The Role of Impulsivity in Co-occurring Social Anxiety and Substance Misuse

by

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List of Abbreviations

ABS.................Australian Bureau of Statistics
AUD...............Alcohol Use Disorder
AUDIT............Alcohol Use Disorders Identification Test
APA...............American Psychiatric Association
ASSIST..........The Alcohol, Smoking and Substance Involvement Screening Test
BAS...............Behavioural Activation System
BIC...............Bayesian Information Criterion
BIS...............Behavioural Inhibition System
BLRT...............Bootstrapped Parametric Likelihood Ratio Test
CARROT...........Card Arranging Reward Responsiveness Objective Test
DSM...............Diagnostic and Statistical Manual of Mental Health Disorders
DV...............Dependent Variable
EPQ...............Eysenck Personality Questionnaire
I7.................Eysenck Impulsiveness Questionnaire
IIP-C..............Inventory of Interpersonal Problems Circumplex Scales
IV...............Independent Variable
LCA...............Latent Class Analysis
LMR...............Lo-Mendell-Rubin Test
MINI...............Mini International Neuropsychiatric Interview
RST...............Reinforcement Sensitivity Theory
SAD...............Social Anxiety Disorder
SPSRQ............Sensitivity to Punishment and Sensitivity to Reward Questionnaire
SR...............Sensitivity to Reward
TPQ...............Tridimensional Personality Questionnaire
Abstract

Social anxiety disorder (SAD) and substance use disorders co-occur at a high rate in clinical and epidemiological samples. Despite the high comorbidity between these diagnoses, and the poorer outcomes that characterise this clinical population, few studies have examined the potential mechanisms underlying the co-occurrence of SAD and substance misuse (i.e., hazardous substance use, where diagnosis may or may not be specified). Drawing on previous research, the focus of this thesis was to examine whether a personality profile characterised by elevated impulsivity may underlie the co-occurrence of social anxiety and substance misuse. In particular, this thesis employed a two-facet conceptualisation of impulsivity, which is consistent with the findings of several factor analytic studies examining the multidimensional nature of impulsivity. Within the clinical literature these two facets have been termed rash impulsiveness (i.e., rash behaviour with lack of forethought for future consequences) and reward sensitivity (i.e., sensitivity to rewarding stimuli). In order to investigate the utility of a two-facet conceptualisation of impulsivity in understanding the relationship between social anxiety and substance misuse, two cross-sectional studies were conducted. Study one was conducted in a community sample \( (n = 351) \) using self-report measures. Consistent with hypotheses, the findings of a latent class analysis indicated that two qualitatively distinct social anxiety subgroups could be identified. Specifically, the first social anxiety subgroup was characterised by prototypical SAD symptomatology (i.e., behavioural inhibition and risk-avoidance), whereas the second social anxiety subgroup was characterised by elevated rash impulsiveness, reward sensitivity, risk-taking and co-occurring substance misuse. Study two was conducted using self-report methodology in a
clinical sample ($n = 74$) of individuals suffering from social anxiety symptomatology who were seeking treatment for their substance use disorder. The data did not support hypotheses that rash impulsiveness and reward sensitivity would moderate the relationship between social anxiety symptoms and substance misuse. Post-hoc analyses demonstrated that rash impulsiveness moderated the relationship between social anxiety symptoms and substance misuse in a community sample. It was argued that sample or qualitative differences between individuals in clinical and community samples may explain the differences between findings. Overall, this thesis demonstrates that a subset of socially anxious individuals are characterised by an impulsive personality profile, which may underlie the co-occurrence of social anxiety and substance misuse. It was postulated that for a subset of individuals with social anxiety symptoms, a personality style characterised by elevated reward sensitivity may represent a risk factor for the onset of substance misuse, whereas elevated rash impulsiveness may underlie the exacerbation and maintenance of substance misuse. Assessment, prevention and treatment implications were discussed. It was concluded that the two-facet conceptualisation of impulsivity warrants further investigation in research examining the co-occurrence of social anxiety and substance misuse.
Synopsis

The high prevalence of social anxiety disorder (SAD) among individuals seeking treatment for substance use disorders has been well documented (Bakken, Landheim, & Vaglum, 2005; Staiger, Ricciardelli, McCabe, Young, & Cross, 2008). According to Australian data, approximately 40% of individuals presenting for treatment of their substance use disorder also suffer from SAD (Staiger et al., 2008). Notably, evidence suggests that individuals with subthreshold symptoms of SAD are more likely to develop a co-occurring substance use disorder than individuals who meet diagnostic criteria for SAD (Crum & Pratt, 2001; Merikangas, Avenevoli, Acharyya, Zhang, & Angst, 2002; Robinson, Sareen, Cox, & Bolton, 2011). In spite of this finding, individuals who do not meet diagnostic criteria for SAD are often excluded from comorbidity research (e.g., Buckner, Timpano, Zvolensky, Sachs-Ericsson, & Schmidt, 2008; Driessen et al., 2001). For this reason, the studies reported in this thesis will specifically include individuals with subthreshold SAD symptomatology.

Whilst SAD tends to precede the onset of comorbid conditions (Kessler et al., 2005), it is clear that SAD alone does not predict the onset of substance use disorders, as only a proportion of SAD sufferers develop co-occurring substance use diagnoses (Buckner et al., 2012; Lecrubier et al., 2000; Ruscio et al., 2008). Hence, it seems that a subset of SAD sufferers are at greater risk of developing this specific comorbidity. Given the co-occurrence of SAD and substance misuse (i.e., hazardous substance use, where diagnosis may or may not be specified) compromises treatment efficacy for either disorder (Randall, Thomas, & Thevos, 2001), and is associated with increased symptom severity and poorer clinical outcomes (Bakken et al., 2005), it is important to examine the mechanisms that
may underlie the relationship between these disorders. Such research may inform the development of preventative and treatment interventions that target the mechanisms involved in the onset and maintenance of co-occurring SAD and substance misuse.

A small series of empirical studies investigating heterogeneity among socially anxious individuals has shed light on etiological variables that may explain the relationship between SAD and substance misuse. Specifically, research suggests that a subset of “atypical” socially anxious individuals are characterised by a number of impulsive-like traits and behaviours, including hostile interpersonal problems, aggression, novelty seeking, substance use, and risk-taking (Kachin, Newman, & Pincus, 2001; Kashdan, Elhai, & Breen, 2008; Kashdan & Hofmann, 2008; Kashdan, McKnight, Richey, & Hofmann, 2009). Although these findings may seem paradoxical considering the characteristics that are typically associated with SAD (i.e., behavioural inhibition, shyness and risk-avoidance; Lorian & Grisham, 2010; Stein & Stein, 2008), these atypical characteristics may provide an etiological explanation as to why a subset of SAD sufferers develop substance use disorders while others do not. Considering the well-established relationship between high levels of impulsivity and the use and misuse of substances (Fergusson, Boden, & Horwood, 2008; Sher, Bartholow, & Wood, 2000), this thesis will expand on previous findings by examining whether a personality profile characterised by elevated impulsivity underlies the co-occurrence of social anxiety and substance misuse.

Whilst impulsivity is prominent in the substance misuse literature, it is important to acknowledge that this trait is central in several major theories of personality (e.g., Cloninger, 1987; Eysenck, 1987; Gray, 1987) and is a core
feature of several psychiatric diagnoses (American Psychiatric Association [APA], 2000). Thus, impulsivity is frequently measured construct within clinical literature. In spite of this, evidence suggests that several of the measures that are used to assess this trait are only modestly correlated (Caseras, Ávila, & Torrubia, 2003; Dolan & Fullam, 2004; Monterosso & Ainslie, 1999), and are in fact capturing different aspects of impulsivity (Caseras et al., 2003; Miller, Joseph, & Tudway, 2004). To address this limitation, the present thesis will draw upon a series of factor analytic studies (e.g., Franken & Muris, 2006b; Quilty & Oakman, 2004), which have consistently found that impulsivity consists of two distinct but related facets. Dawe and Loxton (2004) termed these two facets of impulsivity “reward sensitivity” and “rash impulsiveness”.

Theoretically, reward sensitivity is considered to be a part of the Behavioural Activation System (BAS), which stems from Gray’s Reinforcement Sensitivity Theory (RST; Gray, 1987). Gray (1987) held that those with BAS sensitivity are sensitive to signals of reward, which suggests that these individuals are more likely to engage in goal-directed action and experience positive emotions when they are exposed to signals of impending reward (Carver & White, 1994). The other facet of impulsivity, termed rash impulsiveness, is associated with disinhibition and the inability to stop engaging in approach behaviour despite the potential for negative consequences (Loxton, Nguyen, Casey, & Dawe, 2008).

Importantly, this shift from a unidimensional perspective of impulsivity has significant implications for theory and clinical research. Specifically, the two-facet conceptualisation of impulsivity captures the multidimensional nature of this trait, which will ultimately enhance knowledge about how rash impulsiveness and
reward sensitivity differentially relate to behaviours, psychological constructs, and diagnoses. In fact, it has been argued that distinguishing between different impulsive processes has the potential to enhance knowledge regarding specific personality risk (Dick et al., 2010). For example, Dawe and Loxton (2004) have proposed that reward sensitivity relates to the motivating factors that are behind the initial decision to use a substance, whereas rash impulsiveness is posited to relate to the decreased ability to cease using substances in spite of negative consequences. Notably, there is evidence supporting Dawe and Loxton’s contention that reward sensitivity and rash impulsiveness play differential roles in the onset and maintenance of substance misuse (see Gullo, Dawe, Kambouropoulos, Staiger, & Jackson, 2010; Kabbani & Kambouropoulos, 2013; Lyvers, Duff, Basch, & Edwards, 2012).

