. A measure of hazardous and harmful drinking behaviour (AUDIT), the BIS/BAS scales and the BIS-11 were used. A main effect of hazardous drinking on all dimensions of impulsivity, BIS and BAS/Reward Responsiveness and BAS/Fun Seeking, were reported with hazardous drinkers showing higher levels on these dimensions than non-hazardous drinkers. These findings suggest a critical role for the BAS in the initiation and development of addictive behaviours.

The relationship of the BAS to alcohol expectancies has also been investigated. Wardell, Read, Colder, and Merill (2012) argued that the BAS may facilitate positive alcohol expectancies over time, leading to increases in alcohol consumption. The authors tested the hypothesis that BAS prospectively predicts positive alcohol expectancies and that positive alcohol expectancies mediate the relationship between the BAS and subsequent drinking behaviour. The study showed that BAS/Fun Seeking indeed prospectively predicted positive alcohol expectancies and positive expectancies

mediated the link between BAS/Fun Seeking and subsequent alcohol use. Although the BIS showed some positive associations with positive alcohol expectancies, it did not have indirect effects on drinking behaviour. The findings are in parallel with the theory of the BAS, suggesting that individuals with high Fun Seeking find the rewarding properties of alcohol more reinforcing, which in turn leads to stronger positive alcohol expectancies and higher volumes of alcohol use.

Henges and Marcinzki (2012) investigated the way different aspects of impulse control, particularly the ability to inhibit a response, predict patterns of recent alcohol consumption in young social drinkers. Participants were instructed to perform a cued go/no go task, which requires participants to respond as quickly as possible to go-stimuli and to withhold responses in the presence of no-go stimuli. Alcohol use was assessed with the timeline follow back (TLFB; L.C. Sobell & Sobell, 1992) questionnaire, which measures recent alcohol consumption; the BIS-11 was used as a measure of self-report impulsivity in the study. Although both inhibitory failures from the task and total scores of the BIS-11 predicted various aspects of drinking behaviour such as total units consumed in a week, number of drunk days, only inhibitory failures from the task, and not the self-report impulsivity questionnaire, predicted binge use of alcohol during the past month.

Studies with alcohol dependent patients have also revealed a history of elevated impulsive behaviour (Patton et al., 1995; Boschloo et al., 2012; Joos et al., 2012); positive associations have been reported between severity of alcohol use and self-reported impulsive behaviour (Jakubczyk et al., 2012; Irwin, Schuckit, & Smith, 1990). The level of impulsivity has been shown to vary depending on the stage of alcohol use. For example, early stage alcohol abusers reported higher levels of impulsivity in comparison to late onset alcoholics. Dom, Hulstijn, and Sabbe (2006) compared early

onset (EOA) and late onset alcoholic (LOA) inpatients on the severity of substance use and problems, impulsivity, sensation seeking and aggressiveness. EOA showed higher symptom severity and alcohol related problems than LOA. Moreover, EOA were found to have higher levels of impulsivity as measured by the BIS-11, higher sensation seeking and aggression than LOA. The next section provides an overview of studies that have employed the UPPS-P measure of impulsivity in alcohol and other substance use research.

The UPPS-P impulsivity scale and substance use. Since its development, the UPPS-P questionnaire has been used in relation to substance use. The urgency facets have been often shown to associate with substance use, including alcohol use and related problems (Martens, Pedersen, Smith, Stewart, & O'Brien, 2011; Fisher & Smith, 2008; Fisher, Anderson, & Smith, 2004; Lynam et al., 2004). Negative urgency, in particular, has received increased attention in the investigation of maladaptive behaviours and substance abuse (Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007; Simons, Dvorak, Batien, & Wray, 2010; Gipson et al., 2012). Studies looking at a wide range of maladaptive behaviours encompassing substance use, alcohol abuse and related problems using the UPPS-P scale in college students samples, have reported elevated urgency scores(Zapolski et al., 2009; Cyders, Flory, Rainer, & Smith, 2009;Curcio & George, 2011; Kaiser, Milich, Lynam, &Charnigo, 2012). Increases in cigarette craving (Doran, Cook, McChargue, & Spring, 2009; Billieux, Van der Linden, & Ceschi, 2007), violent behaviour (Derefinko, DeWall, Metze, Walsh, & Lynam, 2011; Miller, Flory, Lynam & Leukefeld, 2003), problem gambling (Michalczuk, Bowden-Jones,Verdejo-Garcia, & Clark, 2011; Cyders & Smith, 2008), drug and alcohol use (Martens et al., 2011; Verdejo-Garcia et al., 2007; Anestis, Selby, & Joiner, 2007) are some of the examples of outcomes that have demonstrated the role of urgency

facets in addictive behaviours and substance use. Some research has suggested that individuals who experience extreme negative affect may have limited cognitive resources, which results in poor decision making or problems associated with acting rationally (Cyders & Coskunpinar, 2011; Billieux, Gay, Rochat, & Van der Linden, 2010; Cyders et al., 2009). College students under the influence of negative affect were found to be prone to excessive alcohol use and related problems (Martens et al., 2008; Carey & Correia, 1997).

Previous studies have linked the occurrence of maladaptive behaviours, including problem drinking, to rash actions in response to positive emotions. College students with high levels of positive urgency have been shown to be more vulnerable than students with low levels on this trait to excessive drinking and related problems (Cyders et al., 2010; Zapolski et al., 2009; Cyders & Smith, 2007); these studies showed that positive urgency explained variance in risky behaviours that was not explained by other impulsivity related dimensions; it also differentiated individuals at high risk for gambling from those with low risk, and differentially explained positive mood based risky behaviours. Positive urgency was also found to significantly interact with motives and expectancies to predict problem drinking (Coskunpinar & Cyders, 2012).

Cyders et al. (2009) examined the prospective roles of the five facets of the UPPS-P in predicting drinking quantity, frequency and negative outcomes from alcohol use behaviour in a sample of 418 undergraduate college students. Participants completed the UPPS-P impulsivity questionnaire, the PUM and the Drinking Style Questionnaire (DSQ) in the beginning and at the end of the first year of college. The study found that whereas sensation seeking predicted the frequency of alcohol consumption, positive urgency was related to the quantity of alcohol consumed in any given drinking episode. Cyders et al. (2010) in two experimental studies have shown

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that positive urgency significantly predicted risk taking behaviour and increases in the amount of alcohol consumption in a positive affective state. Participants had a positive mood induced prior to performing the Balloon Analogue Risk Taking Task (BART, Lejuez et al., 2002) in the first study. Positive urgency significantly predicted the number of balloons explosions (an index of high risk taking) following a positive mood manipulation. The second study examined whether positive urgency predicted beer consumption following a positive mood induction. Participants were placed in a room with two different types of non-alcoholic beers and two types of alcoholic beers and asked to consume as much or as little beer as they would like, and then rate them on various dimensions in a 90 minute beer taste test paradigm. Positive urgency was found to predict beer consumption over and above other UPPS-P facets. The study is described in more depth in Chapter 6.

The role of the other two facets, lack of premeditation and lack of perseverance, which assess the ability to plan a task and focus on a task until the end, respectively, have also been investigated in relation to addictive behaviours. Although lack of perseverance was found to be significantly higher among poly-substance users (Verdejo-Garcia et al., 2010) and predicted internet addiction among undergraduate students (Mottram & Fleming, 2009), there is not much empirical evidence demonstrating its role in predicting alcohol use or related problems (Dick et al., 2010; Whiteside & Lynam, 2003). Lack of premeditation has been related to problem use of alcohol in some studies among college students (Adams, Kaiser, Lynam, Charnigo, & Milich, 2012). Adams et al. found that higher levels of lack of premeditation were associated with higher problematic drinking scores. Enhancement motives were shown to partially mediate the relationship between lack of premeditation and problem use of

alcohol in that study, indicating both direct and indirect effects of this facet on problem drinking.

Despite the increasing number of studies investigating the associations between the UPPS-P facets and alcohol use and related problems, there have not been enough studies addressing the relationship between positive urgency and alcohol use, as compared to the other UPPS-P facets. Although traits related to positive affectivity appear to contribute to reduced risk taking in some circumstances (Wills, Sandy, &Yaeger, 2000), there are individual differences in the propensity to respond to positive emotional states with impulsive, risky behaviours. Previous research on positive urgency has predominantly relied on cross-sectional self-report studies of associations between positive urgency and risk behaviours. This thesis aims to employ both self-report and experimental laboratory-based studies to provide additional evidence on the links between positive urgency and alcohol use. The thesis will also examine the mediating/moderating role of urgency in drinking motives, executive functions, risk taking and alcohol use relationships.

In providing insight into the etiological pathways to alcohol use and problems it is critical to consider proximal determinants (e.g. motives, emotions), as well as distal predictors (e.g. traits) of such behaviours. The next section will address the potential mechanisms through which impulsivity might relate to alcohol use and problems.

Mediators and Moderators of Self-Report Impulsivity and Alcohol Use

Personality traits (distal predictors) do not always present direct associations with behaviours, or the results may vary across different samples. This may be due to the characteristics of the sample, individual differences in socio-economic status, emotions, motives and expectancies. These factors are often more proximal predictors

of behaviours and can potentially influence the relationship between traits and behaviours. This suggests the involvement of other mechanisms that may be partially or fully mediating and/or moderating the relationship between impulsivity and alcohol use. The distal predictors (e.g. impulsivity) no longer predict the behaviour (e.g. alcohol use) after the inclusion of proximal predictors (e.g. motives, emotions) in the cases of full mediation, whereas in partial mediation, distal predictors still have a direct influence on behaviour to some extent but this effect is smaller in the presence of the mediating variable.

Drinking motives. One of the most widely researched pathways to alcohol use is motives for engaging in this behaviour (Kuntsche, Knibbe, Gmel, & Engels, 2005; Cooper, 1994). Drinking motives are associated with alcohol consumption in different situational contexts and they often explain substantial variance in drinking behaviour. It is thought that individuals consume alcohol to achieve different outcomes and each motive serves a distinct function. Different motives are associated with different drinking patterns and related consequences. Although individuals consume alcohol for various reasons, four primary motives identified by Cooper have been the focus of alcohol studies among college students: social, coping, enhancement and peer pressure. Social motives are associated with non-problematic use of alcohol and are commonly endorsed by light drinkers in social settings; they reflect anticipated positive reinforcement in the form of social rewards (Cox, Hosier, Crossley, Kendall, & Roberts, 2006). Similarly, peer pressure motives or drinking to avoid disapproval by peers are endorsed by adolescents and younger individuals, and have been shown to weaken with maturity (Kuntsche & Stewart, 2009). Enhancement and coping motives on the other hand, have been identified as internal motives relating to emotions; they have often been associated with heavy drinking and alcohol related problems (Kuntsche & Muller, 2012;

Adams et al., 2012). Enhancement motives refer to alcohol consumption with the aim of enhancing positive mood, while coping motives are endorsed by individuals who experience negative emotions.

Students are more likely to drink to socialise and they might drink in excess to keep up with friends; heavy and constant drinkers are often people with high levels of stress and anxiety who consume alcohol with a motivation to cope with problems or to elevate mood. Drinking motives are derived from personal experiences, decisions, situations and expectancies, and they play a prominent role in cognitive models of alcohol decision-making in both adults and adolescents (Anderson, Grunwald, Bekman, Brown, & Grant, 2011; Bekman et al., 2011; Palfai & Ralston, 2011; Doyle, Donovan, & Simpson, 2011; Kuntsche et al., 2005; Carpenter & Hasin, 1998). Previous research has shown that personality traits predict drinking motives, alcohol use and related problems. Studies have investigated proximal mechanisms through which personality traits exert their effects on alcohol use and problems. Drinking motives were predominant candidates in these studies. Mood enhancement has been reported to be one of the most common motivations for consuming alcohol among the general population (Cooper, Agocha, & Sheldon, 2000); studies with student populations supported these findings (Coskunpinar & Cyders, 2012; Borsari, Murphy, & Barnett, 2012; O'Connor & Colder, 2005). It has also been shown that individuals who drink to enhance positive mood make more risky decisions (Read, Wood, Kahler, Maddock, & Palfai, 2003; Nygren, Isen, Taylor, & Dulin, 1996).

Studies focusing on trait impulsivity have shown that different facets of the construct are uniquely associated with drinking motives. As noted earlier in this chapter, the Sensation Seeking theory proposed by Zuckerman (1994) stated that individuals with elevated sensation seeking have a strong need for varied and intense stimulation. In

accordance with this theory, Magid, Maclean, and Colder (2007) suggested that sensation seekers drink to achieve optimum arousal level and are able to cease drinking once this level is achieved. In contrast to sensation seeking, impulsivity has been associated with failure to inhibit a behaviour that is likely to result in negative consequences among college students (Baumeister & Vohs, 2004). Magid et al. showed that coping motives fully mediated the relationship between impulsivity and alcohol related problems, while enhancement motives were significant mediators between sensation seeking and alcohol use, which indicated that sensation seekers had strong endorsement of enhancement motives, which in turn were associated with increases in alcohol use. The authors argued that impulsivity may be a particularly impairing trait because when faced with a problem; individuals high on this trait may be likely to rely on coping methods that can be implemented quickly and provide short-time relief, regardless of the long-term negative consequences.

Studies employing the UPPS-P impulsivity measure to examine the associations between different facets of the trait and the reasons for alcohol consumption among college students reported that people who are high on negative urgency are more likely to drink in a risky context, for a temporary fix of the problem or to elevate mood, to alleviate stress, anxiety or negative affect (Curcio & George, 2011; Adams et al., 2012; Anestis et al., 2007). It was also suggested that individuals with high levels of positive urgency are more likely to consume alcohol to enhance the existing positive mood (Cyders et al., 2010), while people who experience negative affect drink increasingly to cope with persistent distress or depression (Dick et al., 2010; Littlefield et al., 2010; Martens et al., 2008). Curcio and George investigated the meditational role of drinking motives, enhancement and coping, in the relationship between urgency facets, sensation seeking, alcohol use and related problems. While

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sensation seeking was shown to influence alcohol use via enhancement motives, negative urgency directly predicted alcohol related problems, but not use.

Adams et al. (2012) examined the indirect effects of the five UPPS-P facets on problem use of alcohol in a college student sample. Out of five facets, negative urgency, sensation seeking and lack of premeditation were shown to have indirect effects on problem use of alcohol through enhancement and coping motives. While the relationship between negative urgency and problem drinking was fully mediated by enhancement and coping motives, the relationship between sensation seeking, lack of premeditation and problem drinking was only partially mediated by enhancement motives. Social and peer pressure motives, on the other hand, have been shown to influence drinking behaviour among adolescents. (Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010; Kuntsche et al., 2005; Simons-Morton, & Chen, 2006). However, there are not many studies investigating the role of these motives in college students. As well as drinking motives, affective states are also important factors that potentially determine the relationship between different personality dimensions and alcohol use behaviour.

Emotional states. Emotions motivate action tendencies in response to the environment and trigger behaviours to attain various goals, such as satisfying a need or maintaining homeostasis; in this respect emotions are fundamentally adaptive (Billieux, Gay, Rochat, & Van der Linden, 2010). Nevertheless, emotions do not always result in adaptive behaviours. Previous research has demonstrated that intense emotions may trigger risky and maladaptive behaviours. For example, negative emotions have been shown to promote binge drinking (Selby, Anestis, & Joiner), urge to smoke (Leventhal et al., 2013), self- injury (Nock& Prinstein, 2004) and compulsive buying (Miltenberger et al., 2003); while positive emotions triggered risky decision making (Yuen & Lee,

2003), emotional eating (Bongers, Jansen, Havermans, Roefs, & Nederkoorn, 2013) and increase in alcohol consumption among college students (Cyders et al., 2010).

Emotions are also important factors that may contribute to the effects of personality on engagements in problem behaviours. Cyders and Coskunpinar (2010) using a college student sample showed that urgency significantly predicted risky actions independently of the intensity/frequency of emotions, and those who are high on urgency and drinking motives are at greatest risk of alcohol use. However, the study relied on self-report assessment of these behaviours. Self-report impulsivity questionnaires, the UPPS-P and the PUM, self-report mood measure, the Mood Based Questionnaire (MBQ), the Risky Behaviour Scale (RBS) and the revised DMQ were employed. Both negative and positive urgency have been shown to predict alcohol consumption, gambling, negative outcomes from risk taking and drinking to cope or enhance emotions respectively (Cyders et al., 2007; Cyders et al., 2009; Miller et al., 2003; Fischer et al., 2007).

As noted above, emotions are also related to many of these behaviours. They can reduce self-control and advantageous decision making (Tice, Bratslavsky, & Baumeister, 2001; Dreishbach & Goschke, 2004; Dolan, 2007) and can lead to behaviours such as alcohol use, drug use, binge eating, gambling and self-harm behaviours (Larsen, 2000). Individuals with a high propensity to experience negative emotions engage in risky behaviours to relieve the aversive mood states, whereas, extraverted individuals involve in risky behaviours to enhance positive affective experiences (Cooper et al., 2000). Although emotions and urgency facets appear to have separable effects on problem behaviours, they may interact to trigger these behaviours. Moreover, different types of positive emotions may differentially moderate the effect of positive urgency on alcohol use and perhaps on other risky actions.

Cyders et al. (2010) experimentally assessed the effects of positive urgency on beer consumption in a positive emotional state among college students. Using a within subjects design, participants were induced in a positive mood state prior to alcohol use. It was shown that positive urgency significantly predicted increases in beer consumption following positive mood induction. This study will be described in more detail in Chapter 6, where the moderating effects of positive mood states on the positive urgency and alcohol use relationship will be examined. Although these studies begin to address whether emotional states and urgency facets have separable effects on risky behaviours, they are not sufficient to answer this question. It is possible that positive urgency is most predictive in highly activated positive emotional states, as compared to low-activation positive moods. Elucidating interrelations between urgency facets, prior emotional experience, the intensity of current affective state, and acute urge to consume alcohol could inform affective models of addiction and treatment development for alcohol addiction. The study in Chapter 6 will examine the moderating role of the two levels of activated positive mood in the relationship between positive urgency and beer consumption. As well as emotions, behavioural impulsivity is another factor which will be examined in relationship with urgency and alcohol use. Urgency facets may act as proximal predictors to influence the affects of previous and acute alcohol use on behavioural task performance. The next section will critically evaluate a body of literature examining the associations between behavioural measures of the trait and alcohol use.

Behavioural measures of impulsivity. Previous studies investigating the self-report and behavioural impulsivity facets among college students have mainly suggested small or no associations between the two types of measures of rash action (Cyders & Coskunpinar, 2011; Reynolds et al., 2006; Lane, Cherek, Rhoades, Pietras, &

Tcheremissine, 2003). Cyders and Coskunpinar argued that if there is low convergent validity between self-report and behavioural measures of impulsivity, this could indicate that these two measures are assessing different constructs. If these are different measures referring to them as 'impulsivity' in the literature may lead one to think that they represent a unitary underlying construct, when in fact they measure disparate behaviours. In an attempt to bring clarification to the extent to which these measures overlap, Cyders and Coskunpinar completed a meta- analysis including 27 published papers assessing the relationship between multidimensional self-report and laboratory task measures of impulsivity. More specifically, the relationship between the five facets of the UPPS-P and behavioural constructs assessing prepotent response inhibition which measures the inability to inhibit a response, resistance to distractor interference, which measures the inability to focus on a target stimulus and ignore distractors, resistance to proactive interference, which measures the ability to recall information in the face of distractors were examined. The relationships between UPPS-P facets and delayed response, which measures the inability to delay responding in the face of a larger reward, and TIME paradigm, which is designed to assess distortion in judging elapsed time, were also examined. A small significant relationship between multidimensional self-report and lab task impulsivity measures was reported   ($r = 0.097$). In this review, the authors reported significant relationships between lack of perseverance and prepotent response inhibition ($r = 0.099$); between lack of premeditation and prepotent response inhibition ($r = 0.106$), delayed response ($r = 0.134$) and distortion in elapsed time ($r = 0.104$), and also between sensation seeking and delay response ($r = 0.131$), and between negative urgency and prepotent response inhibition ($r = 0.106$). The comparisons between positive urgency and lab task constructs were non-significant. The study suggested that research should take care in specifying the particular unidimensional constructs operationalized not only with impulsivity, but also with other

traits. If indeed self-report and behavioural task conceptualisations assess disparate dimensions of impulsivity, one cannot expect to find large conceptual overlap between these measures.

Studies investigating the link between impulsivity and substance use employing both self-report and behavioural measures of the trait have indicated the involvement of behavioural impulsivity in substance use (Lawrence, Luty, Bogdan, Sahakian, & Clark, 2009; Rubio et al., 2008; Aragues, Jurado, Quinto, & Rubio, 2011). However, retrospective self-report measures of impulsivity have been shown to assess different aspects of impulsivity as compared to laboratory measures of the trait (White et al., 1994; Lane et al., 2003; Gorlyn, Keilp, & Tryon, 2005; Reynolds et al., 2006). This finding indicates the importance of using self-report and behavioural measures of impulsivity concurrently to clarify the role of each facet of this complex construct and its relevance to addiction.

Fernie, Cole, Goudie, and Field (2010) investigated specific components of impulsivity and risk taking that explained the greatest variance in heavy and problem drinking in a sample recruited among university students. Participants were asked to complete a test battery comprising two response inhibition tasks (Go/No Go task, Stop signal task), a delay discounting task and the BART as an index of risk taking. The BIS-11 was also used as a measure of trait impulsivity. The risk taking task was the only behavioural measure that predicted alcohol use and problems in that study. This result remained statistically significant even when controlling for trait impulsivity, which indicates that behavioural risk taking predicts significant variance in alcohol use and problems independent of individual differences in trait impulsivity. However, behavioural measures of response inhibition and delay discounting were not found to predict unique variance in alcohol use in that study.

On the other hand, Henges and Marczinski (2012), using the same self-report measure of the trait (BIS-11) and a behavioural response inhibition task (cued go/no go task) demonstrated that impulsivity questionnaire scores as well as inhibitory failures on the response inhibition task predicted various aspects of drinking behaviour in young social drinkers. Alcohol consumption was measured using the TLFB and Personal Drinking Habits Questionnaire (PDHQ; Vogel-Sprott, 1992). The drinking patterns derived from these questionnaires used as criterion in the study were total number of drinks consumption, total number of drunk days, number of heavy drinking days (5 or more drinks) and highest number of drinks consumption in a day. The study found that all alcohol use patterns, except episodic drinking, predicted both self-report impulsivity and inhibitory failures from the task. However it was only the inhibitory failures from the task, but not the questionnaire scores, that predicted episodic drinking (highest number of drinks consumed in one occasion). The study indicates that different facets of impulsivity may be contributing to patterns of drinking differently.

Dom, Wilde, Hulstijn, and Sabbe, (2007) examined self-report and behavioural impulsivity in a group of abstinent alcohol dependents using two self-report impulsivity questionnaires (BIS-11, SSS), and two behavioural measures reflecting different dimensions of the trait, behavioural disinhibition (Go/No go task) and delay discounting (DDT), as well as a neuropsychological measure of decision making and Iowa Gambling Task (IGT). The study demonstrated strong correlations between self-report measures of the trait; however the correlations between behavioural and self-report measures of impulsivity were weak, suggesting that they tap into different aspect of the construct. In a principal components analysis, the study also showed that behavioural measures of impulsivity loaded on separate factors which support some of the previous findings suggesting that behavioural inhibition and delay discounting are independent

dimensions of impulsivity and that decision making is a separate dimension, independent of both behavioural measures.

Moreno et al. (2012) have used similar measures to examine self-report and behavioural impulsivity in recreational cannabis users and episodic drinkers. Impulsivity, sensation seeking traits, inhibitory control, and impulsive decision making, along with other psychological vulnerabilities such as anxiety and depression, were evaluated in three groups of university students: cannabis users, alcohol binge drinkers and non-drug users. Participants completed self-report measures of impulsivity (BIS-11, SSS-V), behavioural response inhibition (Go/No go, Stop tasks) and decision making tasks (Two-choice task, IGT). The study demonstrated that both cannabis and binge drinking groups had elevated scores on impulsivity and sensation seeking traits. They also exhibited elevated impulsive decision making on the Two-choice task and the IGT; however, only the cannabis group was significantly different from the non-drug group on tasks measuring inhibitory control.

Further studies are needed to address the interrelationships between self-report and behavioural measures of impulsivity, and the relationship of each facet to different patterns of alcohol use. The investigation of the relationship between behavioural task performance and substance abuse in different groups, such as individuals with high and low impulsivity levels, alcohol and other substance dependents and clinically impulsive individuals, may help to further clarify these associations. One of the aims of this thesis is to assess the relationships between different facets of the trait and behavioural measures of impulsivity and executive functions and their links to alcohol use. Although self-report and behavioural measures of the trait have been reported to show weak associations, and to differentially predict alcohol use and substance abuse, the moderating role of impulsivity facets in the relationship between different patterns of

alcohol use and these behaviours have not been widely examined. Alcohol use may interact with distinct facets of the trait to influence behavioural task performance. The following section summarises the individual study aims and the broad plan of investigation for each study in the thesis.

Overall Plan of Studies

The overarching objective of this thesis is to investigate the links between trait impulsivity and alcohol consumption. More specifically, the thesis aims to explore the variables that may mediate the relationship between facets of the UPPS-P, with a focus on urgency facets, and alcohol use patterns; it will also examine the potential moderating effects of these facets in the relationship between alcohol use and behavioural measures of impulsivity and executive functions. The relationships between impulsivity self-report measures, alcohol use and problem drinking, as well as the link between behavioural impulsivity and alcohol use have been previously researched, however, the mechanisms by which impulsivity relates to alcohol use remains elusive. The present thesis aims to study these mechanisms. The potential proximal predictors of alcohol use that will be investigated in this thesis include drinking motives, affective states, behavioural measures of impulsivity and executive functioning, more specifically prepotent response inhibition, distractor interference and risk taking.

Study 1: Self- report Impulsivity and Alcohol use: Patterns of Alcohol Use and the UPPS-P Impulsivity Facets

The first study in the thesis will focus on the urgency facets of the UPPS-P impulsivity questionnaire as determinants of different patterns of alcohol use. The study aims to explore whether mood based rash actions predict alcohol use and related problems over and above other facets of the UPPS-P. The extent to which urgency facet

is associated with various patterns of drinking behaviour, including typical weekly consumption, episodic use of alcohol and hazardous and harmful drinking behaviour will be examined.

Study 2: Drinking Motives as Potential Mediators of the Relationship between Impulsivity and Alcohol use

The second study will address the role of drinking motives as potential mediators in the relationship between facets of the UPPS-P and patterns of alcohol consumption. A drinking motives questionnaire will be used to examine social, coping, enhancement and peer pressure motives in the relationship between impulsivity facets and alcohol use patterns. These factors theoretically have been connected to alcohol use as means of coping with negative affect and enhancing positive emotions. Study 2 will examine the mediating role of each motive between the facets of the UPPS-P, with a specific focus on urgency, and alcohol use patterns such as binge drinking, weekly total consumption and hazardous and harmful use of alcohol. Unlike previous studies, Study 2 will examine all four drinking motives in this relationship. Although the mediating role of drinking motives in the relationship between impulsivity and alcohol use has been previously examined, most studies have focused on internal motives (enhancement and coping) and overlooked the external drinking motives (social and peer pressure) in this relationship; these motives are particularly important among first year undergraduate students.

Study 3: Moderating Role of Urgency in the Relationship between Alcohol Use and Executive Functions

The third study will investigate the role of urgency facet in moderating the relationship between alcohol use and inhibitory and interference related functions. This

study will examine the effects of regular alcohol use on the performance on prepotent response inhibition and distractor interference tasks and the extent to which urgency facets moderate this relationship. The focus will be on lack of perseverance and urgency facets due to their associations with prepotent response inhibition and interference related functions in previous studies (Cyders & Coskunpinar, 2011).

Study 4: Moderating Effect of Urgency in the Relationship between Acute Alcohol Use and Executive Functioning

Study 4 will extend the third study by including a state manipulation of acute alcohol administration. In a between subjects design, the performance of placebo and alcohol groups on both tasks used in study 3 will be assessed following a moderate dose of alcohol (0.8 g/kg) and placebo drink administration. Additionally, the study will examine behavioural risk taking as measured by the BART in both groups. The acute effects of alcohol on prepotent response inhibition, distractor interference and risk taking, and the moderating role of urgency in these relationships, will be reported.

Study 5: Moderating Effects of Positive Mood on the Relationship between Positive Urgency and Alcohol Use

Study 5 will examine the moderating role of positive affect in the relationship between positive urgency and alcohol use. The aim is to explore whether individuals with high levels of positive urgency consume higher amounts of alcohol when they are in highly activated positive affective states as compared to low-activation positive and neutral affective states. The momentary changes in mood in response to the mood induction procedures will be elicited using a pre and post-mood adjectives list. Induced positive affect has been shown to increase alcohol consumption and to encourage risk taking among those with high levels of positive urgency (Cyders et al., 2010). Study 5

in this thesis will bring clarification to the role of high and low-activation positive affect in positive urgency and alcohol use relationship by measuring the level of alcohol use among those with elevated positive urgency following high-activation positive mood induction, and contrasting this mood state with low-activation positive mood.

CHAPTER 2

Self- Report Impulsivity and Alcohol Use: Patterns of Alcohol Use and the UPPS-P Impulsivity Facets

Impulsivity is a robust predisposing factor that has been shown to lead college students to initiate and develop alcohol dependence (Magid et al., 2007; Zapolski et al., 2009; Fox, Bergquist, Gu, & Sinha, 2010; Henges & Marczinski, 2012). The contribution of impulsivity to increases in alcohol exposure and dependence may in turn lead to further impairments in impulse control resulting in greater increase in alcohol intake and dependence in a vicious cycle (De Wit, 2009). Research has shown that impulsivity is not unitary, but is a multi-faceted construct and each facet differentially relates to different patterns of alcohol use and associated problems (Cyders & Smith, 2008; Adams et al., 2012; Castellanos-Ryan, Rubia, & Conrod, 2011). Identifying specific facets of the trait, their function and relevance to different patterns of alcohol consumption and related problems can guide the design of intervention and treatment strategies.

Alcohol related problems are closely associated with high frequency and quantity of consumption, and impulsivity appears to be a prominent contributor to mortality in individuals with alcohol related problems. Blonigen, Timko, Moos, and Moos (2011) investigated the mortality risk in impulsive and non-impulsive individuals with alcohol related problems in a 15-year longitudinal study. Impulsivity was shown to be a robust and independent predictor of mortality risk among those with alcohol related problems. Since heavy episodic drinking and problem use of alcohol appears to be the most harmful forms of alcohol use, it is important to identify the facets of impulsivity that contribute to these patterns of alcohol consumption. The next section provides a critical review of the literature on heavy episodic, hazardous use of alcohol, alcohol

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related problems and the relationship between patterns of consumption and different facets of trait impulsivity.

Impulsivity, Episodic and Problem Use of Alcohol

Heavy episodic drinking commonly refers to excessive amounts of alcohol consumption in a given drinking episode. Although the amount that defines binge drinking varies between studies (McAlany & McMahon, 2006; Courtney & Polich, 2009), on average, consuming 6 or more units of alcohol on a single occasion at least once per month is considered hazardous and carries significant risks. These include accidents, injuries, heart and liver diseases (Gmel & Rehm, 2003). Different facets of trait impulsivity may predispose individuals to drink in different patterns depending on the motivation for alcohol consumption. Hazardous and harmful drinking behaviour, episodic use and general consumption may exhibit distinct associations with different facets of the trait.

Studies employing a more recent measure of the trait (UPPS-P), which consists of delineated multiple, separate dispositions to engage in risky behaviours, have also found different associations between distinct facets of impulsivity and patterns of drinking. Curcio and George (2011) investigated the contribution of sensation seeking, positive urgency and negative urgency facets of the UPPS-P impulsivity scale in alcohol use and related problems amongst a sample of undergraduate students. The study found that sensation seeking was the only significant predictor of alcohol use, while negative urgency was shown to be the only predictor of alcohol related problems. Adams et al. (2012), using the same impulsivity scale, examined the associations between facets of impulsivity and problem drinking among college students. It was shown that negative urgency, sensation seeking and lack of premeditation predicted problematic drinking behaviour. Cyders et al. (2010) found that positive urgency uniquely contributed to

increases in alcohol use, while another study demonstrated a significant contribution of urgency, but not other facets, in alcohol related risky behaviours such as drinking and driving (Treolar, Morris, Pedersen, & McCarthy, 2012).

Shin, Hong, and Jeon (2012) also assessed the way distinct facets of impulsivity influence three patterns of alcohol use: alcohol related problems, binge drinking and alcohol use disorders in a community sample of young individuals. The study found that urgency and sensation seeking facets predicted all three constructs of alcohol use. It was suggested that different facets of impulsivity may play different roles in the development and maintenance of alcohol use and disorders. This is perhaps due to individual differences in the psychological mechanisms that link the impulsivity traits to drinking behaviours in emerging adulthood. While sensation seeking appears to be related to alcohol misuse through a drive for increased stimulation and positive mood, urgency may be associated with pathological alcohol use outcomes through a motivational need to regulate negative emotions. In the UPPS model of impulsivity, urgency refers to the tendency to act impulsively to alleviate negative mood (Whiteside & Lynam, 2001). Individuals with high urgency may initially consume increasing amounts of alcohol to alleviate negative mood and continue to engage in binge drinking for self-medication which in turn becomes negatively reinforcing over time leading to development of alcohol addiction. Previous studies have shown that impulsivity and emotional lability, a trait of frequent and excessive emotional reaction, interact to increase risk for alcohol problems and dependence (Simons, Carey, & Wills, 2009; Simons, Carey, & Greh, 2004). Thus, problem drinking and dependence may be construed as a behavioural outcome of urgent behaviours used to regulate affects, which might alleviate negative mood in the short-term, but can have adverse long-term consequences.

Sensation seeking has been frequently shown to be a risk factor for a wide range of alcohol use behaviours (Whiteside & Lynam, 2001). Whilst some studies associated sensation seeking with drinking frequencies (Fisher & Smith, 2008; Grau & Ortet, 1999; Cyders et al., 2009), Shin, Hong and Jeon (2012) showed that sensation seeking is also relevant to binge use of alcohol, alcohol related problems and disorders. This may be due to identity exploration related issues during emerging adulthood (Shin, Hong & Jeon, 2012; Arnett, 2005). Individuals high on sensation seeking may consume increased amounts of alcohol as part of their identity exploration. Identity confusion may lead to heavy use of alcohol and eventually to dependence. Quinn, Stappenback and Fromme (2013) found a prospective effect of heavy drinking on increases in sensation seeking during emerging adulthood suggesting a bidirectional relationship between sensation seeking and alcohol use. Perhaps sensation seeking leads to increases in frequency and quantity of consumption during emerging adulthood and high levels of consumption, in turn, increases sensation seeking in young adulthood.

Cyders et al. (2009) compared the prospective roles of negative urgency, sensation seeking, lack of premeditation, lack of perseverance and positive urgency in predicting frequency and quantity of alcohol consumption and negative outcomes from alcohol use among first year college students. Sensation seeking was shown to predict increases in the frequency of drinking, whilst positive urgency significantly predicted increases in the quantity of alcohol consumed at any given episode; positive urgency was also a significant predictor of negative outcomes experienced from alcohol use. The results of that study are in parallel with previous studies indicating the critical role of sensation seeking in participation in alcohol use, while high quantities and negative outcomes from excessive consumption may be a function of positive urgency.

In contrast, Simons et al. (2010) found that neither negative nor positive urgency exhibited expected associations with alcohol use. Negative urgency was not significantly related to alcohol use, and positive urgency presented negative associations with intoxication. Premeditation, however, showed significant negative associations with alcohol use, which indicated a relationship between self-control and decreased involvement in substance abuse. The findings of that study contradict most previous studies in that the level of alcohol use did not vary as a function of positive urgency (e.g. Cyders et al., 2010). This may be due to the characteristics of the sample; participants in that study were either moderate or heavy drinkers. Perhaps positive and negative urgency facets play more prominent role during the initiation and development of alcohol use, where level of alcohol intake is more likely to show high variation as a function of emotion based rash actions (negative and positive urgency); this may explain different results across studies examining drinking patterns and impulsivity in college samples. As a result of this variation in consumption during the initiation and development of alcohol abuse, depending on the intensity of emotions, individuals may present higher levels of engagement in alcohol use, binge drinking and hazardous and harmful drinking behaviours. Self-control facets (lack of premeditation, lack of perseverance) may be more significant dimensions during the escalation of problem use and alcohol dependence.

The lack of consensus among studies investigating the relationships between facets of impulsivity and alcohol use and associated problems is perhaps also due to a broad conceptualization of the impulsivity construct. As noted earlier, impulsivity is a multi-faceted construct with each facet defining different aspects of impulsive behaviour. The trait has been assessed with a number of impulsivity measures to understand the role of individual facets defining impulsivity in alcohol use and

problems. The inconsistency among these studies indicates the need for further research to examine the association between facets of impulsivity and different patterns of alcohol use. The particular focus of this study is to further validate the role of positive and negative urgency in alcohol use and related problems. The study aims to explore whether urgency facets uniquely contribute to different patterns of alcohol use and problems over and above other facets of impulsivity, as measured by the UPPS-P in a UK first year university student sample.

The study in this chapter will also add to the impulsivity and alcohol use literature by examining the direct associations between the five facets of the UPPS-P impulsivity scale, negative urgency, lack of premeditation, lack of perseverance, sensation seeking and positive urgency, and different patterns of alcohol use such as general use, total units per week, binge drinking and alcohol related problems. Bivariate associations between these variables will be reported; regression analyses will be used to examine whether the urgency variables predict variance in different patterns of alcohol use above and beyond other facets of the UPPS-P. The next section states the more specific hypotheses for Study 1.

Hypotheses

1. It is predicted that the five facets of the UPPS-P questionnaire will be positively correlated with self-report alcohol use measures. This prediction is based on a synthesis of the previous findings in the literature.
2. It is hypothesised that positive and negative urgency will both significantly and positively predict measures of problem drinking (binge drinking, AUDIT), after controlling for the other UPPS-P facets.

3. It is expected that sensation seeking, lack of perseverance and lack of premeditation will significantly and positively predict weekly total alcohol consumption after controlling for urgency facets, but they will not predict binge drinking or the AUDIT; these problem drinking measures will be predicted by the two urgency facets.

Method

Participants

One hundred and forty adults (17.1 % male) aged between 18 and 37 years (M=19.47, SD = 3.19) were recruited from Goldsmiths, University of London. There were 116 females and 24 males. The mean age for female participants was 19.33 years (SD = 2.73), and it was 20.60 years (SD = 4.73) for male participants. All participants were undergraduate psychology students who participated in a questionnaire session as part of their course requirements.

Measures

UPPS-P impulsive behaviour scale. The UPPS-P is a 59 item scale which is designed to assess trait impulsivity (Lynam et al., 2006). The inventory measures five distinct facets of impulsive behaviour; these are negative urgency, lack of perseverance, lack of premeditation, sensation seeking and positive urgency. The negative urgency facet assesses an individual's tendency to act in an impulsive manner, specifically when accompanied by negative emotions such as depression, anxiety, or frustration. The negative urgency facet consists of items such as *'Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse'*. The lack of perseverance facet assesses an individual's ability to persist in completing jobs or obligations, despite boredom or fatigue. An example item is *'I tend to give up easily'*.

Lack of premeditation assesses an individual's ability to think through the potential consequences of his or her behaviour before acting. All items of this facet are reverse scored. An example item is *'My thinking is usually careful and purposeful'*. The sensation seeking facet measures an individual's attitude towards excitement and stimulation. It includes items such as *'I generally seek new and exciting experiences and sensations'*. Positive urgency assesses an individual's tendency to act impulsively while experiencing positive emotions. An example item in this facet is: *'When I am very happy, I can't seem to stop myself from doing things that can have bad consequences'*. Cyders et al. (2007) added this facet to the original version of the UPPS scale. Each item on the UPPS-P is scored on a 4-point Likert scale on a continuum from 'Strongly Agree' to 'Strongly Disagree'.

The UPPS-P scale was used in this study to assess the relationship between each facet of the scale and alcohol use outcomes such as binge drinking, weekly total units consumption and hazardous drinking behaviours. Cronbach's Alpha was .85 for negative urgency, .79 for lack of premeditation, .83 for lack of perseverance, .85 for sensation seeking and .93 for positive urgency.

Alcohol use questionnaire (AUQ). Alcohol use was measured using the AUQ, based on the timeline follow-back method, which was developed by L.C. Sobell and Sobell (1992). The timeline follow back method (TLFB) is a method for assessing recent drinking behaviour. In this method participants are asked to retrospectively estimate their daily alcohol consumption over a time period ranging from a week to 6 months. The AUQ is the most commonly used questionnaire that measures quantity and frequency of alcohol consumption, and it also incorporates beverage specificity (Mehrabian & Russel, 1978; Townshead & Duka, 2002).

The AUQ asks specific questions about drinking behaviour. It consists of 12 items; the first 9 items require participants to indicate their typical consumption of alcoholic beverages on a weekly basis over the last six months. The first three items ask about the number of days per week participants consume wine; the number of wine glasses they consume on each day they drink and the total number of drinks they consume per week when they drink wine. These three questions repeat for other beverages, such as beer and spirits. The last three items ask participants about the speed of their drinking, the number of times they have been drunk in the last six months and the percentage of times they get drunk each time they drink. These final three items are used for calculating a binge drinking score (Townshead & Duka, 2001, 2002). The measure derived from the AUQ was the total number of alcohol units consumed in an average week over the last six months. The standard UK measures for units were used. According to that, 25 ml single shot of any spirit was calculated as 1 unit; 175 ml standard glass of wine (12%) as 2 units and a pint of beer (4%) as 2.3 units.

A general alcohol use score (AUQ) was obtained by adding, and weighting as shown below, the weekly amount of wine, beer and spirit consumption, speed of drinking in one occasion, number of times a participant gets drunk and the percentage of time feeling drunk in the last 6 months ($AUQ = AUQ3 + AUQ6 + AUQ9 + (4 * AUQ10) + AUQ11 + (0.2 * AUQ12)$). Weekly total alcohol consumption in units was derived from the general scores by adding specific number of units of wine, beer and spirit consumption in the past week over the last 6 months. (Total units per week, $TUPW = (AUQ3 * 2) + (AUQ6 * 2.3) + (AUQ9 * 1)$). To further assess the relationship between alcohol use and impulsive behaviours, a binge score was included for all subjects. The scoring was calculated based on the responses given to items 10, 11 and 12. The calculation was done in the same way as in the AUQ without the inclusion of

items 1-9 with information on types and quantity of drinks (Binge score = 4 * (AUQ10) + AUQ11 + 0.2 * (AUQ12)) (Mehrabian & Russel, 1978; Townshend & Duka, 2002). Cronbach's Alpha for the AUQ was .48 in this study. It was .68 for total units per week and was .37 for binge drinking.

Alcohol use disorder identification test (AUDIT). The AUDIT is a screening tool that is used to identify people who are at risk of developing alcohol problems. The self-report measure was developed by the World Health Organisation in 1982 and it is used in identifying the preliminary signs of hazardous drinking and mild dependence within the last year. The AUDIT was reported to be valid across all ethnic and gender groups (Saunders et al., 1993). The self- report measure contains 10 multiple choice items examining three distinct domains: recent consumption, dependence and harmful use. An example item assessing recent consumption would be '*how often do you have a drink containing alcohol?*' items assessing dependence included '*how often during the past year have you failed to do what was normally expected of you because of drinking?*' and an example item that examines harmful use is '*how often during the past year have you been unable to remember what happened the night before because you had been drinking?*'

The responses to the questionnaire are scored on a points-based system; the overall score is obtained by adding scores for responses on each domain. A score of 11 and more indicates hazardous drinking (Saunders et al., 1993; Babor, Biddle-Higgins, Saunders, & Monteiro, 2001; Anderson et al., 1993; Allen, Litten, Fertig, & Babor, 1997). The AUDIT measure was used to identify risky and hazardous drinking behaviour among college students in this study. The Cronbach's Alpha for the AUDIT was .72 in the current study.

Procedure

First year psychology undergraduate students were asked to complete self-report measures of alcohol use, hazardous and harmful drinking and impulsivity, in a questionnaire session. The questionnaires were completed and returned back at the end of the session.

Results

Descriptive Statistics for the UPPS-P and Alcohol Use Measures

Table 2.1 shows the means and standard deviations of the UPPS-P and alcohol use scales. Independent sample t- tests were conducted on these scores to analyse gender differences. The results indicated a significant difference in TUPW between males ($M = 28.60$, $SD = 23.33$) and females ($M = 10.53$, $SD = 13.22$); with male participants consuming higher amounts of alcohol as compared to females, ($t (138) = -3.67$, $p < .01$). The results showed a similar pattern for the AUDIT, ($t (138) = -2.62$, $p < .05$), however, males ($M = 18.48$, $SD = 15.91$) and females ($M = 16.38$, $SD = 17.88$) did not significantly differ on binge scores ($t (138) = -0.53$, $p = .59$). A significant difference was also found in sensation seeking between males and females, with males scoring higher than females ($t (138) = -6.00$, $p < .01$) on that scale. The Levene's test for homogeneity of variances was performed to examine whether variances were different in two groups. Where Levene's test was significant (the variances are significantly different-assumption of homogeneity has been violated), the data from the row in the t-test statistic output labelled 'the equal variances not assumed' was reported.A separate column was used to report corrected degree of freedom (*df*).

Table 2.1

Descriptive Statistics for the Alcohol Use and the UPPS-P Scales

Measure	Males (*N*=116)	Females (*N*=24)	*t*	*df*
	Mean (*SD*)	Mean (*SD*)		
AUQ	30.60 (23.03)	22.76 (24.31)	-1.45	138
Binge	18.48 (15.91)	16.38 (17.88)	-0.53	138
TUPW	28.60 (23.33)	10.53 (13.22)	-3.67**	138
AUDIT	4.66 (4.82)	1.97 (3.06)	-2.62*	138
NU	27.20 (7.16)	27.70 (6.77)	0.32	138
L of Prem	21.21 (4.86)	23.79 (6.24)	1.71	124
L of Pers	21.69 (5.29)	21.50 (5.29)	-0.15	135
SS	39.70 (4.74)	32.69 (7.04)	-6.00**	138
PU	28.70 (12.04)	27.77 (8.74)	-0.44	138

Note. * $p< .05$, ** $p< .01$

Note. AUQ= Alcohol use questionnaire, TUPW= Total units per week, NU= Negative urgency, L of Prem= Lack of premeditation, L of Pers = Lack of perseverance, SS= Sensation seeking, PU= Positive urgency.

Correlations between the UPPS-P Scales and Alcohol Use

The correlations between alcohol use outcomes and the five UPPS-P facets are presented in Table 2.2. All UPPS-P scales positively and significantly correlated with alcohol use outcomes, general consumption, binge scores, and the weekly total consumption, except that binge scores and typical alcohol use (AUQ) did not significantly correlate with sensation seeking, and weekly total alcohol use was the only alcohol use variable that showed significant and positive correlations with lack of premeditation.The UPPS-P facets, except lack of premeditation,significantly and positively correlated with the AUDIT. Bonferroni corrections were applied to each *p*

value to control for Type I error due to high number of correlations performed. The

uncorrected p value of each correlation was multiplied by the number of tests (36).

Alpha at .05 level was used as reference to determine whether the adjusted p value was

Table 2.2

Correlations between the UPPS-P and Alcohol Use Measures

Measure	1	2	3	4	5	6	7	8	9
1.Negative Urgency	-	.22	.49*	.14	.77*	.50*	.40*	.47*	.43*
2. Lack of Premeditation		-	.48*	.03	.29*	.26	.20	.30*	.26
3. L of Perseverance			-	-.11	.36*	.45*	.38*	.41*	.31*
4. Sensation Seeking				-	.27*	.19	.16	.31*	.30*
5. Positive Urgency					-	.55*	.44*	.56*	.50*
6. AUQ						-	.96*	.70*	.61*
7. Binge							-	.50*	.48*
8. TUPW								-	.69*
9. AUDIT									-

Note. * $p < .05$

Note. AUQ= Alcohol use questionnaire, TUPW= Total units per week.

significant.

Regression Analyses

A series of multiple regression analyses were performed to analyse if the

urgency facets, positive and negative urgency, accounted for additional variance in

TUPW, binge score and the AUDIT when controlling for the other UPPS-P traits.

Positive and negative urgency were run in separate models due to their relatively high

inter-correlation ($r = 0.77$). Gender was entered in the first step of all regression models. In step 2, the three UPPS-P facets, sensation seeking, lack of premeditation and lack of perseverance, were entered as predictors of alcohol use measures. Positive urgency was entered in the third step of the analysis in the first set of regression models. In the second set of regression models negative urgency was entered in the final step of the model.

Table 2.3 shows the standardized beta weights and R^2 for each analysis with the AUDIT as an outcome. As can be seen in Table 2.3, lack of perseverance and sensation seeking were significant and positive predictors of the AUDIT in the second step of the regression model. Inclusion of positive urgency in the final step of the model predicted additional variance in the AUDIT scores; the trait was the only significant positive predictor of the AUDIT in the final step of the model. The change in R^2 in each step is presented in Table 3. The analysis was repeated with negative urgency in the final step of the regression model (Table 2.3). Both negative urgency and sensation seeking have positively and significantly predicted the AUDIT scores in the final step of the model.

Table 2.3

Regression of AUDIT Scores on Positive and Negative Urgency Controlling for Other UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.03	0.03	1,122
Gender	1.52	0.82	0.16			
Step 2				0.20	0.17**	3,119
Gender	1.05	0.81	0.11			
L of Prem	0.09	0.05	0.17			
L of Pers	0.13	0.06	0.21*			
SS	0.12	0.04	0.26**			
Positive Urgency						
Step 3				0.28	0.08**	1,118
Gender	1.52	0.78	0.16			
L of Prem	0.07	0.05	0.12			
L of Pers	0.09	0.06	0.14			
SS	0.06	0.04	0.13			
PU	0.13	0.04	0.33**			
Negative Urgency						
Step 3				0.26	0.06**	1,118
Gender	1.44	0.79	0.15			
L of Prem	0.09	0.05	0.17			
L of Pers	0.04	0.06	0.07			
SS	0.06	0.04	0.18*			
NU	0.15	0.04	0.29**			

Note. * $p < .05$, ** $p < .01$

*Note.*SS=Sensation Seeking, L of Prem=Lack of premeditation, L of Pers=Lack of perseverance, NU=Negative urgency, PU=Positive urgency.

A set of regression analyses was performed to test whether the urgency facets predict any additional variance in binge drinking when controlling for lack of perseverance, lack of premeditation and sensation seeking. All predictors explained 30% of the variance ($R^2 = .30$, $F_{(5,123)} = 10.18$, $p < .01$) in binge scores in the final step of the first model. Lack of perseverance and positive urgency significantly and positively predicted binge scores (Table 2.4). A second multiple regression analysis examining whether negative urgency predicts binge scores above the other UPPS-P traits revealed a similar pattern of results to positive urgency (Table 2.4).

Table 2.4

Regression of Binge Scores on Positive and Negative Urgency Controlling for Other UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	1,122
Gender	1.12	4.42	0.02			
Step 2				0.19	0.19**	3,119
Gender	-1.44	4.33	-0.03			
L of Prem	0.06	0.28	-0.02			
L of Pers	1.33	0.32	0.39**			
SS	0.49	0.22	0.20*			
Positive Urgency						
Step 3				0.30	0.11**	1,118
Gender	1.49	4.10	0.03			
L of Prem	-0.12	0.26	-0.04			
L of Pers	1.04	0.30	0.31**			
SS	0.13	0.22	0.05			
PU	0.81	0.19	0.38**			
Negative Urgency						
Step 3				0.24	0.05**	1,118
Gender	0.34	4.26	0.00			
L of Prem	0.06	0.27	0.02			
L of Pers	0.92	0.34	0.27*			
SS	0.33	0.22	0.13			
NU	0.70	0.25	0.25*			

Note. * $p < .05$, ** $p < .01$
Note. SS=Sensation seeking, L of Prem=Lack of premeditation, L of Pers=Lack of perseverance, NU=Negative urgency, PU=Positive urgency

A final set of multiple regression analyses were performed to examine if the urgency traits significantly predicted weekly total alcohol consumption. In the first regression model, gender, lack of perseverance and positive urgency positively predicted TUPW at a significant level in the third step of the analysis (Table 2.5). In the

second regression model, lack of premeditation, lack of perseverance and sensation seeking together with negative urgency accounted for 41 % of the variance in TUPW in the final step of the regression model (Table 2.5).

Table 2.5

Regression of TUPW on Positive and Negative Urgency Controlling for the Other

UPPS-P Facets

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.10	010**	1,122
Gender	12.74	3.46	0.31**			
Step 2				0.35	0.25**	3,119
Gender	11.00	3.19	0.27**			
L of Prem	0.47	0.20	0.20*			
L of Pers	0.88	0.23	0.32**			
SS	0.51	0.16	0.25**			
Positive Urgency						
Step 3				0.42	0.07**	1,118
Gender	12.95	3.06	0.32**			
L of Prem	0.35	0.20	0.14			
L of Pers	0.69	0.23	0.25**			
SS	0.26	0.16	0.13			
PU	0.54	0.14	0.31**			
Negative Urgency						
Step 3				0.41	0.05**	1,118
Gender	12.53	3.11	0.31**			
L of Prem	0.47	0.20	0.20*			
L of Pers	0.53	0.25	0.19*			
SS	0.37	0.16	0.18*			
NU	0.60	0.18	0.27**			

Note. $* p < .05$, $** p < .01$

Note. SS=Sensation seeking, L of Prem=Lack of premeditation, L of Pers=Lack of perseverance, NU=Negative urgency, PU=Positive urgency, TUPW= Total units per week.

Discussion

The purpose of this study was to explore the associations between the five UPPS-P impulsivity facets and different patterns of alcohol use. Furthermore, in an attempt to address the inconsistencies in the existing literature on the number of impulsivity facets implicated in alcohol use and associated problems, the current study aimed to explore the impulsivity facets that are strongly related to alcohol use and problems. The focus in this study has been specifically on the urgency facets. The study examined whether urgency facets predicted general consumption, binge drinking and hazardous and harmful drinking behaviour, above and beyond the other facets of the UPPS-P in a UK university student sample.

The first hypothesis stated that the UPPS-P facets would be positively correlated with TUPW, binge use and the AUDIT. This hypothesis was supported. All of the UPPS-P facets significantly and positively correlated with TUPW, binge drinking and the AUDIT, except that sensation seeking did not significantly correlate with binge use of alcohol. The self-control facets, lack of premeditation and lack of perseverance showed a significant positive relationship with TUPW and the AUDIT; however this relationship was numerically weaker as compared to the urgency facets.Positive urgency and negative urgency facets showed higher positive correlations than other facets with all of the alcohol use variables: TUPW, binge drinking and the AUDIT.

As predicted in hypothesis 2, postive urgency also predicted binge use of alcohol above and beyond the other UPPS-P facets. This finding is consistent with some of the previous research. Positive urgency is an emotion based facet which refers to the tendency to act impulsively while experiencing positive affect. The facet was shown to

predispose individuals to engage in risky behaviours such as substance abuse, risky sexual behaviours (Zapolski et al., 2009) and binge drinking (Cyders &Smith, 2008), mainly among first year college students. This finding is also in line with a previous study by Cyders et al. (2009) where it was found that positive urgency predicted the amount of alcohol consumption in one episode (binge), whereas sensation seeking was associated with frequency of consumption. In addition to binge drinking, positive urgency was a highly significant predictor of the AUDIT when controlling for the other UPPS-P facets in this study.

The hypothesis 2 also expected that negative urgency would predict problem drinking, but not general use. This prediction was based on previous findings demonstrating significant associations between problem use of alcohol and negative urgency (Adams et al., 2012; Curcio & George, 2011). Adams et al. using the same problem alcohol use measure (AUDIT) and the UPPS-P impulsivity scale found that negative urgency and sensation seeking predicted hazardous and harmful alcohol use. Negative urgency and sensation seeking also significantly predicted the AUDIT in this study. Further analyses showed that when controlling for the other UPPS-P facets, negative urgency significantly predicted general use and binge drinking. Although negative urgency was hypothesised to significantly predict binge drinking, it was not expected to predict general alcohol use. This result suggests that in addition to it is role as a risk factor for problem use of alcohol, negative urgency facet may also be a significant determinant of general alcohol consumption. Since negative urgency refers to the tendency to act impulsively when in negative affective states, the results suggest that negative mood may lead to increases in the amount of alcohol consumption among impulsive individuals. This effect may be more prominent in the presence of depression or anxiety. This interpretation is consistent with Simons et al. (2010) where it was

shown that negative urgency did not predict alcohol intoxication directly, but it moderated the relationship between anxiety and intoxication, making it stronger. This finding suggests that negative urgency may also be indirectly associated with intoxication through affective mechanisms, such as stress, depression and anxiety.

The hypothesis 3 predicted that sensation seeking would be significantly associated with TUPW, but not with the AUDIT or binge drinking. Sensation seeking showed significant moderate correlations in a positive direction with TUPW and the AUDIT, but not with binge drinking. This result is partially consistent with previous studies (Cyders et al., 2009), where it was shown that sensation seeking was related to the frequency and positive urgency to the quantity of alcohol consumption, which indicated higher frequency of participation in drinking behaviour for sensation seekers, while the amount consumed in one episode (binge) was higher for individuals with high positive urgency. Sensation seeking also predicted problem use of alcohol in some other studies (Adams et al., 2012; Willem, Bijttebier, & Claes, 2010; Gunn & Smith, 2010). The regression analyses revealed that when negative urgency was entered in the final step of the regression analyses, sensation seeking remained a significant predictor of both TUPW and the AUDIT. However, in the regression analyses where positive urgency was included in the final step, sensation seeking was no longer a significant predictor of either TUPW or the AUDIT. This result possibly indicates that positive urgency is a stronger predictor of specifically problem use of alcohol above and beyond sensation seeking, lack of perseverance and lack of premeditation.

The hypothesis 3 also predicted that lack of perseverance would be positively associated with alcohol use variables and would significantly predict weekly total consumption, but not problem use of alcohol. This hypothesis was partially confirmed. Moderate correlations were found between all of the alcohol use patterns and lack of

perseverance. Lack of perseverance also consistently predicted TUPW and binge drinking, but it did not predict the AUDIT. Lack of perseverance may be associated with fear of failure among first year college students, which may in turn lead to a general increase in the amount consumed in a period, and also in one episode to cope with the stress of the new social and academic environment, and with the increase in responsibilities. Whilst sensation seekers may engage in frequent alcohol use in search of a thrill and enhancement of current mood; college students with lack of perseverance may consume excessive amounts of alcohol to cope with social and academic problems they may encounter in the first year of college. This is different from the AUDIT, which includes items asking individuals if they have caused an injury to themselves or others in the last year as a result of excessive alcohol use. These factors may be more relevant to students who continue to drink frequently and excessively in later years.

As predicted in hypothesis 3, lack of premeditation significantly predicted weekly total unit consumption but not binge drinking or AUDIT. Although this finding is consistent with the hypothesis in this study, it is not consistent with some previous research indicating that decreased self-control is associated with increases in alcohol use (Adams et al., 2012; Simons et al., 2010).

The study in this chapter should be understood within the context of the potential limitations of the study. The predictors not included in this study such as socio-economic background, environmental and psychological factors, and use of other substances might explain further variance in alcohol use. The relationship among overlapping predictors will need to be studied in order to understand their different possible effects on risk behaviours. Secondly, the impact of personality on subsequent drinking is likely to include indirect and moderated effects that are not included in this study. For example, studies have shown that traits interact with motives and

expectancies to predict alcohol use behaviour concurrently (Fischer, Smith, Anderson, & Flory, 2003; Coskunpinar & Cyders, 2012). It is possible that urgency and sensation seeking are stronger predictors of problem behaviours for some individuals than for others.

The typical alcohol use, binge drinking and problem use measure were derived from a self-report alcohol use questionnaire; the measure relies on the retrospective report of drinking quantity and frequency in the last 6 months. The reliability of the AUQ scale was low in this study and other studies in thesis. The predictive effect of urgency and sensation seeking may have been stronger if more comprehensive measures of alcohol use patterns were employed. The effects observed in this study presumably operate in conjunction with several other contributors to risk. The study is limited to first year college students, alcohol use and problems likely to vary across groups, so the generalisability of findings to other groups needs to be tested.

The findings of this study may have implications for prevention or intervention. It appears that the experience of intense emotions can deplete an individual's self-control (Baumeister et al., 2007; Tice, 2001). Intervention strategies such as dialectical behaviour therapy have been developed to help individuals avoid rash actions when experiencing extreme negative emotions (Linehan, 1993). Perhaps intervention programmes geared toward safe management of intense positive emotional state will be useful for preventing engagement in risky impulsive actions such as excessive alcohol use.

To conclude, separate facets of the UPPS-P showed unique relationships with different patterns of alcohol use and related problems. This may be attributed to the multi-faceted nature of the impulsivity construct. Whilst some facets of the trait showed strong direct associations with most patterns of alcohol use (lack of perseverance), but

not related problems, others (sensation seeking) showed significant direct associations with general use and alcohol related problems, but not with other patterns of consumption such as binge drinking. Other facets presented very weak or no associations with general use and related problems (lack of premeditation). This result does not imply that there is no association between these dimensions of impulsivity and alcohol use and related problems, but rather the traits may be influencing behaviour through distinct pathways; thus, the association between facets of impulsivity and alcohol use and problems may be indirect, through other pathways such as motives and emotions. Further research is needed to explore the proximal mechanisms through which distinct impulsivity facets operate to influence different patterns of alcohol use and related problems.

The overall results of this study highlight the critical role of positive and negative urgency in predicting both general alcohol consumption and problem use of alcohol over and above other facets of the UPPS-P. Future studies should aim to confirm the effect of urgency facets in problem use of alcohol such as binge drinking and hazardous and harmful alcohol use, and further explore the mechanisms through which urgency facets influence different patterns of drinking behaviour among university students and alcohol dependents.

The study in the next chapter aims to explore the indirect relationships between the facets of the UPPS-P and patterns of alcohol use and related problems through four drinking motives: coping, social, enhancement and peer pressure. The meditational roles of these motives in the relationships between separate impulsivity facets and alcohol use and related problems will be reported. The focus will be on the urgency facets for their empirical and conceptual links to affects, alcohol use and related problems.

What this chapter adds to the literature

The study in this chapter contributes to the impulsivity and alcohol use literature by examining the direct associations between the five facets of the UPPS-P impulsivity scale: negative urgency, lack of premeditation, lack of perseverance, sensation seeking and positive urgency, and different patterns of alcohol use such as general use, total units per week, binge drinking and problem drinking behaviour. Although the role of different facets of impulsivity in alcohol use has been previously examined, these studies have mainly been conducted using other impulsivity questionnaires (e.g. BIS-BAS, BIS-11, SSS-V). The UPPS is a relatively new impulsivity self-report measure that initially seperates impulsivity in to four different facets. Unlike other impulsivity questionnaires it emphasises the role of emotion based rash actions in risky behaviours. Since the addition of the fifth facet, positive urgency, there has been a very limited number of studies investigating the role of five different facets of the UPPS-P as risk factors for alcohol use among university students. This is particularly important as first year college students, males and students who live on campus particularly, have been shown to present higher risk for alcohol use and problems (Kuntsche et al., 2005; Cashell-Smith, Connor, & Kypri, 2007; Curcio & George, 2011). However the majority of these studies have been conducted among US college students (Cyders et al., 2010. Zapolski et al., 2009).

This is the first study to examine the relationship between all five facets of the UPPS-P, with a particular focus on emotion based facets, positive and negative urgency, and different patterns of alcohol consumption, among UK university students. The study shows that emotion-based facets, positive and negative urgency, uniquely contribute to different patterns of alcohol consumption above other facets of the UPPS-P. Future studies should aim to confirm this finding using larger samples of university students to

understand better the impulsivity facets associated with early onset use, which is the most important risk factor for the development of addiction. These studies will also inform us about how each of these impulsivity facets are related to different patterns of alcohol consumption; they will, therefore contribute to the design of prevention and intervention strategies for this group.

CHAPTER 3

Differential Roles of Drinking Motives in Personality and Alcohol Use

The relationship between personality traits and alcohol use has been largely examined in cross-sectional and prospective studies. Factors such as age, conditions of the individual, circumstances, time of the day and personality have been shown to determine the motives for alcohol use. Such factors could also determine the level and the patterns of alcohol consumption (e.g. binge drinking, weekly total consumption, hazardous and harmful consumption). Mood is another critical factor which has been shown to affect the motivation for alcohol consumption. Individuals may drink differently when they experience positive or negative mood; feeling depressed or anxious or trying to cope with difficult life events differentially feeds motives for drinking; drinking style and level can also vary in different social situations.

If affect influences motives for drinking, individuals may choose to consume alcohol to preserve or prolong positive affective states and to relieve negative affect, or cope with situations that cause negative emotions. Therefore different motives will lead to an urge to consume alcohol in order to control the current mood state and to bring it to an optimum level. This self-manipulation of mood by alcohol use can also be linked to different personality traits. The pattern and the level of alcohol use differ among individuals who present different personality traits. For instance, some studies suggest that individuals high on trait sensation seeking are under-stimulated and consume alcohol to enhance mood and bring it to the optimum mood level and so they would stop drinking once this is achieved, whereas people with high urgency would continue drinking after reaching the optimum mood level to cope with negative situations or to

enhance current positive affective state (Kuntsche, Knibbe, Engels, & Gmel, 2007; Tragesser, Trull, Sher, & Park, 2008; Magid et al., 2007; Trull, Waudby, & Sher, 2004).

Ultimately, different personality traits can influence mood and therefore motives for alcohol use. In order to address this potential link between affect, alcohol use and personality, Study 2 investigates the indirect relationships through drinking motives between the UPPS-P impulsivity facets and alcohol use in a group of first year university students. The study aims to explore the way each drinking motive is related to impulsivity facets and alcohol use outcomes. The emotion based rash actions, positive and negative urgency facets, are the focus of this study. The potential mediating role of drinking motives between urgency facets and different patterns of drinking will be referred to in the following sections. Prior to assessing the role of motives as mediators, it is critical to understand the relationship of each drinking motive to alcohol use and the way they have been investigated in previous studies.

Cooper (1994) proposed that motives for drinking differ in the nature of the reinforcement sought from alcohol use, as well as in the source of desired consequences from consuming alcohol. In his influential model, Cooper emphasised the importance of an individual's expectancies from alcohol use and the mechanism by which different motives lead to distinct styles and amounts of alcohol consumption. The nature of reinforcement sought from alcohol use could be either negative or positive. Individuals who drink for positive reinforcement seek to enhance the current mood state to reach the highest level possible, while individuals who consume alcohol for negative reinforcement expect alcohol to relieve the current negative mood; these individuals consume alcohol to cope with depression or stressful life events. The first group is associated with enhancement motives, while the second group is linked to coping motives. The expectation from alcohol use in each of these motives seems to affect the

style of alcohol consumption. In both enhancement and coping motives alcohol consumption is internally motivated; the desired consequence in both motives involve regulation of affective states (Arbeau, Kuiken, & Wild, 2011; Tragesser et al., 2008; Kuntsche et al., 2007). Although the aim is to regulate the affective state in both motives, enhancement and coping motivated drinkers differ in the way they consume alcohol (Merill & Read, 2010). The style of alcohol use for enhancement motivated drinkers appears to be appetitive, whilst coping motivated drinkers consume alcohol as a reaction to cope with negative affect and they are reactive drinkers.

The other two drinking motives that have been identified in Cooper's motivational model of alcohol use are the social and peer pressure motives. These motives pertain to social reinforcement and peer confirmation, respectively. While the first group drink with expectations such as tension reduction and social enhancement, the latter engage in drinking behaviour to gain peer acceptance. These motives have been commonly associated with adolescent drinking and have not been widely investigated among university students. Social and peer pressure motives can continue to pose a risk for excessive drinking and alcohol related problems especially in the first year of university. The role of each drinking motive in the relationship between alcohol use and personality will be discussed in the following sections. Table 3.1 includes some of the recent studies investigating the relationship between drinking motives and different personality facets.

Table 3.1
The Relationship between Different Personality Facets and Drinking motives in Previous Studies

Personality Dimension	Drinking Motive	Study
Neuroticism Conscientiousness	Coping	Littlefield, Sher, and Wood (2010)
Sensation seeking	Enhancement	Curcio and George (2011)
Sensation Seeking	Social Coping Enhancement Peer Pressure	Urban, Kokonyei, and Demetrovics (2008)
Neuroticism Negative affect	Coping	Goldstein and Flett (2009)
Neuroticism Conscientiousness Agreeableness	Coping Enhancement	Loukas, Krull, Chassin, and Carle (2000)
Neuroticism Extraversion	Coping Enhancement	Cooper, Agocha, and Sheldon (2000)
Conscientiousness Sensation Seeking	Coping Enhancement	Arbeau, Kuiken, and Wild (2011)
Positive Urgency Negative Urgency	Enhancement Coping	Coskunpinar and Cyders (2012)
Negative Urgency Lack of Premeditation Sensation Seeking	Coping Enhancement	Adams et al. (2012)
Negative Urgency Positive Urgency Sensation Seeking	Coping Enhancement Social	Curcio and George (2012)
Sensation Seeking	Peer Pressure	Yanovitzky, Stewart, and Lederman, (2006)

Enhancement Motives and Alcohol Use

Enhancement motives are commonly associated with internal motivations and emotional dysregulation (Kunthsche et al., 2007). The desired consequence from enhancement motives is emotional regulation. Enhancement motives have positively reinforcing elements and emphasise positive mood as a result of appetitive alcohol use. Although enhancement motives have been investigated in relation with alcohol use and different personality traits in different groups, less is known about potential antecedents of these motives. A study investigated whether theoretically plausible trait and situational antecedents differ in their ability to predict the extent to which alcohol consumption is motivated by enhancement or coping motives on any given day. University students were asked to complete an online diary for 14 days which assessed completion of tasks on a daily basis, daily alcohol consumption and whether drinking was enhancement or coping motivated on the days they consumed alcohol. The main effects of daily positive affect ($\beta = 0.11$, $p<0.05$), enhancement motives ($\beta = 2.88$, $p<0.01$), and trait sensation seeking ($\beta = 0.36$, $p<0.01$), were reported to qualify by cross- level interactions between daily task accomplishment and trait conscientiousness ($\beta = 0.03$, $p<0.01$), and daily task accomplishment and trait sensation seeking ($\beta = 0.03$, $p<0.01$)(Arbeu et al., 2011). This study shows the different roles of motives, and their association with distinct personality traits also indicates that drinking motives are not only individual differences variables, but they are also influenced by other factors such as task accomplishment on a daily basis.

Extraversion and sensation seeking are two personality traits that have been commonly associated with enhancement motives in alcohol use studies. Kuntsche, Knibbe, Gmel, and Engels (2006) reviewed 82 empirical studies carried out over the last 15 years on the characteristics of young people who have specific motives for drinking.

The study reported that extraversion and sensation seeking consistently showed positive

correlations with enhancement motives. In addition to cross-sectional studies relying on

retrospective assessments, the role of drinking motives in particular circumstances was

also investigated. Drinking motives were assessed two weeks prior to a diary study

where individuals were asked to report number of drinks via short message service

(SMS) on weekend days. Drinking motives were used to predict the number of drinks

consumed at weekends. Based on 391 reports from 55 participants, the study found that

only enhancement motives predicted weekend drinking well over the usual alcohol

consumption. Gender, age or other drinking motives did not predict alcohol

consumption on weekend days (Kuntsche & Cooper, 2010). Enhancement motives were

found to predict heavy weekend drinking in another study (Mezquita et al., 2011).

These studies support the significance of circumstantial /situational factors in alcohol

use or abuse; they also show that drinking motives differentially associated with

different patterns of alcohol use.

Coping Motives and Alcohol Use

Drinking to cope with distress is considered to be a learned behaviour that is

used by individuals who lack adaptive means of coping with negative emotions

(Cooper, Frone, Russell, & Mudar, 1995). Coping motives have been examined to

explore whether the motivational model of alcohol consumption could be used to

understand the relationship between suicidal ideation and alcohol use outcomes. The

role of negative emotions, more specifically depression, in the association with

suicidality and alcohol use was investigated among underage college drinkers

(Gonzalez, Bradizza, & Collins, 2009). The study examined whether coping motives

were an intervening variable or a mediator in the relationship between suicidal ideation

and alcohol use outcomes. Coping motives were found to significantly mediate the

relationship between suicidal ideation and alcohol use, alcohol problems and heavy episodic drinking. The results remained significant even after controlling for depression. These results show that the significant relationship between suicidal ideation and alcohol use outcomes may be due to excessive alcohol use to regulate negative mood and to escape from distress or depression associated with suicidal ideation.

Individuals who consume alcohol to cope with negative emotions and depression are thought to have poor coping strategies to deal with stressful life events. They are likely to depend on alcohol to cope with negative affect and depression, which in turn leads to deterioration in coping skills. Since maladaptive coping skills lead to a greater risk for alcohol dependence especially among college students (Cooper et al., 2005), it may be a viable prevention strategy to improve adaptive coping skills to help individuals deal with negative emotions without the need to engage in alcohol use behaviour. In addition to their role in alcohol use and dependence, coping motives have also been found to contribute to other substance abuse and related disorders. A study has been conducted among current marijuana users evaluating the role of coping motives as mediators between anxiety sensitivity and marijuana dependence. Coping motives were found to significantly mediate the relationship between anxiety sensitivity and marijuana dependence, even after controlling for other co-occurring marijuana use motives (Johnson, Mullin, Marshall, Bonn-Miller, & Zvolensky, 2010). The study supports the putative explanatory role of coping motives in the relationship between not only alcohol use, but other substances and negative affect and related mood disorders.

Social Motives and Alcohol Use

Social motives present the highest prevalence of alcohol related problems among college students (Grant et al., 2004; Knight et al., 2002). Social and peer pressure motives are specifically critical risk factors in alcohol use and abuse in this

period of life. A longitudinal study tested separate time varying covariate models of the relationship between academic/ social motives and alcohol use and related problems from senior year in high school through the end of second year in the college. A small but significant relationship between academic motives and alcohol use was found across all time points. The study found a much larger positive relationship between social motives and alcohol use at all time points, with a smaller but still significant relationship between social motives and alcohol related problems. Academic motives were reported to play a stronger protective role for women while social motives were more robust risk factors, especially for Latino and Caucasian students and for individuals with positive family history of alcohol problems (Vaughan, Corbin, & Fromme, 2009).

Prevention efforts have garnered increased attention in recent years (Corbin, Iwamoto, & Fromme, 2011; Wechsler, Issac, Grodstein, & Sellers, 1994). Despite the increase in research conducted to understand and reduce the level of alcohol consumption among college students, the problem has remained persistent, with an increase in binge drinking (heavy episodic drinking). An increase in binge drinking was reported between 1993 and 2001 (Wechsler et al., 2002). It is clear that the university environment contributes to alcohol use and related problems among students (Borsari & Carey, 2006), and social motives could be an important factor mediating between risky alcohol consumption and associated problems. Lee, Geisner, Lewis, Neighbors, and Larimer (2007) evaluated injunctive norms (perception of friend's approval of drinking) and social motives as a moderator of the relationship between descriptive norms (perceived prevalence of friends drinking) and personal alcohol consumption. It was found that both descriptive and injunctive norms positively associated with alcohol use behaviour. Furthermore, the relationship between perceived descriptive norms and

personal alcohol consumption was stronger among students who perceived their friends were more approving of alcohol use; this was only valid among students who reported high social drinking motives.

Social motives are proximal predictors of alcohol use behaviour. Personality traits are often linked to motives; although they are closely related, traits and motives are distinct constructs. This was demonstrated in a number of models in the literature (Hogan & Roberts, 2000; Costa & McCrae, 1994; Cantor, 1990). The commonly shared idea is that personality traits are broad constructs that operate through goals and motives which are more proximal to behaviour; personality traits are rather distal predictors of behaviour (Corbin et al., 2011).

Peer Pressure Motives and Alcohol Use

Social pressure from friends to use drugs and alcohol is one of the major contributors to substance abuse. Peer pressure is considered to be among the strongest predictors of substance abuse and delinquency among adolescents (Burk, van der Vorst, Kerr, & Stattin, 2012; Kiuru et al., 2010; Simons & Chen, 2006). The social processes including socialization, social selection, group pressure and rationalization have been shown to dictate causal pathways that lead to substance abuse and risky behaviours (Shope, Raghunathan, & Patil, 2003; Stigler, Neusel, & Perry, 2011; J.H. Kim & Kim, 2012). The reciprocal relationships between social pressure from peers, favourable attitudes towards substance abuse and individual use were investigated in a study using National Youth Survey data (Reed & Roundtree, 1997). The study revealed significant associations between social selection, rationalization, the influences of socialization and substance abuse, however, overt peer pressure was not found to have any significant effect on substance abuse; there was also no reciprocal effect of peer pressure on substance abuse.

If peer influence is not reciprocal, and does not happen overtly, what is the mechanism that leads to conforming to peer behaviour? Longitudinal studies have been conducted to explore the factors that influence peer behaviour. The deviance regulation theory was postulated to understand the action and the identity related questions among adolescents (Blanton & Christie, 2003). According to this theory, individuals form identities by deviating from peers in ways they perceive as desirable. The stages of identity development are critical factors that need to be considered when making assumptions about individuals' attitudes towards substance abuse. Based on deviance regulation theory, Ferrer, Dillard, and Klein (2011) examined the way alcohol associated attitudes and behaviours are related to descriptive and injunctive norms over time, and the mechanism by which these perceptions are linked to alcohol related problems, among 239 college students over three time points. The study demonstrated that conformity and projection were linked to the first year of college, while greater drinking, positive attitudes towards alcohol and higher descriptive norms were related to alcohol related problems. Alcohol use behaviour and the attitude towards alcohol were reported to change in the second year of college. The attitude towards alcohol was characterised by deviance –those who believed others consumed larger amounts reported relatively lower alcohol consumption. This study emphasises the importance of the role and the stages of identity development when making predictions about alcohol use among adolescents. It also draws our attention to deviation processes in this age group, and the factors that influence conforming to, or deviating from, peers.

Peer pressure motives do not operate independently of the environment, social norms and personality traits. A study designed to evaluate the strength of social norms, demographics, alcohol use motives and expectancies in predicting alcohol use and related problems among heavy drinking college students substantiated social norms as

the best predictor of alcohol consumption. The study also demonstrated that descriptive and injunctive norms were among the best predictors of college drinking (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). Although most previous studies focused on norms and environmental influences when investigating peer pressure effects on alcohol use and related problems, the contribution of an individual's affective states or personality traits to peer pressure motivated drinking still needs clarification. The following section provides an overview, and critical evaluation of a body of literature relating to the use of drinking motives as mediators in the relationship between trait impulsivity and alcohol use.

The Mediational Role of Drinking Motives in the Relationship between Trait Impulsivity and Alcohol Use

An increasing number of studies have examined the mechanism by which personality dispositions effect alcohol use behaviour. The motivational pathways, which serve as proximal mechanisms through which personality traits influence alcohol use behaviour and related problems have previously been investigated (Sher, Trull, Bartholow, & Vieth, 1999; Kuntsche et al., 2007; Coskunpinar & Cyders, 2012; Cooper et al., 1995; Adams et al., 2012). The drinking motives linked to affect, coping and enhancement motives have been identified as risk factors for excessive alcohol use and related problems, especially among individuals with high levels on impulsivity facets related to sensation/fun seeking and urgency (Kuntsche & Cooper, 2010; Goldstein & Flett, 2009; Kuntsche et al., 2005; Hussong, 2003).

Previous studies of personality traits and alcohol use suggested that alcohol use may be motivated by the effort to regulate the negative emotions experienced as a result of personality disorders (Trull, Sher, Minks-Brown, Durbin, & Burr, 2000; Tragesser et al., 2008; Newhill, Mulvey, & Pilkonis, 2004). On this basis, the high level of alcohol

consumption among individuals with high impulsivity may be motivated by the desire to regulate negative emotions. In an effort to further explore the role of negative and positive affect and rash actions in alcohol use, Coskunpinar and Cyders (2012) have examined the mediating role of coping motives in the relationship between negative urgency and alcohol related problems, and the role of enhancement motives in the relationship between positive urgency and alcohol related problems among college students. Coping motives were found to fully mediate the relationship between negative urgency and alcohol problems, supporting previous findings that suggest alcohol use serves as a means of coping with stressful life events. Enhancement motives were found to partially mediate the relationship between positive urgency and alcohol related problems.

Additionally to the affect related rash actions, the other impulsivity facets can also predispose individuals to consume alcohol for different motives. Adams et al. (2012) investigated the impulsivity facets of lack of premeditation, sensation seeking and negative urgency and their involvement in problematic drinking among college students, and the meditational role of drinking motives in this relationship. All three impulsivity traits were found to have direct significant associations with problem drinking behaviour. When drinking motives were included in the model, indirect effects of lack of premeditation and sensation seeking on problem drinking was observed through enhancement motives. Negative urgency was found to have a significant effect on problem drinking through both enhancement and coping motives. Coping motives, however, were found to be stronger mediators between negative urgency and problem drinking as compared to enhancement motives.

Individuals higher on negative urgency are considered to be more likely to consume alcohol in situations that are hazardous due to their tendency to react impulsively when faced with distress (Cyders & Smith, 2008). Spillena, Cyders, and

Maurelli (2012) proposed that individuals with a high propensity to act rashly when experiencing negative affect will be more likely to drink excessively and to experience negative consequences related to this consumption. Studies examining the associations between different drinking patterns and motives for alcohol use also showed that coping with anxiety, social and enhancement motives predicted higher alcohol use on weekends, but only coping and social motives were related to consumption on weekdays. Alcohol dependent individuals were found to obtain the highest scores on drinking motives as compared to moderate and heavy drinkers (Mezquita et al., 2011). Curcio and George (2011) showed that enhancement motives mediated the relationship between sensation seeking and alcohol use but not related problems, while negative urgency predicted problem drinking. Kuntsche et al. (2006), in a review including 82 studies, showed that studies distinguished two specific patterns: extraversion and sensation seeking correlated with enhancement motives, while neuroticism and anxiety correlated most strongly with coping motives. The study found that coping motives are the most likely to lead to negative consequences from drinking, while enhancement motives are associated with heavy alcohol consumption.

Coping motives have been shown to lead to drinking problems both directly and indirectly, whereas enhancement motives typically lead to drinking problems indirectly through increases in alcohol use (Cooper et al., 1992; Cooper et al., 1995). Moeller and Crocker (2009) also suggested that coping motives initiate alcohol related problems. The study showed that self-image goals were related to coping motives, but not enhancement motives; coping motives then related to heavy episodic drinking, which in turn related to alcohol related problems. Coping motives have been shown to be maladaptive to a greater extent than other drinking motives (Lecci, MacLean, & Croteau, 2002; Moos, Brennan, Fondacaro, & Moos, 1990), and have been found to

lead to alcohol related problems, regardless of the amount of alcohol consumed (Read, Wood, Kahler, Maddock, & Palfai, 2003). In line with these studies, Magid et al. (2007) showed that enhancement motives were more strongly related to alcohol use, and coping motives were more strongly related to alcohol related problems. Furthermore, the study found that enhancement motives mediated the relationship between sensation seeking and alcohol use, while coping motives were strong mediators in the relationship between impulsivity and alcohol related problems. It is critical to differentiate between mechanisms of risk for alcohol involvement associated with different impulsivity facets. Together, these studies indicate that distinct personality facets may operate through different motivational pathways to affect drinking behaviour, and it highlights the importance of considering individual differences when tailoring prevention or intervention strategies.

The study in this chapter aims to confirm the direct relationship between trait impulsivity and alcohol use among first year university students, and to further explore the function of drinking motives in this relationship. A correlational design will be used to examine the extent to which drinking motives mediate the relationships between the facets of the UPPS-P and the different patterns of alcohol use among a sample of first year university students. The study hypothesises that positive and negative urgency, lack of perseverance and sensation seeking will be positively related to alcohol use and problem drinking through unique meditational pathways. Social and peer pressure motives are expected to emerge as stronger mediators of the relationship between impulsivity facets and general alcohol use, as compared to coping and enhancement motives. This is due to the significance of social acceptance and confirmation by peers in the first year of college. Social and peer pressure motives may become even more important in the university environment where individuals come from diverse

backgrounds, and are often anxious about fitting in to a new group and a new environment. While an increase in general consumption is expected to be mediated through social and peer pressure motives in particular, enhancement and coping motives are predicted to show higher relevance to binge use and problem drinking, specifically among those who exhibit high level urgent behaviours. Based on previous findings, coping motives are expected to show higher associations with problem use of alcohol, while enhancement motives are hypothesised to mediate the relationship between both general consumption, problem drinking and the urgency facets, sensation seeking and lack of perseverance. The mediational role of drinking motives will be examined in three models, for weekly total alcohol use (TUPW), binge drinking and problem alcohol use (AUDIT). The hypothesised paths for the meditational roles of drinking motives in the relationship between impulsivity facets and the three different patterns of alcohol consumption are demonstrated in the following models in Figure 1.1, Figure 1.2 andFigure 1.3.
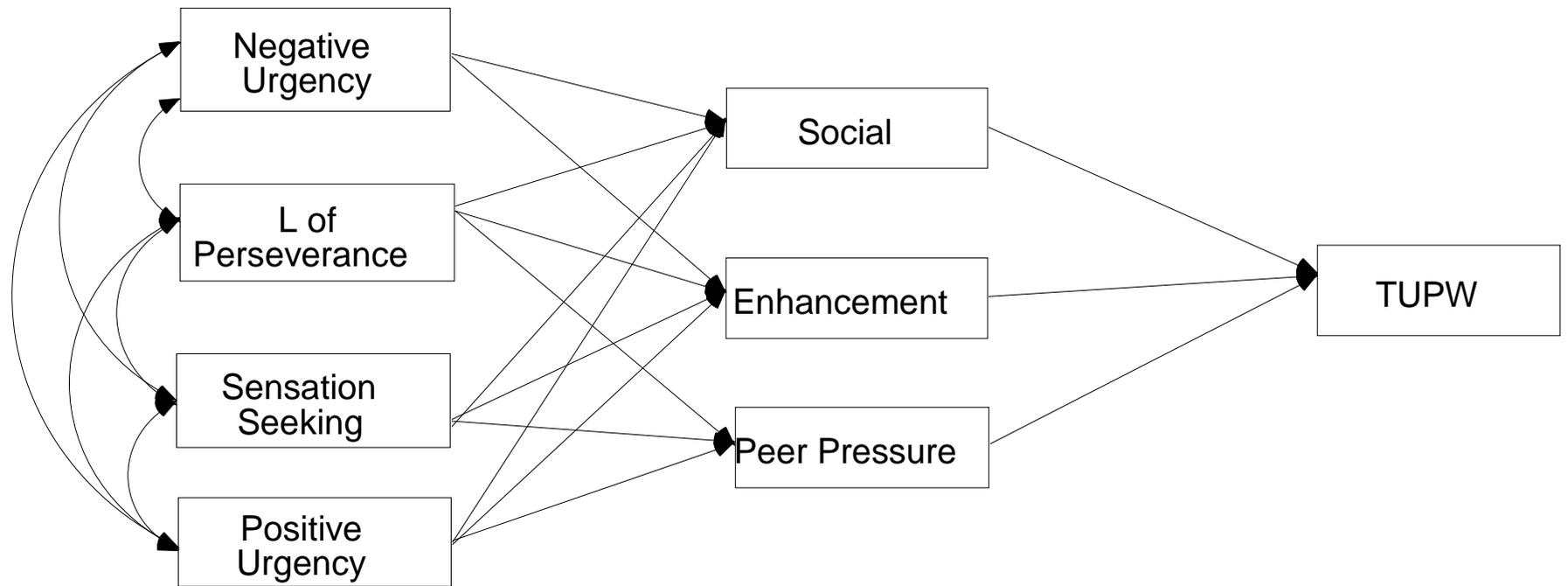
Figure .11. Hypothesised paths for model 1.