Furthermore, research has begun to examine the involvement of rash impulsiveness and reward sensitivity in the etiology of comorbidity (i.e., the co-occurrence of two psychiatric disorders or the co-occurrence of a psychiatric disorder with a substance use disorder), with a particular focus on the co-occurrence of two disorders, which are appetitive in nature (e.g., bulimia nervosa and substance misuse; Kane, Loxton, Staiger, & Dawe, 2004). Specifically, Kane et al. (2004) proposed that elevated rash impulsiveness and reward sensitivity may represent a shared personality vulnerability underlying the co-occurrence of bulimia nervosa and substance misuse. In contrast, the relationship between impulsivity and anxiety has traditionally been conceived of as orthogonal (Barratt, 1965; Gray, 1987). More recently however, it has been postulated that impulsivity and anxiety are dimensional traits (Corr, 2004). This suggests that is possible for
individuals to be characterised by elevated levels of anxiety and impulsivity concomitantly.

In light of recent research suggesting that a subset of individuals with social anxiety symptomatology are characterised by impulsive-like traits, which are involved in the onset and maintenance of substance misuse (Fergusson et al., 2008; Sher et al., 2000), this thesis argues that a subset of socially anxious individuals, who are characterised by elevated levels of rash impulsiveness and reward sensitivity, may be at higher risk of developing co-occurring substance misuse. Hence, the interaction between social anxiety and both facets of impulsivity may pose a specific risk for the development of comorbid substance misuse. This issue will be the main focus of this thesis.

In summary, the findings of this thesis will be presented in seven chapters. Chapter one will provide an overview of co-occurring SAD and substance use disorders with reference to the clinical characteristics and diagnostic criteria associated with these mental health conditions. The theoretical models explaining this comorbidity will then be reviewed before discussing some of the limitations of current explanatory models and presenting the rationale for examining the role of personality in SAD and substance misuse comorbidity.

In chapter two, the two-facet conceptualisation of impulsivity will be proposed as a useful framework to examine the co-occurrence of SAD and substance misuse by reviewing past research that has demonstrated heterogeneity among socially anxious individuals. Furthermore, two systematic reviews of the literature will examine how previous studies have applied the two-facet conceptualisation of impulsivity to substance misuse and comorbidity research, respectively.
In chapter three, the limitations within the clinical literature will be discussed with reference to the current proposed studies. Firstly, it will be argued that elevated rash impulsiveness and reward sensitivity may characterise a subset of socially anxious individuals with co-occurring substance use problems. Secondly, it will be argued that rash impulsiveness and reward sensitivity moderate the relationship between social anxiety symptoms and substance misuse.

The primary aim of this thesis is:

1. To investigate the utility of a two-facet conceptualisation of impulsivity in understanding the relationship between social anxiety and substance misuse.

Two cross-sectional studies will be carried out to investigate this overall aim. In chapter four, the first study will expand on a series of previous studies (i.e., Kachin et al., 2001; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009) by examining whether individuals in the community with elevated symptoms of social anxiety are characterised by qualitatively distinct personality profiles. Specifically, a latent class analysis will be carried out on symptoms typically associated with SAD, including social anxiety symptom severity and behavioural inhibition, and symptoms proposed to be involved in co-occurring SAD and substance misuse; including reward sensitivity, rash impulsiveness and risk-taking. Consistent with the findings of previous studies it is expected that there will be two distinct subgroups of socially anxious individuals. The two social anxiety subgroups will then be compared on measures of substance use frequency and dependence to examine whether significant differences can be identified across social anxiety subgroups. Notably, this study
will be the first to investigate whether reward sensitivity and behavioural inhibition distinguish the two social anxiety subgroups and will contribute to the literature by utilising validated measures of substance misuse.

In chapter five, the second study will investigate the moderating role of reward sensitivity and rash impulsiveness in the relationship between social anxiety and substance misuse. This study will be carried out in a clinical sample of individuals presenting for treatment of their substance use disorder with co-occurring social anxiety symptomatology. Specifically, it will be hypothesised that the relationship between social anxiety and substance misuse is stronger among those with elevated rash impulsiveness and reward sensitivity. Whilst one previous study has examined the moderating role of reward sensitivity (Booth & Hasking, 2009), no previous studies have examined whether rash impulsiveness moderates the relationship between social anxiety and substance misuse. A secondary aim of this study is to describe the demographic and clinical characteristics of the sample, as there are a paucity of studies examining the relationship between social anxiety and substance misuse in a clinical sample of individuals seeking treatment for their substance use disorder. A subsequent chapter will present some post-hoc analyses that will inform the general discussion.

Finally, the general discussion will summarise the results of the two studies reported in this thesis. The contribution of these findings to the clinical literature will be highlighted before the clinical and research implications are discussed. Lastly, the limitations of the studies reported in this thesis and avenues for future research are considered.
CHAPTER ONE

Co-occurring Social Anxiety and Substance Misuse

Overview

The high prevalence of co-occurring SAD and substance misuse has been well documented in a large number of clinical (e.g., Bakken et al., 2005; Staiger et al., 2008; Staiger, Thomas, Ricciardelli, & McCabe, 2011) and epidemiological samples (e.g., Buckner et al., 2012; Schneier et al., 2010). Whilst there has been a predominant focus on the relationship between SAD and the use of central nervous system depressants, including alcohol and cannabis (e.g., Booth & Hasking, 2009; Buckner, Schmidt, et al., 2008), there is strong evidence to suggest that SAD also co-occurs with stimulant use, including amphetamines and cocaine (e.g., Bakken et al., 2005; Darke & Ross, 1997; Myrick & Brady, 1997).

Interestingly, research suggests that individuals with subthreshold SAD symptomatology are at higher risk of developing a substance use disorder than those who meet the Diagnostic and Statistical Manual of Mental Disorders (DSM-III; APA, 1980 and DSM-IV; APA, 1994) criteria for SAD (Crum & Pratt, 2001; Merikangas et al., 2002; Robinson et al., 2011). In spite of this finding, clinical research often excludes individuals who do not meet diagnostic criteria for SAD. Hence, the two studies reported in this thesis will specifically include individuals with subthreshold symptoms of SAD.

The purpose of this chapter is to provide an overview of the clinical characteristics and diagnostic criteria for SAD and substance use disorders in isolation, before discussing the co-occurrence of these disorders. This will be followed by a review of the well-established theories that have been proposed to
explain the relationship between SAD and substance misuse before a personality-based approach is proposed to examine the comorbidity between these diagnoses.

**Clinical Characteristics and Diagnostic Criteria**

**Social anxiety disorder.**

Social anxiety disorder is characterised by a fear of humiliation or embarrassment in social situations (APA, 2000; Kashdan & Herbert, 2001). Consequently, for those suffering from SAD (also known as social phobia; Liebowitz, Heimberg, Fresco, Travers, & Stein, 2000), the fear of engaging in social situations is so excessive that it often leads to avoidance of social situations, ranging from specific situations to all interpersonal contact (Heckelman & Schneier, 1995). Hence, SAD significantly interferes with everyday functioning (Katzelnick et al., 2001). In fact, it is generally agreed that SAD follows a chronic, unremitting course without treatment (Keller, 2003).

The DSM-IV-TR (APA, 2000) recognises two distinct patterns of SAD, referred to as generalised and non-generalised SAD. According to diagnostic criteria, generalised SAD should be specified if the social anxiety extends to most social situations. Conversely, non-generalised SAD should be specified if the social anxiety relates to specific social situations, such as public speaking (APA, 2000).

In terms of prevalence, SAD is the second most common anxiety disorder in the Australian population (Australian Bureau of Statistics [ABS], 2007). Consistent with recent international figures (e.g., Ohayon, & Schatzberg, 2010), the one-year prevalence rate of clinically significant diagnoses is approximately 4.7% (ABS, 2007), with a lifetime prevalence rate of approximately 12.1% (Ruscio et al., 2008).
With regard to age of onset, SAD is often first diagnosed in childhood or early adolescence (Chavira & Stein, 2005) and generally precedes the onset of comorbid conditions (Buckner, Schmidt, et al., 2008; Lipsitz & Schneier, 2000), which are common among SAD sufferers. In fact, approximately 70 to 80% of individuals diagnosed with SAD will suffer from at least one comorbid mental health problem over the course of their illness (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996; Ruscio et al., 2008). Similarly, high rates of psychiatric comorbidity have also been identified among individuals with subthreshold SAD symptomatology (Fehm, Beesdo, Jacobi, & Fiedler, 2008). Hence, comorbidity in SAD is an important clinical and research concern.

**Subthreshold SAD.**

When an individual does not meet the full diagnostic criteria for a formal psychiatric diagnosis their presentation is often referred to as a “subthreshold” disorder (Helmchen & Linden, 2000). Crum and Pratt (2001) defined individuals with subthreshold SAD as those who are characterised by an unreasonable fear of specific social situations but who do not experience clinically significant impairment. Using this definition in a large-scale prospective study ($n = 3481$), Crum and Pratt found that compared to individuals who met diagnostic criteria for SAD, subthreshold SAD was associated with greater risk for harmful alcohol consumption, and alcohol abuse or dependence, during a follow-up period of 13 years. Considering the longitudinal research design of Crum and Pratt’s study, this finding provides strong evidence to suggest that individuals with subthreshold SAD may be at greater risk of developing of comorbid substance misuse.

The high prevalence of subthreshold SAD in the general population has led a number of researchers to recommend a dimensional approach to
conceptualising SAD (e.g., Merikangas et al., 2002; Ruscio, 2010). According to this approach, SAD symptoms would range along a continuum of severity, including subthreshold social anxiety, non-generalised and generalised SAD, and avoidant personality disorder, as opposed to representing a discrete diagnostic category (Merikangas et al., 2002; Schneier, Blanco, Antia, & Liebowitz, 2002; Stein, Torgrud, & Walker 2000).

Consistent with this contention, studies have begun to empirically evaluate the concept of a dimensional approach for SAD diagnosis to inform modifications to the pre-existing diagnostic system in the forthcoming DSM-5. For example, Ruscio (2010) investigated the utility of the current DSM-IV-TR (APA, 2000) diagnostic system, and an alternative dimensional approach, in a large-scale sample ($n = 2,166$) of individuals who had a history of excessive social fear.

The results of several taxometric procedures and reliability analyses were consistent with a dimensional solution, suggesting that SAD exists on a continuum with subthreshold symptoms of SAD (Ruscio, 2010). Notably, follow-up analyses revealed that a dimensional approach to SAD diagnosis was a better predictor of important clinical outcomes, including comorbid mood pathology, suicidality, and treatment seeking, than the traditional DSM-IV-TR (APA, 2000) diagnostic categories (Ruscio, 2010). These findings are of particular relevance to the present thesis considering the focus on subthreshold symptoms of social anxiety and the high prevalence of subthreshold SAD among those with co-occurring substance use disorders (Crum & Pratt, 2001; Merikangas et al., 2002; Robinson et al., 2011).
Substance use disorders.

Alcohol and drug abuse poses a significant threat to the health of individuals worldwide (Mortlock, Deane, & Crowe, 2011). In Australia, Collins and Lapsley (2008) estimated that the total social costs associated with drug and alcohol abuse accounted for $55.2 billion in 2004-2005, which is an increase of more than $20 billion from the 1998-1999 national estimates (Collins & Lapsley, 2002). As a result, alcohol and drug abuse places a significant burden of suffering on individuals, families and communities (Hamilton, King, & Ritter, 2004).

In terms of prevalence, the most recent Australian National Survey of Mental Health and Wellbeing indicated that the 12-month prevalence of any substance use disorder in Australia is 5.1%, while the lifetime prevalence is 24.7% (Slade, Johnston, Browne, Andrews, & Whiteford, 2009). Notably, findings comparing Western nations suggest that Australia has significantly higher rates of illicit substance abuse and dependence than New Zealand and the United States (McBride et al., 2009; Slade et al., 2009). For example, recent statistics suggest that the 12-month prevalence rates for illicit substance dependence in Australia were 2.7%, which was nearly four times that of the United States (0.7%; McBride et al., 2009). Overall, cannabis was the second most commonly used substance after alcohol, while males were more likely to be dependent on any substance, excluding rates of stimulant abuse and dependence, which were similar across genders (McBride et al., 2009).

With regard to substance use onset, longitudinal research has consistently demonstrated that the prevalence of substance use and substance-related problems increases throughout adolescence and reaches its peak in early adulthood (McGorry, Purcell, Goldstone, & Amminger, 2011). In part, the age of onset may
explain why SAD has been found to precede the onset of substance use disorders (e.g., Buckner, Schmidt, et al., 2008), as the onset of SAD is typically in childhood or early adolescence (Chavira & Stein, 2005).

According to the DSM-IV-TR (APA, 2000), substance abuse and substance dependence are specified as two distinct substance use disorders. Substance dependence is characterised by significant cognitive, behavioural, and physiological symptoms, including tolerance and withdrawal (APA, 2000). These symptoms are directly related to the continued use of a substance despite the presence of significant substance-related problems (e.g., damage to internal organs or severe symptoms of depression; APA, 2000). Furthermore, substance dependence tends to adversely interfere with social, occupational and recreational functioning, which often results in several unsuccessful attempts to reduce substance use (APA, 2000).

Substance abuse is similarly characterised by the repeated use of a substance despite the presence of significant adverse consequences (APA, 2000). These consequences may be in the form of recurrent failure to carry out day-to-day obligations, repeated substance use in situations in which it is hazardous, legal problems, and social and interpersonal problems related to ongoing substance use (APA, 2000). In contrast to the criteria for substance dependence, the criteria for substance abuse do not include symptoms of tolerance and withdrawal. Notably, a diagnosis of substance abuse is pre-empted by a diagnosis of substance dependence if an individual has ever met the diagnostic criteria for substance dependence for a particular class of substance (APA, 2000).

In this thesis the term “substance use disorder” will be used to refer to abuse or dependence on alcohol or illicit drugs as defined by the DSM-IV-TR.
The term “substance misuse” will be used to refer to hazardous substance use more generally, where diagnosis may or may not be specified. The use of the term “substance misuse” in this context is consistent with the use of this term in the wider clinical literature (e.g., Dawe, Gullo, & Loxton, 2004; Staiger, Kambouropoulos, & Dawe, 2007).

**Social Anxiety and Substance Misuse Comorbidity**

Among adults seeking treatment for substance misuse the rates of SAD are significant, ranging between 23 and 55% (Bakken et al., 2005; Thomas, Thevos, & Randall, 1999; Tomasson, & Vaglum, 1995). An Australian study reported rates which are consistent with these international findings, with 47% of females and 36% of males seeking treatment for substance misuse also meeting DSM-IV (APA, 1994) criteria for SAD (Staiger et al., 2008). Notably, if a dimensional approach to SAD diagnosis is taken in the forthcoming DSM-5 this rate is likely to be significantly higher.

The high prevalence of co-occurring SAD and substance misuse is worrying considering significant clinical differences have been found between individuals diagnosed with co-occurring SAD and substance misuse, and those with either SAD or substance misuse diagnoses in isolation. For example, Buckner, Timpano, et al. (2008) compared individuals diagnosed with SAD, with those suffering from co-occurring alcohol use disorders (AUD) and SAD. This study analysed a data set of over five thousand respondents in the United States, of which 794 met AUD or SAD diagnostic criteria. It was found that those suffering from comorbid AUD and SAD reported more severe SAD symptomatology, higher levels of psychiatric comorbidity, and more problems with physical health than those suffering from SAD alone (Buckner, Timpano, et
al., 2008). This finding has been replicated in other studies with AUD and SAD sufferers (Schneier et al., 2010).

Similar findings have also been reported among patients diagnosed with an illicit substance use disorder in isolation, and those suffering from co-occurring SAD. Specifically, Bakken et al. (2005) found that those with co-occurring SAD and an illicit substance use disorder were more likely to have an additional axis one or two diagnosis. Further, these patients were more likely to abuse more than one illicit substance than those without co-occurring SAD (Bakken et al., 2005).

Consistent with these findings, Buckner and colleagues (2012) reported that the co-occurrence of SAD and cannabis misuse was associated with lower levels of education, lower income, greater utilisation of welfare, and lower perceived health than either disorder in isolation. Moreover, converging with the findings of Bakken et al. (2005), co-occurring SAD and cannabis misuse was associated with higher rates of co-occurring axis one and two disorders (Buckner et al., 2012).

Considering the impairments faced by this clinical population it is unsurprising that individuals suffering from co-occurring SAD are more likely to relapse following treatment for their AUD. Kushner et al. (2005) and Driessen et al. (2001) reported that in contrast to individuals presenting for treatment of their AUD alone, those presenting with a comorbid anxiety disorder were more likely to relapse after completing an inpatient treatment program for alcohol misuse. Although Driessen et al. did not differentiate between anxiety disorders, Kushner et al. reported that this finding was exacerbated among those who had co-occurring SAD or panic disorder.
Furthermore, failure to identify co-occurring SAD may have implications for those presenting for treatment of their substance use disorder. This contention is consistent with the findings of Book, Thomas, Dempsey, Randall, and Randall (2009) who found that SAD influenced willingness to participate in substance misuse treatment activities. This may be partly due to the strong focus on group interventions in substance misuse treatment settings, including Therapeutic Communities, Alcoholics Anonymous and Narcotics Anonymous (Book et al., 2009).

Although there are well-established psychological interventions for SAD (Heimberg, 2002) and substance use disorders (Dutra et al., 2008) in isolation, little is known about how to effectively treat these disorders when they co-occur (see Morris, Stewart, & Ham, 2005 for a review). For example, a randomised controlled trial investigating this issue reported poorer outcomes among those who received a simultaneous treatment targeting co-occurring SAD and alcohol misuse, when compared to those who received treatment for alcohol misuse in isolation (Randall et al., 2001). Considering that evidence suggests long-term recovery from either disorder is compromised by failure to treat the comorbid diagnosis (Schneier et al., 2010), further research is needed to examine the mechanisms that underlie the co-occurrence of SAD and substance misuse. Arguably, such research will inform the development of treatment protocols that target the mechanisms involved in the onset and maintenance of these disorders. The following section will review the theoretical explanations that have been proposed to explain the relationship between SAD and substance misuse.
Theoretical explanations for SAD and substance misuse comorbidity.