Note. TUPW= Total units per week, L of Perseverance= Lack of premeditation
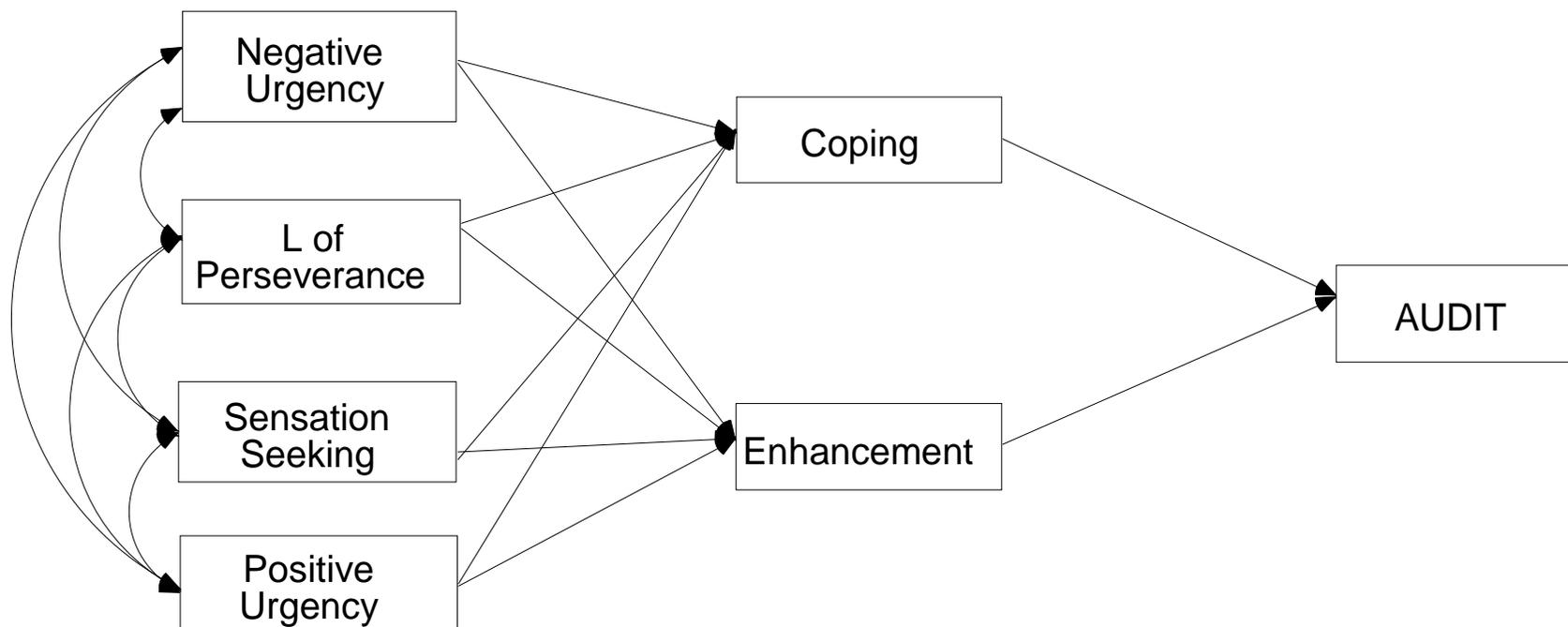
*Figure 1.2.*Hypothesised paths for model 2

Note. AUDIT= Problem alcohol use measure, L of Perseverance= Lack of premeditation
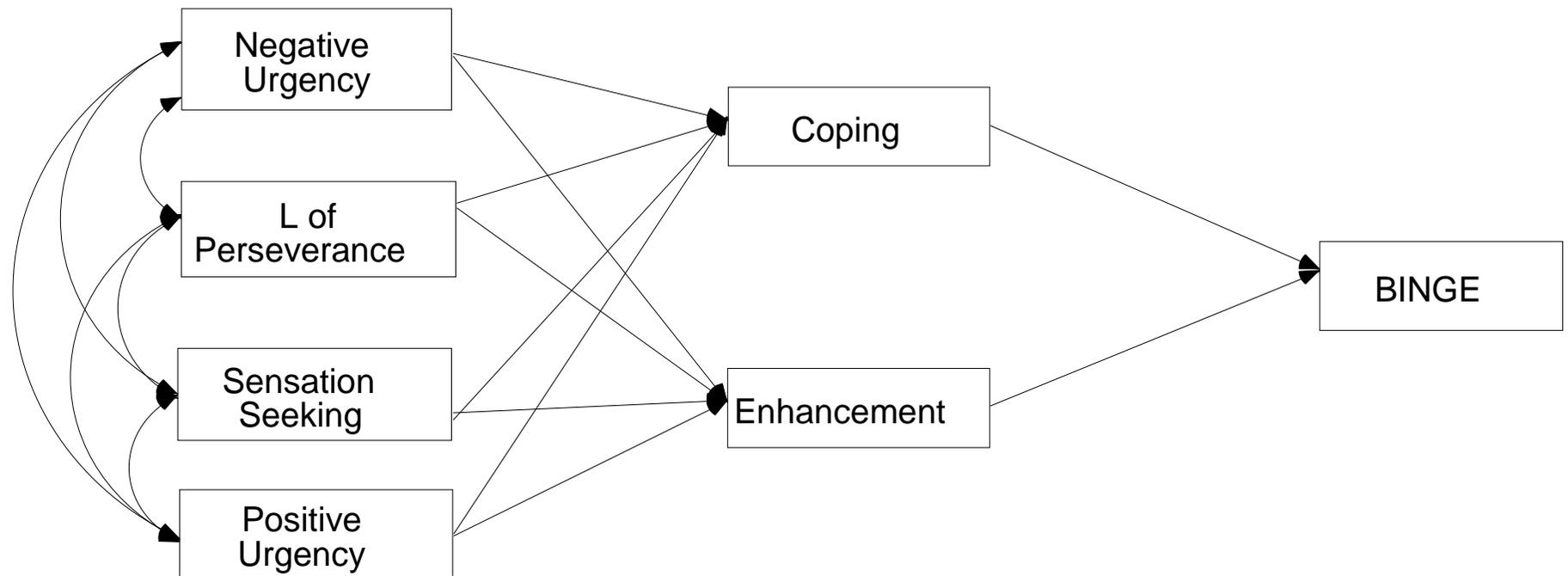
Figure 1.3. Hypothesised paths for model 3

Note. L of Premeditation= Lack of perseverance

The following section states the hypotheses for these models more specifically.

Hypotheses

1. It is expected that enhancement, social and peer pressure motives will significantly mediate the relationships between the urgency facets, lack of perseverance and sensation seeking, and weekly total alcohol consumption.

2. It is hypothesised that coping and enhancement motives will mediate the relationships between both urgency facets, sensation seeking, lack of perseverance and the AUDIT.Coping and enhancement motives are also expected to mediate the relationships between urgency facets, sensation seeking, lack of perseverance and binge drinking.

Method

Participants

Participants were 386 Goldsmiths, University of London psychology undergraduate students who participated in a questionnaire session as part of their course requirements. There were 212 females (54.9 %) and 61 males (15.8 %), with a mean age of 20.75 ($SD = 3.90$) for females and 22.62 ($SD = 5.98$) for male participants. Gender information was not available for 113 (29.3%) participants. All participants were 18 years or over.

Measures

Impulsivity and Alcohol Use Measures

UPPS-P impulsive behaviour scale. The UPPS-P is a 59 item scale which is designed to measure impulsivity (Lynam et al., 2006). The inventory emphasises five

distinct personality pathways to impulsive behaviour. Each item on the UPPS-P is scored on a 4-point scale from 'Strongly Agree' to 'Strongly Disagree'. This scale was also used in the first study and was described in the method section of Chapter 2. Cronbach's Alpha was .86 for negative urgency, .81 for lack of premeditation, .84 for lack of perseverance, .84 for sensation seeking and .93 for positive urgency in the present study.

Alcohol use questionnaire. The AUQ was also employed in Study 1 and was explained in the method section of Chapter 2. Cronbach's Alpha for the AUQ in the present study was .59. The weekly wine, beer and spirit consumption in units (TUPW) and binge drinking scores were derived from the total AUQ scores. The calculation is explained in the methods section of Chapter 2. The TUPW and binge scores were examined in separate models in this study. Cronbach's Alpha was .66 for TUPW and was .48 for binge scores. The reliability of the AUQ and binge scores was improved as compared to Study 1.

Alcohol use disorder identification test. The AUDIT screening measure was used to identify risky and hazardous drinking behaviour in this study. The AUDIT was also employed in study 1 and was explained in the methods section of Chapter 2. Cronbach's Alpha for AUDIT was .84.

Drinking motives questionnaire. The drinking motives questionnaire (DMQ) consists of 20 items and four subscales measuring social, coping, enhancement and peer pressure motivated alcohol use behaviour. The DMQ was developed to explore the motives for drinking alcohol among young population. The social factor includes items such as '*how often would you say you drink to be sociable*', coping factor includes items asking about the frequency of drinking to cope with certain situations or stress, e.g. '*How often do you drink because it helps you when you feel depressed or nervous?*'.

The enhancement factor consists of items that ask about the number of times a person drink to get high, e.g. '*How often do you drink because you like the feeling?*' Finally, the peer pressure factor measures the drinking motive related to social pressure and includes items like '*How often do you drink because your friends pressure you to drink?*' The items are scored on a 6 point scale (1-6) ranging from 'never' to 'almost always'. Cronbach's Alpha was .85 for social motives, .76 for coping, .81 for enhancement and it was .82 for peer pressure motives in the current study.

Procedure

Goldsmiths University of London psychology undergraduate students were asked to participate in the study. Three hundred and eighty six participants completed a pen and paper version of the UPPS-P impulsivity scale, the AUQ, the AUDIT, and the DMQ. The self- report questionnaires were completed and handed back to the researcher.

Data Analysis

In order to support a mediation hypothesis, it is required to exhibit elimination or a reduction of a significant pathway of association between an independent variable and a dependent variable by inclusion of a putative mediator (Baron & Kenny, 1986). One commonly used method to analyse mediation is linear regression analysis performed in stepwise fashion. In the first step, a linear regression model is computed with an independent variable (e.g. negative urgency) as the predictor of the outcome variable (alcohol use). Second, another multiple regression model is performed with a mediator as the dependent variable (e.g. coping motives) and independent variable as the predictor (e.g. negative urgency). Finally, the effect of the independent variable on the outcome variable with the inclusion of a mediator in the model is examined. The

effect of the independent variable (negative urgency) on alcohol use becomes zero in the case of full mediation, or this effect is reduced in partial mediation when controlling for the mediator.

Structural equation modelling (SEM) is a more effective way of presenting multiple mediation analyses for large data sets with multiple variables. SEM was performed to explore the mediating role of drinking motives in the relationship between impulsivity facets and alcohol use / related problems in this study. The analyses were performed using AMOS Version 5. The personality traits were conceptualised as distal predictors of alcohol use and related problems, while motives were considered as proximal mediators. Personality traits and drinking motives and alcohol use/problems were all treated as observed variables. The estimate means and intercepts were used as participants had missing data for some of the variables included in the model. The data analytic strategy used in this study was based on the previous paper by Adams et al. (2012).

The direct and indirect paths from personality traits to alcohol use and related problems were examined in stepwise fashion. At the first step of each structural model, the direct paths from the five UPPS-P scales to alcohol use were identified; this was done to specify the candidate traits for mediation analyses. The traits that were directly associated with alcohol use were selected for mediation analyses; the traits that did not have any direct relationship with alcohol use were eliminated as these did not meet the conditions for mediation. In the second step of the model, the relationship between the traits identified in the first step and the four drinking motives were examined; the direct paths from these traits to each motive were specified. In the third step, controlling for the impulsivity traits which were identified in step 1, the effects of drinking motives on alcohol use were assessed. The traits that had direct significant paths to alcohol use in

step 1 and the direct paths from these traits to drinking motives in step 2 were carried to the final step. The direct significant paths from drinking motives to alcohol use were identified, and non-significant paths were removed. The constructed final model consisted of significant paths obtained through these steps described above.

Results

The final sample consisted of 386 participants. The data was screened for influential outliers and normality; no observation was removed from the sample. Negative urgency scores ranged from 13 to 47, with lack of premeditation ranging from 11 to 44, lack of perseverance from 10 to 40, sensation seeking from 16 to 48, and positive urgency from 14 to 68.

Descriptive Statistics and Correlations

T-tests were conducted to explore the differences between males and females on the alcohol use measure, hazardous drinking, drinking motives and impulsivity facets. The results revealed a significant difference in weekly total alcohol units between males ($M = 32.19$, $SD = 43.38$) and females ($M = 11.73$, $SD = 14.93$); t (272) = -3.62, $p <.01$. Males and females also significantly differed on the sensation seeking facet of the UPPS-P, and on all subscales of the drinking motives questionnaire. See Table 3.2 for gender mean differences and the t-test results. Levene's test for equality of variances was used to test the homogeneity of variance assumption in two groups. Where Levene's test was significant (the variances are significantly different-assumption of homogeneity has been violated), the data from the row in the t-test statistic output labelled 'the equal variances not assumed' was reported. A separate column was used to report the corrected degree of freedom for each test.

Table 3.2
Descriptive Statistics for the Alcohol Use, the UPPS-P and Drinking Motives Scales

Measure	Females (*N*=61)		Males (*N*= 211)			
	M	*SD*	*M*	*SD*	*t*	*df*
Alcohol Use						
TUPW	11.73	14.93	32.19	43.38	-3.62**	271
Binge	16.59	22.09	28.04	30.56	-2.72**	270
AUDIT	3.31	5.34	5.27	6.52	-2.15*	268
AUQ	23.51	28.44	46.40	50.09	-3.41**	270
Impulsivity (UPPS-P)						
NU	29.96	6.74	30.82	7.99	-0.74	256
L of Prem	23.14	5.36	22.49	4.96	0.81	254
L of Pers	21.54	5.48	22.10	5.07	-0.70	255
SS	34.20	7.26	37.59	5.71	-3.77**	256
PU	28.73	9.50	30.68	9.32	-1.39	258
Drinking Motives						
Social	8.14	3.86	10.50	4.95	-3.43**	270
Coping	9.53	3.82	11.65	4.32	-3.69**	271
Enhancement	10.31	4.46	12.32	4.60	-3.03**	268
Peer Pressure	9.09	4.19	11.90	4.66	-4.48**	269

Note. * $p < .05$, ** $p < .01$
Note. TUPW= Total units per week, AUQ= Alcohol use questionnaire, L of Prem=Lack of premeditation, Lof Pers= Lack of perseverance, NU= Negative urgency, PU= Positive urgency.

Alcohol use outcome measures were moderately correlated with all four drinking motives and with some of the UPPS-P facets in a positive direction. The correlations between study variables are demonstrated in Table 3.3. The Bonferroni corrections were used to adjust for the *p* value for each correlation. This test was used to control for the likely Type I error due to high number of correlations.The *p* value for each correlation was multiplied by the total number of tests. The significance of each test was evaluated at alpha-level 0.05.

Table 3.3 *Correlations between UPPS-P Facets, Alcohol Use Patterns and Drinking Motives*

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Negative Urgency	-	.32*	.35*	.14	.73*	.21*	.16	.21*	.17	.23*	.21*	.17	26*
2. Lack of Premeditation		-	.46*	.21*	.32*	.15	.16	.13	.15	.10	.13	.10	13*
3. Lack of Perseverance			-	-.01	.27*	.15	.13	.16	.10	.15	.16	.16	22*
4. Sensation Seeking				-	.23*	.25*	.24*	.25*	.21*	.19*	.21*	.18	21*
5. Positive Urgency					-	.15	.09	.18*	.11	.20*	.15	.12	.19*
6. AUQ						-	.92*	.81*	.55*	.54*	.56*	.56*	.60*
7. Binge							-	.54*	.55*	.47*	.53*	.53*	.54*
8. TUPW								-	.42*	.49*	.47*	.46*	52*
9. AUDIT									-	.48*	.52*	.49*	.50*
10.Social Motives										-	.80*	.70*	89*
11. Coping Motives											-	.87*	83*
12. Enhancement Mot.												-	.79*
13. Peer Pressure Mot.													-

Mediating Role of Drinking Motives in the Relationship between Impulsivity and TUPW

There were significant positive correlations between the exogenous variables (traits); the error terms for the respective drinking motives were also correlated, and so were the error terms for alcohol use and related problems (endogenous variables). There does not appear to be universally agreed parameters for adequate model fit (Kenny & McCoach, 2003). The indices used to assess the model fit were: the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the relative Chi square (CMIN/*df*). Values above .90 or .95 for CFI, and .08 or lower RMSEA were considered a good fit (Hu & Bentler, 1999).

Step 1: Personality predicting TUPW

Means, standard deviations and correlations for all variables considered for inclusion in the model were presented in Tables 2 and 3. Standardized β values were used to represent the direct effects throughout the model. Sensation seeking ($\beta =.22$, $p < .01$), lack of perseverance ($\beta =.13$, $p < .05$), and negative urgency ($\beta =.12$, $p < .05$), showed significant direct relationships to alcohol use (TUPW). Positive urgency and lack of premeditation were not related to the TUPW. Thus, negative urgency, lack of perseverance and sensation seeking were identified as candidates for mediation analyses in the following step.

Step 2: The Direct Paths from Personality to Drinking Motives

The paths that were identified in the first step as having significant direct relationships with TUPW were used in this step. The paths from the three personality facets specified in the first step to social, enhancement, coping and peer pressure motives were assessed. Negative urgency was significantly related to coping motives (β

= .16, $p < .01$); it was also significantly related to enhancement motives ($\beta = .12$, $p < .05$), social motives ($\beta = .17$, $p < .01$) and peer pressure motives ($\beta = .18$, $p < .01$). Lack of perseverance was significantly related to peer pressure motives ($\beta = .18$, $p < .01$), social motives ($\beta = .12$, $p < .05$), enhancement motives ($\beta = .13$, $p < .01$) and coping motives   ($\beta = .12$, $p < .05$). Sensation seeking was also significantly related to coping motives   ($\beta = .21$, $p < .01$), enhancement ($\beta = .19$, $p < .01$), social ($\beta = .18$, $p < .01$) and peer pressure motives ($\beta = .20$, $p < .01$). All significant paths were retained for the next step.

Step 3: Mediational Pathways between Personality and TUPW

The traits that showed significant relationships with TUPW in the first step and the significant paths from personality to drinking motives, along with paths from motives to the TUPW, were reintroduced into the model in this step. Although paths from negative urgency, lack of perseverance and sensation seeking facets to four drinking motives were specified, only peer pressure motives was included in the final model, as the paths from other drinking motives to TUPW were not significant. The path from peer pressure to TUPW was significant ($\beta = .52$, $p < .01$).

The direct path from negative urgency to TUPW was no longer significant when peer pressure motives were introduced in the model, indicating a significant mediating role for these motives in the relationship between negative urgency and alcohol use. The path from lack of perseverance to TUPW was also no longer significant after the inclusion of these motives in the model. Sensation seeking, however, had a significant relationship to the TUPW in this step, which indicated a partial meditational role of peer pressure motives in the relationship between sensation seeking and TUPW.

The overall model fit was adequate across indices, (CMIN = 3.118., $df = 3$, CMIN/$df =$ 1.039, CFI = .99, RMSEA = .010). The final model is presented in Fig 1.4.

Figure 1.4. Results of the structural model. Proportion of variance accounted for by the model (R^2) in the outcome variables: Peer pressure motives=.13, TUPW=.29. Only significant standardized effects at $p<.05$ and $p<.01$ are shown.

Note. TUPW= Total units per week, Lof Perseverance= Lack of perseverance

Negative urgency, lack of perseverance and sensation seeking retained significant total effects on the TUPW through their relationship with peer pressure motives. The estimated standardised total effect of lack of perseverance through peer pressure motives was .17, $p < .01$. Individuals with high levels on this trait showed higher motivations for peer confirmation, which in turn led to increases in the TUPW.

High levels of negative urgency were associated with strong endorsement for peer pressure motives, which in turn was associated with high levels of weekly alcohol consumption. The estimated standardised total effect of negative urgency on the TUPW through peer pressure motives was .17, $p < .01$. The effect of sensation seeking on the TUPW however was partially mediated by peer pressure motives, as the effect of this trait on alcohol use was still significant after the inclusion of drinking motives in the model. The estimated standardised total effect of sensation seeking on the TUPW was .42, $p < .01$. Approximately 45% of the effect of sensation seeking on the TUPW was mediated by peer pressure motives (estimated standardized total effect =.19, $p < .01$), and the remaining 55% (estimated standardised total effect =.23, $p < .05$) of the effect was accounted for by the positive, direct effect of sensation seeking on the TUPW.

Mediating Role of Drinking Motives between Impulsivity and Problem Use of Alcohol

A second structural model was constructed to examine the mediating role of drinking motives in the relationship between impulsivity and problem drinking. First, the direct relationships between the five UPPS-P facets and the AUDIT were examined. Negative urgency (β =.14, $p < .01$) and sensation seeking (β =.19, $p < .01$) were the only facets that had significant direct associations with the AUDIT. These facets were specified as candidates for mediation analyses. Second, the paths specified in the first step were examined for their relationship with four drinking motives. Both negative

urgency and sensation seeking showed significant direct paths to all four motives. The paths from negative urgency to social (β =.21, $p < .01$), coping (β =.19, $p < .01$), enhancement (β =.16, $p < .01$) and peer pressure motives (β =.24, $p < .01$) were significant. Sensation seeking also had significant paths to social (β =.16, $p < .01$), coping (β =.19, $p < .01$), enhancement (β =.16, $p < .01$), and peer pressure motives (β =.19, $p < .01$) .However only coping and peer pressure motives were retained for the final step, as the paths from enhancement and social motives to problem drinking were not significant. The paths from coping (β =.34, $p < .01$) and peer pressure motives (β =.21, $p < .01$) to AUDIT were significant. In the final step, the endogenous variable (AUDIT) was reintroduced to the model, along with significant paths from personality to motives and from motives to problem drinking from the previous steps. The effects of negative urgency and sensation seeking on the AUDIT through coping and peer pressure motives were assessed. Overall model fit was acceptable across indices (CMIN = 7.410, df = 2, CMIN/df = 3.705, CFI = .99, RMSEA = .084). The final model is demonstrated in Figure 1.5.

Sensation seeking retained a significant path to the AUDIT in the final model, which indicated partial mediations by coping and peer pressure motives. The estimated standardised total effect of sensation seeking on the AUDIT was .56, $p < .01$. Approximately 34% of the effect of sensation seeking on the AUDIT was mediated by coping motives (estimated standardized total effect =.19, $p < .01$), and 32% of this effect was mediated by peer pressure motives (estimated standardised total effect = .18, $p < .01$). The remaining 34% (estimated standardised total effect =.19, $p < .05$) of the effect was accounted for by the positive, direct effect of sensation seeking on problem drinking.

High levels of negative urgency were associated with stronger endorsement of coping and peer pressure motives, which in turn was associated with higher levels of problem drinking. Coping and peer pressure motives fully mediated the relationship between negative urgency and the AUDIT. The estimated standardised total effect of negative urgency on the AUDIT was .43, $p < .01$. Approximately 44% of the effect was due to coping motives (estimated standardised total effect $= .19$, $p < .01$), and 56% was mediated by peer pressure motives (estimated standardised total effect $= .24$, $p < .01$).
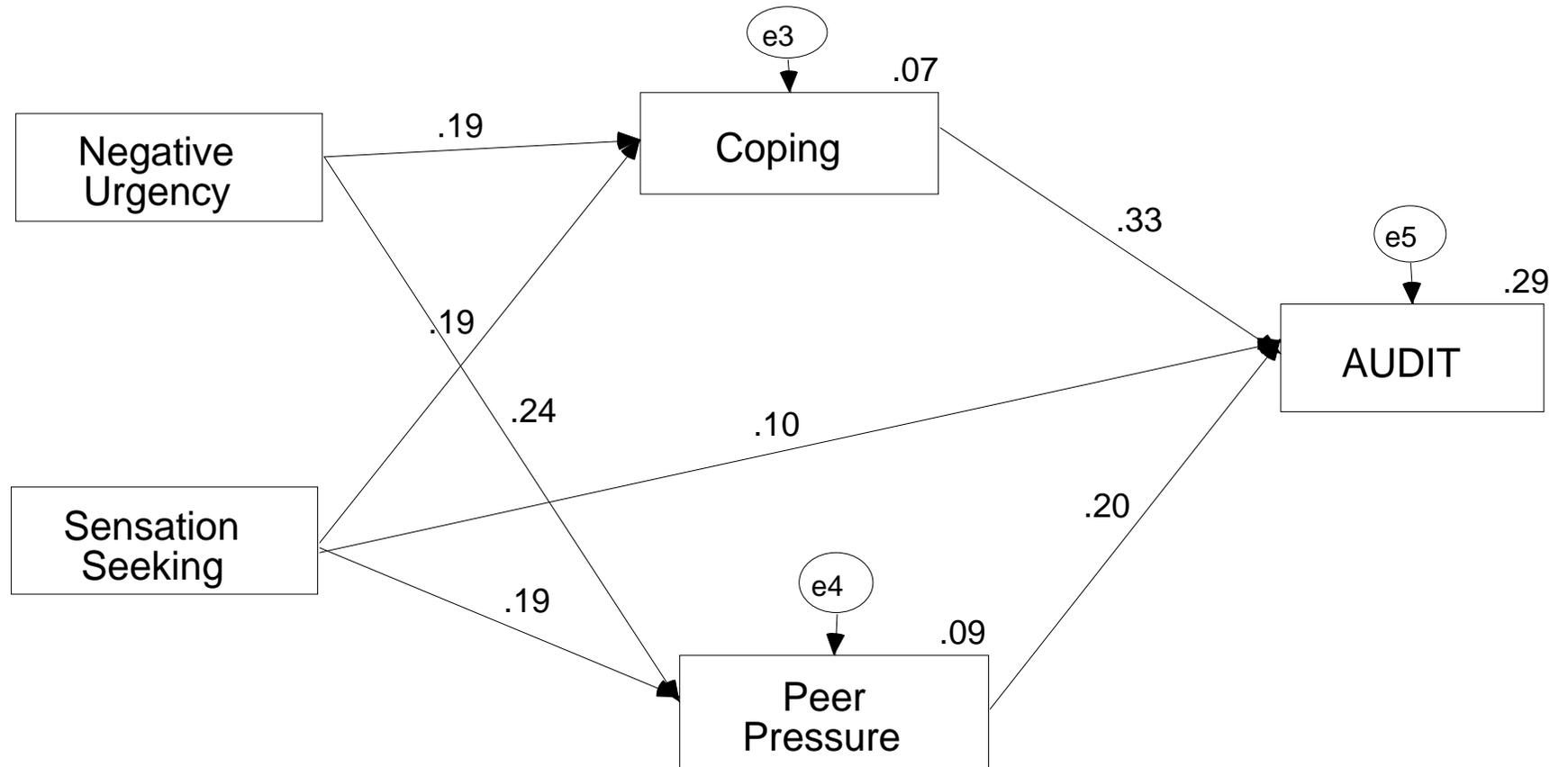
Figure 1.5. Results of the structural model. Proportion of variance accounted for by the model (R^2) in the outcome variables: peer pressure motives =.09, coping motives =.07, AUDIT=.29. Only significant standardized effects at $p < .05$ and $p < .01$ are shown.

Note. AUDIT= Problem alcohol use measure

Mediating Role of Drinking Motives between Impulsivity and Binge Use of Alcohol

In the third structural model, the associations between the five UPPS-P facets and binge drinking through four drinking motives were examined. The model was constructed in a stepwise fashion as in the previous two models. First, direct paths from personality to binge scores were identified. Similarly to the first model, lack of perseverance (β =.13, $p < .05$) and sensation seeking (β = .24, $p < .01$) positively and directly associated with binge drinking; positive urgency, lack of premeditation and negative urgency were not found to be directly related to binge scores, therefore, these three impulsivity facets were removed from the model. In the second step, paths from personality facets specified in the first step to four drinking motives, social, coping, enhancement and peer pressure, were identified. Both impulsivity facets were directly related to four drinking motives in a positive direction. Significant paths from lack of perseverance to social (β = .16, $p < .01$), coping (β = .17, $p < .01$), enhancement (β = .17, $p < .01$) and peer pressure motives (β = .22, $p <.01$) were identified. Sensation seeking also retained significant relationships to social (β =.19, $p < .01$), coping (β = .22, $p < .01$), enhancement (β = .18, $p < .01$) and peer pressure motives (β = .22, $p < .01$). In the third step, the relationship of the drinking motives identified in the second step to binge scores was assessed. Enhancement motives (β = .27, $p < .01$) and peer pressure motives (β = .33, $p < .01$) were the two drinking motives retained for the final step as these motive were significantly associated with binge drinking; the paths from coping and social motives to binge scores were not significant.

The final step of the model included significant paths from impulsivity facets to binge scores, significant paths from impulsivity facets specified in the first step to drinking motives, and significant paths from drinking motives to binge scores. The path from lack of perseverance to binge scores was no longer significant after the inclusion

of drinking motives in the model. The effect of lack of perseverance on binge drinking was fully mediated through indirect effects of enhancement and peer pressure motives in a positive direction. High levels of lack of perseverance were associated with stronger endorsement of enhancement and peer pressure motives, which in turn were related to higher levels of binge drinking. A similar pattern of results was observed for sensation seeking, however the direct path from sensation seeking to binge scores remained statistically significant in the final step, which indicated partial mediations by enhancement and peer pressure motives. The overall model fit was good across indices (CMIN = .420, *df* = 2, CMIN/*df* = .210, CFI = 1.000, RMSEA = .000). The final model is demonstrated in Figure 1.6.
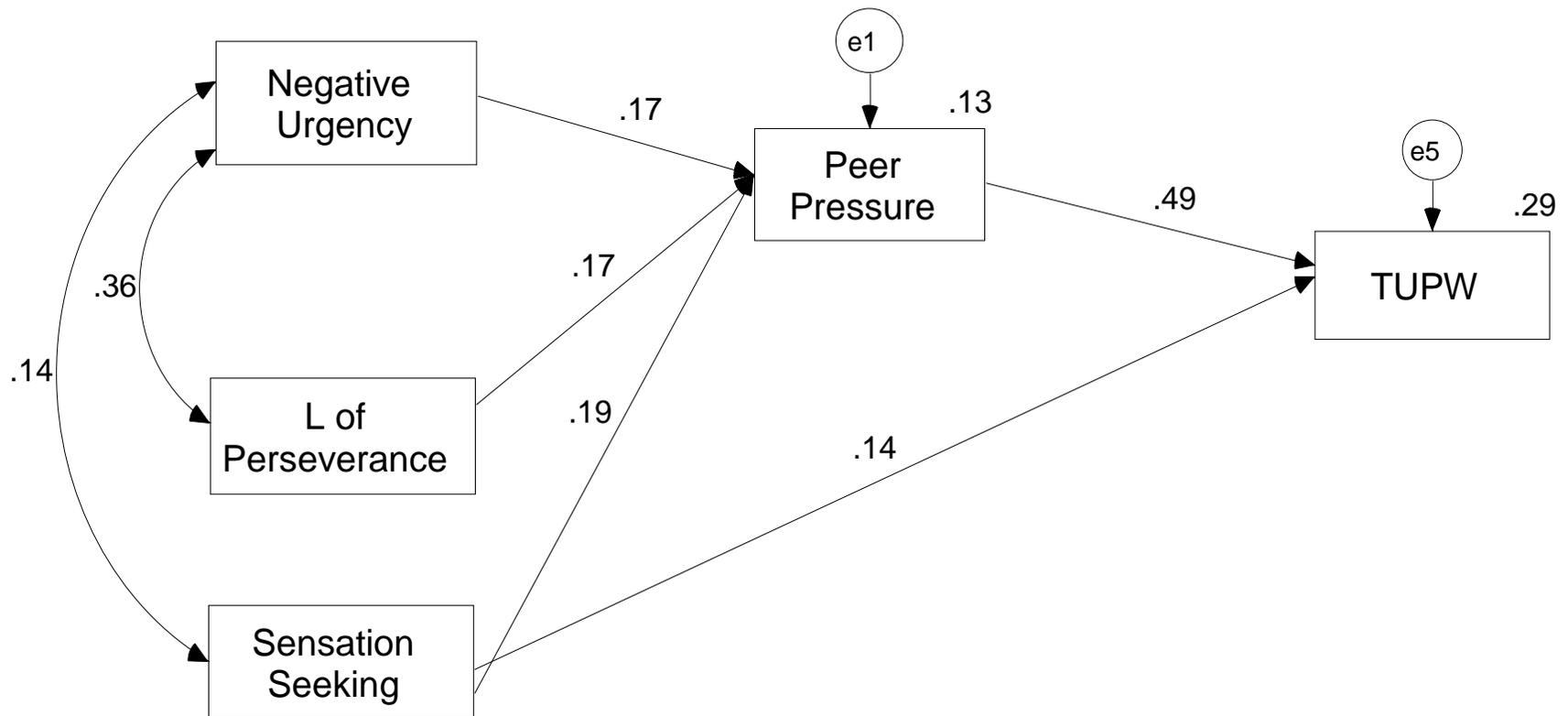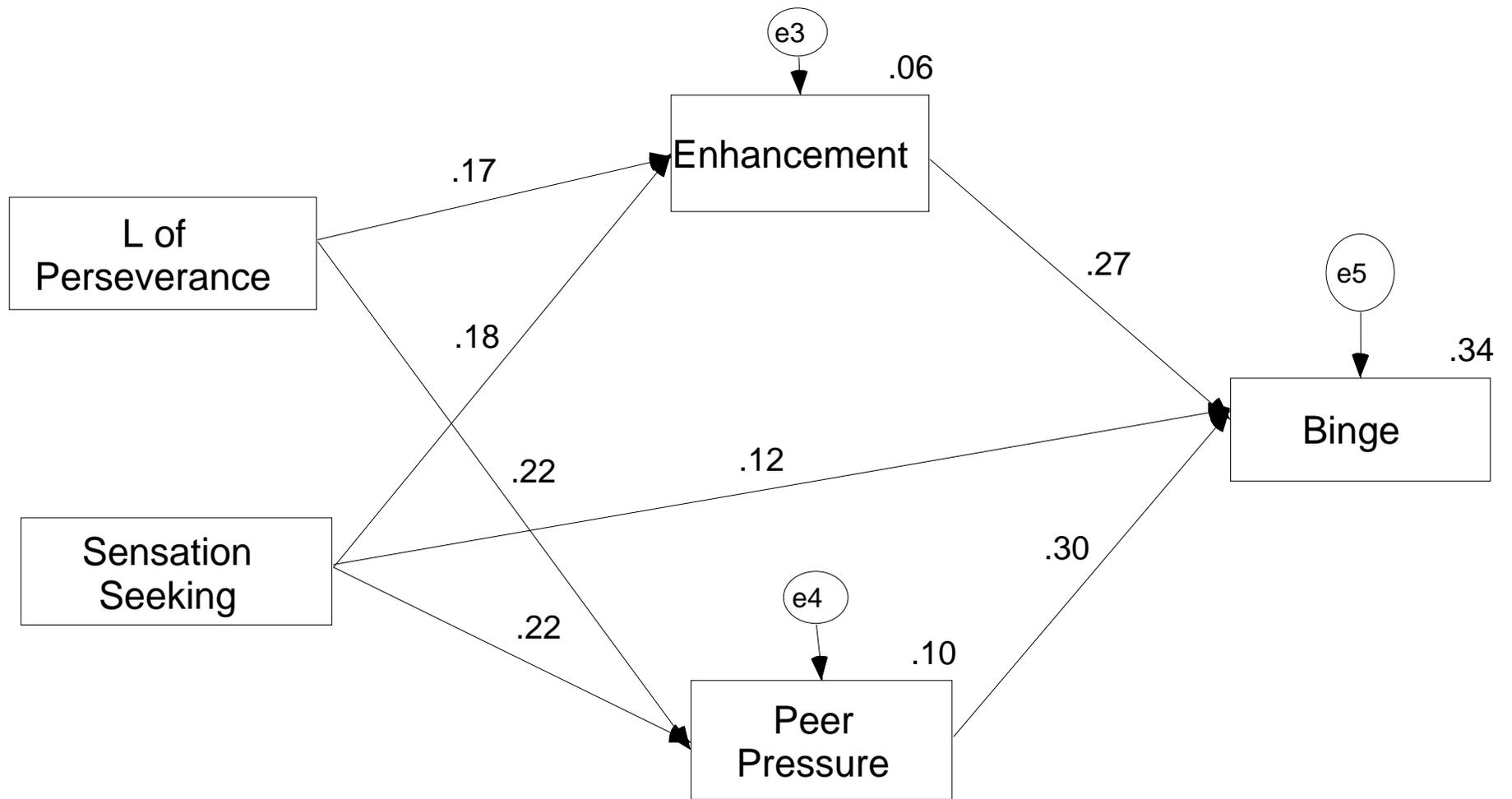
Figure 1.6. Results of the structural model. Proportion of variance accounted for by the model (R^2) in the outcome variables: enhancement motives =.06, peer pressure motives=.10, Binge =.34. Only significant standardized effects at $p < .05$ and $p < .01$ are shown.

Note. L of Persev= Lack of perseverance

The estimated standardised total effect of lack of perseverance on binge drinking through enhancement and peer pressure motives was .39, $p < .01$. The estimated standardised total effect was .22, $p < .01$ for pressure motives, and .17, $p < .01$ for enhancement motives, which indicated that approximately 56% of the direct effect of lack of perseverance on binge drinking was mediated by peer pressure motives, and 44 % of this effect was due to the indirect effect of enhancement motives.

The estimated standardised total effect of sensation seeking on binge scores was .64, $p < .01$. This effect was .22, $p < .01$ for peer pressure motives and .18, $p < .01$ for enhancement motives, which meant 34% of the effect of sensation seeking on binge scores was mediated by peer pressure motives, and 28% was mediated by enhancement motives. The remaining 37 % was accounted for by the direct, positive effect of sensation seeking on binge use of alcohol.

Discussion

The purpose of the study in this chapter was to test the hypothesis that drinking motives operate as proximal mechanisms through which trait impulsivity affects alcohol use behaviour (Coskunpinar & Cyders, 2012; Adams et al., 2012). The direct and indirect relationships between impulsivity and three patterns of alcohol use, weekly total consumption, binge drinking and problem drinking, via drinking motives, were examined. Although a growing number of studies have investigated the mediating effects of drinking motives in impulsivity and alcohol use relationship, they have predominantly focused on the mediating effects of coping and enhancement motives. In examining the relationship of impulsivity to alcohol use and problems, it is imperative to acknowledge the critical background factors that have been consistently demonstrated to contribute to alcohol use and related problems. For example, first year college students, males and students who live on campus have been shown to present higher

risk for alcohol use and problems (Kuntsche et al., 2005; Cashell-Smith, Connor, & Kypri, 2007; Curcio & George, 2011). This indicates the possible effects of peer pressure and social motives in addition to coping and enhancement motives. Although most studies have been conducted using first year college students samples, the role of impulsivity in alcohol use/problems through social and peer pressure motives is not well understood. The literature also lacks studies examining the role of these motives among UK university students. These motives are particularly important for the initiation and development of alcohol use among first year university students, thus it is critical to identify the impulsivity facets that are associated with each drinking motive, and the way these motives affect different patterns of alcohol consumption in this group.

Different reasons for alcohol use also appear to influence the way alcohol is consumed; hence, understanding the reasons for the initiation and subsequent drinking behaviour may prevent alcohol use from reaching dependence among students in their second and third year of university, and it can also guide intervention strategies. The present study extends previous studies by Magid et al. (2007), Adams et al. (2012) and Curcio and Angela (2011) where mediating effects of only coping and enhancement motives were examined in the relationship between facets of impulsivity and alcohol use or problems. The present study tested the meditational role of all four drinking motives in the relationship between the five UPPS-P facets and different patterns of alcohol use in a first year university student sample.

The results of the structural equation modelling indicated significant direct associations between negative urgency, lack of perseverance and sensation seeking facets of the UPPS-P and TUPW. Positive urgency and lack of premeditation facets were not directly associated with TUPW. This result is consistent with some of the recent literature where positive urgency was not found to have a direct relationship with

alcohol use (Simons et al., 2010; Curcio & George, 2011, Adams et al., 2012), and one or both of the self-control facets, lack of premeditation and lack of perseverance, were shown to directly relate to alcohol use or problems (Adams et al., 2012; Simons et al., 2010). The hypothesis for the first model was partially supported; peer pressure motives fully mediated the relationship between negative urgency and lack of perseverance, and TUPW, while the effect of sensation seeking on the TUPW was partially mediated by these motives. This result indicates a strong endorsement of peer pressure motives for those with high levels of negative urgency, lack of perseverance and sensation seeking facets, which in turn is associated with increased general consumption. These results support the hypothesis 2 and the argument that peer pressure motives are important in the initiation and development of alcohol use in the first year of college.

The results are also partially in line with Cyders et al. (2009), where sensation seeking was shown to be associated with frequency, and positive urgency with quantity, of alcohol consumption. It may be that individuals with high levels of sensation seeking, negative urgency and lack of perseverance participate in drinking behaviour more frequently with peer pressure motives, but do not consume alcohol at a problematic level. Social and enhancement motives were not significant mediators of the relationship between impulsivity and TUPW. Social motives were not found to mediate between impulsivity and any of the drinking patterns in this study. Perhaps these motives exhibit stronger associations with alcohol use among anxious individuals who experience difficulty being part of a group.

As predicted in hypothesis 2, coping motives did not mediate the relationship between impulsivity facets and the TUPW. Negative urgency appears to be a stronger predictor of problem drinking, but not general use through coping motives. An increasing number of studies support a meditational role of coping motives in the

relationship between negative urgency and alcohol related problems (Adams et al., 2012; Coskunpinar & Cyders, 2012), and the mediating role of enhancement motives between sensation seeking and alcohol use, but not related problems. Sensation seeking was related to alcohol use to a greater extent as compared to urgency in this study; this result is in line with some of the previous findings (Yanovitzky et al., 2006; Curcio & George, 2011). The results did not support the prediction in hypothesis 1 that enhancement motives will mediate the relationship between facets of the UPPS-P and TUPW in the first model. There are, however, inconsistencies among studies in terms of the mediational role of coping and enhancement motives in the relationship between particularly sensation seeking and negative urgency facets and alcohol use and related problems. While some studies demonstrated mediating effects of enhancement motives in the relationship between sensation seeking and alcohol use, but not related problems (Magid et al., 2007, Curcio & George, 2011), some others reported indirect effect of sensation seeking on problem use of alcohol through these motives (Adams et al., 2012). In contrast with the study by Adams et al., drinking motives did not mediate the relationship between lack of premeditation and alcohol use in this study. However, as predicted in hypoyhesis 1, drinking motives (peer pressure) mediated the relationship between lack of perseverance and weekly total alcohol use.