The most frequently cited explanation for SAD and substance misuse comorbidity is the self-medication hypothesis (see Carrigan & Randall, 2003 for a review; Kushner, Abrams, & Borchardt, 2000). Consistent with earlier explanatory models for SAD and substance misuse comorbidity, including the tension reduction hypothesis (Conger, 1956), and the stress-response dampening hypothesis (Levenson, Sher, Grossman, Newman, & Newlin, 1980), the self-medication hypothesis posits that drugs and alcohol are used as a means to alleviate symptoms of mental health problems, and that the repeated use of substances in this context may lead to dependence (Khantzian, 1985). This hypothesis is consistent with retrospective self-reports, with symptoms of social anxiety reported long before the onset of drug or alcohol abuse (Buckner, Timpano, et al., 2008; Myrick & Brady, 1997; Randall et al., 2001).

Furthermore, symptoms of social anxiety often remain at clinical levels following addictions treatment (Kushner et al., 2005; Liappas, Paparrigopoulos, Tzavellas, & Christodoulou, 2003). In contrast, retrospective self-reports suggest that comorbid depression frequently develops after the onset of substance misuse (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Marmorstein, Iacono, & Malone, 2009). Consequently, symptoms of depression often diminish after addictions treatment (e.g., Havard, Teesson, Darke, & Ross, 2006).

Chutuape and de Wit (1995) outlined three assumptions of the self-medication hypothesis. Firstly, it is assumed that psychiatric symptoms precede substance use; secondly, that the substance relieves these symptoms; and thirdly, that relief of psychiatric symptoms through the use of a particular substance leads to ongoing and excessive use of that substance (see Carrigan, & Randall, 2003 for
a review). Several studies lend support to these assumptions (see Carrigan & Randall, 2003 for a review; Merikangas, & Angst, 1995), with a large proportion of individuals seeking treatment for their substance use problem reporting that they use alcohol or drugs to cope with their social anxiety (e.g., Buckner et al., 2012). However, there have also been some inconsistent findings regarding the role of self-medication within the literature.

For example, a recent longitudinal investigation ($n = 34,653$) found that self-medication with alcohol and illicit drugs was a robust predictor of SAD in different baseline populations (Robinson et al., 2011). Firstly, it was found that being diagnosed with a pre-existing substance use disorder at baseline was a predictor of SAD at follow-up (Robinson et al., 2011). Secondly, among those with subthreshold anxiety at baseline, endorsement of self-medication with alcohol or other drugs was associated with a diagnosis of SAD three years later (Robinson et al., 2011).

Although the findings of Robinson et al. (2011) seem at odds with the self-medication hypothesis, arguably, the subthreshold anxiety symptoms at baseline are consistent with the literature that suggests individuals with subthreshold SAD are more likely to develop a co-occurring substance use disorder than those with a diagnosis of SAD (e.g., Crum & Pratt, 2001; Merikangas et al., 2002). However, these findings also provide evidence to suggest that SAD symptomatology does not always precede a substance use diagnosis. This is an important finding considering that longitudinal studies indicative of the temporal precedence of SAD and substance use diagnoses are sparse in the clinical literature.
Whilst the self-medication hypothesis provides partial explanation of the relationship between SAD and substance misuse, there is scope for a personality-based approach to examine etiological processes that may underlie this relationship. Specifically, although SAD and substance misuse co-occur at a high rate, a substantial number of individuals with SAD do not develop co-occurring substance misuse (Buckner et al., 2012; Lecrubier et al., 2000; Ruscio et al., 2008). Hence, some individuals suffering from SAD appear to be at greater risk of developing a co-occurring substance use disorder. In order to investigate this question the present thesis will examine personality traits that may underlie the relationship between co-occurring social anxiety and substance misuse.

This is an important avenue for future research as the aforementioned theories have failed to identify personality-based predispositions that may be involved in the development of co-occurring SAD and substance use disorders. Hence, it is argued here that a personality-based approach may make significant contribution to understanding the co-occurrence of these two clinical diagnoses (Conrod & Stewart, 2005; Watt, Stewart, Conrod, & Schmidt, 2008).

Summary

SAD and substance use disorders are highly prevalent diagnoses, which co-occur at a high rate within clinical and epidemiological populations. This rate is particularly elevated among individuals with subthreshold SAD symptomatology. Although a number of well-established theories partially explain the relationship between SAD and substance misuse there have been some inconsistent findings, suggesting there is scope for an alternative approach in examining this relationship. Arguably, personality-based differences may explain
why some individuals with SAD develop co-occurring substance use disorders while others do not.

The next chapter will examine the role of personality in co-occurring SAD and substance misuse by reviewing a series of studies investigating heterogeneity among socially anxious individuals. The findings of these studies are discussed with reference to co-occurring substance misuse and it is proposed that impulsivity may characterise a subset of SAD sufferers with co-occurring substance use problems.
CHAPTER TWO

Personality in Social Anxiety and Substance Misuse Comorbidity

Overview

Over the past decade a series of studies have been investigating heterogeneity among SAD sufferers (i.e., Kachin et al., 2001; Kashdan & Hofmann, 2008; Kashdan et al., 2009) and among individuals with elevated symptoms of social anxiety (i.e., Kashdan, Collins, & Elhai, 2006; Kashdan et al., 2008). The findings of these studies have consistently found that a subset of socially anxious individuals are characterised by personality traits and behaviours that are qualitatively different from those that are typically associated with SAD. Specifically, there is evidence to suggest that some individuals with symptoms of social anxiety are characterised by hostile interpersonal problems, novelty seeking, behavioural disinhibition, substance use and risk-taking (Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009). Taken together, these findings suggest that impulsive-like traits characterise a subset of SAD sufferers, including those with subclinical symptoms of social anxiety.

Importantly, there is considerable evidence to suggest that a personality profile characterised by elevated impulsivity predicts the onset of substance use disorders (e.g., Fergusson et al., 2008; Sher et al., 2000). Furthermore, recent research has begun to examine the relevance of two facets of impulsivity in understanding comorbidity, with a particular focus on the co-occurrence of two disorders, which are appetitive in nature (e.g., bulimia nervosa and substance misuse; Kane et al., 2004). In this chapter it is argued that the impulsive-like traits
that have been found to characterise a subset of socially anxious individuals may underlie the comorbidity between social anxiety and substance misuse.

In this chapter the construct of impulsivity will be reviewed, including the theoretical and biological underpinnings of a two-facet conceptualisation of impulsivity that stems from a series of factor-analytic studies (e.g., Quilty & Oakman, 2004). These two facets have been termed rash impulsiveness and reward sensitivity (Dawe & Loxton, 2004). Further, the well-established role of impulsivity in substance misuse will be discussed before studies examining the involvement of rash impulsiveness and reward sensitivity in substance misuse and comorbidity research are systematically reviewed.

**Heterogeneity in SAD**

Since SAD was first recognised as a diagnostic category in the DSM-III (APA, 1980) research examining heterogeneity in SAD has commonly examined differences between the generalised and non-generalised subtypes. Such research has consistently demonstrated that the generalised and non-generalised SAD subtypes differ quantitatively, with regard to number and types of feared or avoided social situations (e.g., Herbert, Hope, & Bellack, 1992; Kachin et al., 2001). Specifically, it has been found that those with generalised SAD fear and avoid a larger range of social situations than those with non-generalised SAD. These findings are consistent with the contention that the generalised and non-generalised subtypes are on a spectrum of SAD (see Merikangas et al., 2002; Schneier et al., 2002; Stein et al., 2000) rather than qualitatively distinct diagnostic entities.

Whilst differences between diagnostic subtypes provide some utility in enhancing knowledge about SAD, there have been fewer examinations of whether
individuals suffering from SAD are characterised by qualitative differences. Specifically, qualitative differences would suggest that SAD subtypes differ on relevant clinical or theoretical variables (e.g., personality profile, symptoms), whereas quantitative differences would suggest that SAD is a single disorder with different levels of severity (Herbert et al., 1992).

Currently, many treatment programs provide “one size fits all” treatment approaches for different psychiatric conditions, which account for quantitative differences in terms of variation in symptom severity. For example, it has been found that both subtypes of SAD respond to the same treatment (i.e., cognitive behavioural therapy), with equivalent levels of change over the course of treatment (Brown, Heimberg, & Juster, 1995; Turner, Beidel, Wolff, Spaulding, & Jacob, 1996). However, despite engaging in evidence-based psychotherapy for SAD, only 25 to 65% of SAD sufferers achieve clinically significant improvement in symptomatology after treatment completion (Davidson et al., 2004; Rapee, Gaston, & Abbott, 2009; Stangier, Schramm, Heidenreich, Berger, & Clark, 2011).

One explanation for the abovementioned findings is that traditional therapies for SAD may only be suited for those with generalised or non-generalised SAD who fit the typical personality profile associated with SAD (i.e., shy, behaviourally inhibited and risk-avoidant; Lorian & Grisham, 2010; Stein & Stein, 2008). For this reason, an examination of qualitative differences (e.g., impulsive-like traits) among socially anxious individuals may be particularly important in the development of more effective treatment protocols. To date, a small number of empirical papers have examined qualitative differences among individuals with a diagnosis of SAD and individuals with subclinical symptoms of
social anxiety. The findings of these studies are particularly important in forming the rationale for the two studies conducted in this thesis; hence these papers will be reviewed in the following section.

Research Investigating Qualitative Differences Among Socially Anxious Individuals

Kachin et al. (2001) were the first researchers to explicitly postulate and test a model exploring qualitative differences among individuals with SAD. Their study was based on the theory of pathoplasticity, which suggests a bi-directional relationship between psychopathology and personality (Klein, Wonderlich, & Shea, 1993; Widiger & Smith, 2008). Hence, pathoplasticity recognises that an individual’s response to their psychiatric symptomatology is based on an interaction with their personality disposition.

This contention has strong utility in psychopathology research and has been examined in a number of psychiatric conditions, including depression (Cain et al., 2012), bulimia nervosa (Hopwood, Clarke, & Perez, 2007), and generalised anxiety disorder (Przeworski et al., 2011). Further, pathoplasticity has been shown to predict variability in response to psychological therapy (e.g. Alden & Capreol, 1993; Borkovec, Newman, Pincus, & Lytle, 2002). Hence, Kachin et al. (2001) argued that pathoplasticity is particularly relevant for research investigating heterogeneity in SAD and sought to examine whether individuals suffering from SAD use qualitatively distinct interpersonal strategies to cope with their social anxiety symptoms.

Specifically, Kachin and colleagues (2001) argued that individuals with SAD, who find themselves in the same socially threatening situation, might utilise differential interpersonal behaviour to cope with and/or respond to the same
situation. To examine this question Kachin et al. administered the Inventory of Interpersonal Problems Circumplex Scales (IIP-C; Alden, Wiggins, & Pincus, 1990) in a sample of 30 socially anxious individuals suffering from generalised SAD, 30 socially anxious individuals suffering from non-generalised SAD, and 30 control participants ($n = 90$). Consistent with their hypotheses, Kachin et al. found that individuals suffering from SAD could not be reliably distinguished based on DSM-IV (APA, 1994) diagnostic subtypes (i.e., generalised and non-generalised SAD), rather, they could be reliably differentiated on the basis of interpersonal problems.

Using cluster analysis on the IIP-C, a two-cluster solution was consistently demonstrated across different clustering methods (Kachin et al., 2001). Specifically, one subgroup of SAD sufferers ($n = 23$) reported problems related to hostile, angry behaviour ($R^2 = .92$), whereas the other SAD subgroup ($n = 37$) reported problems with unassertiveness, exploitability and over-nurturance ($R^2 = .96$; Kachin et al., 2001). It was found that these subgroups were unrelated to the DSM-IV (APA, 1994) subtypes, which were a poor fit to the interpersonal circumference ideal (i.e., generalised SAD, $R^2 = .68$, and non-generalised SAD, $R^2 = .33$). Despite the preliminary nature of these findings, the study carried out by Kachin et al. provided a strong rationale for researchers to continue examining qualitative differences among socially anxious individuals.

Expanding on the findings of Kachin et al. (2001), Kashdan and his colleagues have carried out a series of studies examining heterogeneity among socially anxious individuals. Specifically, Kashdan et al. have examined whether individuals diagnosed with SAD (Kashdan & Hofmann, 2008; Kashdan et al., 2009), or socially anxious individuals in the community (Kashdan et al., 2006;
Kashdan et al., 2008), could be distinguished based on their reliance on inhibited responses and avoidance strategies, compared to a reliance on approach strategies, including disinhibited responses and impulsive behaviours (Kashdan, & McKnight, 2010). Taken together, these studies have provided strong evidence to suggest that there is important heterogeneity in SAD that is not being accounted for, which the present thesis argues is relevant to the co-occurrence of social anxiety and substance misuse. These studies will be reviewed below.

In the first of a series of studies, Kashdan et al. (2006) examined whether a community sample of socially anxious individuals ($n = 84$), with positive outcome expectancies regarding risk-taking behaviours, would report more risk-prone behavioural intentions than those expecting less desirable outcomes. Their findings converged with their hypotheses in the domains of unsafe sexual practices and aggression. That is, socially anxious individuals expecting desirable outcomes in the domains of aggression and unsafe sexual practices reported more risk-taking intentions.

Surprisingly, Kashdan et al. (2006) found no evidence to suggest that positive outcome expectancies moderated the relationship between social anxiety and heavy drinking, or illicit drug use, but found an independent relationship between social anxiety and intentions to use illicit drugs. One possible explanation for these unexpected findings is that positive outcome expectancies do not interact with social anxiety to predict substance misuse. Alternatively, the findings may relate to the statistical methodology, which did not allow for heterogeneity in the sample. That is, Kashdan et al. (2006) examined relationships between variables rather than exploring whether different subsets of socially
anxious individuals could be identified. Hence, the statistical methodology used in Kashdan and colleagues’ (2006) study may explain their unexpected findings.

Addressing this limitation in a later study, Kashdan et al. (2008) sought to investigate whether qualitatively distinct subsets of individuals with symptoms of social anxiety could be identified based on approach-avoidance appraisal patterns. Using cluster analysis in a community sample of undergraduate university students ($n = 280$), three qualitatively different groups were found. Of these distinct subgroups, two were characterised by elevated levels of social anxiety, and one subgroup was characterised by minimal anxiety. Subgroups were determined by social anxiety symptom severity and subjective appraisals about risky activities, including aggression, sex, substance use and socialising.

The findings of Kashdan et al. (2008) indicated that the two subgroups characterised by elevated symptoms of social anxiety reported divergent appraisal patterns. One socially anxious subgroup was characterised by disinhibited appraisal patterns and indicated that risk-taking would offer opportunities to satisfy curiosity and enhance social status. Conversely, the second socially anxious subgroup was characterised by inhibited appraisal patterns and indicated that risk-taking would be hazardous and offer minimal opportunities to satisfy curiosity or enhance social status (Kashdan et al., 2008).

Upon tracking the behaviour of participants over the course of a three month summer period, using a calendar based tracking method (i.e., the Timeline Followback; Sobell & Sobell, 1992), Kashdan et al. (2008) found that the disinhibited subgroup reported engaging in more frequent social interactions, risky sexual behaviour, aggression, and substance use than the other socially anxious subgroup. The findings of Kashdan et al. (2006, 2008) paved the way for
further research exploring underlying mechanisms that may be accounting for the relationship between social anxiety and risk-taking behaviours.

Expanding on the abovementioned studies, Kashdan and Hofmann (2008) explored whether novelty seeking tendencies could be used to identify two qualitatively distinct subgroups of people suffering from generalised SAD (n = 82). Using cluster analysis, Kashdan and Hofmann found that one SAD subgroup was characterised by low novelty seeking tendencies, whereas the other SAD subgroup was characterised by high novelty seeking tendencies. These subgroups could not be differentiated on the basis of SAD severity.

Despite the well-established relationship between novelty seeking and substance misuse (Fergusson et al., 2008) participants with a comorbid substance use disorder were excluded from Kashdan and Hofmann’s (2008) study. In spite of this, it was reported that clinician severity ratings provided preliminary evidence to suggest that substance use may be greater in the high novelty seeking SAD subgroup. Thus, Kashdan and his colleagues sought to expand on previous research by replicating earlier findings and specifically examining co-occurring substance use problems in a recent study.

Kashdan et al. (2009) conducted a latent class analysis on risk-prone behaviour items derived from a large-scale comorbidity survey (n = 1822). Latent class analysis was used due to its superiority over previously used cluster analytic procedures, which Kashdan and colleagues (2009, p. 561) reported are known to be “unstable”. Converging with the findings of previous studies examining heterogeneity in social anxiety, Kashdan et al. (2009) found evidence for two SAD classes. The largest SAD class (79% of the sample) was characterised by a prototypical pattern of risk-aversion, and the second SAD class (21% of the
sample) was characterised by an atypical pattern of risk-prone behaviour, including elevated levels of aggression and sexual impulsivity.

Furthermore, the risk-prone subgroup reported more substance use problems than the prototypical SAD subgroup, based upon their responses to seven binary questions (e.g., in the past 12 months have you had a strong/irresistible urge to drink?), which were derived from a larger survey for the purposes of the study (Kashdan et al., 2009). Unfortunately, Kashdan et al. (2009) were unable to comment on the severity of substance use problems in the risk-prone SAD subgroup due to the binary format of their substance misuse questionnaire and the lack of validated measurement tools used to assess substance misuse (with regard to frequency, quantity and severity of symptomatology).

Overall, the aforementioned findings suggest that a series of impulsive-like traits (e.g., novelty seeking, aggression and risk-taking) characterise a subset of socially anxious individuals. Considering the strong links between a personality style characterised by impulsivity and the onset of substance misuse (Fergusson et al., 2008; Sher et al., 2000), which will be reviewed later in this chapter, it is argued that impulsivity may underlie the co-occurrence of social anxiety and substance misuse. To date, no previous studies have conceptualised impulsivity as explaining the comorbidity between social anxiety and substance misuse. The following section will discuss the theoretical and clinical relevance of impulsivity in psychopathology research and review evidence supporting a two-facet conceptualisation of impulsivity.
Impulsivity

Impulsivity is a multidimensional construct that can be broadly defined as the tendency to engage in inappropriate or maladaptive behaviours with little or inadequate forethought (Evenden, 1999). In psychopathology research, impulsivity is a frequently measured construct, which is related to its prominence in major theories of personality and in psychiatric diagnoses. For example, impulsiveness is a core element of three major personality frameworks proposed by Cloninger (1987), Eysenck (1967), and Gray (1987). Furthermore, in the DSM-IV-TR (APS, 2000) a number of psychiatric diagnoses specify impulsivity as a core symptom. Notably, there is also a chapter dedicated to “impulse control disorders” (APS, 2000). However, it is important to acknowledge that impulsivity is not only prevalent in psychopathology but is widely classified as a personality trait that varies across individuals as a dimension of normal behaviour (de Wit, 2009).