In the second structural model, direct associations between negative urgency, sensation seeking and the AUDIT were observed. The other facets of the UPPS-P were not directly related to the AUDIT. All four drinking motives were also significantly associated with the impulsivity facets, however only coping and peer pressure motives were directly related to the AUDIT. In contrast to the first model, as predicted in the second hypothesis, the effect of negative urgency on the AUDIT was fully mediated by coping motives; full mediations by peer pressure motives in the negative urgency and

problem drinking relationship were also reported. This result suggests that high levels of negative urgency are associated with stronger endorsement for coping and peer pressure motives, which are associated with high levels of problem use of alcohol.

Negative urgency has been widely researched in association with negative affect and coping motives. Individuals with high levels of negative urgency were shown to consume alcohol to relieve negative affect and cope with situations that cause negative emotions (Kuntsche et al., 2007). The results of this model are partially in line with Curcio and George (2011), where negative urgency was demonstrated to predict alcohol related problems, but not use, however coping motives failed to mediate negative urgency and problem use relationship in that study. Coping motives were shown to fully mediate the relationship between negative urgency and problem drinking in other studies (Adams et al., 2012; Coskunpinar & Cyders, 2012).

The effects of sensation seeking on the AUDIT was partially mediated by coping and peer pressure motives, which indicated that higher levels of sensation seeking were associated with stronger endorsement of coping and peer pressure motives, which in turn were associated with higher levels of problem drinking behaviour. The results of the second model are partially consistent with hypothesis 2 and with some of the previous studies (Curcio & George, 2011; Coskunpinar & Cyders, 2012). Adams et al. have demonstrated full meditational effects of coping and enhancement motives in the relationship between negative urgency and problem drinking, and partial mediations by enhancement motives in the relationship between sensation seeking and problem use of alcohol. The second model extends this finding by demonstrating mediating effects of peer pressure motives in the relationship between negative urgency, sensation seeking facets and problem use of alcohol. Siviroj, Peltzer, Pengpid, Yungyen, and Chaichana (2012) have also shown significant associations

between sensation seeking and drinking frequency, as well as hazardous and harmful drinking behaviour among college students. Boredom susceptibility was shown to be the strongest predictor of hazardous drinking. The study also indicated the importance of peer pressure, coping motives and trait sensation seeking in problem drinking among college students. The results of the second model are in line with these findings.

The relationship between positive urgency and the AUDIT was not mediated by any of the drinking motives. This finding is in line with some of the previous studies. Although Coskunpinar and Cyders (2012) have shown that enhancement motives mediated the relationship between positive urgency and alcohol use, this finding was not confirmed by Adams et al. (2012), where indirect effects of coping and enhancement motives did not significantly mediate the relationship between positive urgency and problem use of alcohol. Curcio and George (2011) examined coping and enhancement motives in the relationship between negative urgency, positive urgency and sensation seeking facets, and alcohol use and related problems. The study did not find significant mediating effects of coping or enhancement motives in the positive urgency and alcohol use or related problems relationships. Enhancement motives also did not mediate the relationship between negative urgency, sensation seeking and the AUDIT in this study but they significantly mediated binge use of alcohol in the third model. This result indicates that personality factors and drinking motives together determine the patterns of drinking behaviour.

Model 3 hypothesised that the effects of negative urgency, positive urgency, sensation seeking and lack of perseverance on binge use of alcohol would be mediated by coping and enhancement motives. The final structural model examining the direct relationships between impulsivity facets and binge scores revealed significant positive associations between sensation seeking, lack of perseverance and binge use of alcohol.

Positive urgency showed a direct negative relationship to binge drinking at a marginally significant level. This result is in parallel with a previous finding where positive urgency was negatively associated with intoxication (Simons et al., 2010). However it contradicts the finding by Cyders et al. (2009), where positive urgency was shown to predict episodic drinking while sensation seeking predicted the frequency of consumption.

The hypothesis 2 was partially supported in Model 3. The effect of lack of perseverance on binge use of alcohol was fully mediated by the enhancement and peer pressure motives in a positive direction. Peer pressure motives appeared to have a slightly stronger effect in this relationship. A similar pattern of results was found for the effects of sensation seeking on binge drinking, except that the relationship between sensation seeking and binge drinking was partially mediated by these motives. This result indicates that high levels of sensation seeking and lack of perseverance are associated with stronger endorsement of enhancement and peer pressure motives which in turn are associated with higher levels of binge drinking.

Finally, the relationship between negative urgency and binge drinking was not significantly mediated by any of the drinking motives. Negative urgency has been shown to be a stronger predictor of problem drinking, and coping motives in particular present proximal associations with problem use of alcohol (Adams et al., 2012; Coskunpinar & Cyders, 2012). Peer pressure motives have consistently emerged as strong mediators between facets of impulsivity and all three patterns of drinking. The study suggests that these motives continue to pose a risk in early adulthood, and particularly among university students with high levels of sensation seeking, negative urgency and lack of perseverance.

Overall, the findings of the study in this chapter indicate that the relationships between facets of the UPPS-P and different patterns of alcohol use are differentially mediated through drinking motives. Peer pressure appears to be a strong risk factor for the initiation and development of alcohol use, while drinking to enhance positive mood is a stronger predictor of excessive use and progression, and drinking to cope with negative emotions seems closely related to problem use and dependence. The findings of the study in this chapter suggest that sensation seeking is a strong and consistent risk factor for all three patterns of alcohol use, while lack of perseverance is most influential in the initiation and progression of alcohol use, and negative urgency is most influential for the problem use of alcohol. Perhaps positive urgency is a stronger risk factor for problem use among clinically diagnosed alcohol dependent individuals and among those with mood disorders. Further studies are needed to clarify the role of positive urgency in problem use and dependence, and the mediating role of motives in this relationship.

The present findings also suggest that interventions that seek to limit frequency of alcohol use and problem drinking, in particular for individuals with high negative urgency and sensation seeking, should take into account the effects of peer influence in the first year of university when tailoring prevention or intervention strategies. Future research should aim to assess experimentally the effects of peer influence on level of alcohol consumption, specifically among individuals who exhibit high level urgency and sensation seeking. The result that drinking motives only partially mediated the relationship between sensation seeking and alcohol use indicate the involvement of other mechanisms between sensation seeking and alcohol use/problems that leads to excessive and problem drinking behaviour among college students. It may also indicate stronger direct associations between sensation seeking and alcohol use/problems, which

implies high risk for the initiation and development of alcohol problems for sensation seekers.

Finally, a growing body of research investigating the associations between distinct facets of impulsivity and drinking motives indicates the involvement of outcome expectancies among individuals who consume excessive amounts of alcohol with different motives. Urban et al. (2008) investigated the meditational role of positive/negative outcome expectancies and drinking motives in the relationship between sensation seeking and alcohol use. It was found that as well as drinking motives, positive alcohol expectancies significantly mediated the sensation seeking to alcohol use relationship. Coskunpinar and Cyders (2012) examined the mechanism by which urgency, drinking motives and risk/benefit perception concurrently influence problem drinking among young adults. The study found that benefit perception moderated the relationship between coping motives and alcohol use, as well as the relationship between enhancement motives and alcohol use. Coping motives were reported to significantly mediate between negative urgency and alcohol use while enhancement motives were shown to significantly mediate between positive urgency and alcohol use in the same study.

These studies together suggest that modifying expectations and perceptions about the benefits of alcohol could be a viable prevention or intervention strategy among young population, especially among university students, who exhibit high sensation seeking and urgent behaviours. Future research may benefit from a close examination of the involvement of socio-economic and demographic factors in impulsivity, drinking motives and alcohol use relationship. Although previous research has shown that peer pressure is implicated in adolescent substance abuse, the mediating effects of these motives in the impulsivity and alcohol use relationship may be extended

to early adulthood. Identifying motivations for alcohol use among different age and clinical groups could also be beneficial for tailoring effective prevention strategies.

The findings of the study in this chapter should be considered in the context of some limitations. First, the sample was predominantly female and white Caucasian. It was limited to first year university students, so the findings cannot necessarily be generalised to other groups. Although university populations are important to study, it is not known whether the findings of this study will be present for individuals of other ages or who face different life transitions. Perhaps longitudinal assessment of these motives will aid better understanding of their meditational role.

Secondly, the study relied on the self-report assessment of alcohol use, drinking motives and impulsivity. Although measures of the traits have been shown to be consistent across method of assessment (Cyders & Smith, 2007), a clearer mediational effect may have been observed if direct observation of risky behaviour engagement was employed. Future studies should aim to explore the motives for drinking under the influence of intense positive or negative emotions, or in real social environments, to find out if individuals exhibit risky, impulsive responses to these emotions or situations. Future research should also examine the effectiveness of treatment approaches tailored for specific impulsivity facets and drinking motives. The results indicate distinct negative and positive reinforcement pathways, suggesting that targeted approaches may work best for people with specific impulsivity facets and drinking motives. The approaches would ideally target specific motives for engaging in alcohol use, and would aim to provide alternative means of achieving the same goal.

What this chapter adds to the literature

The present study extends previous studies by Magid et al. (2007), Adams et al. (2012) and Curcio and Angela (2011) where mediating effects of only coping and enhancement motives were examined in the relationship between facets of impulsivity and alcohol use or problems. The study in this chapter tested the meditational role of all four drinking motives in the relationship between the five UPPS-P facets and three different patterns of alcohol use. The assessment of the relationship between these facets and different patterns of alcohol use in one study is particularly helpful for understanding how drinking motives mediate between each impulsivity facet and different pattern of alcohol use. It also allows comparison between different models testing mediating effects of drinking motives in the relationship between impulsivity facets and weekly alcohol consumption, binge drinking and problem alcohol use. There are no previous studies to our knowledge that have examined these relationships in a single study. Previous studies testing the relationships between impulsivity facets, alcohol use and drinking motives have predominantly been conducted among college students. This study also contributes to the literature by assessing these relationships in a UK university student sample.

Finally, the second model in Study 2 extends the findings by Adams et al. (2012) by demonstrating mediating effects of peer pressure motives in the relationship between negative urgency, sensation seeking facets and problem use of alcohol. Although previous research has demonstrated that peer pressure is implicated in adolescent substance abuse, the study in this chapter shows that the strong mediating effects of these motives in the impulsivity and alcohol use relationship may be extended to early adulthood.

CHAPTER 4

Moderating Role of Urgency in the Relationship between Alcohol Use and Executive Functions

Impulsivity as a personality trait has been linked to alcohol use related risk factors such as a tendency to binge drink, increased risk of relapse and early onset drinking behaviour (Soloff, Lynch & Moss, 2000; Tedstone & Coyle, 2004; Dom et al., 2006). Although the relationship between impulsivity and alcohol use is well documented, the behavioural mechanism by which this personality trait might promote alcohol use is not well understood. As a multi-faceted personality construct impulsivity encompasses several behavioural aspects such as inhibition, delay gratification, risk taking and attentional impairments (Marinkovic, Rickenbacher, Azma, & Artsy, 2012; Cyders et al., 2010; Nederkoorn, Baltus, Guerrieri, & Wiers, 2009).

Although impulsivity research has predominantly relied on self-report indices of the trait in the past, there has been an increase in the number of studies employing both self-report and behavioural measures in recent years, in an effort to better understand different aspects of the construct and their relationship with addictive behaviours. There are different interpretations from the studies attempting to demonstrate the associations between self-report and behavioural measures of the construct. Some studies have argued that self-report measures of the trait and the behaviours measured by laboratory tasks are not isomorphic. Trait measures refer to stable characteristic individual differences in perceiving and responding to the world and they are reflective of affective and cognitive processes, whilst laboratory tasks refer to relatively specific cognitive and behavioural processes (Dick et al., 2010). Hence, it

may not be surprising that the two types of processes do not strongly relate to each other. In parallel with this reasoning, a study assessing self-report and behavioural aspects of impulsivity did not find a strong association between these measures (Reynolds et al., 2006).

The other explanation is that it is only recently since impulsivity has been disaggregated into five separate facets (UPPS-P, Cyders et al., 2007). The efforts to unravel likely associations between the five facets and laboratory task performance are still ongoing (Cyders & Coskunpinar, 2011; Gay, Rochat, Billieux, d'Acremont, & Van der Linden, 2008). There will perhaps be critical new developments linking trait measures to laboratory tasks with an increasing number of studies. One of the attempts to relate personality traits to cognitive tasks was by Bechara and Van der Linden (2005). It was suggested that urgency associated with prepotent response inhibition -or as defined by Dougherty, Mathias, Marsh, and Jagar (2005), difficulty to inhibit a response that is already on its way to execution- while lack of perseverance may be linked with proactive interference. Consistent with the hypothesis, urgency was specifically related to errors in prepotent response inhibition, and lack of perseverance to errors due to difficulties overcoming proactive interference (Gay et al., 2008; Bechara & Van der Linden, 2005). Recently Cyders and Coskunpinar have also shown associations between lack of perseverance and interference effects. In line with these findings, McCarthy, Kroll, and Smith (2001) demonstrated that errors in a go no /go task were related to neurotic extraversion. More direct empirical evidence has been provided to support this argument. It was found that negative urgency did indeed associate with go no/go task errors, and lack of perseverance did correlate with difficulties in overcoming proactive interference, and also with intrusion of task unrelated thoughts (Gay et al., 2008).

The study in this chapter examines the effect of alcohol use on two distinct behavioural components of impulsivity, and the degree to which this relationship is moderated by the urgency facets in a university student sample. These two behavioural components represent difficulty suppressing a prepotent response and poor attentional control. The present study aims to test the possibility that the associations between alcohol use and prepotent response inhibition and distracter interference may be more pronounced in individuals who report high level urgent behaviours. Among the two components, difficulty in inhibiting a response is probably the most studied aspect of behavioural impulsivity. Response inhibition is a critical function that sets the occasion for many other activities that require self-control and behavioural regulation, including excessive alcohol use (Weafer, Milich, & Fillmore, 2011). Behavioural measures of response inhibition, such as stop-signal and go no/go tasks, have been developed to assess the ability to inhibit a prepotent response in a laboratory setting (Logan, 1994; Miller, Schaffer, & Hackley, 1991), and this initiated the studies examining the associations between inhibitory control and drinking behaviour. For example, Rubio et al. (2008) reported greater impairment in prepotent response inhibition measured by the Stop-signal task among heavy drinkers as compared to a healthy control group, and the impairment on this task predicted their level of alcohol use at four year follow up. Nederkoorn et al. (2009), using the Stop-signal task, found that response inhibition was deficient in only heavy drinking females, but not male participants.

Impulsivity is also characterised by poor attentional control, which refers to the inability to successfully ignore irrelevant stimuli. Attentional control is an important component of executive functioning that is associated with goal directed behaviour and requires dealing with conflicting responses. It is often measured with choice reaction time tasks where participants are required to designate a response to relevant stimuli.

For instance, one stimulus may require a speeded button response with the left hand, while an alternative stimulus requires a speeded button press response with the right hand. The task requires efficiently processing information in order to make the correct choice between conflicting stimuli in a limited time that is allocated to complete a response. As noted earlier, the ability to inhibit a response refers to the ability to contain an inappropriate, premature or incorrect response. Thus, controlling a response is a key instrument of attentional execution. Studies have proposed control models for different inhibitory mechanisms to facilitate selective attention through diverting cognitive resources towards relevant stimuli and away from irrelevant stimuli (Houghton & Tipper, 1994). It is critical to clarify the distinct functions of inhibitory and interference control prior to examining the relationship of these functions to trait impulsivity and alcohol use.

Miyake et al. (2000) defined inhibitory and interference control as the ability to suppress prepotent responses and interference, respectively, when engaged in goal directed behaviours. In his taxonomy, Nigg also defined interference control as 'suppressing a stimulus that pulls for a competing response so as to carry out a primary response, to suppressing distractors that might slow the primary response or to suppressing internal stimuli that may interfere with the current operations of working memory' (Nigg, 2000, p.222). A number of theories have proposed that inhibitory and interference control are not distinct but are a single unitary construct, both parts of a family of functions (Nigg, 2000; Harnishfeger, 1995). However, the literature lacks empirical evidence supporting or rejecting these theories. Friedman and Miyake (2004) also called inhibitory and interference control 'inhibition related functions' and examined the associations among these functions. Although they have been reported to be functions of the same construct, if this is true (i.e. they do measure the same

construct) then it is difficult to explain mixed results illustrating non-significant correlations between these measures. One of the explanations is that some of the complex executive functioning tasks which are thought to be measures of inhibitory control tend to show poor reliability (Rabbitt, 1997). Practice effects or level of task demand, in other words the inhibitory requirements of the task, may be the reason for the measurement error or poor reliability (J. Cohen & Cohen, 1983).

Another possible explanation is that there is no pure measure of response inhibition. The tasks designed to gauge inhibitory control often measure other dimensions too. For example, an inhibition task is either a measure of a response, distractor or a thought inhibition; since these measures of inhibition are not putative indices of inhibitory control, poor performance on a task may not be necessarily due to impaired inhibitory control per se (Friedman & Miyake, 2004). Friedman and Miyake performed latent variable analysis (Confirmatory factor analysis (CFA) and SEM), in an effort to distinguish functions of the tasks which involve inhibitory control, and to explore the associations between different forms of inhibition and interference control. The first goal of their study was to provide an initial attempt to examine the distinctions among three inhibition-related functions, using CFA. The three functions were resistance to distrator interference, resistance to proactive interference and prepotent response inhibition. The second goal of their study was to explore the way these inhibition functions contribute to other cognitive tasks and measures that have been linked, sometimes controversially, to inhibition-related functions. Using SEM, they explicitly tested existing hypotheses about the types of inhibition related functions implicated for each measure they examined. These measures included one aspect of Randon Number Generation (RNG) performance (related to suppression of stereotyped sequences), negative priming, task switching ability, recall performance on the reading

span (Daneman & Carpenter, 1980), tests and occurrences of everyday cognitive failures (Broadbent, Cooper, FitzGerald, & Parkes, 1982), and of unwanted intrusive thoughts (Wener & Zanakos, 1994).

The three target inhibition-related functions were expected to be differentially related to these additional measures hypothesized to involve inhibition or interference control, to the extent they are separable. CFA suggested that prepotent response inhibition and resistance to distractor interference were closely related, but both were unrelated to resistance to proactive interference. SEM, which combined prepotent response inhibition and resistance to distracter interference into a single latent variable indicated that one aspect of RNG performance, task switching ability and everyday cognitive failures were related to Response-Distractor Inhibition, whereas reading span recall and unwanted intrusive thoughts were related to Resistance to Proactive Interference. This study emphasises the importance of specificity when discussing and measuring inhibition-related functions.

The inhibition-related tasks, prepotent response inhibition and resistance to distractor interference, were shown to have reasonable reliability, mostly above .70 in that study. However resistance to proactive interference tasks (Brown-Peterson, and cued recall) had unacceptably low reliability estimates, .12 and .08 respectively. The findings of that study were taken into consideration during task choice for the study in this chapter. Table 4.1 provides examples of task measures for each form of inhibition and highlights the tasks that will be employed in this chapter.

Table 4.1
*Three inhibition-related functions according to Friedman and Miyake
(2004), with the tasks used in this study highlighted in bold*

Behavioural Dimension	Task	Study
Prepotent Response Inhibition	Antisaccade task **Stop Signal Task** Stroop Task	Hallet (1978) Logan and Cowan (1984) Stroop (1935)
Resistance to Distractor Interference	**Eriksen flanker task** Word naming Shape matching	Eriksen and Eriksen, 1974 Kane, Hasher, Stoltzfus, Zacks, and Connelly (1994) DeSchepper and Treisman (1996)
Resistance to Proactive Interference	Brown-Peterson variant AB-AC-AD Cued recall	Kane and Engle, (2000) Rosen and Engle, (1998) Tolan and Tehan, (1999)

This classification is in accordance with Nigg's taxonomy of the inhibitory system. The taxonomy was a theoretical attempt to describe different inhibitory functions. Two different inhibitory processes were described in this theory: a) Effortful inhibition of motor or cognitive response and, b) Automatic inhibition of attention. Nigg placed prepotent response inhibition and distractor interference tasks under the effortful inhibition of a motor or cognitive response. The study in this chapter focuses on two potentially separable executive control functions, inhibitory control and interference control processes, from a personality perspective. The aim in this chapter is to explore the mechanism by which these functions are related to alcohol use and impulsivity in a university student sample. The next section provides an overview of the literature employing inhibitory/interference control measures in impulsivity and alcohol use studies.

Interference and Inhibitory Control in Impulsivity and Alcohol Use

Impairments in response inhibition have been reported in heavy drinking females (equal number of males and females were used, *N*=64) using a modified version of the Stop-signal task (Nederkoorn et al., 2009), and in abstinent alcohol dependents using the Stroop task (Tedstone & Coyle, 2004). Houben and Wiers (2009) also used the Stroop task to demonstrate the moderating effect of response inhibition in the relationship between implicit associations and drinking behaviour. However, there are no studies examining the relationship between prepotent response inhibition and social alcohol consumption using the Stop-signal task with no modification. Tedstone and Coyle reported no difference in interference control between abstinent alcohol dependents and a control group using the Eriksen flanker task, however there are no studies that have examined distractor interference effect among social drinkers using this task. This information is particularly critical, as impairment in inhibitory and/ or interference processes may be a determinant of impulsive behaviour, and thus increase alcohol use as indicated in dual process theory (Strack & Deutsch, 2004; Bechara & Van der Linden, 2005). According to the dual process theory, addictive behaviours are determined by the dynamic interplay of two different systems: impulsive and reflective systems. The impulsive system is fast, implicit and associative, whilst the reflective system is slow, rule based and explicit and includes control processes that are linked to conscious decisions, affect regulation and expected outcomes (Wiers et al., 2007). These two systems trigger simultaneous, conflicting signals. While the reflective system determines behaviour through conscious deliberation, the impulsive system activates behaviours automatically through the process of spreading activation in an associative network (Strack & Deutsch, 2004). However, the ultimate behavioural decisions are

determined by the relative strength of impulsive and reflective processes (Bechara & Van der Linden, 2005).

Our behaviour is to a large extent influenced by impulsive processes but these impulsive decisions can be regulated through control processes, however this requires cognitive resources and motivation that may not always be available (Wiers et al., 2007). According to the dual process model of addiction, the impulsive system becomes sensitized as a result of excessive and frequent use of alcohol, which in turn leads to an increase in appetitive motivation to consume more alcohol. Heavy alcohol consumption may diminish the control processes; this may leave individuals with only the impulsive system leading to loss of behavioural control and resulting in more alcohol use in a vicious circle. The ability of controlled processes to moderate impulsive processes is a central element of executive functioning, which can be referred to as cognitive control mechanisms that are relevant to goal directed behaviour (Houben & Wiers, 2009). As noted earlier, response inhibition and interference control have been identified among the essential executive functions and they play a central role in numerous research domains in psychology (Friedman& Miyake, 2004; Miyake et al., 2000). Thus, according to dual process theory, individual differences in executive functioning abilities are important determinants of the impulsivity and alcohol use relationship. Higher executive control would mean a weaker relationship between impulsivity and alcohol use relationship. Consequently, individual differences in executive functioning may pose a risk for alcohol abuse and dependence.

The current study tests the dual process theory by examining whether regular and excessive alcohol consumption leads to compromised cognitive control abilities, as proposed by Wiers et al. (2007), and aims to extend the theory by examining the degree to which the level of potential impairment is determined by different facets of trait

impulsivity, with a focus on the urgency facets. This will be assessed in a series of moderated regression analyses testing the potential moderating role of impulsivity facets in the relationship between alcohol use and behavioural response inhibition and interference. The study will specifically focus on the effects of urgency facets in these relationships as both urgency facets have been shown to associate with problem alcohol use and other risky behaviours. It is expected that lack of perseverance may also significantly moderate the effects of alcohol use on distracter interference and prepotent response inhibition. This prediction is based on previous studies showing a significant relationship between lack of perseverance and proactive interference and prepotent response inhibition (Cyders & Coskunpinar, 2011; Dick et al., 2010; Gay et al., 2008; Bechara & Van der Linden, 2005). The following section states the hypotheses of the study in this chapter.

Hypotheses

1. It is predicted that facets of the UPPS-P will positively and significantly correlate with alcohol use variables, with urgency facets showing high correlations with problem use of alcohol.

2. It is hypothesised that urgency facets will moderate the effect of previous alcohol consumption on prepotent response inhibition and distractor interference. More specifically, the possible detrimental effects of long-term alcohol use (in the last 6 months or longer) on the focus of attention and prepotent response inhibition will be greater for individuals with high levels of positive urgency and negative urgency.

3. It is expected that lack of perseverance will significantly and positively moderate the effects of alcohol use on distracter interference and prepotent response inhibition

Method

Participants

Sixty two participants were recruited from among Goldsmiths, University of London students. The sample consisted of 33 females and 29 males. The mean age for females was $M = 25.18$, $SD = 4.84$ and for males was $M = 25.31$, $SD = 4.25$. The study was advertised by an e-mail circulated in the psychology department. Participants who were interested in the study responded by e-mail. A quick assessment was completed over the phone or by e-mail to find out if participants met the criteria of consuming at least one unit of alcohol per week. Participants were asked to refrain from alcohol at least 12 hours prior to participating in the study.

Measures

Impulsivity and alcohol use measures

UPPS-P impulsive behaviour scale. The UPPS-P impulsivity scale was also used in Study 1 and Study 2 and described in the method section of Chapter 2. Cronbach's Alpha in the present study was .87 for negative urgency, .85 for lack of premeditation, .82 for lack of perseverance, .84 for sensation seeking and .95 for positive urgency facets.

Alcohol use questionnaire. The AUQ was used in this study to identify the quantity and frequency of alcohol consumption on a weekly basis in the last 6 months. The scale is described in the method section of Chapter 2. Cronbach's Alpha for the AUQ was .63 in the present study. This value was .67 for weekly total unit consumption, and .45 for binge drinking.

Alcohol use disorder identification test. The AUDIT was used as a measure of problem drinking in this chapter. The scale is described in the method section of Chapter 2. Cronbach's Alpha for the AUDIT was .88 in this study.

Task measures

Stop-signal task. Participants performed a stop-signal task as a measure of response inhibition (Logan, 1994; Lawrence et al, 2009). The stop signal task used in this study was a Windows executable software program called STOP-IT, as well as an additional analysis program called ANALYZE-IT. Both programs are precompiled executable and for basic use; there is no need for additional programming (Verbruggen, Logan, & Stevens, 2008). In this task, subjects are instructed to respond as fast as possible to a stimulus unless a stop-signal is presented after a variable delay.

The experiment started by entering a subject number, instructions appeared once the number was entered. The task consisted of a practice block and 3 trial blocks. Participants completed 32 trials in the practice block followed by 64 trials on each experimental block. Each trial started with a presentation of a fixation cross that was followed by the task stimulus after 250ms. Participants were instructed to press a key on the lower left of the keyboard (Z) when they saw a square and to press a key on the lower right of the keyboard (/)when they saw a circle. They were asked not to respond if the stimulus was followed by a sound, and reminded that speed and accuracy were important in this task. The stimulus remained on the screen until participants responded or for a maximum reaction time (1250 msec). The inter-stimulus interval was 2000ms. The stop-signal (750 Hz, 75 msec) was presented shortly after the stimulus onset in the primary task. The stop signal duration (SSD) was initially set at 250 msec and was adjusted continuously. When the participants succeeded in inhibiting their response, the SSD increased by 50 msec. Subject had to wait 10 sec between each block before they

could proceed with the next block of trials. During that time a summary of their performance briefly appeared on the screen.

The output file was written for each participant once the experiment was completed. The data file of each participant consisted of a block number, trial number, stimulus number (1 = square; 2 = circle), trial type (0 = no-signal trial; 1 = stop-signal trial), whether the response was correct (0 =incorrect no-signal trial or signal-respond trial; 2 = correct no- signal trial or signal-inhibit trial), reaction times (RT), measuring error in milliseconds and the SSD. The data was analysed using software called 'ANALYZE-IT' which is a part of the Stop-signal task package. The software asked for number of participants (N); once this was entered mean p (respond/signal), mean SSD, SSRT, mean signal RT, no-signal RT, percentage of correct responses on no-signal trials and percentage of missed responses on no-signal trials were calculated. The analysis calculated SSRT by subtracting SSD from no-signal mean RTs; however this calculation was done after removal of incorrect responses. The software calculated the z score and corresponding p value to determine whether each subject inhibited responses significantly more or less than 50%.

The SSRT index was used as the primary dependent variable in this study as it has been shown to successfully measure prepotent response inhibition in previous studies employing the Stop-signal task (e.g. Nederkoorn et al., 2009; Li et al., 2009; Lawrence et al., 2009). Higher SSRTs on this task reflected poorer performance on this task.

Eriksen flanker task. The distractor interference task used in the present study was designed on E-prime and adapted from a previous study by Friedman and Miyake (2004). Participants were required to respond by pressing a relevant computer key to identify the target letter as fast and as accurately as they could, ignoring other

flanking letters surrounding the target letter. They were asked to press the right key when the target letter was H or K, and to press the left key when the target letter was S or C. There were three conditions where the target letter was flanked by other letters, with three letters on each side of the target letter. In the first condition, the target and the noise letters were the same (HHHHHHH); in the second condition the flanking (noise) letters were response-compatible, which meant that the target and the noise letters required responding by pressing the same key (KKKHKKK), and in the third condition the noise letters were response-incompatible, which meant that the response key for the target letter was different to that of the noise letters (SSSHSSS). Lastly, there was a no-noise condition where the target letter appeared on its own with no surrounding noise letters (H). They were all presented as capital letters, 22-point, bold, Courier font (3/16-in [0.4763 cm] square), and the letters were spatially separated as in a printed word spacing (1/16 in [0.1588 cm]). Each trial started with 1000 ms blank screen preceding a 500 ms fixation point. Following the fixation point, stimuli appeared in black on a white screen and remained there until the participant responded. There were 160 trials in total with 40 trials in each condition and participants completed 32 practice trials with all four conditions presented prior to starting the actual trials. All four trial conditions were presented in a fixed random order, with the constraint that the same trial type did not appear more than 3 times in a successive order. There were also no negative priming trials where the current target letter occurred as the flanker letter on the previous trial. The trials were presented in 4 subblocks.

The difference in reaction times (RT) in the noise response-incompatible condition versus the no-noise condition was the primary dependent measure. This measure was obtained by subtracting no-noise trials reaction times from incompatible trials reaction times. The measure was selected on the basis of being the most similar to other distractor interference measures, which are calculated by subtracting no-noise

trials from response-incompatible trials. High scores indicated higher distraction by flanking stimuli, while low scores on this task indicated less interference by distractors or better focus on the target stimuli.

Procedure

Participants who consumed at least 1 unit of alcohol per week were invited to take part in the study. They were asked to sign a consent form indicating that they understood the study and that they were 18 years old or over. Participants were asked to complete two alcohol use measures, a self-report impulsivity measure, a computerised response inhibition task (Stop-signal task) and a distractor interference task (Eriksen flanker task). They were required to complete self-report impulsivity and alcohol use measures prior to performing the tasks. Participants performed the tasks in a random order. The instructions for the computerised tasks were given by the researcher. Participants completed the practice trials of the tasks in a quiet room with the researcher present in the room. They were then left to perform the actual trial blocks on their own. Once they had completed the tasks, they were debriefed and thanked for taking part in the study. The study lasted from forty minutes to an hour; participants received £5 for their time.

<div align="center">

Results

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Descriptive Statistics for the UPPS-P and Alcohol Use Measures

The data was screened prior to analysis; all questionnaire and task data was checked for extreme scores and normality. The sample was found to be free from any influential outliers. No observation was removed from the analysis.

Analysis of gender differences. T-tests were conducted to analyse gender differences on alcohol use and impulsivity measures. The results revealed a significant difference in weekly total alcohol unit consumption, binge scores and general alcohol use between males and females, with males scoring significantly higher than females on all alcohol use indices, except for the AUDIT. Males and females also significantly differed on the lack of perseverance facet of the UPPS-P, with males reporting higher lack of perseverance than females. See Table 4.2 for gender mean differences and t- test results.

Table 4.2

Descriptive Statistics for the Alcohol Use and the UPPS-P scales

Measure	Females		Males		
	M	*SD*	*M*	*SD*	*t*(62)
Alcohol Use					
TUPW	21.05	16.31	36.10	30.55	-2.37*
Binge	17.24	13.44	27.47	21.64	-2.20*
AUDIT	10.68	6.56	14.44	8.85	-1.78
AUQ	28.69	19.56	47.19	36.94	-2.41*
Impulsivity (UPPS-P)					
NU	28.36	5.59	30.82	5.23	-1.34
L of Prem	25.69	5.96	23.89	4.92	1.30
L of Pers	20.84	4.69	23.24	5.00	-1.94*
SS	32.84	6.75	36.03	6.65	-1.86
PU	27.87	10.27	31.03	9.53	-1.24
Tasks					
SSRT	286.5 5	47.57	290.60	42.15	-0.35
DI	55.41	37.17	60.71	63.39	-0.40

Note. * $p< .05$, ** $p< .01$

Note. TUPW= Total units per week, AUQ= Alcohol use questionnaire, NU= Negative urgency, L of Prem= Lack of premeditation, L of Pers= Lack of perseverance, PU= Positive urgency, SSRT=Stop signal reaction times, DI= Distractor interference.

Table 4.3 demonstrates bivariate correlations between the alcohol use measures, impulsivity facets and task variables. The AUQ scores, total units per week (TUPW), binge scores, and the AUDIT significantly correlated with all of the UPPS-P facets in a positive direction. Prepotent response inhibition as measured by the SSRT did not show any significant relationships with either the alcohol use measures or impulsivity facets. The AUQ, binge scores and the TUPW significantly and positively correlated with distractor interference; the AUDIT, however, was not found to be related to distractor interference.

Table 4.3 *Correlations between Impulsivity Facets, Alcohol Use and Task Measures*

Measure	1	2	3	4	5	6	7	8	9	10	11
1.Negative Urgency	-	.47**	.49**	.20	.76**	.38**	.38**	.38**	.61**	.07	-.05
2. Lack of Premeditation		-	.30**	.04	.49**	.22	.14**	.33**	.36**	.00	.00
3. Lack of Perseverance			-	.00	.51**	.45**	.44**	.34**	.42**	.12	.17
4. Sensation Seeking				-	.18	.36**	.29*	.40**	.27**	.10	.21
5. Positive Urgency					-	.30*	.29*	.31*	.55**	-.03	.00
6. AUQ						-	.91**	.85**	.70**	.36**	-.11
7. Binge							-	.61**	.62**	.30*	-.10
8. TUPW								-	.70**	.32**	-.12
9. AUDIT									-	-.05	-.16
10.DI										-	-.06
11. SSRT											-

Note. * *p*< .05, ** *p*< .01

Note. AUQ= Alcohol use questionnaire, DI=Distractor Interference, SSRT= Stop signal reaction times

Regression Analyses

A set of multiple regression analyses was performed to examine whether urgency facets predicted prepotent response inhibition over and above the other UPPS-P facets. Separate regression models were used for positive and negative urgency due to a high inter-correlation between these subscales, ($r = .76$). Gender was controlled in step 1 of the analyses; the three UPPS-P facets were entered in the second step; positive urgency was entered in the last step of the regression model. Positive urgency did not significantly predict prepotent response inhibition; however sensation seeking and lack of perseverance were found to be positively and significantly related to the SSRT. The analysis was repeated with negative urgency; it was also not found to be associated with prepotent response inhibition. The results are demonstrated in Table 4.4.

Table 4.4

Regression of the SSRT Scores on Positive and Negative Urgency Controlling for the other UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.02	0.00	1,60
Gender	4.09	11.48	0.04			
Step 2				0.08	0.08	3,57
Gender	-7.08	12.46	-0.08			
L of Prem	-0.71	1.13	-0.08			
L of Pers	2.02	1.27	0.22			
SS	1.57	0.85	0.24			
Positive Urgency						
Step 3				0.10	0.01	1,56
Gender	-5.62	12.55	-0.06			
L of Prem	-0.17	1.25	-0.02			
L of Pers	2.59	1.39	0.28*			
SS	1.73	0.87	0.26*			
PU	-0.75	0.75	-0.16			
Negative Urgency						
Step 3				0.12	0.04	1,56
Gender	-4.51	12.41	-0.05			
L of Prem	0.08	1.22	0.01			
L of Pers	2.81	1.35	0.31*			
SS	1.83	0.86	0.28*			
NU	-1.57	0.99	-0.25			

Note. $* p < .05$, $** p < .01$

Note. L of Prem=Lack of premeditation, L of Pers=Lack of perseverance, SS=Sensation Seeking, NU=Negative urgency, PU=Positive urgency, SSRT=Stops signal reaction times.

Another set of multiple regression analyses were performed to assess the relationship between the urgency facets and distractor interference. Gender was controlled in step 1 of the analyses, the other three UPPS-P facets were entered in step 2 and the urgency facets were entered in step 3 of each regression analysis. The urgency facets did not predict distractor interference; the other UPPS-P facets were also not

found to predict distractor interference in the analyses. The results are shown in Table

4.5.

Table 4.5
Regression of Distractor Interference Scores on Positive and Negative Urgency
Controlling for the other UPPS-P Facets

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.00	0.03	1,60
Gender	5.29	13.01	0.05			
Step 2				0.02	0.02	3,57
Gender	-1.63	14.58	-0.01			
L of Prem	-0.47	1.32	-0.05			
L of Pers	1.49	1.48	0.14			
SS	0.78	1.00	0.10			
Positive Urgency						
Step 3				0.04	0.02	1,56
Gender	0.15	14.66	0.00			
L of Prem	0.18	1.46	0.02			
L of Pers	2.19	1.62	0.21			
SS	0.98	1.02	0.13			
PU	-0.92	0.87	-0.18			
Negative Urgency						
Step 3				0.03	0.00	1,56
Gender	-1.79	14.83	-0.01			
L of Prem	-0.52	1.46	-0.05			
L of Pers	1.44	1.61	0.14			
SS	0.76	1.03	0.10			
NU	0.10	1.18	0.01			

Note. * $p < .05$, ** $p < .01$

Note. DI= Distractor interference, L of Prem=Lack of premeditation, L of Pers=Lack of perseverance, SS=Sensation seeking, NU=Negative urgency, PU=Positive urgency.

Effects of alcohol on prepotent response inhibition as moderated by

urgency. A set of moderated regression analyses were performed to explore the

potential moderating role of urgency in the relationship between alcohol use and

prepotent response inhibition. Gender was controlled in the first step of the analyses.

The centred variables for alcohol use and positive urgency were entered in step 2, and

the interaction term for positive urgency and alcohol use was entered in step 3 of the

first moderated regression analysis. The hypothesis 2 was not supported in the analyses.

Positive urgency did not moderate the relationship between alcohol use and prepotent

response inhibition. The results are shown in Table 4.6.

Table 4.6

SSRT on Positive Urgency and Alcohol Use Interaction

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.00	0.00	1,60
Gender	4.04	11.48	0.04			
Step 2				0.02	0.02	2,58
Gender	7.77	12.18	0.08			
AUQ_C	-0.23	0.21	-0.15			
PU_C	0.19	0.61	0.04			
Step 3				0.03	0.01	1,57
Gender	7.44	12.32	0.08			
AUQ_C	-0.21	0.21	-0.14			
PU_C	0.34	0.64	0.07			
PU_C X AUQ_C	-0.01	0.01	-0.10			

Note. $* p < .05, ** p < .01$

Note. DV= SSRT, AUQ_C = Centered alcohol use questionnaire scores, PU_C = Centered positive urgency scores.

The analysis was repeated to test the moderating role of negative urgency in the

relationship between alcohol use and prepotent response inhibition. Negative urgency

also was not found to moderate the effect of alcohol use on prepotent response

inhibition. The results are demonstrated in Table 4.7.

Table 4.7

SSRT on Negative Urgency and Alcohol Use Interaction

Predictor	B	SE B	B	R^2	R^2Ch	Df
Step 1				0.00	0.00	1,60
Gender	4.04	11.48	0.04			
Step 2				0.02	0.02	2,58
Gender	8.10	12.18	0.09			
AUQ_C	-0.21	0.21	-0.14			
NU_C	-0.07	0.87	-0.01			
Step 3				0.04	0.03	1,57
Gender	7.81	12.12	0.08			
AUQ_C	-0.19	0.21	-0.12			
NU_C	0.01	0.86	0.00			
NU_C X AUQ_C	-0.03	0.02	-0.16			

Note. * $p < .05$, ** $p < .01$

Note. DV= SSRT, AUQ_C= Centered alcohol use questionnaire scores, NU_C=
Centered negative urgency scores.

Effects of alcohol on distractor interference as moderated by urgency. A set

of moderated regression analyses were conducted to explore if, as predicted in

hypothesis 2, positive urgency moderates the effect of alcohol use on distractor

interference. Gender was controlled in step 1, centred variables for alcohol use and

positive urgency was entered in step 2, and the interaction term for positive urgency and

alcohol use was entered in step 3 of the analysis. Alcohol use significantly and

positively predicted DI. However, positive urgency did not significantly moderate the

relationship between alcohol use and distractor interference. Table 4.8 shows the results

of the moderated regression analysis.

Table 4.8

Distractor Interference on Positive Urgency and Alcohol Use Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	1,60
Gender	5.29	13.01	0.05			
Step 2				0.15**	0.15	2,58
Gender	-5.37	12.82	-0.05			
AUQ_C	0.71	0.22	0.42**			
PU_C	-0.80	0.64	-0.15			
Step 3				0.15	0.00	1,57
Gender	-5.45	12.94	-0.05			
AUQ_C	0.71	0.22	0.42**			
PU_C	-0.76	0.68	-0.15			
PU_C X AUQ_C	-0.00	0.01	-0.02			

*Note. * $p < .05$, ** $p< .01$

Note. DV=DI= Distractor interference, AUQ_C= Centered alcohol use questionnaire scores, PU_C= Centered positive urgency scores.

Another moderated regression analysis was performed to test the moderating role of negative urgency in the relationship between alcohol use and distractor interference. Negative urgency also did not moderate the effect of alcohol use on distractor interference. The results are shown in Table 4.9. This result is not in line with hypothesis 2.

Table 4.9

Distractor Interference on Negative Urgency and Alcohol Use Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	1,60
Gender	5.29	13.01	0.05			
Step 2				0.13*	0.13	2,58
Gender	-6.09	12.95	-0.06			
AUQ_C	0.68	0.23	0.40**			
NU_C	-0.50	0.92	-0.07			
Step 3				0.14	0.00	1,57
Gender	-6.27	13.00	-0.06			
AUQ_C	0.69	0.23	0.41**			
NU_C	-0.45	0.93	-0.06			
NU_C X AUQ_C	-0.01	0.02	-0.08			

Note.* $p < .05$, ** $p < .01$

Note. DV= DI = Distractor interference, AUQ_C= Centered alcohol use questionnaire scores, NU_C= Centered negative urgency scores.

The potential moderating effects of the urgency facets in the relationships between problem use of alcohol and both task measures (prepotent response inhibition, distractor interference) were assessed in a series of moderated regression analyses. The urgency facets did not moderate the effects of problem alcohol use on either prepotent response inhibition or the distractor interference task.