Consistent with the theoretical and clinical significance of impulsivity, it is unsurprising that a number of questionnaires have been developed to measure this construct. However, over the past decade it has been demonstrated that many commonly used measures are capturing different aspects of impulsivity, or related constructs (Caseras et al., 2003; Miller et al., 2004). In fact, research suggests that there are only modest correlations between many measures of impulsivity (Caseras et al., 2003; Dolan & Fullam, 2004; Monterosso & Ainslie, 1999).

This finding is consistent with Depue and Collins’ (1999) well-known definition of impulsivity, which states “impulsivity comprises a heterogeneous cluster of lower-order traits that includes terms such as impulsivity, sensation seeking, risk-taking, novelty seeking, boldness, adventuresomeness, boredom
susceptibility, unreliability, and unorderliness” (p. 495). Hence, lack of consistency is a prominent issue that has long faced the measurement of impulsivity (de Wit, 2009).

To address this issue a number of researchers have carried out studies using factor analytic and principal components analyses on measures of impulsivity (e.g., Quilty & Oakman, 2004; Zelenski & Larsen, 1999). The results of these analyses have consistently demonstrated that impulsivity measures tend to load on two separate factors, reflecting two different facets of impulsivity (see Table 2.1 for an overview of studies). Dawe and Loxton (2004) termed these two distinct but related components of impulsivity “reward sensitivity” and “rash impulsiveness”.

Whilst findings have largely converged across factor analytic studies, it is important to acknowledge that there have been some inconsistent findings with regard to particular impulsivity scales. For example, the Fun Seeking subscale of Carver and White’s (1994) Behavioural Inhibition System and Behavioural Activation System (BIS/BAS) scales tend to correlate with measures that load on both facets of impulsivity (Caseras et al., 2003; Zelenski & Larsen, 1999). In spite of this, it has been argued that the items on the BAS Fun Seeking scale tend to reflect the measurement of rash impulsiveness rather than measurement of reward sensitivity (Dawe et al., 2004). Similarly, the Reward Dependence subscale of the Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987) fails to consistently load on either impulsivity domain. Dawe and Loxton (2004) argue that this subscale measures dependence on social approval rather than a range of rewarding stimuli, which is inconsistent with other measures of rash impulsiveness or reward sensitivity. In fact, it has been demonstrated that the
Reward Dependence subscale is a good predictor of behavioural inhibition (Mardaga & Hansenne, 2007), which is purported to be orthogonal to the measurement of impulsivity (Gray, 1987).

Table 2.1

*Overview of Factor Analytic and Principal Components Analyses Reflecting Two Facets of Impulsivity*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Measures/Subscales</th>
</tr>
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<tbody>
<tr>
<td><strong>Rash</strong></td>
<td>Impulsiveness Scale of the Eysenck Impulsiveness Questionnaire (Eysenck, Pearson, Easting, &amp; Allsopp, 1985)(^{1,2,4,6})</td>
</tr>
<tr>
<td><strong>Impulsiveness</strong></td>
<td>Novelty Seeking Subscale of the Tridimensional Personality Questionnaire (Cloninger, 1987)(^{1,2,3,5})</td>
</tr>
<tr>
<td></td>
<td>Barratt Impulsiveness Scale (Patton, Stanford, &amp; Barratt, 1995)(^{4,5})</td>
</tr>
<tr>
<td></td>
<td>Sensation Seeing Scale (Zuckerman, Eysenck, &amp; Eysenck, 1978)(^{5})</td>
</tr>
<tr>
<td></td>
<td>The BAS Fun-Seeking subscale of the BIS/BAS scales (Carver &amp; White, 1994)(^{1,2,4,6})</td>
</tr>
<tr>
<td><strong>Reward Sensitivity</strong></td>
<td>The BAS Drive and Reward Responsiveness subscales of the BIS/BAS scales (Carver &amp; White, 1994)(^{1,2,4,5,6})</td>
</tr>
<tr>
<td></td>
<td>The Sensitivity to Reward subscale of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (Torrubia, Ávila, Moltó, &amp; Caseras, 2001)(^{1,2,3,5})</td>
</tr>
</tbody>
</table>


\(^{1}\) Caseras et al. (2003)  
\(^{2}\) Franken and Muris (2006b)  
\(^{3}\) Ibáñez et al. (2010)  
\(^{4}\) Miller et al. (2004)  
\(^{5}\) Quilty and Oakman (2004)  
\(^{6}\) Zelenski and Larsen (1999)
Consistent with the findings of factor-analytic studies presented in Table 2.1, there is now a general consensus within the literature that impulsivity is a multifaceted construct that comprises at least two distinct but related facets (see de Wit & Richards, 2004; Franken & Muris, 2006b). Importantly, this shift from a unidimensional perspective of impulsivity is likely to have significant theoretical and clinical implications.

For example, different measures of impulsivity have been shown to predict different outcomes (Curcio, Mak, & George, in press; Dick et al., 2010), and to predict substance use through differential pathways (Gullo, Dawe, et al., 2010; Kabbani & Kambouropoulos, 2013). Hence, the measurement of both facets of impulsivity in future research will advance current knowledge regarding how each facet relates to different behaviours, psychological constructs and diagnoses.

Consistent with this contention, Dick et al. (2010) argue that substantive conclusions cannot be made about the meaning of findings when a single score is used to represent processes that only correlate modestly with each other (e.g., measures of rash impulsiveness and reward sensitivity). Smith and Combs (2010) contend that this leads to theoretical and scientific imprecision. Such imprecision has implications for research attempting to identify neurobiological and genetic bases to psychological phenomena, as constructs need to be homogenous for this type of research (Smith, McCarthy, & Zapolski, 2009).

Ultimately, progress in understanding how rash impulsiveness and reward sensitivity relate to specific outcomes may have been limited by the plethora of heterogeneous measures capturing the construct of impulsivity. It is argued here that future research should utilise the two-facet conceptualisation of impulsivity
to address the abovementioned limitations of using a unidimensional measure of impulsivity to capture a multidimensional construct. The following two sections discuss the theoretical and biological underpinnings of reward sensitivity and rash impulsiveness, respectively.

**Reward sensitivity.**

Reward sensitivity reflects a drive to acquire rewarding stimuli (Dawe & Loxton, 2004). Theoretically, reward sensitivity is considered to be part of the BAS, which stems from Gray’s RST (Gray, 1970, 1987). Reinforcement sensitivity theory is a biologically based model of personality that has its basis in animal learning research (Gray, 1970, 1981, 1991). This theory posits that individual differences in personality can be attributed to variation across major brain systems. Two of the primary systems proposed by Gray (1987) are termed the BAS (i.e., reward sensitivity) and Behavioural Inhibition System (BIS), which are proposed to relate to impulsivity and anxiety, respectively.

Gray (1987) held that those with BAS sensitivity are sensitive to signals of reward, which suggests that these individuals are more likely to engage in goal-directed action and experience positive emotions (e.g., elation, hope) when they are exposed to cues that signify impending reward (Carver & White, 1994). Recent findings have also documented links between anger and BAS activation (Carver, 2004; Harmon-Jones, & Sigelman, 2001). This finding supports the contention that reward sensitivity may characterise a subset of socially anxious individuals given previous research has documented aggression among a subset of individuals suffering from SAD (see Kachin et al., 2001; Kashdan et al., 2009).

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1 While there has been a revision of RST (Gray & McNaughton, 2000) the present thesis will draw upon the original RST (Gray 1970, 1981, 1987, 1991) due to its ongoing prominence in the clinical literature and the well-validated measures that are used to capture the different components of this theory (Bijttebier, Beck, Claes, & Vandereycken, 2009). Further, this is consistent with recent research examining RST in social anxiety (e.g., Booth & Hasking, 2009; Kimbrel, Mitchell, & Nelson-Gray, 2010).
Gray posited that variation in dopaminergic neurotransmissions underlie individual differences in reward sensitivity (Pickering & Gray, 1999). Specifically, Pickering and Gray (1999) hypothesise that the expression of reward sensitive behaviour is reflected in less efficient inhibitory dopaminergic synapses. Consistent with the propositions of Pickering and Gray, Dawe et al. (2004) contend that the primary neural pathway involved in reward sensitive behaviour is the mesolimbic dopaminergic pathway. Notably, the mesolimbic dopaminergic pathway is hypothesised to underlie the reinforcing effects of substances of abuse (Goldstein & Volkow, 2002; Jentsch & Taylor, 1999) and a number of rewarding activities, including eating and sex (Blum et al., 2012; Davis et al., 2007).

Importantly, RST explicitly posits that self-report personality questionnaires can be used to assess the sensitivity of BIS and BAS functioning (Pickering & Gray, 1999). Although there are a number of measures that have been developed to assess BAS sensitivity, which is akin to the measurement of reward sensitivity, two measures have been prominent in the literature and demonstrate good reliability and validity. These measures are the BAS subscales of Carver and White’s (1994) BIS/BAS scales and the Sensitivity to Reward (SR) subscale of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001). Differences between these measures will be discussed in greater detail in a systematic review reported later in this chapter.

Whilst RST is relevant to understanding the theoretical basis of reward sensitivity, it also provides a framework for conceptualising SAD. Neurobiologically, Gray (1982) posited that the BIS was mediated by the septo-hippocampal system, however more recent research indicates that the amygdala plays a central role in BIS sensitivity (i.e., the expression of anxiety; see Barros-
Consistent with Gray’s (1976) contention that BIS is the biologically based personality substrate for anxiety, several researchers have found a positive relationship between social anxiety and BIS. For example, heightened BIS sensitivity has been positively correlated with symptoms of social anxiety in community (Kashdan & Roberts, 2006; Kimbrel, Cobb, Mitchell, Hundt, & Nelson-Gray, 2006) and clinical samples (Morgan et al., 2009).