The hypothesis 3 predicted a significant moderating effect of lack of perseverance in the relationship between alcohol use and distracter interference/prepotent response inhibition tasks. This hypothesis was partially supported in the analysis. The moderating role of lack of perseverance in the relationship between

alcohol use and prepotent response inhibition, and also in the relationship between

alcohol use and distractor interference was examined. Lack of perseverance

significantly predicted prepotent response inhibition in the positive direction in the last

step of the moderated regression analysis; however the interaction term was not

significant. The facet did not moderate the effect of alcohol use on prepotent response

inhibition. The results are demonstrated in Appendix K.3. The analysis examining the

moderating effect of lack of perseverance in the relationship between alcohol use and

distractor interference showed that lack of perseverance significantly and positively

potentiated the effect of alcohol use on distractor interference. The alcohol use to

distractor interference relationship was stronger in the case of high lack of perseverance.

The results of the moderation analysis are presented in Table 4.10.

Table 4.10

Distractor Interference on Lack of Perseverance and Alcohol Use Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	1,60
Gender	5.29	13.01	0.05			
Step 2				0.13*	0.13	2,58
Gender	-6.06	13.05	-0.06			
AUQ_C	0.66	0.23	0.39**			
L of PersC	-0.40	1.41	-0.04			
Step 3				0.20*	0.06	1,57
Gender	-8.67	12.70	-0.08			
AUQ_C	0.35	0.27	0.21			
L of PersC	- 0.61	1.37	-0.06			
L of PersC X AUQ_C	0.09	0.04	0.33*			

Note. * $p < .05$, ** $p < .01$

Note. DV= DI= Distractor interference, AUQ_C= Centered alcohol use questionnaire
scores, L of PersC= Centered lack of perseverance scores.

Figure 1 depicts the relationship between DI and alcohol use as moderated by lack of perseverance.
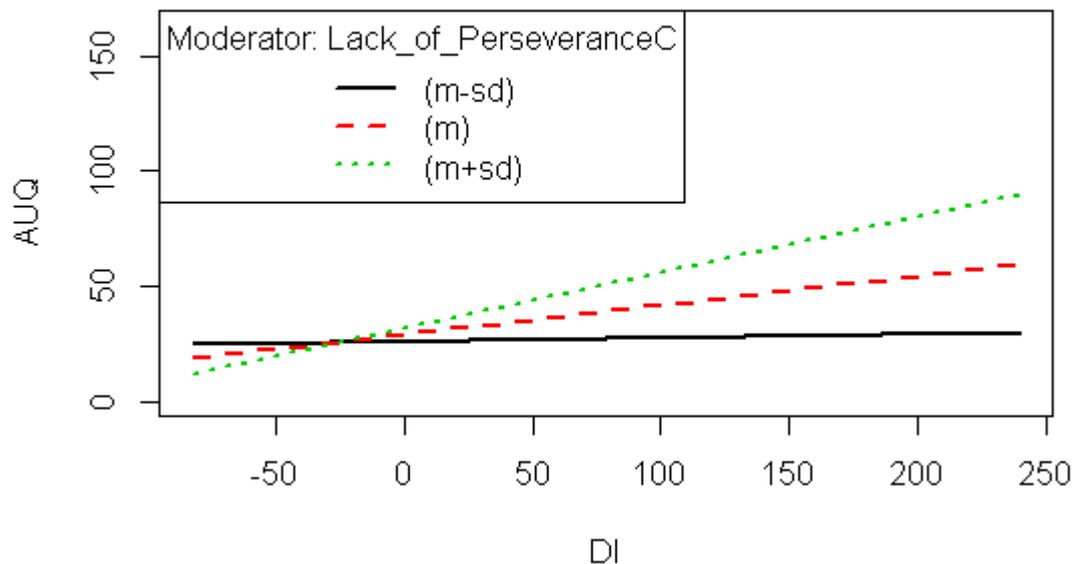
Figure 2.1. Figure depicts the relationship between distractor interference (DI) and alcohol use (AUQ) for three levels of lack of perseverance.

The analyses were repeated with alcohol use as the outcome variable. This was done to test whether distracter interference also moderated the effects of alcohol use on lack of perseverance. Although the interaction of lack of perseverance and distracter interference was only significant at a marginal level ($p = 0.10$), the direction of the relationship indicates that the relationship between alcohol use and lack of perseverance may also be influenced to different degrees by the distracter interference. The results of these analyses are presented in Table 4.11.

Table 4.11

Alcohol Use on Distracter Interference and Lack of Perseverance Interaction

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.09*	0.09	1,60
Gender	18.49	7.38	0.30*			
Step 2				0.33**	0.24	2,58
Gender	12.18	6.62	0.20			
DI	0.18	0.64	0.30**			
L of PersC	2.23	0.67	0.36**			
Step 3				0.37	0.03	1,57
Gender	10.28	6.61	0.17			
DI	0.12	0.07	0.21			
L of PersC	1.86	1.70	0.30*			
L of PersC X DI	0.02	0.14	0.21			

Note. $* p < .05, ** p < .01$

Note. DV=AUQ = Alcohol use questionnaire scores, L of PersC= Centered lack of perseverance scores, DI= Distractor interference.

Figure 2.2 demonstrates the relationship between lack of perseverance and alchol use as moderated by the distracter interference.
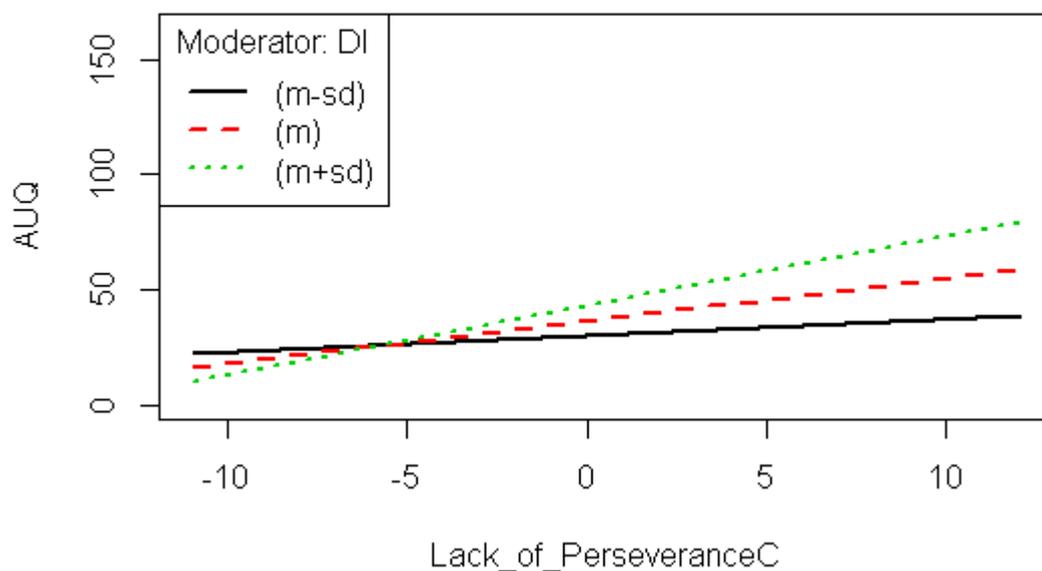
Figure 2.2. Figure demonstrates the relationship between lack of perseverance and alcohol use (AUQ) as moderated by distractor interference (DI).

The Relationship between the other UPPS-P Facets, Alcohol Use and Task Variables

Previous studies have inconsistently shown small significant relationships between the UPPS-P facets and task measures (Cyders et al., 2011; Dick et al., 2010). Although not the primary focus of this study, in order to further explore the relationship of the other UPPS-P facets to alcohol use and task measures, the moderating roles of sensation seeking and lack of premeditation in the relationships between alcohol use and task measures were examined in separate analyses. The results revealed that sensation seeking did not significantly moderate the effect of alcohol use on prepotent response inhibition; however the facet significantly and positively predicted prepotent response inhibition as an individual variable, such that high sensation seeking was significantly associated with higher reaction times on the Stop-signal task. The results are demonstrated in Appendix K.1. The moderating role of sensation seeking in the

alcohol use and distractor interference relationship was also examined in a moderated

regression analysis. Sensation seeking was not found to significantly moderate the

effect of alcohol use on distractor interference, however alcohol use significantly and

positively predicted distractor interference; high levels of previous alcohol consumption

was significantly associated with higher distraction by flankers on the Eriksen flanker

task. The results are shown in Appendix K.2. Finally, the moderating role of lack of

premeditation in the relationship between alcohol use and prepotent response inhibition

and distractor interference was assessed in a set of moderated regression analyses;

however the facet was found to be unrelated to the task variables.

Discussion

The goal of this study was to test the prediction that individual differences in

positive and negative urgency and lack of perseverance moderate the relationship

between alcohol use and inhibition and interference related functions in a sample of

non-dependent university student drinkers. Although the relationship between urgency

facets and negative outcomes from risky behaviours has been well-established in

previous cross-sectional self-report studies, the potential moderating role of positive and

negative urgency in the alcohol use and behavioural response inhibition/interference

relationship has not been investigated. Previous studies aiming to explore associations

between the UPPS-P facets and behavioural task measures, found small or no

relationships between these facets and behavioural measures of the trait. The meta-

analytic reviews by Cyders and Coskunpinar (2011) and Dick et al. (2010) showed a

small significant relationship between the UPPS-P facets and task measures. Dick et al.

reported the task measures that show some preliminary evidence of tapping into the

same facets of the UPPS-P impulsivity scale: Negative and positive urgency were

shown to tap into prepotent response inhibition, while lack of perseverance was shown

to associate with both resistance to distractor interference and resistance to proactive interference; sensation seeking was reported to tap into judgement of time elapsed, however lack of premeditation was not shown to relate to either alcohol use or task measures in that study. Cyders et al. in a meta-analytic study that included 27 published papers examining self-report measures and behavioural lab task conceptualisations reported a small statistically significant relationship between multidimensional self-report and lab task measures of impulsivity ($r = 0.097$). Significant relationships were reported between lack of perseverance and prepotent response inhibition ($r = 0.099$), between lack of planning and prepotent response inhibition ($r = 0.106$), delay response ($r = 0.134$) and distortion in elapsed time ($r = 0.104$), between negative urgency and prepotent response inhibition ($r = 0.106$), and between sensation seeking and delay response ($r = 0.131$).

The results of the study in this chapter are partially consistent with previous findings: the initial analyses examining urgency facets in predicting task variables, controlling for the other UPPS-P facets, showed that lack of perseverance and sensation seeking, but not urgency facets, significantly predicted poorer performance on the prepotent response inhibition task. Although large SSRT and short SSDs have been previously linked to alcohol abuse and dependence (Logan, 1994; Nederkoorn et al., 2009), the current study found no correlations between alcohol use patterns and either of these response inhibition components. None of the UPPS-P facets predicted distractor interference. As predicted in hypothesis 1, UPPS-P facets moderately correlated with all acohol use variables, with positive and negative urgency displaying particularly higher correlations with problem drinking.

Following the initial analysis examining the relationship between urgency and task measures controlling for the other UPPS-P facets, the moderating role of urgency

in the relationships between previous alcohol use and task performance on prepotent response inhibition and distractor interference tasks was examined. The hypothesis 2 stated that urgency would moderate the effect of alcohol use on task performance, such that the effect of alcohol on task performance would be greater for those with a high score on this facet. This prediction was based on previous findings showing significant associations between urgency facets and engagement in risky behaviours (e.g. alcohol use and related problems). The direct positive relationship between urgency and prepotent response inhibition has also been demonstrated in previous studies (Cyders & Coskunpinar, 2011). However, the potential moderating effects of the urgency facets on the relationship between alcohol use and behavioural task performance has not been previously researched.

The hypothesis 2 was not supported in the analyses. The results of the moderation analyses showed that urgency did not significantly moderate the alcohol use and prepotent response inhibition or distractor interference relationships. However, previous alcohol use significantly predicted distractor interference in a positive direction, such that regular and excessive alcohol consumption was associated with high level distraction by flankers on the Eriksen flanker task. There are not many other studies assessing the relationship between distractor interference and alcohol use (Tedstone & Coyle, 2004; Marinkovic et al., 2012); also, there are no previous studies examining the moderating effects of impulsivity in the alcohol use and distractor interference relationship. Thus, it is not possible to confirm the validity of the present finding. However, significant positive correlations between different patterns of alcohol use such as general consumption, weekly total alcohol use, binge drinking and distractor interference in this study indicate a possible association between previous regular and excessive drinking and poor selective attention. In support of this argument, as noted

earlier in this chapter, Marinkovich et al. found that alcohol increased reaction times to incongruent trials and reduced accuracy overall.

This result is not consistent with a previous study showing that the performance of sober alcoholic individuals did not significantly differ from that of healthy controls on distractor interference as measured by the Eriksen flanker task, but they still performed worse than the healthy control group on a response inhibition task as measured by the Stroop task (Tedstone & Coyle, 2004). The authors argued that semantic information processing may take longer to recover from, or may be permanently impaired, in alcohol dependent individuals. While the interference effect was related to higher levels of alcohol consumption on the distractor interference task in the present study, it was uncorrelated with self- report impulsivity. These results suggest that although alcohol may impair the ability to selectively attend, this component of executive functioning is not related to trait impulsivity. It appears that drinking behaviour affects prepotent response inhibition and selective attention abilities of university student drinkers through separate pathways and that self-report impulsivity and behavioural measures of the trait tap into disparate aspects of impulsive behaviour.

The hypothesis 3 was partially supported in the analyses. Lack of perseverance was found to significantly predict prepotent response inhibition in a positive direction. This result supports that of Cyders et al. where lack of perseverance was shown to be related to prepotent response inhibition. This finding is also consistent with Dick et al. (2010) where this facet was positively associated with distractor interference. Lack of perseverance, out of the five UPPS-P facets, was the only facet that significantly moderated the relationship between alcohol use and distractor interference, making it stronger. Lack of premeditation was not found to be related to any of the task variables in the present study. The trait was also unrelated to task variables in the study by Dick

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et al. However, Cyders et al. found a small significant association between lack of premeditation and response inhibition. Further research is required to confirm the relationship of self-control facets to behavioural constructs of impulsivity, and the moderating roles of these facets in the relationship between alcohol use and task performance.

In order to further explore whether other UPPS-P facets potentiated the effects of alcohol use on task performance, the moderating roles of sensation seeking and lack of premeditation, in the relationship between alcohol use and task performance were assessed. The results revealed that sensation seeking did not moderate the relationships between alcohol use and prepotent response inhibition or distractor interference; however this UPPS-P facet significantly predicted prepotent response inhibition in a positive direction, so that high sensation seeking was significantly associated with larger reaction times on the Stop-signal task. Sensation seeking has been commonly investigated in reward and risk taking behaviours and previous studies have shown that the trait taps into tasks such as delay response and judgement of time elapse but not response inhibition. Negative urgency has been associated with prepotent response inhibition in these studies (Dick et al., 2010; Cyders & Coskunpinar, 2011); however urgency facets were found to be unrelated to response inhibition in the present study. The significant positive relationship between response inhibition and sensation seeking requires further confirmation.

Together, these results indicate that the relationship between inhibition and interference related functions and alcohol use may be influenced by individual differences in impulsivity (lack of perseverance in this case). The study in this chapter also suggests that the level of interference by distracting stimuli is closely and positively associated with previous regular and excessive alcohol use. While the findings by

Houben and Wiers (2009) suggest that the relationship between automatic cognitive processes originating in the impulsive system, and drinking behaviour depends on individual differences in response inhibition exerted by the reflective system, the findings of the present study indicate that poor performance on executive functioning tasks as a result of previous regular and excessive alcohol use is determined to different degrees by different facets of impulsivity. The significant moderating role of lack of perseverance in the relationship between alcohol use and distractor interference, as well as the association between specified impulsivity facets-lack of perseverance, sensation seeking- and prepotent response inhibition, may carry important clinical implications. Previous research has shown that chronic alcohol abuse causes impairments in both selective attention and response inhibition (Abroms, Fillmore, & Marczinski, 2003; Noel, Bechara, Dan, Hanak, & Verbanck, 2007). Consequently, the present findings suggest that this relationship may be moderated to different degrees by facets of impulsivity.

Further studies will allow a better understanding of the relationship between executive functions, impulsivity and alcohol use. In an effort to further explore whether alcohol use affects the performance on the reflective system (response inhibition, distractor interference), the study in the next chapter investigates the effects of acute alcohol use on task performance as moderated by different impulsivity facets, with a specific focus on the urgency facets.

Limitations and Future Directions

The study in this chapter has weaknesses, which should be noted. First, the study was conducted in a group of social drinkers and the generalizability to clinical populations should be further examined. Secondly, the prepotent response inhibition task that was employed in this study was the Stop-It task (Logan, 1994). A modified

version of the task (e.g. alcohol cues) has been used in previous research (Nederkoorn et al., 2009). However, there are not many studies that have used this task without modification, thus it is not possible to compare the validity of the present findings; the results from a few studies that have employed the task in the investigation of alcohol use and behavioural impulsivity are inconclusive (Fernie et al., 2010; Li, Luo, Yan, Bergquist, & Sinha, 2009). It would be interesting to find out if the results remain similar using a different measure of response inhibition task such as the Stroop task (Friedman & Miyake, 2004) or the antisaccade task (Hallet, 1978). Another limitation of the current study is that the use of other substances or the psychopathology of the sample was not controlled. Although both are typically relatively low in student samples, the results may be different if we controlled for these factors. Additionally, it would be interesting to test whether the findings of this study remain similar for other substances. One of the major limitations of this study is the low statistical power for moderation effects given the small sample size; larger moderation effects may have been found with a sample over 100 participants.

Finally, as noted earlier in this chapter, the dual process theory account of addiction posits that executive functions are potential determinants of the interplay between impulsive system and addictive behaviours. The present study tested the urgency, lack of perseverance and alcohol use interactions as the predictors of executive functions. Executive functions could be examined as moderators in the impulsivity and alcohol use relationship to explore whether impulsivity facets interact with executive functions to influence alcohol use and problem behaviours. In other words, given the present study employed a correlational design, the causal pathways between these variables could not be elucidated. The inability of regression analyses to reveal causal direction is another limitation of this study. Mediation analyses could have been

performed to explore the three-way relationship between impulsivity facets, alcohol use and executive functions. In all likelihood, the relationships between behavioural and self-report indices of impulsivity and alcohol use are bi-directional, if not more complex. The executive function measures were treated as the dependent variable in this study largely for comparative purposes with the study in the next chapter, where alcohol is administered and these task variables are also used as outcome measures. Future research should aim to address the causality of the relationship between behavioural task constructs and different patterns of alcohol use, and the moderating role of trait impulsivity in this relationship, using more sensitive longitudinal designs.

The study in the next chapter aims to partly address this last issue. A group of university student drinkers will be administered a moderate dose of alcohol prior to performing the same tasks in this study to test whether the urgency facets moderate the effect of a moderate dose of alcohol on executive task performance. It also extends the study in this chapter by examining risk taking behaviour following alcohol administration.

What this chapter adds to the literature

The findings from Study 3 add to our understanding of the relationship between alcohol use and executive functions, and test the possibility that the relationship between alcohol use and inhibition and interference control may be moderated to different degrees by different facets of impulsivity. Although previous studies have examined the relationship between executive functions and alcohol use (e.g. Cyders & Coskunpinar, 2011; Houben & Wiers, 2009; Dick et al., 2010), the moderating effects of impulsivity facets, and particularly the role of urgency facets in this relationship, have not been assessed. Impulsivity facets may be determinants of the strength of the relationship between alcohol use and inhibition/interference control and,

if so, identifying these facets can guide the design of prevention and intervention strategies. The study in this chapter adds to the previous alcohol use and impulsivity literature by demonstrating that lack of perseverance, but not the urgency facets, is a significant moderator of the relationship between alcohol use and interference control. As stated earlier in this chapter, the dual process account of addiction proposed by Houben and Wiers (2009) posits that excessive drinking occurs as a result of impaired response inhibition that makes individuals act impulsively, which in turn leads to more alcohol consumption. The study in this chapter suggests that it is also possible that high level impulsivity (ie. lack of perseverance) leads to increases in alcohol use, which in turn leads to impairment in executive functions.

CHAPTER 5

Moderating Effects of Urgency on the Relationship between Acute Alcohol Use and Executive Functioning

Previous studies have agreed that intense affective states lead to a weakness in inhibitory control and result in loss of control over behaviours that may have negative outcomes (Webb, Miles, & Sheeran, 2012; Billieux et al., 2010; Wiers et al., 2010; Carvalho & Ready, 2010; Tice et al., 2001). One of the theories proposed is that affective experiences recruit some of the cognitive resources available for effortful control, impairing effectiveness. This happens through focusing on an emotionally significant stimulus or an event having triggered an emotional experience (Euser & Franken, 2012; Nederkoorn et al., 2009). Therefore, there are so far several possible explanations for the occurrence of risky or problem behaviours. One of these is individual differences in executive functioning are implicated in inhibitory control, and the other is individual differences are implicated in the way affective intensity is experienced (Dour, Cha, & Nock, 2011; Nock, Wedig, Holmberg, Hooley, 2008). From this point of view, the urgency facet of impulsivity-a concept that refers to individual differences in the tendency to act rashly when experiencing extreme emotions- may reflect a disposition toward risky behaviours depending on the degree to which an individual experiences emotions.

Previous studies have mainly focused on the role of rash actions or individual differences in executive functions as determinants of risky behaviours (e.g. Houben & Wiers, 2009; Cyders et al., 2010), and others have investigated the effect of retrospectively reported alcohol use and related problems on behavioural self-control and trait impulsivity (e.g. Nederkoorn et al., 2009; Papachristou, Nederkoorn, Havermans, van der Horst, & Jansen, 2012); however the way in which behavioural

self-control is affected by acute alcohol consumption among highly impulsive individuals remains elusive. Individuals who exhibit a high propensity to act rashly in response to intense positive or negative emotions may be more sensitive to the acute effects of alcohol use. Moreover, engagement in risky rash actions in response to extreme emotions perhaps potentiates the effects of acute alcohol consumption on behavioural response inhibition, leading to higher levels of disinhibition. Mood based impulsive actions may also influence the effect of alcohol on focus of attention or risk taking behaviours, causing high urgency individuals to perform poorly on tasks that requires focusing or to engage in high risky behaviours, such as gambling.

The study in this chapter examines the moderating role of urgency in the relationship between acute alcohol use and executive functions/risk taking behaviours. The following section provides an overview of the previous studies that have examined the relationship between alcohol use, impulsivity and executive functions.

Impulsivity, Alcohol Use and Executive Functions

The possible impairing effects of long-term and excessive alcohol use on some aspects of executive functioning have been demonstrated in previous studies. For example, Tedstone and Coyle (2004) employed a between subjects design where abstinent alcohol dependents were compared to a matched healthy control group on their performance on neurobiological tasks and tasks measuring different aspects of attention. It was found that semantic information processing, as measured by the Stroop task and divided attention task, was impaired among abstinent alcohol dependents, however selective attention (Eriksen flanker task) was found to be intact. Nederkoorn et al. (2009) tested motor impulsiveness as measured by the Stop signal task with four classes of pictures (alcohol-related, soft drinks, erotic, and neutral) among light and heavy drinkers, using a between subjects design. The study found that there was no

domain specific difference in response inhibition in both groups, however heavy drinking females displayed stronger response inhibition deficits than other groups. Abroms et al. (2003) using a between subjects design tested the degree to which acute alcohol use impairs response-suppression and response-alterations. Participants performed a cued reaction time task before and after receiving alcohol (0.65 g/kg) or a placebo. Alcohol related impairments were observed when behavioural control was dependent on response suppression, but no impairment was observed when control relied on response alteration. These results suggested that alcohol can be detrimental to behavioural control in situations where prepotent responses must be completely suppressed. Abroms, Gottlob, and Fillmore (2006), in a within subjects design, used a delayed ocular response task and a saccadic interference task to examine the effects of alcohol on both intentionally controlled and automatic inhibitory influences on selective attention. Participants performed tasks under two doses of alcohol (placebo, 0.45 g/kg, and 0.65 g/kg). The results showed that alcohol reduced intentional inhibitory control over selective attention but had no effect on automatic inhibitory influences, suggesting that intentional inhibitory control may be more susceptible to the impairing effects of a moderate dose of alcohol than processes dependent on automatic inhibition.

In line with the studies showing an effect of acute alcohol use on inhibitory control processes, a recent study by Caswell, Morgan, and Duka (2013) using a between subjects design, examined the effects of alcohol and alcohol outcome expectancies on subtypes of impulsivity. Impulsivity was assessed using the Stop-signal Task (SST), the Single Key Impulsivity Task (SKIP), which is a modified version of delay discounting task in which longer delays between responses result in greater rewards, and the Information Sampling Task (IST) to test decision making and reflective impulsivity, respectively. Reflective impulsivity refers to the ability to gather and evaluate

information prior to decision making. IST measures reflection impulsivity by calculating the probability of the subject selecting the correct answer at the point of decision on the basis of their sampling of information prior to that decision. Participants were administered a placebo, a low (0.4 g/kg), or a high dose of alcohol (0.8 g/kg) prior to completing the impulsivity measures. The study found that motor impulsiveness was affected by the dose of alcohol; participants receiving a high dose displayed reduced inhibitory control, reflection impulsivity was affected by cognitive alcohol expectancies but not by alcohol condition, and temporal impulsivity-the preference for smaller and sooner over larger and later rewards, due to excessive discounting of future rewards-was not affected by alcohol dose or outcome expectancies. The study concluded that the effects of alcohol on subtypes of impulsivity are dissociable.

Neuroimaging studies have also indicated sensitivity of cognitive control mechanisms to acute intoxication in brain regions associated with executive control. Marinkovic, Rickenbacher, Azma, Artsy, and Lee (2013) employing a between subjects design, have examined whether acute effects of alcohol on top-down cognitive control would generalise to the oculomotor system during inhibition of saccadic responses. Participants were administered alcohol (0.6 g/kg) or placebo drinks. The study found that alcohol administration selectively attenuated activity in the anterior cingulate cortex (ACC) to volitional antisaccade responses and erroneous responses. The study shows selective ACC vulnerability to acute alcohol use during conflict across different response modalities and executive tasks and indicates that acute alcohol use may impair top-down regulative functions by attenuating the ACC activity, resulting in behavioural disinhibition and decreased self-control. In a similar study Marinkovic, Rickenbacher, Azma, and Artsy (2012) have examined the effects of moderate dose of alcohol use (0.6 g/kg) on executive functions in a group of social drinkers. A between subjects design

was employed to test the effects of alcohol on a modified 4-colour Stroop task combined reading and colour naming that requires manual responses, while being scanned using blood oxygen level dependent (BOLD) fMRI. Alcohol increased reaction times and a tendency to make more errors on incongruent trials. Behavioural indices of alcohol-induced premature responding correlated with the current drinking levels and impulsivity traits, more specifically with Psychoticism scale of Eysenck's Personality Questionnaire ($r = 0.76$, $p < 0.001$) and Impulsivity Scale on Eysenck's Impulsiveness and Venturesomeness Scale ($r = 0.54$, $p < 0.01$), suggesting an interaction between effects of alcohol and personality predispositions. The study also found that moderate alcohol inebriation selectively attenuated ACC activation during both high conflict and erroneous responses indicating vulnerability of regulative function subserved by the ACC. These results indicate that alcohol-induced prefrontal impairments diminish inhibitory control and are modulated by dispositional risk factors and the level of alcohol consumption.

Marinkovic, Rickenbacher, and Azma (2012) in a similar design investigated the effects of a moderate dose of alcohol on the performance on a colour version of the Eriksen flanker task. The study found that alcohol increased reaction times to incongruent trials and decreased accuracy overall. Activity evoked by response incongruity in the medial frontal cortex and insula was insignificant under the effect of alcohol, indicating its interference with response inhibition and preparation. Conversely activity in ventrolateral prefrontal and premotor areas was relatively greater under alcohol than placebo, suggesting their compensatory engagement. The results support the findings suggesting that a moderate dose of alcohol influences response inhibition, selection and execution.

Although studies investigating the behavioural and neural basis of the relationship between alcohol use and executive functions show some associations between different aspects of these functions and acute use of alcohol, the moderating role of trait impulsivity in this relationship has not been researched. Individual differences in personality may have an influence on the effects of alcohol on executive task performance. The study in this chapter tests the possibility that emotion based rash actions, positive and negative urgency, potentiate the effects of acute alcohol use on behavioural response inhibition and selective attention. Additionally to executive functions, the study in this chapter also aims to explore acute alcohol effects on risk taking as moderated by the urgency facets. The associations between alcohol use and risk taking have been previously researched. The following section provides a critical review of the previous studies that have investigated this relationship.

Effects of Impulsivity and Acute Alcohol Use on Risk Taking

Risk taking is a multifaceted construct that is closely associated with trait impulsivity, alcohol use and related problems (Cyders et al., 2010; Zapolski et al., 2009). However, the mechanism by which alcohol use leads to risk taking is poorly understood. Studies that have employed behavioural tasks as an index of risk taking to assess this behaviour among individuals who consume alcohol at high levels or alcohol dependents have shown inconsistent findings. Fernie et al. (2010) in a within subjects design, using a behavioural risk taking task, the Balloon Analogue Risk Task (BART), found that risk taking predicted variance in alcohol use even when controlling for trait impulsivity. On the other hand, Ashenhurst, Jentsch, and Ray (2011) have shown low negative associations between the same risk taking task and alcohol consumption using a between subjects design, but indicated a significant mediating role of age between risk taking propensity and alcohol use symptoms. Some other studies have demonstrated

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that acute alcohol use leads to increases in risk taking behaviour, and this behaviour depends on the dose of alcohol consumption (Reynolds et al., 2006). Reynolds et al. also found that high levels of alcohol consumption elicited more impulsive responses among participants on the Stop task.

High levels of alcohol consumption have also been associated with poor performance on behavioural impulsivity in other studies. Courtney et al. (2012) simultaneously tested the following dimensions of impulsivity as predictors of alcohol use and related problems: risky decision making (BART), self-report risk attitudes (Domain Specific Risk Attitude Task, DOSPERT), response inhibition (Stop Signal Task) and impulsive decision making (DDT). Using a sample of 158 non-treatment seeking problem drinkers the study found a good fit of the model accounting for the 38% of the variance in alcohol related problems and identified two impulsivity facets that significantly loaded onto alcohol use outcomes: a) impulsive decision making as measured by the DDT and, b) risky decision making, as measured by the BART. The study highlighted the importance of considering the distinct facets of impulsivity to elucidate their individual and combined effects on alcohol use initiation, escalation and dependence.

Likewise, Lane, Cherek, Pietras, and Tcheremissine (2004) using a within subjects design have shown significant dose-response relationships between alcohol consumption and gambling behaviour. Participants were administered placebo, 0.2, 0.4 and 0.8 g/kg alcohol. The study found that alcohol dose-dependency increased selection of risky response option, and at the 0.8 g/kg dose, increased the probability of making consecutive losing risky responses following a gain on the risky response option. Research has also shown that intoxicated individuals were more disinhibited on behavioural response inhibition tasks such as go/ no go and Stroop tasks (Birak, Higgs,

& Terry, 2011; Field et al., 2010; Nederkoorn et al., 2009; Fillmore &Vogel-Sprot, 1999, 2000; Curtin & Fairchild, 2003; Mulvihill, Skilling, & Vogel-Sprott, 1997). Reynolds, Richards, and de Wit (2006) have examined the sensitivity of impulsive choices to acute effects of alcohol. The study employed a self-report measure of delay discounting, the Experiential Discounting Task (EDT), the BART, the Stop-Task and the Go/No Go Task. A three session, double blind, placebo controlled within subjects design was used. Placebo or alcohol doses (0.4 or 0.8 g/kg) were administered in a counterbalanced order over three testing sessions. The study found that alcohol increased impulsive responses only on the EDT and the Stop -Task. Participants were found to perform more impulsively on the EDT following the 0.8 g/kg dose compared to placebo, whereas on the Stop- Task both the 0.4 g/kg and 0.8 g/kg dose increased impulsive responding.

Different phases of acute alcohol effects on impulsive behaviours have also recently been investigated. Bidwell et al. (2013) in a between subjects design have examined different stages of acute alcohol consumption on delay and probability discounting across the ascending and descending limbs of breath alcohol concentration (BAC) curve. Delay and probability were measured at four time points (Baseline, Ascending, Descending and End Point) across BAC curve at two target alcohol doses (40 mg/dl and 80 mg/dl) in healthy adults. The study found no significant effects of alcohol on delay discounting at either dose. Alcohol significantly affected probability discounting such that a reduced discounting for uncertain rewards was evident during the descending limb of the BAC curve at the lower dose and during both ascending and descending limb of the BAC curve at the higher dose. The study suggested that alcohol leads to increased risky decision making, in particular during the descending limb, which is primarily characterised by the sedative effects of alcohol. These findings

indicate that the biphasic effects of alcohol across ascending and descending limbs of BAC have differential effects on behaviours related to decision making for probabilistic but not delayed rewards.

Despite the abundance of studies investigating the effects of alcohol on behavioural response inhibition and risk taking, the role of trait impulsivity and particularly the function of urgency facets, in this relationship are yet to be explored. Although it is well established that urgency linked behaviours aim to regulate affective states, the psychological processes underlying these facets, in other words, the mechanism by which urgency leads to engagement in problem behaviours has not been widely researched. The study in this chapter aims to examine the moderating role of urgency facets in the acute alcohol use and executive functions/risk taking relationship in a university student sample. The following section states the more specific study hypotheses.

Hypotheses

1. It is hypothesised that positive urgency will potentiate the effect of a moderate dose of alcohol on behavioural risk taking. More specifically, positive urgency will enhance negative outcomes (balloon explosions) from risk taking following a moderate dose of alcohol.

2. It is expected that both negative and positive urgency facets will moderate the relationship between a moderate dose of alcohol use and the performance on the executive functioning tasks (prepotent response inhibition and distractor interference); higher levels of urgency will be related to poorer performance on these tasks in the alcohol group.

Method

Participants

A total of 87 participants with 46 females, ($M = 21.83$ years of age, $SD = 5.19$) and 41 males, ($M = 24.59$ years of age, $SD = 5.03$) were recruited from among Goldsmiths, University of London students through a first year psychology research participation scheme or as paid volunteers. They were at least light drinkers who consumed at least 1 unit of alcohol per week. The data was assessed for outliers and five observations were removed as their weekly alcohol unit consumption exceeded 155 units. The final sample consisted of 82 participants with 44 females, ($M = 21.93$ years of age, $SD = 5.28$) and 38 males, ($M = 24.79$ years of age, $SD = 5.16$); 50% of the participants were randomly allocated to the alcohol condition ($n = 41$). Information about the study, such as alcohol administration, expected duration of the study and the rationale, was provided prior to participation. Participants who volunteered to take part were asked to refrain from alcohol at least 12 hours prior to the study.

Measures

Impulsivity and Mood Measures

UPPS-P impulsive behaviour scale. The UPPS-P self-report questionnaire was used as a measure of impulsive behaviour in this study and in previous chapters. Study 4 particularly focused on the urgency facets in the assessment of acute alcohol use, risk taking and executive functioning relationships. Cronbach's Alpha in this study was .87 for negative urgency and .93 for positive urgency facets. It was .86 for lack of premeditation, .86 for lack of perseverance and .82 for sensation seeking scales.

The UWIST mood adjective checklist (UMACL: Matthews, Jones, & Chamberlain, 1990). The UMACL is a mood adjective checklist which comprises 29

adjectives used to describe different mood states, rated on a 4-point Likert scale. Participants are required to circle the response that best matches their current mood, with 1 being 'definitely' and 4 being 'definitely not'. The scale requires the participants to respond to each adjective quickly to describe their current mood at that moment rather than how they usually feel; thus, by instructing participants to rate immediate experience, but not typical subjective experience, it ensures reporting of states rather than traits. The sensitivity of the scale to even momentary shifts in mood makes the UMACL ideal to assess response specific situations or interventions.

The UMACL consists of four subscales. Energetic Arousal (EA) measures feelings of subjective positive high activation mood state, with items such as 'energetic', 'alert' and 'vigorous' on the positive end of the scale and negative items such as 'passive', 'sluggish' and 'tired' on the other end. High scores on this scale indicate high EA. Tense Arousal (TA) measures feelings of subjective tension and includes positive items such as 'nervous', 'tense' and 'jittery', and negative items such as 'relaxed', 'composed' and 'calm'. Higher scores on this scale indicate a more tense state. Hedonic Tone (HT) measures the overall pleasantness of mood, and is associated with feelings of somatic comfort and well-being. Positive items include 'happy', 'cheerful' and 'satisfied', and negative items include 'sorry', 'depressed' and 'sad', with higher scores indicating a more pleasant emotional state. The final subscale is the Anger/Frustration (AF); it includes positive items such as 'impatient', 'annoyed' and 'angry'. Higher scores indicate more frustrated or angry mood state.

The UMACL mood adjective checklist was used in this study to measure state changes in EA, HT and TA. The scores obtained from these subscales were reported. The items for the AF scale were not scored as the study in this chapter specifically focused on different levels of positive mood for comparative purposes with the following study in this thesis. Cronbach's Alpha in the present study for pre-alcohol

administration EA was .80, for post-alcohol administration was .73. This value was .88 for pre-alcohol administration HT and .86 for post-alcohol administration HT. Cronbach's Alpha for pre-alcohol administration TA was .78 and for post-alcohol administration was .82.

Alcohol Use Measures

Alcohol use questionnaire. As for previous studies in this thesis, the AUQ was used to assess drinking behaviour in the last 6 months. Cronbach's Alpha for the AUQ was .56; it was .62 for weekly total unit consumption and .52 binge scores in the present study. The scale was described in the method section of Chapter 2.

Alcohol use disorder identification test. The AUDIT is a self-report problem alcohol use questionnaire which consists of 10 items. It was used in this study to identify hazardous and harmful drinking behaviour. The scale was described in the method section of Chapter 2. Cronbach's Alpha for the AUDIT was .84 in this study.

Task Measures

Balloon analogue risk task (BART). The BART is a computerised risk taking task that is designed to assess actual risk taking and behavioural disinhibition (Leujez, 2003). Measures of risk taking from the BART task have been shown to associate with impulsivity measures (BIS-11, Lejuez et al., 2002; UPPS-P, Cyders et al., 2010), and real world risk behaviours including alcohol misuse, delinquency and safety (Lejuez, Aklin, Zvolensky & Pedulla, 2003). The task consists of a small balloon that represents a temporary bank, a balloon pump, a reset button 'Collect $$$' and a permanent bank 'Total earned'. Participants are required to pump up the balloon; in each pump the balloon increases in size and participants bank 5 cents. The balloon pops if it reaches its explosion point and all the money in the temporary bank will be lost.

Participants have the opportunity to transfer the money that they have earned on that balloon to the permanent bank before it reaches its explosion point by pressing 'Collect $$$'. A new balloon will appear after each explosion or money collection until all 30 balloons have been displayed. The explosion point of each balloon is different; the weakest balloon will explode after the first pump and the strongest after 128 pumps.

A slightly shorter version of the task (20 trials) was used in this study. The total number of balloon explosions was used as the main dependent variable in this study. It indicated that risk exceeded an acceptable level (maladaptive risk taking) and was punished with loss of collected money (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005). The adjusted total number of pumps was also used as dependent variable in separate analyses. It indicated average number of pumps on unexploded balloons with higher scores indicative of greater risk-taking propensity (Bornovalova et al., 2005; Lejuez et al., 2002). Participants were informed that the money was hypothetical, but were paid £5 for participation at the end of the task.

Stop-signal task. The Stop-signal task was used in the previous chapter and described in the method section of Chapter 4. Stop signal reaction times (SSRT) was used as a dependent variable. It represents the time participants take to respond to go trials in milliseconds. SSRT has been used as a dependent variable in previous studies assessing the relationship between alcohol use and response inhibition; larger reaction times indicated poorer performance on the task.

Eriksen flanker task. The distractor interference task used in this study was designed on E-Prime (Fiedman & Miyake, 2004). The task was described in the method section of Chapter 4. The reaction time difference between incompatible and no-noise trials (DI) was used as a dependent variable in this study, as this measure was suggested

as an index of distractor interference by Friedman and Miyake. A larger difference between incompatible and no-noise trials indicated higher interference by distractors.

Procedure

Participants were provided with a consent form and brief information was given about the procedure on their arrival. The baseline Breath Alcohol Concentration (BrAC) was measured to ensure that they had not consumed any alcohol prior to the experiment; they were then weighed to determine the amount of alcohol that should be administered. Following these initial preparations, they were asked to complete self-report impulsivity and alcohol use questionnaires, as well as a mood adjectives checklist (UWIST) assessing their current affective state, prior to alcohol administration. They were administered alcohol or a placebo on completing the questionnaire measures. Participants were then asked to complete a post-alcohol administration UWIST. This was followed by the three computerised tasks performed in random order. Once the tasks were completed, they were informed that the study was finished and were debriefed, received £5 for participating and thanked for their time. The BrAC level was measured and participants were asked to remain in the lounge, outside the testing room until it dropped to 0. The BrAC levels of both placebo and alcohol groups were measured after drink administration and at the end of the experiment to maintain the same experimental conditions for both groups.

Alcohol administration. Participants were randomly assigned to the alcohol or placebo group. The BrAC level was measured at the start of the experiment. They were all weighed prior to administration of drinks. A dose of 0.8g/kg with 90% v/v Vodka was topped up with tonic water (Indian tonic) to make up a 300 ml beverage. The placebo group was administered 300ml of tonic water only; their glass was smeared with alcohol. The drink was divided in to 10x30ml portions and participants were

offered the ten portions in 3 minute intervals, so that the total time for alcohol consumption was 30 minutes (Weissenborn & Duka, 2003).

Results

Descriptive Statistics for the UPPS-P and Alcohol Use Measures

BrAC level was measured 40 minutes after the initiation of alcohol consumption and again on completion of the task measures. The results of BrAC for time points 1 and 2 are presented in Table 5.1.

Table 5.1

Mean and Standard Deviations of BrAC (g/ml) for Females and Males Measured by Breathalyser at Time Point 1in the alcohol administration group (BrAC1= 40 minutes after initiation of alcohol consumption, prior to performing tasks), Time Point 2 (BrAC2=80 minutes after initiation of alcohol consumption, on task completion)

Measure	Females		Males		
	M	*SD*	*M*	*SD*	*t*
BrAC1	0.57	0.31	0.67	0.38	-1.03
BrAC2	0.34	0.21	0.39	0.28	-0.95
N	22		19		

Note. BrAC = Breath alcohol concentration

The means and standard deviations for impulsivity facets, typical alcohol use and pre and post- alcohol administration mood measures for placebo and alcohol groups are presented in Table 5.2. T-test analyses revealed no significant differences between placebo and alcohol groups on pre- alcohol administration impulsivity and previous alcohol use measures. Pre- alcohol administration mood ratings did not differ for placebo and alcohol conditions.

A 3 (mood = tense arousal, energetic arousal, hedonic tone) x 2 (time=pre/post) x 2 (condition=placebo/alcohol) repeated measures ANOVA was conducted to test whether alcohol had any effect on mood. The analysis revealed a significant main effect of mood, $F(2, 74) = 140.54$, $p < .001$; a significant main effect of time, $F(1, 74) = 5.40$, $p < .05$ and a significant interaction effect of mood and time, $F(2, 74) = 54.16$, $p < .001$. There were no significant group interaction effects with time and mood, and the three way interaction effect between time, mood and condition was not significant, $F(2, 74) = .23$, $p > .05$.

Table 5.2

Descriptive Statistics for the Alcohol Use, the UPPS-P, Task and Mood Measures

Measure	Placebo		Alcohol		
	M	*SD*	*M*	*SD*	*t* (82)
Alcohol Use					
TUPW	20.43	16.84	22.68	17.87	-0.58
Binge	16.51	14.51	20.42	16.36	-1.14
AUDIT	9.80	5.69	10.29	6.05	-0.37
AUQ	27.00	19.65	32.56	24.26	-1.14
Impulsivity (UPPS-P)					
NU	29.04	6.65	28.82	7.16	0.14
L of Prem	23.60	5.96	23.26	4.92	0.27
L of Pers	21.04	4.79	22.47	5.93	-1.19
SS	35.00	5.64	34.55	7.32	0.31
PU	26.80	7.80	28.37	9.35	-0.82
Tasks					
SSRT	261.53	52.55	281.63	70.95	-1.44
DI	67.99	40.35	53.29	40.06	1.65
Explosions	7.37	2.50	7.58	2.80	-0.35
Mood					
Energetic A(Pre)	21.17	4.54	21.51	4.03	-0.34
Energetic A(Post)	21.67	4.17	22.20	3.39	-0.61
Tense A(Pre)	15.52	3.28	15.63	4.71	-0.12
Tense A(Post)	15.14	2.93	15.07	3.62	0.10
Hedonic T(Pre)	23.73	4.95	25.60	4.54	-1.78
Hedonic T (Post)	25.87	3.95	27.04	3.97	-1.33

Note. $* p < .05, ** p < .01$

Note. TUPW= Total units per week, AUQ= Alcohol use questionnaire, NU=Negative urgency, L of prem= Lack of premeditation, L of pers= Lack of perseverance, SS=sensation seeking, PU=Positive urgency, SSRT= Stop signal reaction times, DI= Inc-Nnoise, the difference between incompatible and no-noise trials, Explosions=Number of balloon explosions on the BART task, Energetic A= Energetic arousal, Hedonic T= Hedonic tone, Tense A= Tense arousal.

Table 5.3 shows the correlations between the UPPS-P scales and alcohol use measures. As was the case in study 1, alcohol use measures significantly and positively correlated with the UPPS-P facets, with negative and positive urgency scales showing particularly high correlations with alcohol use and alcohol problem measures.

Table 5.3

Correlations between the UPPS-P and Alcohol Use Measures

Measure	1	2	3	4	5	6	7	8	9
1.Negative Urgency	-	.40**	.43**	.11	.69**	.39**	.34**	.33**	.43**
2. Lack of Premeditation		-	.40**	.13	.36**	.34**	.27*	.36**	.37**
3. Lack of Perseverance			-	.07	.31**	.24*	.22*	.22*	.33**
4. Sensation Seeking				-	.21	.27*	.26*	.21	.19
5. Positive Urgency					-	.35**	.27*	.35**	.42**
6. AUQ						-	.94**	.81**	.78**
7. Binge							-	.60**	.68**
8. TUPW								-	.76**
9. AUDIT									-

Note. $* p < .05$, $** p < .01$

Note. TUPW= Total units per week, AUQ= Alcohol use questionnaire.

Post-Alcohol Administration Positive Mood as Predicted by Personality

A series of multiple regression analyses were performed to examine the effect of mood following alcohol administration as a function of reported tendencies towards rash action (Table 5.4). The post-alcohol administration mood scores were used as dependent variables in each analysis. In step one of each analysis, condition and the base mood scores were entered for EA, HT and TA. The five UPPS-P facets were

entered in step two of the analysis, as many of these scales were shown to have a strong relationship with alcohol use previously (Adams et al., 2012; Cyders et al., 2009). Positive urgency positively predicted post- alcohol administration EA at a marginally significant level, β= .27, *p*=.06. Negative urgency was also a significant predictor in the opposite direction at a marginal level, β=-.28, *p*=.06. The self-control facet, lack of premeditation, significantly predicted post- alcohol administration EA in the opposite direction, β=-.23, *p*=.04, indicating a positive relationship between premeditation and EA. However the results of the follow up regression analysis examining condition by lack of premeditation interaction in predicting post-alcohol administration EA was non-significant, β=-.54, *p*=.23. The other self- control facet (lack of perseverance) was not associated with any of the post- alcohol administration mood variables. Sensation seeking was a significant predictor of post-alcohol administration HT. However the interaction of sensation seeking with condition did not significantly predict post-alcohol administration HT, β=.18, *p*=.70. There was no significant relationship between any of the UPPS-P subscales and post-alcohol TA. The results are demonstrated in Table 5.5 and Table 5.6. The effect of mood was not further examined, as the alcohol condition was not found to affect positive mood or tense arousal at a significant level. Post-alcohol administration mood also did not show much variation as a function of personality.

Table 5.4

Hierarchical Regression of Energetic Arousal Post- Scores on the UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.27**	0.27	2,72
Energetic A (Pre)	0.47	0.09	0.52**			
Condition	0.43	0.77	0.05			
Step 2				0.36	0.09	5,67
Energetic A (Pre)	0.40	0.09	0.43**			
Condition	0.18	0.78	0.02			
NU	-0.15	0.08	-0.28			
L of Prem	-0.16	0.08	-0.23*			
L of Pers	0.04	0.08	0.05			
SS	0.04	0.06	0.06			
PU	0.12	0.06	0.27			

Note. **p<.001, *p<.05
Note. Energetic A= Energetic arousal, NU= Negative urgency, L of Prem= Lack of premeditation, L of Pers= Lack of perseverance, PU= Positive urgency.

Table 5.5

Hierarchical Regression of Hedonic Tone Post- Scores on the UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.43*	0.43	2,77
Hedonic T (Pre)	0.51	0.07	0.64**			
Condition	0.48	0.67	0.06			
Step 2				0.51	0.07	5,72
Hedonic T (Pre)	0.47	0.07	0.59**			
Condition	0.45	0.66	0.05			
NU	-0.04	0.07	-0.07			
L of Prem	-0.11	0.06	-0.16			
L of Pers	0.04	0.07	0.06			
SS	0.14	0.05	0.23*			
PU	0.06	0.05	0.15			

Note. **p<.001, *p<.05

Note. Hedonic T= Hedonic tone, NU = Negative urgency, L of Prem= Lack of premeditation, L of Pers= Lack of perseverance, SS= Sensation seeking, PU= Positive urgency.

Table 5.6

Hierarchical Regression of Tense Arousal Post- Scores on the UPPS-P Facets

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.38**	0.38	2,76
Tense A (Pre)	0.49	0.07	0.61**			
Condition	-0.34	0.58	-0.05			
Step 2				0.40	0.02	5,71
Tense A (Pre)	0.46	0.07	0.58**			
Condition	-0.42	0.61	-0.06			
NU	0.00	0.06	0.01			
L of Prem	0.01	0.06	0.02			
L of Pers	0.00	0.06	0.00			
SS	-0.04	0.04	-0.09			
PU	0.04	0.05	0.10			

Note. **p<.001, *p<.05

Note. Tense A= Tense Arousal, NU = Negative urgency, L of Prem= Lack of premeditation, L of Pers= Lack of perseverance, SS= Sensation seeking, PU= Positive urgency.

Effects of Acute Alcohol Administration on Executive Functioning as Moderated by Personality

A series of moderated regression analyses were performed to assess executive functioning abilities following alcohol administration, as a function of reported tendencies to rash actions.

Prepotent response inhibition. SSRT was entered as dependent variable in these analyses. Gender and previous alcohol consumption were controlled in step 1 of the model. Condition (placebo/alcohol) and centred variables for positive urgency were entered in step 2; the interaction term for centred positive urgency and condition was

entered in step 3 of the first moderated regression analysis. The interaction of positive

urgency and condition did not significantly predict prepotent response inhibition. Table

5.7 demonstrates the results in detail.

Table 5.7

SSRT on Positive Urgency and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	2,77
Gender	-7.60	14.37	-0.06			
AUQ	0.04	0.32	0.01			
Step 2				0.03	0.02	2,75
Gender	-7.31	14.39	-0.05			
AUQ	- 0.03	0.34	-0.01			
Condition	20.09	14.46	0.16			
PU_C	0.15	0.89	0.02			
Step 3				0.05	0.02	1,74
Gender	-8.14	14.31	-0.06			
AUQ	-0.01	0.34	-0.00			
Condition	21.89	14.42	0.17			
PU_C	-1.28	1.34	-0.17			
PU_C X Condition	2.41	1.69	0.25			

*Note. * $p < .05$, ** $p < .01$

Note. DV= SSRT, AUQ= Alcohol use questionnaire, PU_C = Centered positive urgency.

The moderating role of negative urgency in the prepotent response inhibition

and alcohol use relationship was also examined in a moderated regression analysis. The

interaction of condition and negative urgency predicted SSRT at a marginally

significant level, $\beta = .29$, $t (82) = 1.78$, $p =.07$. The results are shown in Table 5.8.

Simple slopes analysis was performed to explore the way negative urgency related to

prepotent response inhibition for the placebo and alcohol groups. Significance of the

slopes was tested in separate regression analyses for alcohol and placebo groups with

negative urgency predicting SSRTs. The results showed that negative urgency predicted

SSRT in negative direction among those in placebo group, β= -.22, *t* (82) = -1.41, *p* =.16, and in positive direction for alcohol group, β= .17, *t* (82) = 1.10, *p* =.27. Figure 3.1 depicts the relationship between negative urgency and SSRTs for alcohol and placebo group, with high negative urgency individuals in alcohol group showing slightly higher SSRTs compared to placebo group.

Table 5.8

SSRT on Negative Urgency and Condition Interaction

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.01	0.00	2,79
Gender	-7.60	14.37	-0.06			
AUQ	0.04	0.32	0.01			
Step 2				0.06	0.02	2,76
Gender	-7.03	14.45	-0.05			
AUQ	-0.02	0.35	-0.01			
Condition	20.33	14.47	0.16			
NU_C	0.10	1.14	0.01			
Step 3				0.10	0.04	1,72
Gender	-10.03	14.34	-0.08			
AUQ	- 0.07	0.35	-0.02			
Condition	21.94	14.30	0.17			
NU_C	-1.84	1.57	-0.20			
NU_C X Condition	3.71	2.08	0.29			

Note. * *p* < .05, ** *p*< .01

Note. DV= SSRT, AUQ= Alcohol use questionnaire, NU_C=Centered negative urgency.
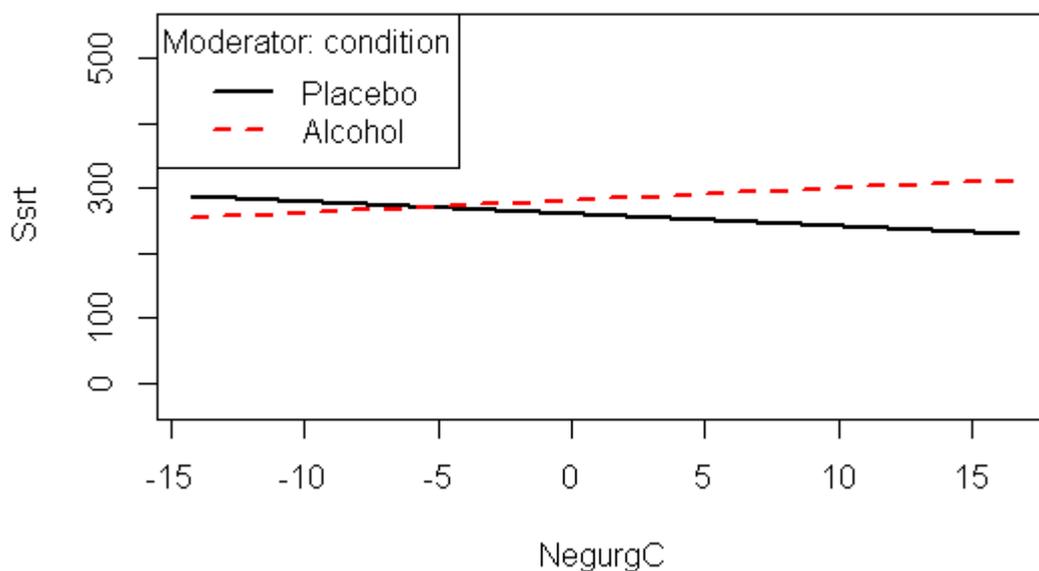
Figure 3.1. Negative urgency (NegurgC) predicting stop signal reaction times (SSRT) for placebo and alcohol conditions.

 Distractor interference. Moderated regression analyses were performed to test the

function of urgency in acute alcohol use and distractor interference relationship. The

positive urgency and condition interaction negatively predicted distractor interference at

a marginally significant level, β = -.31, t (82) = 1.86, p =.06. The results are

demonstrated in Table 5.9. Figure 3.2 demonstrates the relationship between positive

urgency and the DI in reaction time for the alcohol and placebo groups. Simple slopes

analysis was performed to analyse the strength of the slopes. A set of linear regression

analyses was performed with positive urgency as predictor of distractor interference for

alcohol and placebo conditions. The results revealed that positive urgency significantly

and negatively predicted distractor interference only among those in alcohol group, β =

-.38, t (82) = -2.53, p <.05, but not for placebo condition, β = .07, t (82) = 0.82, p =.64.

Table 5.9

Distractor Interference on Positive Urgency and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.02	0.01	2,78
Gender	-10.19	9.15	-0.12			
AUQ	-0.05	0.20	-0.02			
Step 2				0.08	0.06	2,76
Gender	-9.66	8.99	-0.11			
AUQ	0.10	0.21	0.05			
Condition	-13.75	9.03	-0.16			
PU_C	-0.87	0.56	-0.18			
Step 3				0.11	0.04	1,75
Gender	-8.83	8.85	-0.10			
AUQ	0.09	0.21	0.05			
Condition	-15.06	8.91	-0.18			
PU_C	0.28	0.83	-0.06			
PU_C X Condition	-1.96	1.05	-0.31			

Note. * $p < .05$, ** $p < .01$

Note. DV= DI: Distractor interference, PU_C=Centred positive urgency.
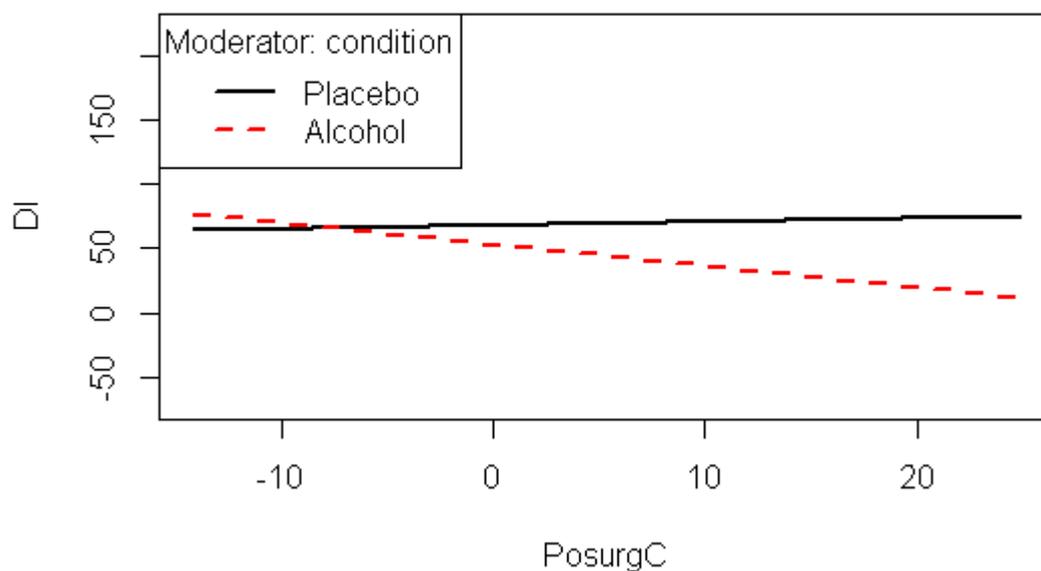
Figure 3.2. Positive urgency (PosurgC) predicting distractor interference (DI, in reaction time) for placebo and alcohol conditions.

The relationship between negative urgency, alcohol use and DI was also examined in another moderated regression analysis. The analysis did not reveal a significant moderating effect of negative urgency in the acute alcohol use and DI relationship. The results are demonstrated in Table 5.10.

Table 5.10

Distractor Interference on Negative Urgency and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.02	0.01	2,78
Gender	-10.19	9.15	-0.12			
AUQ	-0.05	0.20	-0.03			
Step 2				0.05	0.03	2,76
Gender	-10.93	9.15	-0.13			
AUQ	0.04	0.22	0.02			
Condition	-14.87	9.16	-0.18			
NU_C	-0.43	0.72	-0.07			
Step 3				0.05	0.00	1,75
Gender	-10.89	9.28	-0.13			
AUQ	0.04	0.22	0.02			
Condition	-14.89	9.24	-0.18			
NU_C	-0.41	1.01	-0.06			
NU_C X Condition	-0.04	1.35	-0.00			

Note. * $p < .05$, ** $p < .01$

Note. DV= DI: Distractor interference, NU_C=Centered negative urgency.

Risk-Taking. The moderating role of urgency in the alcohol use and risk taking relationship was tested in a series of moderated regression analyses. Number of explosions and adjusted pump total were used as dependent variables in separate analyses. Gender and previous alcohol use was entered in step 1; condition and centered positive urgency were entered in step 2, and the interaction term for positive urgency and condition was entered in step 3 of the first moderated regression analysis. Positive urgency and the interaction of positive urgency with condition did not predict risk taking. The results are demonstrated in Table 5.11.

Table 5.11

Explosions on Positive Urgency and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.11	0.11	2,77
Gender	1.80	0.56	0.34**			
AUQ	-0.00	0.20	-0.02			
Step 2				0.14	0.02	2,75
Gender	1.77	0.56	0.33**			
AUQ	-0.01	0.01	-0.08			
Condition	0.16	0.57	0.03			
PU_C	0.05	0.03	0.15			
Step 3				0.15	0.00	1,74
Gender	1.75	0.57	0.33**			
AUQ	-0.00	0.01	-0.07			
Condition	0.20	0.57	0.04			
PU_C	0.01	0.05	0.04			
PU_C X Condition	0.06	0.06	0.14			

Note. * $p < .05$, ** $p < .01$

Note. DV: Explosions= Number of exploded balloon on BART task, AUQ= Alcohol use questionnaire, PU_C= Centred positive urgency.

Negative urgency significantly predicted explosions in the positive direction in the second step of the analysis, β = .34, t (82) = 3.09, $p < .01$; however a moderate dose of alcohol did not affect risk taking among individuals with high negative urgency, β = .20, t (82) = 1.37, $p = .17$. The results are demonstrated in Table 5.12.

Table 5.12

Explosions on Negative Urgency and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.11	0.11	2,77
Gender	1.80	0.56	0.34**			
AUQ	-0.00	0.01	-0.02			
Step 2				0.21*	0.10	2,75
Gender	1.99	0.54	0.37**			
AUQ	-0.01	0.01	-0.16			
Condition	0.32	0.54	0.06			
NU_C	0.13	0.04	0.34**			
Step 3				0.24	0.02	1,74
Gender	1.90	0.54	0.35**			
AUQ	-0.02	0.01	-0.17			
Condition	0.37	0.54	0.07			
NU_C	0.07	0.06	0.19			
NU_C X Condition	0.11	0.07	0.20			

Note. * $p < .05$, ** $p < .01$

Note. DV: Explosions= Number of exploded balloon on BART task, AUQ= Alcohol use questionnaire, NU_C= Centred negative urgency.

These analyses were repeated with adjusted pump total as the dependent variable and the results remained similar. The interaction of negative urgency and condition was not a significant predictor of behavioural risk taking. Finally, sensation seeking was examined in the relationship between acute alcohol use and executive functions and risk taking. Analogous to the study by Cyders et al. (2010), sensation seeking was not found to predict post-alcohol administration balloon explosions. The results were similar when adjusted pumps total was entered as dependent variable.

Moderated regression analyses were repeated with distractor interference and prepotent response inhibition as dependent variables in separate analyses. The sensation seeking and condition interaction significantly and positively predicted prepotent

response inhibition (SSRT), $\beta = .43$, t (82) = 2.39, $p < .05$. The results are shown in

Table 5.13. A simple slopes analysis was performed to explore the relationship between

sensation seeking and prepotent response inhibition for alcohol and placebo conditions.

The results showed that sensation seeking significantly and positively predicted SSRT

only among those in alcohol condition, $\beta = .31$, t (82) = 2.00, $p = .05$, but not for

placebo group, $\beta = -.21$, t (82) = -1.31, $p = .19$. Figure 3.3 shows the direction of the

relationship between negative urgency and SSRT for alcohol and placebo conditions.

Table 5.13

SSRT on Sensation Seeking and Condition Interaction

Predictor	B	SE B	β	R^2	R^2Ch	Df
Step 1				0.00	0.00	2,77
Gender	-7.60	14.37	-0.06			
AUQ	0.04	0.32	0.01			
Step 2				0.04	0.04	2,75
Gender	-10.10	14.44	-0.08			
AUQ	-0.13	0.33	-0.04			
Condition	21.43	14.33	0.17			
SS_C	1.40	1.15	0.14			
Step 3				0.11*	0.07	1,74
Gender	-11.23	14.01	-0.08			
AUQ	- 0.27	0.33	-0.09			
Condition	23.30	13.93	0.18			
SS_C	-1.74	1.73	-0.18			
SSC X Condition	5.32	2.22	0.43*			

Note. * $p < .05$, ** $p < .01$

Note. DV = SSRT: Stop signal reaction times, AUQ= Alcohol use questionnaire, SS_C= Centred sensation seeking
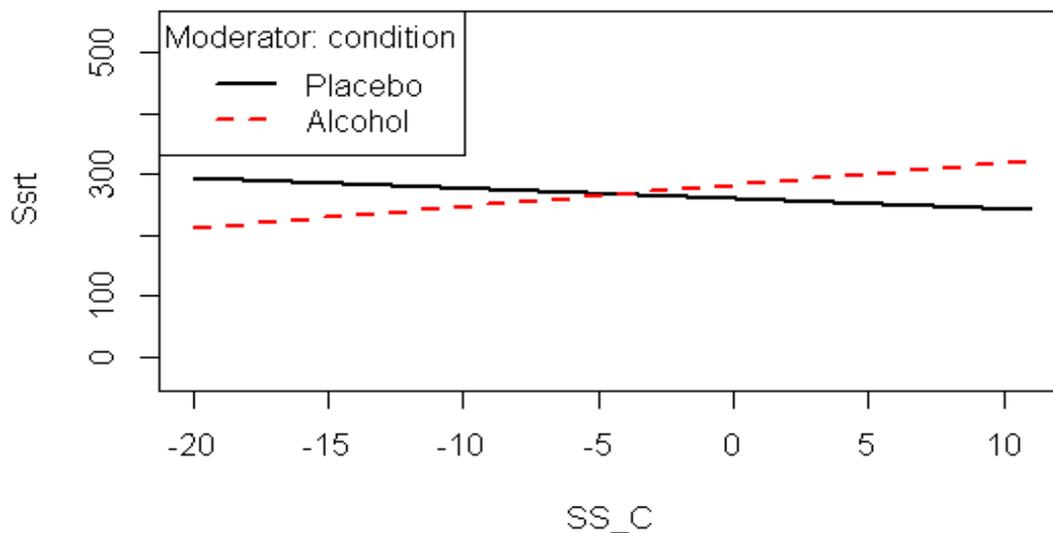
Figure 3.3. Figure depicting the relationship between sensation seeking (SS_C) and stop signal reaction times (SSRT) for placebo and alcohol conditions.

The analysis testing the moderating role of sensation seeking in the relationship between acute alcohol use and DI revealed that the interaction of condition and sensation seeking did not predict DI at a significant level. Sensation seeking did not significantly moderate the relationship between acute alcohol use and DI. The results are demonstrated in Table 5.14.

Table 5.14

Distractor Interference on Sensation Seeking and Condition Interaction

Predictor	B	SE B	β	*R²*	*R²Ch*	*Df*
Step 1				0.01	0.01	2,78
Gender	-10.19	9.15	-0.12			
AUQ	-0.05	0.20	-0.03			
Step 2				0.04	0.03	2,76
Gender	-9.97	9.24	-0.12			
AUQ	0.00	0.21	0.00			
Condition	-14.63	9.18	- 0.18			
SS_C	-0.18	0.74	-0.03			
Step 3				0.05	0.00	1,75
Gender	-9.74	9.28	-0.12			
AUQ	0.03	0.22	0.01			
Condition	-14.98	9.22	-0.18			
SS_C	0.42	1.15	0.06			
SS_C X Condition	-1.02	1.48	-0.12			

Note. $* p < .05$, $** p < .01$

Note. DV: DI = Distractor interference, AUQ= Alcohol use questionnaire, SS_C=Centred sensation seeking.

Discussion

The urgency facets   has been shown cross-sectionally and longitudinally to be associated with a wide range of risky behaviours in previous studies. Although these findings have consistently demonstrated the role of urgency as a risk factor in risky and maladaptive behaviours, they have been predominantly based on self-report assessment of previous engagements in problem behaviours. Furthermore, the relationship between trait urgency and executive functions, such as prepotent response inhibition and distractor interference, has not been experimentally assessed. A study by Cyders et al. (2010) has demonstrated a significant effect of positive urgency on behavioural risk

taking while in a positive mood. However, the effect of urgency on risk taking behaviour and executive functions under the influence of alcohol has not been researched. Thus, to provide further support for the contribution of urgency to potential problem behaviours, like alcohol use, the study in this chapter examined the trait using direct observations of risky behaviour involvement and performance on executive functioning tasks under laboratory control.

The first hypothesis of the present study was that positive urgency would significantly moderate the relationship between a moderate dose of alcohol use and risk taking, making it stronger.The second hypothesis stated that both positive and negative urgency facets would moderate the relationship between alcohol use and performance on executive functioning tasks, so that higher levels of urgency will be associated with poorer performance on tasks in the alcohol group. The initial analyses assessed whether a moderate dose of alcohol had any effect on mood state, and whether the relationship between alcohol use and mood varied as a function of urgency. The relationship between mood and task variables was not further assessed, as alcohol did not have any effect on mood. Consistent with Cyders et al. (2010), baseline mood did not vary as a function of positive urgency. This finding is also consistent with factor analytic findings showing that the trait is unrelated to extraversion as measured by the NEO-PI-R (Costa & McCrae, 1992) and its facets, including positive emotions (Cyders & Smith, 2008). It was suggested by Cyders et al. that perhaps the trait is associated with a tendency to act impulsively when experiencing highly positive emotions, but not a tendency to experience those emotions more often or more intensely than do others. Furthermore, since positive urgency was also found to be unrelated to reported changes in mood following alcohol administration, it does not seem that individuals high on this facet

experienced positive mood more intensely in the alcohol condition than did those low on positive urgency.

The second part of the study examined the moderating effects of urgency facets in the relationship between acute alcohol use and behavioural task performance. Sensation seeking was also examined to allow comparison with other UPPS-P facets and with previous studies that have examined this trait with behavioural task measures. In a series of moderated regression analyses the relationship between acute alcohol use and performance on prepotent response inhibition, distractor interference and risk taking tasks as a function of rash action tendencies was assessed. It was stated in hypothesis 2 that urgency would potentiate the effects of a moderate dose of alcohol on prepotent response inhibition. The hypothesis was partially supported in the analysis. Negative urgency, but not positive urgency, significantly moderated the effect of alcohol on prepotent response inhibition, making it stronger; however, this effect was small. However, although not hypothesised, sensation seeking was found to significantly and positively moderate the relationship between alcohol use and prepotent response inhibition, such that high sensation seekers have shown poor performance following a moderate dose of alcohol. This result suggests that sensation seeking potentiates the effect of alcohol on prepotent response inhibition.

The second hypothesis also stated that urgency would moderate the relationship between alcohol use and DI, so that high urgency would predict high levels of distraction by flanking stimuli following a moderate dose of alcohol. Positive urgency, but not negative urgency, significantly and negatively moderated the relationship between acute alcohol use and DI at a marginal level. Positive urgency, as an individual variable, predicted significantly less distraction by flankers on that task. The direction of this effect is the opposite to that predicted in the hypothesis. There was

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no significant association between negative urgency and DI. Sensation seeking also did not significantly moderate the effect of moderate dose of alcohol on DI. The analysis also did not show any associations between previous alcohol use and performance on DI task. This result is in line with a previous study that had investigated long-term effects of alcohol use on distractor interference among a group of abstinent alcohol dependents; the study also found no associations between the Eriksen flanker task and previous alcohol use (Tedstone & Coyle, 2004). However, there are no previous studies that have investigated the moderating effects of impulsivity in the relationship between alcohol use and distractor interference. The negative relationship between positive urgency and interference needs further confirmation.

The first hypothesis stated that positive urgency would predict negative outcomes from risk taking following a moderate dose of alcohol use. Individuals with high positive urgency were predicted to explode more balloons and/or to continuously pump on a balloon on the BART task. The results showed that positive urgency was not associated with either number of explosions or pumps. It did not predict negative outcomes from risk taking following a moderate dose of alcohol use. This result does not support previous findings where positive urgency was found to predict number of explosions on a balloon task, that is, continued pumps on a single balloon until it exploded, thus costing one all the money one had earned on that balloon up until that point. Cyders et al. (2010) has shown that positive urgency predicted number of explosions on a balloon following a positive mood induction.

Additionally, although not hypothesised, sensation seeking was examined to allow comparisons with previous studies. Sensation seeking was not found to predict number of explosions or pumps following a moderate dose of alcohol in the present study. This result is analogous to the result by Cyders et al. where sensation seeking was

also not found to predict explosions on the BART task. Cyders et al. had used a self-report gambling questionnaire, as well as behavioural risk taking task, and found that positive urgency and sensation seeking played different roles in gambling behaviour; that is positive urgency predicted betting money one does not know how to pay back, a marker of problem gambling, while sensation seeking covaried with common gambling behaviour, betting on sport events, but not with the marker of problem gambling. This finding may explain non-significant associations between sensation seeking and behavioural risk taking in the present study. The findings of the study by Cyders et al. indicates that sensation seeking prompts individuals to engage in risky behaviours with a greater frequency, but positive urgency results in problem level of involvement in risky actions among college students. This contention was supported in a previous study where sensation seeking was positively associated with frequency and positive urgency with the amount of alcohol consumed in one drinking episode (Cyders et al., 2009). As for non-significant associations between positive urgency and behavioural risk taking in the present study, this result needs further investigation. The different results may be due to different samples used in two studies, college students in the US and university students in the UK may present different risky rash actions in response to highly positive affective state. It may also be that induced positive mood as shown in Cyders et al. affects the behavioural risk taking of individuals with high positive urgency at a higher level than a moderate dose of alcohol does. Positive urgency should be closely examined in association with different types of positive mood in order to better understand the role of this trait in alcohol use and other risky behaviour involvements.

Although it was not hypothesised, the present study additionally tested the moderating effects of negative urgency in the relationship between acute alcohol use

and behavioural risk taking, to allow comparison with positive urgency. It was found that negative urgency positively predicted the number of explosions on the BART task in the second step of the moderated regression analysis, but it was not a significant predictor in an interaction with alcohol condition. It appears that individuals with high tendency to act rashly when experiencing intense negative emotions exhibit high sensitivity to engage in risky behaviours related to monetary decisions independently of alcohol. Positive urgency did not predict the balloon explosions, a marker of negative outcomes from risky behaviour involvement. In these ways, the result does not converge with previous findings. On the other hand, the results are in line with other studies showing associations between negative urgency and self-reported risk taking. Cyders and Coskunpinar (2010) have examined positive urgency and positively-valenced emotions and negative urgency and negatively-valenced emotions in predicting self-reported risk taking in a set of hierarchical regression analyses (Risky Behavioural Scale, RBS, Fischer & Smith, 2004). Positive urgency and negative urgency in each analysis were the only significant predictors of self-reported risk taking. Positive and negative affect were also found to predict risk taking as individual variables.

It should be noted that in most previous studies self -reported measure of risk taking was employed. These questionnaires (e.g. RBS) consisted items which were likely to result with negative outcomes such as driving a car after drinking alcohol, having more than five drinks in one occasion and using illegal drugs. Although these items describe risky behaviours which may result in negative outcomes, they are different to behavioural risk taking tasks where an individual experiences risk taking and the task involves potential monetary gains (e.g. BART). It may be that self-report and behavioural risk taking measures explain different aspects of this behaviour.

Behavioural risk taking which governs ones decision making should be further assessed in association with urgency facets to further clarify the role of positive and negative urgency in risk taking behaviour.

The study in this chapter investigated the effects of a moderate dose of alcohol use on three dimensions of impulsive behaviour, risk taking, prepotent response inhibition and distractor interference and, the moderating role of urgency in this relationship. Positive urgency may predict different negative outcomes associated with responses in the presence of high or low-activation positive affect. Taking emotions in to account, the next chapter aims to explore the direct effects of positive urgency on risky behaviours (alcohol use) as moderated by different levels of positive mood. Cyders et al. (2010) have previously shown that induced positive mood has led to increases in beer consumption among individuals with high positive urgency. The study in the next chapter sought to further clarify the distinction between high and low-activation positive affect and their relationship with positive urgency and alcohol consumption.

Limitations and Future Directions

The present findings should be understood in the context of limitations of the study. Firstly, participants were limited to college students thus the effects of a moderate dose of alcohol reported in the present study cannot be generalised to other groups, such as clinically diagnosed alcohol dependents or individuals with personality and mood-related disorders. A moderate dose of alcohol may have differential affects on performance of these individuals. Secondly, alcohol was administered in a laboratory setting; perhaps the effect of alcohol on mood and task performance would have been different in a more ecologically valid environment. The other limitation was that the study did not control for other factors that may have interfered with task performance,

such as use of other substances and mood disorders. Also, participants were randomly allocated to three tasks following alcohol administration, thus lacking strict counter-balancing of effects, which may have had an influence on the performance of alcohol group on different tasks used in the study. Furthermore, alcohol may have different effects on executive functions and risk taking behaviours at different phases of BrAC, as it has been suggested in a previous study showing significant relationships between the descending limb of BrAC, which is characterised with sedative phase, and risk taking behaviour (Bidwell et al., 2013). The present study used a between subjects design; the results may have been different if a within subjects design was used.

It remains to be seen if negative urgency continues to predict poor performance on response inhibition and risk taking tasks, and if moderating effect of sensation seeking holds for clinically diagnosed alcohol dependents. If sensation seeking moderates the effect of heavy drinking on response inhibition, supporting under-aroused individuals to achieve optimum mood level by other means than excessive alcohol use would lead to lower levels of engagement in alcohol use behaviour. Likewise, providing high negative urgency individuals with support to develop better coping strategies would reduce the high level of risk taking they appeared to show in this study.

It would be interesting to test whether behavioural response inhibition moderates the effects of urgency on alcohol use. As noted in the previous chapter, dual process theory posits that poor behavioural self-control leads to increases in alcohol use, and this in turn leads to even weaker response inhibition among impulsive individuals. Houben and Wiers (2009) suggested that training individuals with poor response inhibition to help them increase self-control would reduce the level of alcohol intake among heavy drinkers. Future studies should aim to test the moderating effects of

executive functions and risk taking in the relationship between urgency and alcohol use to better understand whether individual differences on these functions serves as a risk factor that potentiates the effect of urgency on alcohol use.

What this chapter adds to the literature

The urgency facets, negative and positive urgency, have been shown to be associated with a wide range of risky behaviours in previous studies (Cyders et al., 2009; Zapolski et al., 2009). Although the findings from these studies have consistently demonstrated the role of urgency as a risk factor in risky and maladaptive behaviours, they have been predominantly based on self-report assessment of previous engagements in problem behaviours. Furthermore, the relationship between urgency facets and executive functions, such as prepotent response inhibition and distractor interference, has not been experimentally assessed. A study by Cyders et al. (2010) has demonstrated a significant effect of positive urgency on behavioural risk taking in a positive mood. However, the effect of urgency on risk taking behaviour and executive functions under the influence of alcohol has not been researched. Thus, the study in this chapter provided further support for the contribution of urgency to risky behaviour involvement, like alcohol use; it examined these facets using direct observations of risky behaviour involvement and the performance on executive functioning tasks under laboratory control.

CHAPTER 6

Moderating Effects of Positive Mood on the Relationship between Positive Urgency and Alcohol Use

Previous research suggests that our behaviours are guided by affective states and that poor inhibitory control partly stems from an over reliance on affective cues in guiding behaviours (Billieux et al., 2010). Individuals engage in risky and maladaptive behaviours, such as substance abuse, gambling, excessive alcohol use, and risky sexual behaviours, in response to positive (Moore & Chatter, 2003; Cheung & Mikels, 2011; Zapolski et al., 2009) or negative emotions (Zhao, 2006). Findings suggest that engagement in risky behaviours is partly motivated by the desire to regulate affective states (Magid et al., 2007; Forgas, 1995; Isen, Nygren, & Ashby, 1988).

Different theories have been propounded to explain the affect and risky behaviours relationship. Isen et al. (1988) developed the mood- maintenance hypothesis (MMH), which states that individuals in a positive mood are reluctant to become involved in risky behaviours due to the potential aversive consequences that may undermine the happy feeling. Forgas (1995) on the other hand, explained the affect and risk taking relationship in a model (Affect Infusion Model; AIM) that posited that positive mood fosters risk-prone behaviour. According to this model, happy mood cues positive memories that lead to a more favourable assessment of the environment. Furthermore, individuals experiencing a positive mood may exhibit a propensity to rely more heavily on heuristic information processing; this may contribute to risky decision-making. Also, they tend to have higher positive outcome expectancies from risky behaviours, which may lead to increments in the current positive affect, whereas people in a negative mood are more likely to avoid risk due to possible negative outcomes, which may cause greater negative emotions associated with such behaviours (Forgas,

1998). Despite the differences in the approaches, a converging point of these theories is that the ultimate goal for the engagement in risky and maladaptive behaviours is to regulate and enhance positive affective states. Studies have revealed conflicting empirical evidence, with some demonstrating conservative attitudes toward risky behaviours among people in a negative mood as an attempt to avoid extreme negative emotions (Yuen & Lee, 2003), while others reported high involvement in risky behaviours for those in negative affective states as a way to optimise mood level (Magid et al., 2007). Positive emotions, however, were predominantly demonstrated to positively associate with risky behaviours (Lindman, Sjoholm, & Lang, 2000; Forgas, 1995; Chou, Lee, & Ho, 2007; Cummins, Nadorff, & Kelly, 2009).

Although much research has examined the direct relationship between affect and engagement in risky behaviours, the mechanism through which emotions lead to involvement in risky actions has not been widely researched. Recent literature investigating affect and risky behaviour associations indicates the role of personality factors in this relationship. Responses to emotions appear to be potentiated by these factors (Cyders et al., 2010; Simons et al., 2010). Studies investigating the link between mood based dispositions and engagement in risky/maladaptive behaviours have mainly employed the UPPS-P impulsivity questionnaire (Curcio & George, 2011; Adams et al., 2012; Coskunpinar & Cyders, 2012). Emotion based dispositions to rash actions, the positive and negative urgency facets of this scale, have been shown to strongly predict a number of risky behaviours (Zapolski et al., 2009; Cyders & Smiths, 2008), and also to potentiate the relationship between affect and maladaptive actions, such as excessive alcohol use and risk taking (Cyders et al., 2010; Simons et al., 2010). Cyders et al. found that positive urgency significantly predicted risk taking and increases in alcohol use while in a positive mood.

Positive Affect and Urgency

Positive affective associations may exhibit variation as a function of positive urgency. The positive urgency construct does not directly associate with a tendency to experience emotional states (Cyders & Smith, 2008), however it may be facilitating behaviours that are closely tied to those emotions (Cyders et al., 2010). Thus, in addition to its predictive role in alcohol use and related problems, the positive urgency facet may also be acting to potentiate links between specific positive emotions and alcohol use. Positive urgency has not been extensively examined in association with positive mood states and subsequent risky behaviours. In a within subjects design, Simons et al. (2010) reported no moderating effect of positive urgency in the positive affect and alcohol use association. However, the study did not involve positive mood induction; subjects were instructed to retrospectively report on the previous night's drinking behaviour following a day they have experienced positive or negative mood. Negative urgency, however, was found to potentiate negative emotions and subsequent drinking associations making it stronger.

Cyders et al. (2010) examined the effects of a positive mood manipulation on alcohol consumption and risk taking as a function of reported tendencies towards rash action. The first part of the study hypothesised that positive urgency would predict negative outcomes from risky behaviours while in a positive mood state, and sensation seeking would not. Subjects were asked to complete self-report baseline mood and impulsivity measures prior to performing the Balloon Analogue Risk Task (BART). They were compensated for the amount they earned on completion of the task. Participants then underwent a combined modality positive mood induction: a story and imagination mood induction. They were initially instructed to listen to stories to induce positive affect; this was followed by writing a paragraph on how they felt following the

relevant mood induction. They were then instructed to vividly imagine a situation that has put them in an extreme positive mood, and to write down how they felt at the time and what they did in response to these emotions. The positive mood induction was followed by completion of another 30 trials of the BART. It was found that individual differences in pre-mood induction balloon explosions strongly predicted individual differences in balloon explosions while in a positive mood ($\beta = 0.89$, $p < .001$). Positive urgency was found to predict additional variance in exploded balloons post-mood induction ($\beta = 0.12$, $p < .05$), but sensation seeking did not.

The second study hypothesised that positive urgency would be unrelated to the quantity of alcohol consumption during a neutral mood induction, but it would predict quantity consumed following a positive mood induction, even when controlling for the quantity consumed when in a neutral mood. Participants completed two counter-balanced experimental sessions, a positive mood induction session and a neutral mood induction session. At the first session participants were asked to complete the UPPS-P impulsivity questionnaire, the Self Assessment Manikin Scale (SAM) and the Positive and Negative Affect Scale (PANAS). Following this, at each session, participants completed the BART, the mood induction and a 90 minutes beer taste test. Only participants assigned to the positive mood condition were compensated for their performance; this was done to increase the effect of the mood induction procedure. The main dependent variable was the amount of beer consumed in each 90 minutes session. In a multiple regression analysis it was shown that positive urgency was the only significant predictor of the increase in alcohol consumption following the positive mood induction ($\beta = 0.42$, $p < .05$). Using a within subjects design, the study demonstrated that positive urgency predicted increases in alcohol consumption in a positive mood condition, over and above that consumed in neutral condition. None of the other four

UPPS-P dispositions to impulsive behaviour predicted increases in alcohol consumption while in a positive mood state.

Employing multiple mood induction methods, such as instructing participants to listen to a story and giving them monetary incentive for a task they have just performed, or asking them to listen to music pieces and imagine scenarios, has been shown to be more effective for obtaining the desired mood state than a single method (Mayer, Allen, & Beauregard, 1995). The difficulty, however, with mixed modalities and methods used for positive mood inductions is that the procedure often involves different types of appetitive stimuli (e.g. monetary rewards or guided imagery-encountering romance, going on holiday, relaxing on a beach). This makes it difficult to distinguish what properties of the positive stimuli induced the desired effect, and the proportion of contribution for each mood induction modality in the induced mood. Studies often use general positive or negative mood induction procedures to enhance these affective states; however individuals can also show different responses to high and low-activation affective states. The intensity of emotions may influence the subsequent behaviours. For example, individuals may be more prone to act impulsively while in an activated positive affective state, as compared to when they are in non-activated positive states. It is common in the emotion literature to make a distinction between valence and activated mood states (Larsen & Diener, 1992; Russel & Feldman-Barrett, 1999; Yik, Russell, & Steiger, 2011; Smillie, Cooper, Wilt, & Revelle, 2012). Valence refers to a state of pleasantness and consists of emotions such as 'satisfied', 'cheerful' and 'content', whilst activated mood refers to a state of arousal and highly activated affect, and it would include emotions such as 'alert', 'awake' and 'energized'. Since high and low-activation positive affect may influence behaviour differently, it is critical to

distinguish between these emotions in order to use the appropriate mood induction procedure to obtain the desired emotions.