Although an examination of RST is beyond the scope of this thesis, it is important to acknowledge the well-established relationship between BIS and SAD, as the present thesis posits that reward sensitivity, which has been found to be negatively correlated (Coplan, Wilson, Frohlick, & Zelenski, 2006; Kashdan, 2002), and uncorrelated with SAD (Kashdan & Roberts, 2006), may play a role in the relationship between social anxiety and substance misuse. Although this may initially seem counterintuitive, this examination is consistent with the paradoxical symptoms (e.g., novelty seeking, aggression and risk-taking see pp. 24-29) that have been identified among a subset of socially anxious individuals and may help identify biologically based personality differences that underlie the comorbidity between social anxiety and substance misuse.

**Rash impulsiveness.**

Rash impulsiveness is conceptually related to Eysenck and Eysenck (1985), Cloninger (1987), Zuckerman (1984), and Barratt’s (1985) early descriptions of impulsivity. These theoretical propositions will be briefly reviewed to demonstrate their convergence on one facet of impulsivity (i.e., rash impulsiveness) in a series of factor analytic studies (see p. 32).
Stemming from Eysenck’s (1967) earlier theoretical propositions, Eysenck and Eysenck (1985) proposed a personality taxonomy based on three biologically based personality dimensions. They termed these three dimensions; psychoticism, extraversion and neuroticism, with the sub-facet of impulsivity subsumed within the primary dimension of psychoticism (Eysenck & Eysenck, 1985). In its broadest sense, psychoticism reflects the extent to which people are anti-social, egocentric, tough-minded, and unempathic (Eysenck & Eysenck, 1985, p. 14). More specifically, the sub-facet of impulsivity reflects risk-taking, lack of planning, and acting without forethought (Eysenck & Eysenck, 1985).


In contrast to the abovementioned theories, Zuckerman (1984) and Barratt (1985) did not propose tri-dimensional theories of personality. Zuckerman (1969) initially introduced the construct termed sensation seeking based on the theory of individual differences in optimal levels of arousal. Zuckerman (1969, 1979) posited that sensation seeking individuals were in a basal state of under arousal and thus required additional stimulation to reach an optimal level of arousal. Like the abovementioned definitions of impulsivity, sensation seeking is characterised
by the need to seek out novel forms of sensation and experience, and a willingness to engage in these experiences regardless of the risks involved (Zuckerman, 1979, p.10).

Barratt (1985), on the other hand, developed a well-known questionnaire termed the Barratt Impulsiveness Scale, which is currently in its eleventh revision (Patton et al., 1995). In his attempt to relate impulsivity to psychomotor efficiency (Stanford et al., 2009), Barratt conceptualised impulsivity as comprising three main sub-facets, which pertain to cognition, motor processing, and non-planning. Aligned with these sub-facets impulsivity was defined by Barratt as acting without thinking, making quick cognitive decisions, and having a present orientation, as opposed to thinking about future consequences.

Whilst each of the abovementioned theories utilise different terminology in their conceptualisation of impulsivity, and report subtle differences in their definition, the underlying features of impulsivity in each theory involve an element of risk-taking and lack of planning. This is reflected in the convergence of the measures that were derived from the abovementioned theories on a single factor (see p. 32). More recently, rash impulsiveness has been described as the tendency to act rashly and the inability to stop engaging in approach behaviour despite the potential for negative consequences (Loxton, Nguyen, et al., 2008). Hence, rash impulsiveness is related to cognitive processes, namely lack of inhibitory control (Loxton, Nguyen, et al., 2008).

Although each of the aforementioned theories proposed underlying neural processes for impulsivity, current knowledge, which is based on theory and advances in neurobiology, suggest that individual differences in rash impulsiveness involve the orbitofrontal cortex and the ventromedial prefrontal
cortex (Dawe et al., 2004). Jentsch and Taylor (1999) have previously argued that individual differences in the functioning of these brain regions are a consequence of chronic drug use. However, Dawe et al. (2004) propose that the areas of the brain involved in rash impulsiveness reflect individual differences in functioning (and hence individual differences in the expression of rash impulsive behaviour), which are exacerbated by chronic drug use. Notably, there is preliminary support for this hypothesis (see Goldstein & Volkow, 2002; Horn, Dolan, Elliott, Deakin, & Woodruff, 2003; Schoenbaum & Shaham, 2008). Furthermore, akin to reward sensitivity, evidence suggests that the dopamine system plays a principal role in rash impulsiveness (Leyton et al., 2002). However, there is also evidence for the role of serotonin in rash impulsiveness, particularly within the orbitofrontal cortex (Cools, Roberts, & Robbins, 2008).

Although there are a number of measures that capture rash impulsiveness, the Impulsiveness subscale of the Eysenck Impulsiveness Questionnaire (T7; Eysenck et al., 1985) will be utilised in the two studies reported in this thesis. Another commonly used measure of rash impulsiveness is the Novelty Seeking subscale of the TPQ; however, this measure has been shown to correlate with anxiety measures (Caseras et al., 2003), which violates the theoretical assumption that these constructs are orthogonal (Barratt, 1965; Gray, 1987).

It is important to note, that although rash impulsiveness and reward sensitivity are related, they are thought to represent distinct systems (Franken & Muris, 2006b; Quilty & Oakman, 2004). Consistent with this proposition, rash impulsiveness and reward sensitivity are posited to relate to different aspects of substance misuse. Specifically, Dawe and Loxton (2004) proposed that reward sensitivity relates to the motivating factors that are behind the initial decision to
use a substance, whereas rash impulsiveness relates to the decreased ability to cease using substances in spite of negative consequences. Hence, reward sensitivity and rash impulsiveness are posited to relate to substance use initiation and maintenance, respectively. The following section will review the well-established role of impulsivity in predicting the onset of substance misuse, and related clinical outcomes, before reviewing more recent studies examining the utility of a two-facet conceptualisation of impulsivity in research investigating substance misuse.

**Impulsivity in Substance Misuse**

Biologically based theories of personality make two fundamental assumptions about personality traits. Firstly, they posit that traits are stable over time, and secondly they propose that traits directly influence behaviour (Matthews, Deary, & Whiteman, 2003). Research examining impulsivity has largely been consistent with this contention, in that a personality style characterised by elevated impulsivity has repeatedly been shown to predict the onset of later problematic substance use (i.e., the onset of heavy substance use or a diagnosis of substance abuse or dependence; e.g., Fergusson et al., 2008; Masse & Tremblay, 1997; Sher et al., 2000).

In one such study, Sher et al. (2000) examined the cross-sectional and prospective role of personality variables in predicting later substance misuse diagnoses. Sher et al. administered the TPQ, Eysenck’s Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975), and completed structured interviews to ascertain substance use diagnosis in a large sample (n = 489) of undergraduate students. Across Cloninger (1985) and Eysenck’s (1975) personality taxonomies it was found that Cloninger’s Novelty Seeking subscale and Eysenck’s
Psychoticism subscale were the most consistent predictors of substance use disorders both cross-sectionally and at six-year follow up ($n = 457$). That is, individuals with high baseline scores on the Novelty Seeking or Psychoticism subscale were more likely to receive a substance use diagnosis at follow-up (Sher et al., 2000).

Similarly, in the cross-sectional analyses these subscales were significantly related to all substance use disorders (Sher et al., 2000). Interestingly, psychoticism was shown to be a reliable predictor of prospective alcohol use disorders, whereas novelty seeking was shown to be a reliable predictor of illicit drug use disorders and tobacco use. It is likely that these findings reflect subtle differences between the measurement of psychoticism and novelty seeking. As previously discussed, the Novelty Seeking subscale is a measure of rash impulsiveness, whereas the Psychoticism subscale is a broader measure of a number of sub-traits, including impulsivity. Considering the longitudinal nature of Sher et al.’s (2000) study, their findings provide support for the etiological role of impulsive traits in predicting the onset of substance use disorders.

More recently, Fergusson et al. (2008) reported the findings of a longitudinal study examining prospective predictors of illicit drug use and abuse/dependence. The sample was drawn from a 25-year longitudinal study of 1265 New Zealand children, with Fergusson et al. analysing measures across a range of individual and familial domains, including measures of substance misuse, and a measure of rash impulsiveness (i.e., the Novelty Seeking subscale of the TPQ). Information for Fergusson et al.’s study was obtained at four time points, when participants were aged 16, 18, 21, and 25.
Based on the findings of analyses, Fergusson et al. (2008) reported that 40% of the cohort reported using illicit drugs at least once, and 10% met DSM-IV (APA, 1994) criteria for a substance use disorder. To specifically examine the contribution of a range of risk factors in the development of illicit drug use and abuse/dependence over the nine-year time period, a three-stage regression analysis was carried out.

In the first stage of the analysis, several factors were identified as statistically significant predictors of illicit drug use (Fergusson et al., 2008). These factors included, exposure to childhood sexual abuse, gender, rash impulsiveness, conduct problems between the ages of 7 and 13, and parental illicit drug use (Fergusson et al., 2008). In the second and third stages of the analysis, fixed and time-dynamic covariates and lagged illicit drug use were included to examine causality.

Notably, the final model indicated that accounting for time-dynamic variables reduced many of the associations between childhood fixed factors and illicit drug abuse/dependence to statistical non-significance, with the exception of rash impulsiveness and illicit drug use, which remained statistically significant (Fergusson et al., 2008). Although these findings suggest that a number of childhood factors account for later substance use diagnoses, the findings of Fergusson and colleagues (2008) provide strong evidence that impulsivity plays an important role in predicting prospective illicit drug use and illicit drug use diagnoses.