Intensity of emotional experiences also appears to contribute to emotion based rash actions. The study in this chapter aims to experimentally assess whether high-activation positive affective states promote alcohol use at a greater level as compared to low- activation positive affect, as a function of positive urgency. During the development of the scale, positive urgency has been characterised by ill-advised responses to intense positive emotions among those who were high on this trait. Although positive urgency has been shown to predict risky and maladaptive actions including alcohol use, risky sexual behaviour and gambling (Cyders & Smith, 2008; Cyders et al., 2009; Zapolski et al., 2009), these studies have predominantly relied on self-report assessment of these behaviours. Alcohol is often consumed socially in situations that often induce high-activation positive mood. The study will employ vignettes that are highly appetitive (high-activation positive), and contrast these with merely pleasant (low-activation positive) vignettes, both accompanied by relevant music in order to increase the effect of the mood induction. Using a between subjects design, the study aims to elucidate whether a) high and low-activation positive mood differentially affects subsequent drinking behaviour and, b) high and low-activation positive mood states moderate the effects of positive urgency on the level of alcohol consumption.

Hypotheses

1. It is predicted that the positive and negative urgency facets of the UPPS-P and alcohol use outcomes will show significant and positive correlations.

2. It is hypothesised that high-activation positive mood will moderate the relationship between positive urgency and alcohol use, making it stronger. More specifically, it is predicted that positive urgency will lead to increased beer consumption in high-activation positive mood condition, such that those high on positive urgency will consume the most alcohol in the high-activation positive mood condition relative to the low-activation positive and neutral mood conditions.

Method

Participants

The sample consisted of 110 participants aged 18 years or over who were recruited via a psychology student research participation scheme and from other departments at Goldsmiths, University of London. Participants were 61 females ($M = 24.02$ years of age, $SD = 7.68$) and 49 males ($M = 23.79$ years of age, $SD = 5.70$). Only individuals who consumed at least one unit of alcohol per week were eligible for participation.

Participants who were on any prescribed psychoactive medication or receiving treatment for neurological, psychiatric or substance abuse related conditions were excluded from the study. Participants were rewarded with course credits for their time. All volunteers were asked to sign an informed consent form prior to their participation. Participants were debriefed at the end of the study and provided with a debrief form which included a summary of the study, contact numbers and web links for alcohol helplines, along with the contact numbers and e-mails of the researcher.

Measures

Impulsivity and Alcohol Use Measures

UPPS-P impulsive behaviour scale. Impulsivity was assessed using the UPPS-P self- report questionnaire, which was described in Chapter 2. Cronbach's Alpha for the UPPS-P facets in the current study was .87 for negative urgency, .80 for lack of premeditation, .83 for lack of perseverance, .84 for sensation seeking and .93 for positive urgency facet.

Alcohol use questionnaire. The AUQ was employed in this study, as in previous studies in this thesis, to assess the level of alcohol consumption on a weekly basis within the last 6 months. The measure is described in the method section of Chapter 2. Cronbach's Alpha for the AUQ was .55 in this study. This value was .61 for weekly total unit consumption and .48 for binge scores.

Alcohol use disorder identification test. The same measure as in the previous studies in this thesis was used to identify hazardous and harmful drinking behaviour. The scale is described in methods section of Chapter 2. Cronbach's Alpha for the AUDIT was .79 in this study.

Mood Measures

The UWIST mood adjective checklist. The UWIST mood adjective checklist was used to assess pre and post-mood induction affective states. The focus was on the Energetic Arousal (EA) and Hedonic Tone (HT) subscales of the checklist in this study. Tense Arousal (TA) and Anger Frustration (AF) subscales were not of relevance to the current study as the purpose was to test the moderating effects of high and low-activation positive mood in the relationship between positive urgency and beer consumption. EA was used to test high- activation positive and HT for low-activation

positive mood. TA and AF were not removed from the scale but they were not reported. The scale is described in the method section of Chapter 5. The scores obtained from the EA and HT subscales were reported. Cronbach's Alpha was .83 for the pre- mood induction EA and, .75 for the post- mood induction EA; this value was .89 for the pre- induction HT and, .89 for the post- induction HT.

Guided imagery vignettes. Guided imagery vignettes were used in combination with background music to induce positive affect in the present study. The strongest mood induction procedure is believed to involve multiple modalities and often combines two procedures to influence mood. It has been reported that multiple inductions contribute additively to induce the desired mood (Clark, Milberg, & Ross, 1983; Bower, 1981). Dual inductions are also believed to enhance specificity, such that each of the two inductions targets a specific mood of interest. In a successful combination, a foreground induction occupies the individual's attention, whilst the second induction contributes to the background atmosphere (Mayer et al., 1995). Guided imagery is one of the mood manipulation techniques used for manipulating foreground attention; it is described as a procedure in which participants are instructed to imagine themselves as vividly as possible in a series of described situations (e.g. You buy a lottery ticket and you win £200.00 instantly). Several advantages have been reported for using guided imagery and music induction in combination rather than individually. Although employing these procedures on their own makes it difficult to target specific mood and reduces experimental control, it was suggested that using them together would enhance mood specificity (Ahsen, 1989; Clark et al., 1983). Therefore, a combination of guided imagery and music would lead to a more controlled, specific and effective mood induction (Mayer, DiPaolo & Salovey, 1990; Pignatiello, Camp, & Rasar, 1986).

The guided imagery task used in this study was an adapted version of the mood induction procedure used by Larsen and Ketelaar (1991) and Mayer et al. (1995). The task was adapted by Smillie et al. (2012) to assess the affective reactivity hypothesis of extraverted individuals. Guided imagery vignettes to induce high-activation positive mood, low- activation positive mood and neutral mood were used in combination with relevant background music to enhance the effect of each mood induction. Participants who were in the high-activation positive mood condition viewed four brief vignettes describing happy events such as *'It's your birthday and your friends throw you a terrific surprise party'*. Low-activation positive mood condition vignettes included pleasant, relaxing scenarios such as *'You are lying in the warmth of the sun on a tropical beach, with the sound of gentle waves in the background'*. Neutral vignettes included scenarios like *'You are driving down a long stretch of road as you make your way to work in the morning'*.

The background music for the high-activation positive mood condition was the *Waltz of the Flowers from the 'Nutcracker Suite' by Tchaikovsky,* the low-activation positive mood condition vignettes were accompanied by *Venus from 'The Planets' by Holst*, and the background music for the neutral condition was the *Largo movement from 'The New World Symphony' by Dvorak.* These scenarios and background music have been employed in previous studies and were found to be effective (Smillie et al., 2012).

Procedure

Mood induction procedure. Baseline measurement of BrAC was taken from all participants to ensure that they had not consumed any alcoholic drinks on the day of testing. Participants were randomly allocated to one of the following mood conditions: high-activation positive ($n = 37$), low-activation positive ($n = 36$) or neutral ($n = 35$).

All participants completed a self-reported impulsivity questionnaire (UPPS-P), a measure of alcohol use (AUQ), a measure of problem drinking (AUDIT) and a baseline measure of the UWIST mood checklist prior to mood induction. Participants were then taken in to an isolated cubicle individually for the mood induction procedure.

The mood induction procedure consisted of guided imagery and background music. In the guided imagery task, participants were presented with four written vignette scenarios and asked to imagine each scenario for two minutes before moving on to the next one, and to focus on how they would feel in each described situation. They were instructed to get into the feeling of each scene as much as possible, and were told that they would be asked to recall the scenarios afterwards.

All participants read the instructions below on a computer screen prior to imagining the relevant scenarios to their allocated condition:

"Read the following four scenarios and imagine yourself experiencing the events as vividly as you can. Picture the event happening to you. Try to imagine all the details of the situation. Close your eyes and picture in your 'mind's eye' the surroundings as clearly as possible. See the people or objects; hear the sounds; experience the event happening to you. Think the thoughts and feel the same feelings that you would actually think in this situation. Let yourself react as if you were actually there. Later you will be asked to recall parts of the scenario so the more you are able to "get into the feeling" of each scene, the more you are likely to recall. Please spend approximately 1 to 2 minutes on each scenario''.

Participants were not in fact asked to recall parts of the scenarios at the end; this instruction was added to encourage them to undertake the task properly.

Following the instructions for the guided imagery task, participants were left with the background music to begin the task. They were asked to move on to the next scenario after spending two minutes on each one. The task lasted for 8 minutes in total. Participants were given a post-mood induction UWIST checklist to complete immediately after the mood induction procedure.

Beer taste test. The effect of the mood induction on beer consumption was tested using a beer taste test paradigm. Following the mood induction procedure participants were offered three different brands of beers with 200ml in each cup. The brands used in the study were Fosters, Becks and Becks Blue (non- alcoholic). Participants were asked to drink from each beer as much or as little as they needed to rate each beer on a five-point Likert scale, with 1 being 'unpleasant' and 5 being 'pleasant'. They were asked to rate each beer on 4 dimensions: pleasant, strong tasting, sweet and fizzy. The scale was an adapted version of the beer taste test scale used in the study by Jones, Cole, Goudie, and Field (2011). The following specific written instructions were given to participants:

'For this part of the study, we are interested in measuring how various beers taste to you.

The taste of different brands of beer can vary in a number of ways. Some beers may taste strong and bitter, whereas others may be sweet and fizzy. Interestingly, some people seem to have a stronger ability to taste the subtle differences between beers than other people. We would like to assess your personal taste preferences by asking you to rate three types of beer.

In front of you are three cups of beer, labelled A, B, and C. Please give each beer a rating by circling a number from 1 to 5 on every one of the four scales shown. For

example, if you think Beer A is very pleasant tasting, circle 5, but if you think it is very unpleasant, circle 1. You may drink as much or as little beer as you need to make your ratings'.

Following the completion of the beer taste test participants were informed that the task was finished; they were thanked for their time and debriefed. The amount consumed from each beer was measured in millilitres after the participants had left the lab.

Results

Descriptive Statistics for the UPPS-P and Alcohol Use Measures

The bivariate correlations between the UPPS-P and the alcohol measures are shown in Table 6.1.The first hypothesis predicted significant and positive correlations between positive and negative urgency facets and alcohol use variables. Negative urgency was correlated only with the AUDIT, while positive urgency showed a significant and positive relationship with all alcohol use measures as predicted, except total alcohol units per week (TUPW). The UPPS-P facets associated with self-control, lack of premeditation and lack of perseverance, also positively correlated with all alcohol use measures. Finally, sensation seeking showed positive high correlations with all alcohol use measures in this study.

Table 6.1

Correlations between the UPPS-P and Alcohol Use Measures

Measure	1	2	3	4	5	6	7	8	9
1.Negative Urgency	-	.46**	.40**	.20*	.65**	.12	.15	.03	.30**
2. Lack of Premeditation		-	.48**	.35**	.52**	.36**	.32**	.36**	.43**
3. Lack of Perseverance			-	.10	.31**	.24**	.24*	.20*	.35**
4. Sensation Seeking				-	.43**	.38**	.32**	.37**	.41**
5. Positive Urgency					-	.27**	.26**	.20*	.34**
6. AUQ						-	.96**	.79**	.68**
7. Binge							-	.61**	.60**
8. TUPW								-	.64**
9. AUDIT									-

Note. * $p < .05$, ** $p < .01$

Note. AUQ= Alcohol use questionnaire, TUPW= Total units per week.

Group Similarity Checks

A one-way between subjects ANOVA was conducted to examine whether previous alcohol use and problems varied across high-activation, low-activation and neutral mood conditions. Previous alcohol use did not differ across the three mood conditions, $F_{(2,106)} = 0.22$, $p = 0.79$, similarly for binge drinking, $F_{(2,106)} = 0.09$, $p = 0.91$, and for TUPW, $F_{(2,107)} = 1.38$, $p = 0.25$. There was, however, a difference across mood conditions for the AUDIT, $F_{(2,105)} = 3.77$, $p = 0.02$. The post-hoc analysis revealed that participants in the neutral mood condition had higher scores on the AUDIT, ($M = 11.25$, SD = 5.67), as compared to participants in the high-activation

(M =7.94, SD = 4.49) and low- activation positive mood conditions (M = 10.30, SD =

5.62). Multiple comparisons showed significant mean differences between neutral and

high-activation mood conditions ($p < .05$). These differences must be due to sampling

error as the participants were randomly assigned to the 3 conditions. The UPPS-P facets

did not differ significantly across mood conditions. Table 6.2 shows the means and

standard deviations of alcohol use measures and facets of the UPPS-P for the three

mood conditions.

Table 6.2

Means and Standard Deviations for Alcohol Use Measures and the UPPS-P
Facets by Mood Condition

Measures	HAPPY		CALM		NEUTRAL	
	M	*SD*	*M*	*SD*	*M*	*SD*
Alcohol Use						
AUQ	34.04	28.18	33.16	27.91	36.63	28.55
Binge	24.14	24.59	21.64	20.60	23.69	21.42
TUPW	18.88	13.55	21.89	17.83	25.01	19.38
AUDIT	8.20	4.57	10.30	5.62	11.00	5.55
UPPS-P						
NU	26.88	5.96	28.42	7.24	30.44	7.45
L of Prem	22.72	5.74	23.18	5.73	23.58	6.19
L of Pers	21.48	5.93	21.75	5.07	21.76	6.16
SS	33.88	6.82	35.13	7.42	33.52	8.16
PU	27.14	9.25	28.97	9.95	29.02	8.28

Note.AUQ= Alcohol use questionnaire, TUPW=Total units per week,
AUDIT=Alcohol use disorder identification test, NU=Negative Urgency,
L of Prem=Lack of premeditation, L of Pers=Lack of perseverance,
SS=Sensation seeking, PU=Positive urgency, Happy=High-activation positive
mood, Calm=Low-activation positive mood.

Mood Manipulation Check

Two 3 (group=happy, calm, neutral) x 2 (mood= pre-post) repeated measures ANOVAs were performed to test the interaction between the three mood groups, and pre and post positive mood induction mood states for EA and HT. The result for the analysis with EA yielded a significant two-way interaction between mood group, and pre and post EA. Pre-high-activation positive mood induction and post-high-activation positive mood induction mood ratings differed for EA as predicted F (2, 94) = 3.97, p <.05, but EA scores did not differ for pre and post- low- activation positive (calm) or neutral mood inductions. The analysis was repeated to test whether pre-low-activation positive mood induction HT scores differed from post-low- activation positive mood induction HT. The results of repeated measures ANOVA showed that there was no significant difference between pre and post low activation positive mood induction HT scores, F (2, 100) = 2.20, p =.11. Table 6.3 shows that the pre-neutral mood induction ratings on EA did not differ from the pre-positive mood induction ratings on this scale, F (2,100) = 0.17, p = 0.83. The pre-neutral mood induction ratings on HT also did not differ from the pre-positive mood induction ratings on this scale, F (2,103) = 0.34, p = 0.71. Additionally, positive urgency did not significantly correlate with pre-mood induction HT (r = -.15) and EA (r = -.06) scores.

Table 6.3

Means and Standard Deviations for Self-reported Mood Variables Pre and Post-mood Manipulation

Measure	Pre-induction *M (SD)*	Post induction *M (SD)*
Neutral Group		
Energetic A	20.40 (4.74)	20.64 (3.82)
Hedonic T	23.79 (4.98)	25.11 (4.87)
Positive Low (Calm)		
Energetic A	20.44 (4.58)	20.20 (3.60)
Hedonic T	24.19 (5.49)	27.02 (4.82)
Positive High (Happy)		
Energetic A	19.84 (4.52)	22.21 (4.17)
Hedonic T	24.79 (4.53)	27.97 (4.42)

Note. Energetic A =Energetic arousal, Hedonic T= Hedonic tone.

A 3 (beers) X 3 (condition) mixed ANOVA was performed to assess whether the mood induction had an overall effect on beer consumption. The results revealed no significant effect of high-activation, low-activation or neutral mood induction on the amount of beer consumption, F (2,103) = 0.92, p = 0.40. Table 6.4 shows average beer consumption across mood conditions for the three types of beer. The results were non-significant following the mood inductions for Fosters, F (2,103) = 0.18, p = 0.83; Becks, F (2,103) = 0.32, p = 0.72 and non-alcoholic Becks, F (2,103) = 0.29, p = 0.74.

Table 6.4

Means and Standard Deviations for Three Types of Beers by Mood Condition

BEERS	HAPPY		CALM		NEUTRAL	
	M	*SD*	*M*	*SD*	*M*	*SD*
FOSTERS	92.81	66.75	83.52	69.23	80.17	70.56
BECKS	62.64	58.05	48.99	42.29	47.57	58.99
BECKS_BLUE	49.02	58.78	54.05	50.78	48.05	60.62

Note. Happy= High-activation positive mood, Calm= Low-activation positive mood. FOSTERS=Alcoholic beer, BECKS= Alcoholic beer, BECKS_BLUE = Non-alcoholic beer.

One way ANOVA was performed to examine the interactions between mood groups and alcoholic vs non-alcoholic beers. The difference between alcoholic and non-alcoholic beers was entered as the dependent variable (BeersAB_BeerC) and mood groups as the between subjects factor. The effects of mood induction on alcoholic vs non-alcoholic beer consumption was non-significant, $F(2,103) = 1.30$. $p= .27$. Two planned comparisons were conducted to test whether there was any difference between mood groups in alcoholic vs non-alcoholic beer consumption: The first contrast compared neutral group against the two positive mood groups, and the second contrast compared the low-activation positive mood group (calm) to the high-activation positive mood group (happy). The result of the first contrast showed that the two positive mood induction did not significantly increase beer consumption above the level seen in the neutral mood induction group, $t(103) = 0.73$, $p = .46$. The second contrast revealed that happy mood induction increased beer consumption more than a calm mood induction, however not at a significant level, $t(103) = 1.46$, $p=.14$.

Mood Induction and Urgency Effects on Alcohol Consumption

Moderated regression analyses were conducted to assess the moderating role of affective state in the positive urgency and alcohol consumption relationship. The study tested the effect of high-activation positive mood on alcohol consumption and

contrasted this mood state against two levels of low-activated mood, low-activation

positive and low-activation neutral mood states. Mood groups were dummy coded prior

to the moderated regression analyses, with high-activation positive mood condition used

as the reference group. The total amount of beer consumption (measured in ml) for all

participants was entered as the dependent variable. In step one of the analysis, dummy

variables for low-activation positive and low-activation neutral mood conditions along

with centred positive urgency scores were entered. The interaction terms for low-

activation positive mood and positive urgency and the interaction term for low-

activation neutral mood and positive urgency were entered in the second step of the

moderated regression analysis. The results are presented in Table 6.5. The analysis was

repeated controlling for gender and typical alcohol use (AUQ); the results remained

essentially similar.

Table 6.5

*Beer Consumption on Positive Urgency, Neutral and Calm Mood Conditions as
Contrasted with Happy Mood Condition*

Predictor	B	SE B	*t*	R^2	*Df*
Step 1				0.00	3,100
PU	0.97	1.67	0.57		
Neutral	-16.86	38.24	-0.44		
Calm	-6.45	37.22	-0.17		
Step 2				0.06	5,100
PU	6.51	2.90	0.17*		
Neutral	155.47	128.24	1.21		
Calm	254.33	113.87	2.23*		
PU*Neutral	-6.29	4.34	-1.44		
PU*Calm	-9.35	3.86	-2.42*		

Note. $*p < .05$, $** p < .01$

Note. Dependent Variable: Beers (ml), PU=Positive urgency, Happy=High-
activation positive mood, Calm= Low-activation positive mood.

The interactions between positive urgency and the contrast between high-activation vs low-activation positive moods, and between positive urgency and the contrast between high-activation positive vs neutral moods were tested in predicting beer consumption (Table 6.5). The results showed that there was a significant interaction between positive urgency and the high-low activation positive mood contrast. While individuals with high levels of positive urgency in the low-activation positive mood condition consumed less beer, high-activation positive mood predicted higher levels of beer consumption among those with high positive urgency. This result is in line with the prediction in hypothesis 2. Figure 4.1 depicts the relationship between positive urgency, mood and beer consumption.
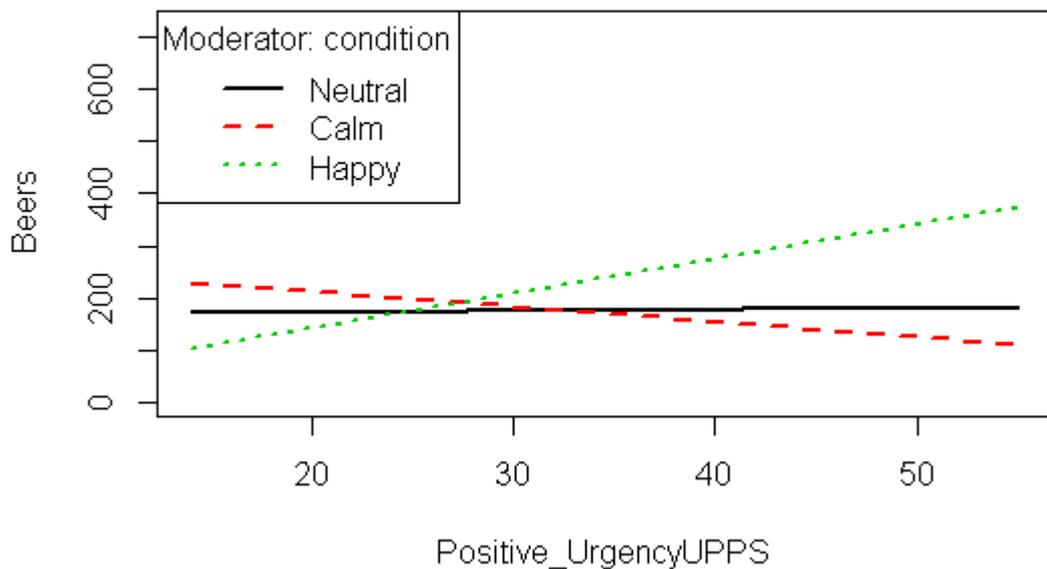
Figure 4.1. Plot depicting the relationship between positive urgency and the amount of beer consumption after happy, calm and neutral mood inductions.

Significance of the slopes for the three mood groups were tested in three separate linear regression analyses, with positive urgency as predictor of total beer

consumption for high- activation positive, low-activation positive and low-activation

neutral mood conditions. The results revealed that positive urgency significantly and

positively predicted total beer consumption only among those in the high-activation

positive mood group, but not in the other mood conditions. The results are demonstrated

in Table 6.6.

Table 6.6
Positive Urgency Predicting Beers for Happy, Calm and Neutral Mood Conditions

Mood Group	Predictor	B	SE B	β	*T*	*R²*	*Df*
HAPPY	Positive Urg	6.51	2.75	0.38*	2.36	0.15	1,32
CALM	Positive Urg	-2.83	2.31	-0.20	-1.22	0.04	1,36
NEUTRAL	Positive Urg	0.22	3.68	0.01	0.06	0.00	1,32

*Note.*p< .05, **p<.01*
Note. Positive Urg= Positive urgency, Happy= High-activation positive mood,
Calm=Low-activation positive mood.

The analyses above were repeated using negative urgency instead of positive

urgency. Mood group did not moderate the effect of negative urgency on beer

consumption. The results are presented in Table 6.7.

Table 6.7

Beer Consumption on Negative Urgency, Neutral and Calm Mood Conditions as
Contrasted with Happy Mood Condition

Predictor	B	SE B	t	R^2	Df
Step 1				0.00	3,102
NU	-1.29	2.23	-0.58		
Neutral	-10.41	38.93	-0.26		
Calm	-2.68	37.25	-0.07		
Step 2				0.03	5,100
NU	1.88	4.57	0.41		
Neutral	-7.73	170.10	-0.04		
Calm	210.44	163.33	1.28		
NU*Neutral	-0.45	5.85	-0.07		
NU*Calm	-7.67	5.79	-1.32		

Note. $* p < .05, ** p < .01$

Note. Dependent Variable: Beers (ml), NU=Negative urgency, Happy=High-activation positive mood, Calm= Low-activation positive mood.

The moderation analyses were repeated to test whether positive urgency predicted
higher levels of alcoholic beer consumption compared with non-alcoholic beer in highly
activated positive mood condition as compared to low-activation positive and neutral
mood conditions. The total amount of non-alcoholic beer consumption (ml) was
subtracted from the sum of the two alcoholic beers. This value was used as the
dependent variable. The interactions between positive urgency and the contrast between
happy vs calm moods; and between positive urgency and the contrast between happy vs
neutral moods were not significant. The results of the analysis are presented in Table
6.8.

Table 6.8

Alcoholic Beer Consumption on Positive Urgency, Neutral and Calm Mood
Conditions as Contrasted with Happy Mood Condition

Predictor	B	SE B	*t*	*R²*	*Df*
Step 1				0.02	3,102
PU	0.37	0.75	0.50		
Neutral	-23.44	17.09	-1.37		
Calm	-24.80	16.64	-1.49		
Step 2				0.05	5,100
PU	1.99	1.31	1.51		
Neutral	18.12	58.22	0.31		
Calm	56.44	51.69	1.09		
PU*Neutral	-1.53	1.97	-0.77		
PU*Calm	-2.90	1.75	-1.65		

Note. * $p < .05$, ** $p < .01$

Note. Dependent Variable: BeerAB-BeerC (ml), PU=Positive urgency,
Happy=High-activation positive mood, Calm= Low-activation positive mood.

The analysis was repeated using negative urgency instead of positive urgency. The
interaction between negative urgency and the contrast between happy vs calm moods,
and negative urgency and the contrast between happy vs neutral mood was non-
significant. Table 6.9 shows the results of this analysis.

Table 6.9

Alcoholic Beer Consumption on Negative Urgency, Neutral and Calm Mood
Conditions as Contrasted with Happy Mood Condition

Predictor	B	SE B	t	R^2	Df
Step 1				0.02	3,102
NU	-0.20	0.99	-0.20		
Neutral	-22.00	17.42	-1.26		
Calm	-23.79	16.67	-1.42		
Step 2				0.05	5,100
NU	1.23	2.06	0.59		
Neutral	18.54	76.84	0.24		
Calm	38.16	73.78	0.51		
NU*Neutral	-1.50	2.64	-0.56		
NU*Calm	-2.25	2.61	0.86		

Note. $* p < .05$, $** p < .01$

Note. Dependent Variable: BeerAB-BeerC (ml), NU=Negative urgency,
Happy=High-activation positive mood, Calm= Low-activation positive mood.

Discussion

Mood based rash actions, negative and positive urgency, have been shown to
associate with a wide range of maladaptive behaviours and substance use in previous
studies. Most longitudinal and cross-sectional studies that have investigated the role of
these facets were exclusively based on the individual's self-reports on retrospective
engagement in risky behaviours. There are few experimental studies demonstrating the
contribution of positive urgency to substance use. The study in this chapter provides
empirical support for the involvement of positive urgency in increased alcohol use
consumption. The aim of this study was to examine the potential moderating role of
three different mood induction conditions in the relationship between positive urgency
and beer consumption. The involvement of positive affect in risky and maladaptive

behaviours has been previously demonstrated (Cyders et al., 2010), however manipulations of activated positive affective states and the effects on substance use have not been researched in the context of the urgency variables. The study in this chapter extends previous findings by breaking down general positive affect in an effort to further understand the aspects of positive mood that have stronger or weaker connections with positive urgency and alcohol use. As noted earlier in this chapter, positive urgency has been characterised by impulsive actions in response to extreme positive affective states, however the literature lacks controlled studies examining the relationship between positive urgency and risky behaviours in the presence of intense positive emotions. The study in this chapter provides direct observations of risky behaviours (alcohol use) in high-activation positive affective states, while also assessing positive urgency, and contrasts this mood state with low-activation positive moods.

The hypothesis 2 predicted that individuals with elevated positive urgency would consume more beer when in a highly activated positive mood state as compared to a low-activation positive mood state. This hypothesis was confirmed. High-activation positive mood significantly moderated the relationship between positive urgency and beer consumption, making it stronger. The present study shows that positive urgency predicts increases in beer consumption in the presence of high-activation positive mood; it does not predict increases in beer consumption in the presence of low-activation positive mood. In fact, positive urgency was found to negatively associate with beer consumption following low-activation positive mood induction.

The results of this study extend those of Cyders et al. (2010) where experimental effects of positive urgency on alcohol use and risk taking were investigated. It was shown that positive urgency significantly predicted negative outcomes on a risk taking task and also significantly predicted increases in beer

consumption following a positive mood manipulation. Although the findings of the study in this chapter support that of Cyders et al. (2010), there are methodological differences, as well as differences in the questions addressed, that should be considered. Cyders et al. used a within subjects design; participants were randomly counterbalanced as to the order of the positive and neutral mood induction sessions. The other distinction was that the beer taste test lasted for 90 minutes and participants were provided with four different types of beers and entertainment (e.g. movies, magazine, music etc). The present study employed a between subjects design to test three different mood induction conditions; participants were offered three types of beers and the taste test session was shorter. As in Cyders et al., participants were asked to drink as much or as little as required to complete the rating scale, but there was no entertainment and no time pressure; participants left the room when they finished rating the beers or when they felt ready.

Although the results of both studies showed a similar pattern, there are inconsistencies in the present literature with regards to the role of positive urgency and positive affect in alcohol use (Simons et al., 2010; Cyders et al., 2010). Simons et al. found a significant moderating effect of negative urgency in the relationship between negative affect and intoxication, however the moderation effect did not hold for positive urgency. Furthermore, although the relationship was not significant, positive urgency was reported to exhibit a negative rather than positive association with the outcome. Different results may be due to the characteristics of the sample used in the study by Simons et al. The sample in that study was recruited among moderate to heavy drinkers. Perhaps affective states have a different influence on individuals who consume alcohol socially and who regularly consume moderate to high doses.

The results of the present study indicate that positive urgency leads to higher levels of engagement in risky behaviours in the presence of high-activation positive mood as compared to low-activation positive and low-activation neutral mood conditions. High activation mood states are arguably inherent to the very concept of urgency as defined in the UPPS model, and so examining the way in which these emotion states lead to engagement in risky behaviours will help to understand better the role of positive affect in impulsive actions, and guide prevention and intervention strategies. If highly activated positive mood trigger risky behaviours among individuals with high positive urgency, mood focused interventions may help with reducing and/or preventing the engagement in excessive alcohol use and dependence.

Limitations and Future Directions

The current study has a number of limitations that should be noted. First, the sample was predominantly a white college population, thus the generalization to other populations should be tested. Although that limits the generalization of the findings to different groups, a first year college student sample is of prime interest in urgency studies, as they are in the developmental period linked to impulsive behaviours which commonly leads to problems (Cyders et al., 2010, Simons et al., 2010; Hingson, Zha, & Weitzman, 2009). Second, despite the laboratory setting providing stringent control over the environment and facilitating the opportunity for direct observations of behaviours, the results obtained from such settings may be ecologically less valid; the results may be different in a more ecologically valid social context. Further research is needed to unravel the positive urgency-mood relationship in real life social situations.

Although the positive mood induction used in this study was effective in inducing the desired positive affect and it was previously shown to be successful in other studies, mood induction in laboratory settings is another limitation in this study.

The effect may have been more pronounced with real life events that produce pleasantly valenced or high-activation positive mood. The effects of positive urgency on other substances and risky behaviours and the moderating role of activated positive affect in these relationships should be further assessed. It may be that positive urgency is a stronger predictor of increases in alcohol use and related problems only in the presence of high-activation positive affect, which was the case in this study. The involvement of high and low-activation positive mood in positive urgency and alcohol use relationship requires further clarification.

What this chapter adds to the literature

The role of positive urgency in risk behaviours, such as excessive alcohol use, risky sexual behaviours, gambling and behavioural risk taking, has been demonstrated previously, predominantly in college student samples (e.g. Cyders et al., 2009; Cyders et al., 2010; Zapolski et al., 2009). Positive urgency was shown to be a risk factor predicting these behaviours over and above other facets of the UPPS-P in these studies. Positive urgency was also shown to significantly predict increases in beer consumption while in a positive mood among college students (Cyders et al., 2010). The study in this chapter adds to the literature by exploring further the effects of positive urgency on beer consumption using two levels of activation for positive affective states (ie. high and low-activation positive affect) in a UK university student sample. Although positive urgency is characterised as rash action in response to intense positive mood states, the literature lacks controlled studies examining the relationship between positive urgency and risky behaviours in the presence of intense positive emotions. Most studies have employed self-report measures to examine the role of positive urgency in addiction and other risk behaviours. This study is the first to use direct observation of risky behaviours (beer consumption) in high activation positive affective states, while also assessing positive urgency. The results indicate that high-

activation positive mood, as opposed to low-activation positive mood, leads to increases in beer consumption among individuals with high level positive urgency. However, more studies are needed to support this finding. If indeed high-activation positive mood leads to increases in beer consumption among students with high level positive urgency, intervention strategies focusing on mood manipulation can help reduce or stop alcohol use among these individuals.

CHAPTER 7

General Discussion

The thesis examined the associations between impulsivity and alcohol use, and the proximal mechanisms through which impulsivity influences different patterns of alcohol use (mediators), and the potential factors that determine the strength of this relationship (moderators). Although there is an extensive body of literature that demonstrates a robust relationship between impulsivity and alcohol use, the mechanisms and other contextual factors through which impulsivity leads to alcohol use and related problems have not been as widely researched. Factors such as motives and emotion states have previously been shown to more proximally predict alcohol use and related problems, while personality traits have been considered to be distal predictors of alcohol use (Adams et al., 2012; Curcio & George, 2011; Magid et al., 2007). The overall aim of this thesis was to explore the mechanisms through which the UPPS-P impulsivity facets lead to alcohol use and related problems, with a specific focus on the urgency facets.

The more specific individual study aims were, a) to explore the relationship between the individual facets of the UPPS-P and different patterns of alcohol use in UK university students, and to assess whether urgency facets predict alcohol use and associated problems over and above the other UPPS-P facets, b) to identify the meditational role of four drinking motives, enhancement, coping, social and peer pressure motives, in the relationship between each facet of the UPPS-P and alcohol use, c) to assess the moderating effects of the urgency facets in the relationship between alcohol use and executive functioning components, distractor interference and prepotent response inhibition, d) to determine the contribution of urgency facets to the effects of acute alcohol use on executive functioning and behavioural risk taking and, e) to

examine the potential moderating roles of high and low-activation positive moods between positive urgency and beer consumption.

The first study in the thesis aimed to explore the relationship between impulsivity facets and different patterns of alcohol use, such as general consumption, weekly total units consumed, binge drinking, and hazardous and harmful use of alcohol. The study hypothesised that all five facets of the UPPS-P would significantly and positively correlate with patterns of alcohol use. Positive urgency and negative urgency were hypothesised to predict problem alcohol use indices (binge drinking, AUDIT) when controlling for other facets of the UPPS-P. Sensation seeking, lack of perseverance and lack of premeditation were expected to associate with weekly total consumption, but not with problem alcohol use measures. The hypotheses were supported; the results of Study 1 revealed significant positive associations between facets of the UPPS-P and multiple indices of alcohol use. As expected, positive urgency and negative urgency significantly predicted problem use and binge drinking over and above the other UPPS-P facets.

The other facets of the UPPS-P were associated with weekly total alcohol use. Additionally, sensation seeking was found to significantly predict problem use of alcohol, while lack of perseverance significantly and positively predicted binge use of alcohol. These results extend the previous findings by Cyders et al. (2009), where positive urgency was shown to be associated with high levels of consumption in any drinking episode, while sensation seeking was associated with frequency of consumption among college students. Study 1 additionally demonstrated the role of both urgency facets in problem use and binge drinking, as well as the contributions of other facets to three different patterns of alcohol use. The results of the first study are also consistent with the previous findings supporting a multifaceted model of trait

impulsivity. For example, in a meta-analytic review, Coskunpinar, Dir and Cyders (2013) have examined the multifaceted conceptualisation of impulsivity and alcohol use relationship. The variability in the magnitude of the bivariate relationship between impulsivity and alcohol use, and the pattern of effects between specific impulsivity traits and patterns of alcohol use across studies were assessed using the UPPS model of impulsivity. The study found that drinking quantity was most strongly predicted by lack of perseverance, whereas all traits equally predicted drinking frequency. Drinking problems were most highly related to negative and positive urgency and alcohol dependence was highly associated with negative urgency and lack of planning. Study 1 in this thesis is one of the very few to examine the relationships between individual facets of impulsivity and patterns of alcohol use in one study.

These data suggest that impulsivity leads to alcohol use through different pathways: 1) drinking to cope with problems related to performing everyday life tasks that require motivation and, 2) drinking to alleviate negative mood and cope with stressful life events or boredom, which is closely associated with affect related problems and disorders. While preliminary, these data suggest that different aspects of impulsivity should be considered carefully as risk factors for different patterns and problem drinking behaviour alongside more established risk factors such as family history, stress, biological liabilities and comorbid psychopathology (Sher et al., 2005). Consistently with previous studies among different populations ranging from college students to alcohol dependents, negative urgency was associated with all three alcohol use indices (weekly total consumption, problem use and binge) in the first study (Adams et al., 2012; Curcio & George, 2011; Simons et al., 2010). Negative urgency, which has been predominantly linked to coping motives, may present even stronger

associations with problem drinking among clinical populations and heavy drinkers (Simons et al., 2010; Adams et al., 2012).

The findings of the first study also demonstrate that when controlling for the other facets of the UPPS-P, positive urgency predicts weekly total consumption, binge use of alcohol and problem drinking. This relationship was found to be stronger for binge drinking behaviour. This result is in line with Cyders et al. (2009), where it was also shown that positive urgency predicted quantity and sensation seeking the frequency of alcohol use behaviour. The finding that sensation seeking moderately predicts alcohol use indices is also consistent with previous literature (Sher & Trull, 1994; Magid et al., 2007; Adams et al., 2012). The overall findings of the first study reveals that urgency facets uniquely contribute to alcohol use behaviour over and above other impulsivity facets.

The second study in the thesis examined the mediating role of four drinking motives in the relationship between five facets of the UPPS-P and different patterns of alcohol use. The study hypothesised three models for three distinct patterns of alcohol use. In the first model, it was hypothesised that enhancement, social and peer pressure motives would mediate the relationships between negative urgency, positive urgency, lack of perseverance and sensation seeking facets and weekly total alcohol use. Model 2 hypothesised that internal motives, coping and enhancement, will mediate the relationships between negative urgency, positive urgency, sensation seeking and problem use of alcohol. Model 3 hypothesised that coping and enhancement motives, will mediate the effects of both urgency facets and sensation seeking on binge use of alcohol.

In the first model, peer pressure motives, but not enhancement or social motives, fully mediated the relationships between negative urgency, lack of

perseverance and weekly total alcohol use. The effect of sensation seeking on weekly total alcohol consumption was partially mediated by these motives. In model 2, coping and peer pressure motives significantly mediated the relationship between negative urgency and problem use of alcohol. Coping and peer pressure motives only partially mediated the effects of sensation seeking on problem alcohol use. These findings confirm the relationship between coping motives and negative urgency; individuals with high levels of this trait consume alcohol mostly to cope with negative affect. On the other hand, partial mediations by these motives suggest that sensation seeking still directly predicts problem drinking behaviour even in the presence of drinking motives. Adams et al. (2012) have also demonstrated that the effect of sensation seeking on problem drinking was partially mediated by enhancement and coping motives. The finding that coping motives fully mediated the relationship between negative urgency and problem use of alcohol is also consistent with the findings by Adams et al. Curcio and George (2011) have also reported a similar pattern of results; it was shown that enhancement motives mediated the relationship between sensation seeking and alcohol use, whilst negative urgency predicted alcohol related problems, but not use. It should be noted that both studies were conducted among college student samples. The results may be different in clinical populations.

Simons et al. (2010), using a sample of moderate to heavy drinkers, found no significant moderating effects of positive urgency in the association between positive affect and alcohol use, while negative urgency was found to moderate the association between anxiety and problem drinking, suggesting more pronounced effects of coping motives for heavy drinkers with high levels of negative urgency. In addition to coping motives, the study in Chapter 3 found that peer pressure motives also mediated the relationship between negative urgency, sensation seeking and problem use of alcohol.

Peer pressure motives have been emphasised in adolescent drinking, but have not been widely researched among university students. The study in Chapter 3 demonstrates that these motives continue to pose a risk for university students with high levels of impulsivity.

In model 3, enhancement and peer pressure motives were found to fully mediate the relationship between lack of perseverance and binge use of alcohol. These motives partially mediated the relationship between sensation seeking and binge drinking. High levels of sensation seeking and lack of perseverance were associated with strong endorsement for enhancement and peer pressure motives, which in turn were associated with high levels of binge drinking behaviour. Although lack of perseverance, which refers to the inability to complete a task to the end due to fatigue or boredom, is relevant to first year college students, there are only a few studies that have examined its association with drinking motives, and the focus has been on the internal drinking motives, enhancement and coping, which have been widely studied in problem alcohol use. The study in Chapter 3 adds to previous findings by demonstrating a consistent significant mediating role of peer pressure motives between lack of perseverance and patterns of alcohol use. Peer pressure motives emerged as strong mediators in the relationship between negative urgency, sensation seeking and lack of perseverance and all three drinking patterns, while coping motives were found to be particularly influential between negative urgency and problem use, and enhancement motives in the relationship between sensation seeking, lack of perseverance and binge drinking.

The overall findings of Study 2 support the theoretical considerations of the Motivational Models of Alcohol Use (Cox & Klinger, 1988; Cooper, 1994), which posit that drinking motives can be classified according to valence (positive or negative) or

expectations about alcohol (internal, external). Kuntsche et al. (2007) distinguished four separate motive dimensions for consuming alcohol by crossing these two dimensions: coping (negative-internal), peer pressure (negative-external), enhancement (positive-internal), and social (positive-external). As well as being the most proximal predictors of alcohol use, drinking motives also reflect distal factors such as personality, culture and expectancies (Cox & Klinger, 1990; Kuntsche et al., 2006). Carey and Correa (1997) argued that drinking motives play a critical role in predicting problem drinking and may be a useful tool for early identification and intervention. The study in Chapter 3 provides support for this argument by identifying specific distal predictors that appear to influence alcohol use patterns differently through drinking motives. Personality factors are important distal determinants of alcohol use and other problem behaviours. Identifying specific traits that are closely associated with problem use of alcohol is critical for developing more effective intervention and treatment strategies.

Much research focuses on internal drinking motives, enhancement and coping, and not much attention has been given to external motives, social and peer pressure, in investigations of alcohol use (Adams et al., 2012; Curcio & George, 2011; Magid &Colder, 2007). External motives have been emphasised in adolescent alcohol use (Anderson et al., 2011; Kuntsche, 2006; Windle &Windle, 1996). However the study in Chapter 3 draws attention to the importance of these motives not only in adolescence, but also in first year university drinking. Consistent significant mediating effects of negative-external motives (peer pressure) between lack of perseverance, sensation seeking and negative urgency facets and alcohol use patterns support this argument. The hypothesis that enhancement motives would mediate positive urgency to weekly total consumption, binge drinking and problem drinking relationship was not supported. This was not totally unexpected, as some of the recent studies examining the mediating role

of internal motives in positive urgency and alcohol use relationship also did not find significant mediating effects of enhancement motives (Adams et al., 2012; Curcio & George, 2011). On the other hand, Coskunpinar and Cyders (2011), in a study where they have examined positive and negative alcohol expectancies, found mediating effects of enhancement motives in positive urgency and alcohol use relationship, while the relationship between enhancement motives and alcohol use was moderated by benefit perception. Simons et al. (2010), however, found that positive affect did not influence the positive urgency and problem alcohol use relationship. Further research is required to determine the function of enhancement motives and positive alcohol expectancies in the positive urgency and alcohol use relationship.

Study 3 in this thesis aimed to explore the moderating effects of the urgency facets on the relationship between alcohol use and response inhibition and distractor interference. The possible interactive effects of alcohol use and personality on executive functioning were assessed. Initial analyses revealed that sensation seeking and lack of premeditation significantly predicted weekly total alcohol consumption; lack of perseverance and sensation seeking predicted binge drinking, and negative urgency predicted problem use of alcohol.

Distractor interference was found to positively and significantly correlate with alcohol use indices, general consumption, binge use of alcohol and weekly total unit consumption, but not with problem alcohol use. However none of the impulsivity facets was significantly correlated with distractor interference as measured by the Eriksen flanker task. The results of the moderation analysis revealed that only lack of perseverance significantly moderated the effect of general alcohol use (AUQ) on distractor interference. The interaction of lack of perseverance and alcohol use in the final step of the moderated regression analysis significantly predicted distractor

interference, suggesting that level of perseverance influences the relationship between alcohol use and distractor interference, making it stronger. An alternative interpretation may be that when individuals are faced with cognitively demanding tasks, they act more impulsively following completion of the task due to loss of cognitive resources. They exhibit weaker self-control, which may lead to more frequent and higher levels of alcohol use; this may be more prominent among highly impulsive individuals, particularly among those with low levels of perseverance. The analysis was repeated with alcohol use as an outcome variable. The results showing an interaction of distractor interference with lack of perseverance predicting higher levels of alcohol use supports this argument. These results are consistent with a dual process account of addiction, which assumes that individual differences in executive functioning serves as a risk factor for engagement in substance use behaviour (Houben & Weirs, 2009; Thush et al., 2008).

The moderating effect of urgency in the alcohol use and prepotent response inhibition relationship was also examined. Alcohol use variables did not predict prepotent response inhibition. However larger SSRTs were predicted by lack of perseverance and sensation seeking. Moderation analyses showed that the urgency facets did not influence the effect of alcohol use on prepotent response inhibition. However, the result that sensation seeking and lack of perseverance predicted stop signal reaction times suggests that behavioural response inhibition and trait impulsivity share some common characteristics. Small but positive significant relationships between lack of perseverance, negative urgency and prepotent response inhibition were reported in a previous review by Cyders and Coskunpinar (2011). The results of Study 3 are consistent with these findings. Study 3 additionally demonstrates a positive significant relationship between sensation seeking and prepotent response inhibition.

Overall, the findings of Study 3 partially support previous research showing that regular alcohol use may affect both selective attention and prepotent response inhibition (Abroms et al., 2006; Nederkoorn et al., 2009; Noel et al., 2007). Consequently, loss of control caused by chronic alcohol use may in turn be activated in the impulsive system. This interpretation is in parallel with a dual process account of addiction. Ultimately, the results suggest that alcohol use could be predicted to an increasing extent by impulsive processes that lead to more alcohol use, causing further impairments in executive functioning. Moreover, the findings that lack of perseverance moderates the relationship between alcohol use and distractor interference and that facets of impulsivity, lack of perseverance and sensation seeking predict prepotent response inhibition, carry important clinical implications and can guide treatment strategies for alcohol dependence. The study indicates that lack of perseverance in particular, is a critical impulsivity dimension that associates closely with alcohol use and the inability to focus successfully on a task among first year college students. Perhaps prevention strategies aiming to increase the level of perseverance and motivation will help reduce the level of alcohol consumption and prevent regular alcohol use from developing to alcohol addiction later in adulthood. It should be noted that all variables in this study were measured cross-sectionally; the relationships between variables are likely to be complex and reciprocal. Study 3 assessed the interactive effects of alcohol use and personality in predicting executive functions. Alcohol use could also be considered as an outcome variable to further explore its relationship with personality and executive functions.

Study 4 examined the moderating effects of urgency on the relationship between acute alcohol use and executive functions and risk taking. The initial analysis tested the effect of a moderate dose of alcohol use on mood. Mood was not included in

the following analyses, as it was not found to be influenced by alcohol consumption. The following analyses testing the moderating effect of urgency in the acute alcohol consumption and task performance relationship revealed that negative urgency marginally predicted the effects of alcohol use on prepotent response inhibition in a positive direction, which indicated that high level negative urgency individuals in the alcohol group performed poorly (large SSRTs) on response inhibition task as compared to placebo group, but this effect was small. On the other hand, positive urgency did not have any effect on the alcohol use and response inhibition relationship. This result is in agreement with a previous review by Cyders et al. (2011), where negative urgency was also found to have a small but significant association with prepotent response inhibition. Study 4 further demonstrated that sensation seeking is a strong predictor of the performance on prepotent response inhibition following acute alcohol administration. Individuals with high sensation seeking performed poorly on that task following alcohol use, as compared to placebo group. However, sensation seeking and the urgency traits did not affect performance on distractor interference task following a moderate dose of alcohol. Interestingly, positive urgency was found to predict distractor interference in a negative direction following alcohol administration, which indicated less distraction for those with high positive urgency. This result requires further confirmation, as there are no studies to our knowledge that have examined the associations between urgency facets and distractor interference following alcohol administration.

The assessment of urgency in the relationship between acute alcohol use and behavioural risk taking revealed a significant positive association between negative urgency and number of exploded balloons, which indicated a high risk of losing the money earned on each balloon. Although the direct relationship between negative urgency and balloon explosions was significant, the moderating effect of negative

urgency on the alcohol use and explosions relationship was only marginally significant, but still showed a similar pattern. Positive urgency was unrelated to balloon explosions on this task. Finally, sensation seeking was also found to be unrelated to balloon explosions on the BART task. These results are partially consistent with a previous study showing a significant positive association between positive urgency and the number of exploded balloons on the same risk taking task (Cyders et al., 2010). Consistent with Cyders et al., the present study also did not find a significant relationship between sensation seeking and exploded balloons. Furthermore, the study in Chapter 5 showed that negative urgency, but not positive urgency, was significantly related to the number of balloon explosions on that task. It should be noted that positive urgency predicted explosions on the risk task following positive mood induction in the study by Cyders et al. The results might have been different in our study if participants had performed the risk task while in a positive mood. Future studies should aim to confirm the role of urgency in behavioural risk taking.

Together these results suggest that executive functioning components, distractor interference and prepotent response inhibition, are differentially affected following moderate doses of alcohol use among those with high levels of impulsivity. Furthermore, positive urgency, negative urgency and sensation seeking facets appear to differentially influence performance on executive functioning and behavioural risk taking tasks. Therefore, they should be treated as separate traits in the investigation of behavioural impulsivity and alcohol use.

The study in Chapter 6 examined the moderating role of positive mood in the relationship between positive urgency and alcohol use. The study hypothesised that the effects of positive urgency on alcohol use may be moderated by positive mood. Furthermore, different levels of activated positive affect may differently potentiate the

effects of positive urgency on alcohol use. Cyders et al. (2010) demonstrated an increase in levels of alcohol consumption among individuals with high positive urgency following a positive mood induction. In a between subjects design, Study 5 showed that high-activation positive affect, as opposed to low-activation positive affect, predicted more alcohol consumption among individuals with high positive urgency. The study suggests that high-activation positive affect states predict higher alcohol use for those with high levels of positive urgency. However, more studies are needed to confirm the moderating effects of positive mood in the relationship between positive urgency and alcohol use and other substances in different groups, such as heavy social drinkers and clinically diagnosed alcohol dependents. If behaviour is guided by emotions, better understanding of the involvement of specific emotions in alcohol use and other problem behaviours and, the potential mechanisms through which personality influence these behaviours (e.g. positive mood) may help with developing more effective prevention and intervention strategies.

 Conclusions and Future Directions

The studies in this thesis converge on the conclusion that impulsivity is a critical risk factor for alcohol use. The results of the studies confirm the notion that impulsivity is a multifaceted construct and support that each facet separately and uniquely explains variance in alcohol use and related problems. The role of each dimension of impulsivity in alcohol use may vary depending on the pattern of use and characteristics of the group. More specifically the urgency facets, lack of perseverance and sensation seeking appear to distinctly influence general alcohol consumption, binge use of alcohol and problems associated with excessive drinking behaviour among college students. Urgency facets seem to be robust and consistent risk factors for binge use of alcohol and problems associated with drinking behaviour. As well as emotion

based dispositions to rash actions, lack of perseverance plays an important role, especially in first year college drinking, where participants are more likely to be anxious about being in a new environment and probably experience fear of failure at a higher level as compared to their peers in the second and third year. The relationship between these facets of the trait and alcohol use and related problems may be potentiated to different degrees by more proximal determinants of alcohol use. The studies in this thesis showed that drinking motives, positive mood and executive functions are important factors that contribute to these relationships.

The findings of the present thesis contribute to research explaining the mechanisms by which impulsive actions in response to extreme positive emotions (positive urgency) and negative emotions (negative urgency) lead to engagement in alcohol use in a risky context. Focusing on urgency traits, the thesis has examined the UPPS-P facets for their association with drinking motives, executive functions, behavioural risk taking and different levels of positive mood to explain the mechanisms underlying different patterns of alcohol use behaviour. The urgency facets were found to exhibit robust and consistent direct relationships with general consumption, binge drinking and alcohol related problems over and above other facets of the UPPS-P. Although this finding is consistent with some of the previous studies, unlike most previous research, the studies in the present thesis demonstrated the relationship between urgency and three different patterns of alcohol use. These initial studies extend previous findings by showing that individuals who often act rashly and without forethought in emotional contexts exhibit higher propensity for episodic drinking and problem alcohol use. The following studies offer an explanation as to why high urgency individuals often act impulsively in response to extreme positive or negative emotions.

The thesis has examined the potential proximal mechanisms through which urgency operates to influence the way in which alcohol is consumed among university students. Drinking motives appeared to contribute to the relationship between negative urgency and problem use of alcohol. More prominently, coping motives mediated the relationship between negative urgency and problem drinking. This finding suggests that college students who act rashly in response to negative mood states show a higher tendency to engage in problematic drinking behaviour. This result could be used for designing effective prevention strategies for college students; providing help and support to individuals who experience extreme negative emotions, by teaching healthier coping strategies to students who tend to drink to relieve anxiety or other negative emotions. These strategies can include engaging in activity groups where students can interact with others through fun activities or organising social groups where students can socialise and share their experience. Another strategy might be exercising response inhibition. Houben and Wiers (2009) suggested that response inhibition can be improved by behavioural exercises such as withholding a response on its way to execution, or resisting an alcoholic stimulus by withholding a response when it is displayed. This could help reduce the level of alcohol consumption and therefore the problems associated with excessive use of alcohol. The findings suggests that initiation of alcohol use and the increase in number of drink consumption in a typical week is closely linked to level of perseverance, negative urgency and sensation seeking through peer pressure motives for first year college students. Perhaps prevention campaigns focusing on engaging first year college students in activities where they can socialise with others, have fun and feel relaxed without the need to consume alcohol will prevent the initiation and development of alcohol use behaviour.

The present findings also shed new light on the role of urgency in problematic behaviours through direct investigation of underlying psychological mechanisms. The effect of activated positive emotions on alcohol use among those who exhibit high positive urgency was directly observed in an experimental setting. If some individuals exhibit urgent behaviours in response to extreme positive affect, identifying the specific positive emotions experienced by these individuals can guide prevention strategies. The previous literature agrees on the effects of positive mood on risk taking and maladaptive behaviours. Study 5 adds to previous studies by identifying the factors (personality) that may be leading individuals in a positive mood to become involved in risky behaviours, such as excessive alcohol use. Future studies should aim to explore whether the moderating effects of positive mood states hold for alcohol dependents and other at risk individuals. If high-activation positive mood moderates the effect of positive urgency on alcohol use among alcohol dependent individuals, intervention strategies focusing on mood manipulation could be used as a treatment option.

The results also clarify the role of urgency and other impulsivity facets in the alcohol use and selective attention relationship. The findings provide an explanation as to whether the ability to focus on target stimuli is influenced by previous alcohol use, and whether emotion based rash actions and other self-control facets potentiate this relationship. The finding that only lack of perseverance potentiated the effects of alcohol use on focus of attention suggest that level of perseverance, but not the urgency facets, play a critical role on the completion of tasks that require attention, and that low perseverance is significantly associated with alcohol use. Thus, the impairing effect of previous alcohol use on selective attention may operate through trait perseverance. First year college students with severe lack of perseverance are more likely to experience anxiety perhaps related to fear of failure and the novelty of the environment. This may

lead to high levels of alcohol consumption, which in turn affect focusing on a task and possibly results in academic failure, leading to higher levels of alcohol consumption in a vicious circle.

The finding that sensation seeking moderated the effects of acute alcohol use on prepotent response inhibition shows that the inability to inhibit a response on its way to execution as a result of acute alcohol use is more prominent for those with high level sensation seeking. Perhaps sensation seekers consume alcohol in an effort to maximise positive mood, and this in turn results in disinhibited responses, loss of self-control and engagement in problem behaviours associated with alcohol consumption. Although sensation seeking has been previously linked to reward sensitivity, studies have not shown any associations between sensation seeking facet of impulsivity and behavioural response inhibition, and the moderating role of sensation seeking in acute alcohol use and prepotent response inhibition relationship has not been examined. The strong moderating effect of sensation seeking in the relationship between acute alcohol use and prepotent response inhibition indicates the need for close examination of this facet in risky behaviour involvement among first year university students. Supporting under-aroused individuals to achieve optimum mood level, and perhaps providing them with help on how to maintain mood stability might be an option for preventing sensation seeking from being a high risk factor leading to alcohol use and associated problems.

Finally, negative urgency appears to affect prepotent response inhibition so that high negative urgency accounts for poor performance on the SSRT task, but the effect was small; this relationship was also shown in previous studies. Alcohol did not seem to affect the relationship between negative urgency and prepotent response inhibition in this thesis. Billieux et al. (2010), using the Stop-signal task with emotional stimuli (faces with negative and positive expressions), found no relationship between negative

urgency and prepotent response inhibition. On the other hand, Schulz et al. (2007) demonstrated that emotional experiences interfere with the effectiveness of inhibitory control, meaning that behaviours occurring in intense emotional contexts are often rash, automatic and unplanned. Furthermore, whether it is negative or positive, the greater the intensity of emotional experience, the more this emotional experience is associated with difficulties in inhibiting a prepotent response (Verbruggen & De Houwer, 2007). In light of these findings, Billiuex et al. explained the absence of a significant relationship between negative urgency and emotional stop-signal task, with the emotional stimuli used in that study (faces with positive and negative expression) not being highly arousing. The lack of emotional arousal used in the stop signal task used here might also explain the small association between negative urgency and the stop-signal task in this thesis. Perhaps individual differences in the way people experience emotions or, in other words, individual differences in emotional reactivity, have an important impact on an individual's tendency to exhibit urgent behaviours (Nock, Wedig, Holmberg, Hooley, 2008). From this perspective and in line with its definition, we expect urgency to manifest itself most prominently in the presence of high-activation negative or positive emotions.

Negative urgency was found to strongly associate with behavioural risk taking, however alcohol did not affect this relationship. It will be interesting to test whether behavioural response inhibition and risk taking shows stronger associations with negative urgency in the presence of extreme negative mood, the emotional state in which negative urgency is thought to be most salient. Future studies should also aim to explore other potential mechanisms through which negative urgency leads to risky decision making. It would be interesting to find out whether the significant relationship

between negative urgency and behavioural risk taking holds for clinically diagnosed alcohol dependents or individuals with impulsivity/mood related disorders.

As noted earlier in the thesis, the dual process account of alcohol abuse proposes that alcohol abuse develops because of dysfunction in the impulsive system, which generates automatic impulses to drink alcohol, and disruptions in the reflective system that in turn leads to an inability to inhibit the influence of these automatic impulses (Houben & Wiers, 2009; Thush et al., 2008). Houben and Wiers investigated whether individual differences in the ability of the reflective system to exert response inhibition moderate the relationship between automatic cognitive process and drinking behaviour. More specifically, the interaction of implicit alcohol related association and response inhibition in predicting alcohol use was examined. Implicit associations were measured using the Implicit Association Test (IAT), and response inhibition was measured using the Stroop task; participants also reported their weekly alcohol use and related problems. It was found that implicit associations were unrelated to drinking behaviour when response inhibition was high, but they were strongly related to drinking behaviour when response inhibition was low. The study indicates that the relationship between automatic cognitive process, originating in the impulsive system, and drinking behaviour depends on individual differences in response inhibition exerted by the reflective system, and suggests that interventions that increase response inhibition, thereby restoring inhibitory control over automatic impulses, are most effective. Study 3 and Study 4 in this thesis offer further explanation for the initiation and development of alcohol use. The studies in this thesis showed that trait impulsivity can also potentiate the effects of alcohol use on executive functions. Highly impulsive individuals may consume more alcohol which in turn leads to poor performance on executive functioning tasks. Interventions aiming to explore the underlying psychological factors

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that lead highly impulsive individuals to consume alcohol at excessive levels, and training these individual to achieve self-control may be beneficial for restoring executive control and reduce level of alcohol intake.

To summarise, the studies in this thesis show new prospects for understanding the mechanisms underlying the urgency facets of impulsivity and their role in problematic and maladaptive behaviour (e.g., binge drinking, alcohol use and related problems). The findings of these studies may be generalised to other maladaptive behaviours occurring in response to intense emotions (e.g., risky sexual behaviour, binge eating and substance abuse).

Limitations

The studies in this thesis have some limitations that should be noted. Firstly, participants in all studies in the thesis were largely university students. University students have been shown to be a high risk group for the development and progression of alcohol use. The results may be different in more heterogeneous samples from the community, and with impulsivity disordered and alcohol dependent individuals. Secondly, estimations of personality and alcohol use were based only on self- report impulsivity and retrospective measures of alcohol use in the first 3 studies. Thus, the data acquired from these measures was solely based on individual's estimation of average weekly alcohol use in the last 6 months. However, the measure has been widely used in several alcohol use studies (e.g. Townshend & Duka, 2002; Henges & Marczinski, 2012). Problem drinking behaviour was also assessed using a self-report measure, the AUDIT. Although it relies on self-assessment, it has also been widely used for identifying individuals at high risk for alcohol dependence and in the investigation of alcohol use and impulsivity relationships (Curcio & George, 2011; Adams et al., 2012).

Future research would benefit from the longitudinal assessment of impulsivity and alcohol use to better understand how facets of impulsivity are associated with patterns of alcohol consumption, as well as with motives and emotions which were found to proximally predict alcohol use and related problems in the present thesis. Although the mediating role of drinking motives has been examined in the impulsivity and alcohol use relationship, previous studies have predominantly focused on internal drinking motives, enhancement and coping, and overlooked external motives, social and peer pressure. There are no studies to our knowledge that have fully examined the involvement of four drinking motives in the relationship between five facets of the UPPS-P and alcohol use and related problems. Peer pressure motives have been more commonly studied in the investigation of adolescent drinking behaviour; however Study 3 in this thesis shows that these motives are also critical among first year college drinkers. Future studies should aim to examine longitudinally whether these motives are still significant proximal predictors of alcohol use in the second and third year of college. Longitudinal assessment of the associations between these variables would allow for a clearer understanding of the relationships between personality and alcohol use as well as the potential mediating factors such as drinking motives and emotions.

Studies employing within subjects designs to allow comparison of performance prior to alcohol use with post-alcohol administration performance will help to clarify further the effects of alcohol on task performance among highly impulsive individuals. Future studies should also aim to explore these associations in clinically diagnosed alcohol dependents for a better understanding of the long-term alcohol effects on executive task performance and behavioural risk taking.

One of the limitations of Study 5 is that the study was conducted in a laboratory. Although laboratory settings provide stringent control over environment and

facilitate the direct observation of behaviour, it may cause less ecologically valid observations. For example, positive urgency may function differently in social contexts; a stronger moderating effect of high-activation positive mood may have been found between positive urgency and the amount of alcohol consumption in real life social context. Although the mood induction procedure used in Study 5 has been shown to be effective in previous studies (Smillie et al., 2012), high and low-activation positive mood may be more pronounced in real life, thus the difference between the amount of alcohol consumption by high and low-activation positive mood groups may have been larger in real life social contexts. Alcohol was served in the afternoon and participants were tested individually. Different amounts may have been consumed at different hours of the day (e.g. more consumption in the evenings) and in different social environments. It would be interesting to find out whether the effects of mood induction and the amounts of beer consumed would have been different if the study was conducted in groups of two or three students rather than individually. The level of alcohol consumption and positive mood may be more pronounced in the presence of a friend.

These limitations notwithstanding, the findings of the present thesis indicate that different facets of impulsivity as measured by the UPPS-P differentially impact alcohol use and related problems, and they do so through more proximal pathways such as drinking motives and emotion states. The thesis emphasises the importance of distinguishing between separate facets of impulsivity in predicting alcohol use outcomes among college students. Exploring the relationships between facets of impulsivity and patterns of alcohol use and related problems remains an important issue among university students and in the community more generally. Epidemiological research indicates that the problem is both severe and pervasive (Hingson et al., 2005). Therefore, more work is needed to identify the mechanisms through which impulsivity

leads to alcohol use and related problems (mediators) and the factors that determine the strength of this relationship (moderators).

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APPENDIX A

Alcohol Use Questionnaire (AUQ)

The following questions ask you about your habitual use of various types of alcoholic drinks.

Please consider your drinking for the last six months in answering the questions and take your time to give an accurate answer to each question.

1.   On how many days per week do you drink wine, or any wine type product e.g. sherry, port, martini (at least one small glass)? _____
Please state your usual brand(s)   _____

2.   On those days you do drink wine (or similar), about how many glasses (pub measure) do you   drink? _____ If you are unsure, please estimate the number of bottles or parts of a bottle
_____

3.   How many glasses (pub measure) of wine do you have in a week in total? _____

4.   On how many days per week do you drink beer or cider (at least half a pint) ? Please state usual brand (e.g. Carlsberg s Special, White Lightning etc
_____

5.   On those days you do drink beer/ cider, about how many pints do you typically have? _____

6.   How many pints of beer/cider do you drink in a week, in total?
_____

7.   On how many days per week do you drink spirits (Whisky, vodka, gin, rum etc-but not beer or wine)? _____Please state usual brand (e.g. Smirnoff Blue Label _____)

8.   On those days do you drink spirits, about how many shots (pub measure) do you typically have? _____If unsure, please estimate number of bottles or parts of a bottle _____

9.   How many drinks of spirits do you have in a week, in total?
_____

10.   When you drink, how fast do you drink? (Here, a drink is a glass of wine, a pint of beer or a shot of spirits, straight or mixed). Please circle the correct response.

Drinks per hour: 7+   6   5   4   3   2   1

1 drink in 2 hours

1 drink in 3 or more hours

11.   How many times have you been drunk in the last 6 months? By 'drunk' we mean loss of co-ordination, nausea, and/or inability to speak clearly. _____

12.   What percentage of the times that you drink do you get drunk? _____

Hazardous and harmful drinking measure (AUDIT)

1.	**how often do you have a drink containing alcohol?** *(please tick the answers that best describe your typical pattern of drinking)*				
	never	monthly or less	2–4 x a month	2–3 x a week	more than 3 x week

2.	**how many drinks containing alcohol do you** **have on a typical day when you are drinking?**				
	1 or 2	3 or 4	5 or 6	7 to 9	10 or more

3.	**how often do you have six or more drinks on one occasion?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

4.	**how often during the past year have you found that** **you were not able to stop drinking once you had started?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

5.	**how often during the past year have you failed to do** **what was normally expected of you because of drinking?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

6.	**how often during the past year have you needed a first drink in** **the morning to get yourself going after a heavy drinking session?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

7.	**how often during the past year have you** **had a feeling of guilt or remorse after drinking?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

8.	**how often during the past year have you been unable to remember** **what happened the night before because you had been drinking?**				
	never	less than monthly	Monthly	weekly	daily or almost daily

9.	have you or has someone else been injured as a result of your drinking?		
	No	yes, but not in the past year	yes, during the past year

10.	has a relative or friend or a doctor or other health worker been concerned about your drinking or suggested you cut down?		
	No	yes, but not in the past year	yes, during the past year

Drinking Motives Questionnaire

INSTRUCTIONS: Listed below are 28 reasons people might be inclined to drink alcoholic beverages. Using the five-point scale below, decide how frequently your own drinking is motivated by each of the reasons listed.

DMQ

YOU DRINK…	Almost Never/Never	Some of the time	Half of the time	Most of the time	Almost Always/Always
1. As a way to celebrate.	1	2	3	4	5
2. To relax.	1	2	3	4	5
3. Because I like the feeling.	1	2	3	4	5
4. Because it is what most of my friends do when we get together.	1	2	3	4	5
5. To forget my worries.	1	2	3	4	5
6. Because it's exciting.	1	2	3	4	5
7. To be sociable.	1	2	3	4	5
8. Because I feel more self-confident and sure of myself.	1	2	3	4	5

	YOU DRINK...	Almost Never/Never	Some of the time	Half of the time	Most of the time	Almost Always/Always
9.	To get high.	1	2	3	4	5
10.	Because it is customary on special occasions.	1	2	3	4	5
11.	Because it helps me when I am feeling nervous.	1	2	3	4	5
12.	Because it's fun.	1	2	3	4	5
13.	Because it makes a social gathering more enjoyable.	1	2	3	4	5
14.	To cheer me up when I'm in a bad mood.	1	2	3	4	5
15.	To be liked.	1	2	3	4	5
16.	To numb my pain.	1	2	3	4	5
17.	Because it helps me when I am feeling depressed.	1	2	3	4	5
18.	So that others won't kid me about not using.	1	2	3	4	5

YOU DRINK...	Almost Never/Never	Some of the time	Half of the time	Most of the time	Almost Always/Always
19. To reduce my anxiety.	1	2	3	4	5
20. To stop me from dwelling on things.	1	2	3	4	5
21. To turn off negative thoughts about myself.	1	2	3	4	5
22. To help me feel more positive about things in my life.	1	2	3	4	5
23. To stop me from feeling so hopeless about the future.	1	2	3	4	5
24. Because my friends pressure me to use.	1	2	3	4	5
25. To fit in with a group I like.	1	2	3	4	5
26. Because it makes me feel good.	1	2	3	4	5
27. To forget painful memories.	1	2	3	4	5

YOU DRINK...	Almost Never/Never	Some of the time	Half of the time	Most of the time	Almost Always/Always
28. So I won't feel left out.	1	2	3	4	5

Impulsivity Scale (Whiteside & Lynam, 2001)

UPPS-P

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree somewhat** circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below. Also, there are questions on the following pages.

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
1. I have a reserved and cautious attitude toward life.	1	2	3	4
2. I have trouble controlling my impulses	1	2	3	4
3. I generally seek new and exciting experiences and sensations.	1	2	3	4
4. I generally like to see things through to the end.	1	2	3	4
5. When I am very happy, I can't seem to stop myself from doing things that can have bad consequences.	1	2	3	4
6. My thinking is usually careful and purposeful.	1	2	3	4
7. I have trouble resisting my cravings (for food, cigarettes, etc.).	1	2	3	4
8. I'll try anything once.	1	2	3	4
9. I tend to give up easily.	1	2	3	4
10. When I am in great mood, I tend to get into situations that could cause me problems.	1	2	3	4
11. I am not one of those people who blurt out things without thinking.	1	2	3	4
12. I often get involved in things I later wish I could get out	1	2	3	4

of.				
13. I like sports and games in which you have to choose your next move very quickly.	1	2	3	4
14. Unfinished tasks really bother me.	1	2	3	4
15. When I am very happy, I tend to do things that may cause problems in my life.	1	2	3	4
16. I like to stop and think things over before I do them.	1	2	3	4
17. When I feel bad, I will often do things I later regret in order to make myself feel better now.	1	2	3	4
18. I would enjoy water skiing.	1	2	3	4
19. Once I get going on something I hate to stop.	1	2	3	4
20. I tend to lose control when I am in a great mood.	1	2	3	4
21. I don't like to start a project until I know exactly how to proceed.	1	2	3	4
22. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.	1	2	3	4
23. I quite enjoy taking risks.	1	2	3	4
24. I concentrate easily.	1	2	3	4
25. When I am really ecstatic, I tend to get out of control.	1	2	3	4
26. I would enjoy parachute jumping.	1	2	3	4
27. I finish what I start.	1	2	3	4
28. I tend to value and follow a rational, "sensible" approach to things.	1	2	3	4
29. When I am upset I often act without thinking.	1	2	3	4
30. Others would say I make bad choices when I am extremely happy about something.	1	2	3	4

31. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	1	2	3	4
32. I am able to pace myself so as to get things done on time.	1	2	3	4
33. I usually make up my mind through careful reasoning.	1	2	3	4
34. When I feel rejected, I will often say things that I later regret.	1	2	3	4
35. Others are shocked or worried about the things I do when I am feeling very excited.	1	2	3	4
36. I would like to learn to fly an airplane.	1	2	3	4
37. I am a person who always gets the job done.	1	2	3	4
38. I am a cautious person.	1	2	3	4
39. It is hard for me to resist acting on my feelings.	1	2	3	4
40. When I get really happy about something, I tend to do things that can have bad consequences.	1	2	3	4
41. I sometimes like doing things that are a bit frightening.	1	2	3	4
42. I almost always finish projects that I start.	1	2	3	4
43. Before I get into a new situation I like to find out what to expect from it.	1	2	3	4
44. I often make matters worse because I act without thinking when I am upset.	1	2	3	4
45. When overjoyed, I feel like I can't stop myself from going overboard.	1	2	3	4
46. I would enjoy the sensation of skiing very fast down a high mountain slope.	1	2	3	4
47. Sometimes there are so many little things to be done that I just ignore them all.	1	2	3	4

48. I usually think carefully before doing anything.	1	2	3	4
49. When I am really excited, I tend not to think of the consequences of my actions.	1	2	3	4
50. In the heat of an argument, I will often say things that I later regret.	1	2	3	4
51. I would like to go scuba diving.	1	2	3	4
52. I tend to act without thinking when I am really excited.	1	2	3	4
53. I always keep my feelings under control.	1	2	3	4
54. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	1	2	3	4
55. Before making up my mind, I consider all the advantages and disadvantages.	1	2	3	4
56. I would enjoy fast driving.	1	2	3	4
57. When I am very happy, I feel like it is ok to give in to cravings or overindulge.	1	2	3	4
58. Sometimes I do impulsive things that I later regret.	1	2	3	4
59. I am surprised at the things I do while in a great mood.	1	2	3	4

Uwist Mood Checklist (UMACL; Matthews, Jones & Chamberlain, 1990)

1. MOOD STATE

First, there is a list of words which describe people's moods or feelings. Please indicate how well each word describes how you feel **AT THE MOMENT**. For each word, circle the answer from 1 to 4 which best describes your mood.

	Definitely	Slightly	Slightly Not	Definitely Not
1. Happy	1	2	3	4
2. Dissatisfied	1	2	3	4
3. Energetic	1	2	3	4
4. Relaxed	1	2	3	4
5. Alert	1	2	3	4
6. Nervous	1	2	3	4
7. Passive	1	2	3	4
8. Cheerful	1	2	3	4
9. Tense	1	2	3	4
10. Jittery	1	2	3	4
11. Sluggish	1	2	3	4
12. Sorry	1	2	3	4
13. Composed	1	2	3	4
14. Depressed	1	2	3	4
15. Restful	1	2	3	4
16. Vigorous	1	2	3	4
17. Anxious	1	2	3	4
18. Satisfied	1	2	3	4
19. Unenterprising	1	2	3	4
20. Sad	1	2	3	4
21. Calm	1	2	3	4
22. Active	1	2	3	4

23. Contented	1	2	3	4
24. Tired	1	2	3	4
25. Impatient	1	2	3	4
26. Annoyed	1	2	3	4
27. Angry	1	2	3	4
28. Irritated	1	2	3	4
29. Grouchy	1	2	3	4

TASTE TEST

For this part of the study, we are interested in measuring how various beers taste to you.

The taste of different brands of beer can vary in a number of ways. Some beers may taste strong and bitter, whereas others may be sweet and fizzy. Interestingly, some people seem to have a stronger ability to taste the subtle differences between beers than other people. We would like to assess your personal taste preferences by asking you to rate three types of beer.

In front of you are three cups of beer, labelled A, B, and C. Please give each beer a rating by circling a number from 1 to 5 on every one of the four scales shown. For example, if you think Beer A is very pleasant tasting, circle 5, but if you think it is very unpleasant, circle 1. You may drink as much or as little beer as you need to make your ratings.

BEER A

Unpleasant	1	2	3	4	5	Pleasant
Tasteless	1	2	3	4	5	Strong tasting
Bitter	1	2	3	4	5	Sweet
Flat	1	2	3	4	5	Fizzy

BEER B

Unpleasant	1	2	3	4	5	Pleasant
Tasteless	1	2	3	4	5	Strong tasting
Bitter	1	2	3	4	5	Sweet
Flat	1	2	3	4	5	Fizzy

BEER C

Unpleasant	1	2	3	4	5	Pleasant
Tasteless	1	2	3	4	5	Strong tasting
Bitter	1	2	3	4	5	Sweet
Flat	1	2	3	4	5	Fizzy

VIGNETTES (HAPPY MOOD)

Read the following four scenarios and imagine yourself experiencing the events as vividly as you can. Picture the event happening to you. Try to imagine all the details of the situation. Close your eyes and picture in your "mind's eye" the surroundings as clearly as possible. See the people or objects; hear the sounds; experience the event happening to you. Think the thoughts and feel the same feelings that you would actually think in this situation. Let yourself react as if you were actually there.

Later you will be asked to recall parts of the scenario so the more you are able to "get into the feeling" of each scene, the more you are likely to recall. Please spend approximately 1 to 2 minutes on each scenario.

SCENARIO 1:

You buy a lottery ticket and you win £200.00 instantly.

SCENARIO 2:

It's your birthday and your friends throw you a terrific surprise party.

SCENARIO 3:

You just got a new job, and it's even better than you expected.

SCENARIO 4:

You and a friend go to a loud and bustling restaurant. The meal, the conversation, and the atmosphere are all perfect.

VIGNETTES (CALM MOOD)

Read the following four scenarios and imagine yourself experiencing the events as vividly as you can. Picture the event happening to you. Try to imagine all the details of the situation. Close your eyes and picture in your "mind's eye" the surroundings as clearly as possible. See the people or objects; hear the sounds; experience the event happening to you. Think the thoughts and feel the same feelings that you would actually think in this situation. Let yourself react as if you were actually there.

Later you will be asked to recall parts of the scenario so the more you are able to "get into the feeling" of each scene, the more you are likely to recall. Please spend approximately 1 to 2 minutes on each scenario.

SCENARIO 1:

You are lying in the warmth of the sun on a tropical beach, with the sound of gentle waves in the background.

SCENARIO 2:

You feel totally relaxed as you have a nice warm bath at the end of long day.

SCENARIO 3:

You are walking peacefully through a quiet and picturesque forest.

SCENARIO 4:

After a very busy day at work, you arrive home to find your partner has cooked a lovely meal for you.

VIGNETTES (NEUTRAL MOOD)

Read the following four scenarios and imagine yourself experiencing the events as vividly as you can. Picture the event happening to you. Try to imagine all the details of the situation. Close your eyes and picture in your "mind's eye" the surroundings as clearly as possible. See the people or objects; hear the sounds; experience the event happening to you. Think the thoughts and feel the same feelings that you would actually think in this situation. Let yourself react as if you were actually there.

Later you will be asked to recall parts of the scenario so the more you are able to "get into the feeling" of each scene, the more you are likely to recall. Please spend approximately 1 to 2 minutes on each scenario.

SCENARIO 1:

You are shopping at the supermarket for groceries that you need to purchase for your dinner.

SCENARIO 2:

You are driving down a long stretch of road as you make your way to work in the morning.
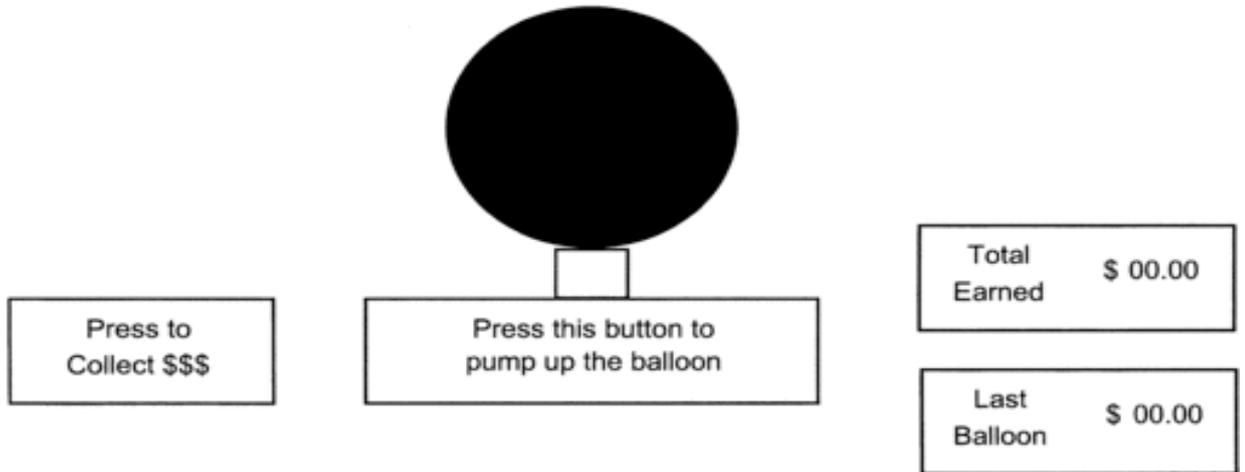
SCENARIO 3:

Your boss has asked you to type up a brief report on a meeting you had earlier in the day.

SCENARIO 4:

You are on a train reading a newspaper as you travel to a city nearby.

Balloon Analogue Risk Task (Lejuez et al., 2002)

APPENDIX I

*Stop Signal Task (*Verbruggen, F., Logan, G. D., & Stevens, M. A. 2008)

Instructions: Please press the left key on the keyboard each time you see a square and press the right key every time you see a circle and withhold your response when square or circle followed by a sound. (The gap between the presentation of the go stimulus and the sound was 50ms and the gap changed with speed of the response.)
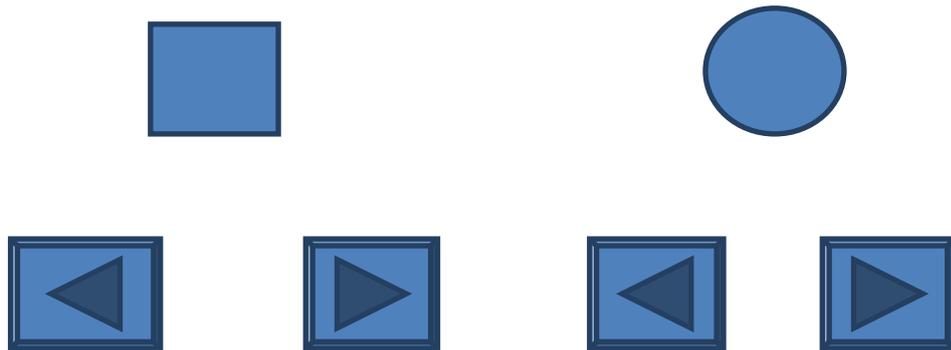
APPENDIX J

Eriksen Flanker Task (Friedman & Miyake, 2002)

Instructions: Press the right key on the keyboard when the centre letter is H or K; press the left key when the centre letter is S or C.

HHHKHHH	Compatible
SSSHSSS	Incompatible
KKKKKKK	Same
C	No noise

H or K

S or C
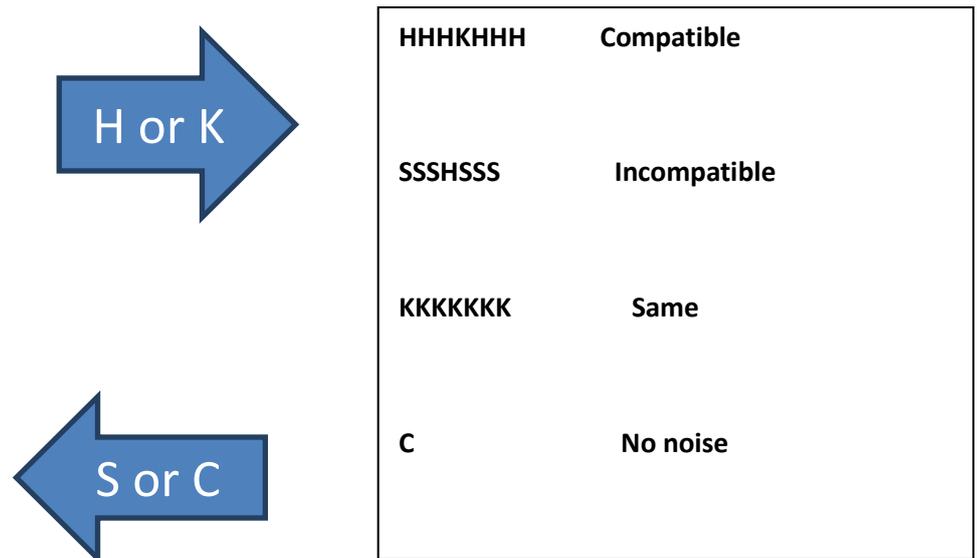
Table K.1

SSRT on sensation seeking and alcohol use interaction

Predictor	B	SE B	β	R^2	Df
Step 1				0.00	1,60
Gender	4.04	11.48	0.04		
Step 2				0.09	2,58
Gender	4.52	11.80	0.05		
AUQ_C	-0.35	0.20	- 0.24		
SS_C	1.92	0.88	0.29*		
Step 3				0.11	1,57
Gender	5.27	11.84	0.06		
AUQ_C	-0.41	0.21	- 0.27		
SS_C	1.94	0.88	0.29*		
SS_C X AUQ_C	0.02	0.02	0.12		

Note. * $p < .05$, ** $p < .01$

Note. DV= SSRT= Stop signal reaction times, AUQ_C= Centred alcohol use questionnaire, SS_C= Centred sensation seeking,

Table K.2

Distractor interference on sensation seeking and alcohol use interaction

Predictor	B	SE B	β	*R²*	*Df*
Step 1				0.00	1,60
Gender	5.29	13.01	0.05		
Step 2				0.13*	2,58
Gender	-6.13	13.08	-0.05		
AUQ_C	0.65	0.22	0.39**		
SS_C	-0.21	0.98	-0.02		
Step 3				0.16	1,57
Gender	-4.92	13.01	-0.05		
AUQ_C	0.57	0.23	0.33*		
SS_C	- 0.18	0.97	-0.02		
SS_C X AUQ_C	0.03	0.02	0.17		

Note. * $p < .05$, ** $p < .01$

Note. DV= DI (Inc-Nnoise), AUQ_C= Centred alcohol use questionnaire, SS_C= Centred sensation seeking,

Table K.3

SSRT on lack of perseverance and alcohol use interaction

Predictor	B	SE B	β	R^2	Df
Step 1				0.00	1,60
Gender	4.04	11.48	0.04		
Step 2				0.08	2,58
Gender	5.16	11.85	0.05		
AUQ_C	-0.39	0.21	- 0.26		
Lof PersC	2.56	1.28	0.28*		
Step 3				0.08	1,57
Gender	5.57	11.99	0.06		
AUQ_C	-0.34	0.25	- 0.23		
LofPersC	2.59	1.29	0.28*		
LofPersC X AUQ_C	-0.01	0.04	0.06		

Note. $* p < .05, ** p < .01$

Note. DV= SSRT= Stop signal reaction times, AUQ_C= Centred alcohol use questionnaire, Lof PersC= Centred lack of perseverance