Whilst the abovementioned longitudinal studies utilised self-report measures of impulsivity there have also been a number of studies that have administered behavioural measures to examine associations with substance
misuse. One common behavioural measure of impulsivity is known as “delayed discounting”, which refers to the preference for smaller immediate rewards over larger but delayed rewards (Rachlin & Green, 1972). For example, Coffey, Gudleski, Saladin and Brady (2003) administered a delayed discounting task whereby participants were presented with hypothetical immediate and delayed rewards (including monetary and substance rewards), with 16 delay conditions ranging from five minutes to 25 years. The objective value of the monetary and substance rewards ranged from $1 to $1,000. Behaviourally, this task can be administered in an interview format (see Coffey et al., 2003) or through a computer program (see Stanger et al., 2012). This behavioural measure of impulsivity is considered to reflect rash impulsiveness (Dawe & Loxton, 2004).

Consistent with broad definitions of impulsivity, individuals with a high rate of delayed discounting tend to be driven by immediate gains rather than future concerns (Dawe & Loxton, 2004). This has been examined extensively in animal (e.g., Monterosso & Ainslie, 1999) and human studies (e.g., Kirby, Petry, & Bickel, 1999). Unfortunately, a majority of studies carried out within substance using populations have examined delayed discounting in those who are already substance dependent and compare the findings to a control group (e.g., Coffey et al., 2003; Kirby et al., 1999). Hence, the temporal precedence of delayed discounting and substance misuse cannot be inferred from these studies.

In a recent study addressing this limitation, Anokhin, Golosheykin, Grant, and Heath (2011) examined the heritability of delayed discounting and the longitudinal association of delayed discounting with a number of outcomes, including substance misuse. Their study was carried out in a sample of adolescent twins ($n = 744$) who were assessed on a range of behavioural and self-report
measures at age 12 and 14. Analyses indicated that delayed discounting was
significantly associated with substance use over the past year at age 14, whereas
these results did not reach significance at age 12 (Anokhin et al., 2011). However,
the onset of substance misuse tends to peak in older adolescence and early
adulthood (McGorry et al., 2011), hence this finding is consistent with the
literature.

Further, Anokhin and colleagues (2011) found that delayed discounting
was significantly associated with a self-report measure of rash impulsiveness,
with individuals scoring higher on delayed discounting similarly scoring higher
on rash impulsiveness at age 12 and 14 than those who did not. Lastly, Anokhin et
al. found a moderate to strong influence of genetic heritability on delayed
discounting. At age 12, heritability was estimated at 30%, whereas at age 14 this
was estimated at 51%. The findings of this study provide evidence to support
early theoretical models that proposed impulsivity is a biologically based
personality trait (e.g., Eysenck & Eysenck, 1985; Gray, 1987).

Whilst the aforementioned heritability and prospective studies provide
evidence to support the genetic basis of impulsivity, it is equally important to
acknowledge research examining the impact substance misuse has on the
expression of impulsivity. In this way, impulsivity has been described as both a
predictor and a consequence of drug use (de Wit, 2009; Verdejo-García,
Lawrence, & Clark, 2008). For example, substance use itself tends to increase
risk-taking and impulsive behaviours, including risky sex and driving while under
the influence of substances (de Wit, 2009; Goldstein & Volkow, 2002). Hence,
although there is strong evidence to suggest that impulsivity predicts later
substance misuse, substance misuse tends to exacerbate engagement in impulsive behaviours.

In light of this finding, it is unsurprising that those who present for treatment of their substance use disorder, with elevated levels of impulsivity, tend to have poorer treatment outcomes. In one such study, Stanger et al. (2012) examined the impact of delayed discounting on substance misuse treatment outcomes in a sample of adolescents ($n = 165$) seeking treatment for marijuana abuse or dependence. Whilst a majority of participants in the sample discounted the smaller reward ($100) for the larger reward ($1000), those who chose the smaller magnitude reward were less likely to abstain from marijuana use during treatment (Stanger et al., 2012). Abstinence was measured over 14 weeks and was on the basis of urine tests, parental and individual self-report. Further, this finding was consistent across the three alternative treatment conditions in the study. Specifically, the three alternative treatment conditions were: (1) cognitive behavioural therapy only; (2) cognitive behavioural therapy in addition to contingency management (i.e., escalating monetary rewards for abstinence, with a reset procedure for substance use; see Stanger et al., 2012, p. 207); and (3) cognitive behavioural therapy, contingency management and a family management curriculum.

Similarly, Patkar and colleagues (2004) sought to examine whether impulsivity predicts treatment outcome in a sample of African American individuals ($n = 145$) seeking treatment for cocaine misuse. Using two measures of rash impulsiveness, scores on the Sensation Seeking Scale (Zuckerman et al., 1978) showed a significant negative correlation with days in treatment, number of negative urine tests, and a significant positive correlation with treatment dropout.
Similarly, scores on the Barratt Impulsiveness Scale were negatively correlated with days in treatment.

Although there is evidence to suggest that there is a genetic basis to impulsivity (Anokhin et al., 2011), it is important to acknowledge that the behavioural effects of impulsivity appear to be modifiable through therapeutic intervention (e.g., Conrod, Castellanos-Ryan, & Strang, 2010; O'Leary-Barrett, Mackie, Castellanos-Ryan, Al-Khudhairy, & Conrod, 2010). However, to date, personality-based interventions have focused on early intervention in adolescence and childhood. Hence, these interventions have not been commonly integrated into substance misuse treatment programs. Considering the impact impulsivity has on substance misuse, alongside important clinical outcomes, interventions aimed at modifying the behavioural effects of impulsivity warrant consideration in future research (Staiger et al., 2007).

Whilst it is beyond the scope of this thesis to review all studies in the clinical literature that have examined the relationship between impulsivity and substance misuse, the abovementioned studies demonstrate the well-established role of impulsivity in predicting substance misuse and treatment outcomes. Consistent with the wider clinical literature, the reviewed studies utilised measures that reflect rash impulsiveness, including self-report measures of Novelty Seeking (Cloninger, 1987), Sensation Seeking (Zuckerman et al., 1978), and the behavioural measure of delayed discounting (Rachlin & Green, 1972).

Converging with factor-analytic studies supporting the two-facet conceptualisation of impulsivity, it has only been more recently that studies have begun including measures of reward sensitivity in substance misuse research (Gullo, Ward, Dawe, Powell, & Jackson, 2011). Considering that the two-facet
conceptualisation of impulsivity is central to the present thesis, the following
section will systematically review all literature examining the influence of rash
impulsiveness and reward sensitivity on substance misuse.

Systematic Review: Two Facets of Impulsivity in Substance Misuse Research

A review of the literature was carried out so that all articles measuring
rash impulsiveness, reward sensitivity and substance misuse were systematically
reviewed. With regard to substance misuse, there were no limitations on class of
substance or type of measurement (e.g., severity, diagnosis, frequency or quantity
measure). The review included peer-reviewed journal articles of varied
methodological quality, which were written in the English language. There were
no limitations on age of participants, type of study (i.e., cross-sectional,
prospective or experimental), type of sample (i.e., community or clinical), or date
of publication. Exclusion criteria included animal studies and studies
investigating one-facet of impulsivity.

A database search was conducted on PsycARTICLES, PsychINFO,
Academic Search Complete, Psychology and Behavioural Sciences Collection,
MEDLINE Complete, and Science Direct (Social Sciences and Humanities
Collection). Articles were obtained using permutations of the following key
words: substance misuse, rash impulsiveness and reward sensitivity. The
reference lists of retrieved articles were scanned for additional relevant
publications. Refer to Appendix A for a detailed method of the review, inclusion
and exclusion criteria, search terms (see Table A1) and a flowchart depicting the
flow of information through different phases of the review (Figure A1).

The review indicated that 16 studies had examined the two-facet
conceptualisation of impulsivity in relation to measuring substance misuse (see
Table A2 for the characteristics of included studies). With regard to specific substance misuse measurement, nine studies measured alcohol misuse, two studies measured drug misuse, and five studies administered measures of both drug and alcohol misuse. Of these studies, three carried out their study in a clinical sample, while the remaining 13 studies were conducted in a community sample.

It is important to note that an examination of the two-facet conceptualisation of impulsivity in substance misuse was not the sole focus of all studies included in the review. Hence, only those findings pertaining to rash impulsiveness and reward sensitivity in substance misuse will be discussed. Specific findings of individual studies will be reviewed in the following sections.

**Two-facet conceptualisation in alcohol misuse.**

Three cross-sectional studies included in the present review utilised hierarchical regression analysis to examine the contribution of rash impulsiveness and reward sensitivity in the prediction of alcohol misuse (Gullo, Jackson, & Dawe, 2010; Lyvers et al., 2012; Willem, Bijttebier, & Claes, 2010). In Gullo, Jackson and Dawe’s (2010) study it was found that the Impulsiveness subscale of the I7, and the SR subscale of the SPSRQ, made a unique contribution to predicting alcohol misuse in a sample of college students \((n = 165)\). Specifically, measures of reward sensitivity and rash impulsiveness predicted greater hazardous alcohol use (i.e., drinking at harmful levels according to the Alcohol Use Disorders Identification Test [AUDIT] cut off scores; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993), with each facet of impulsivity explaining 4% and 5% unique variance, respectively.
Similarly, Lyvers et al. (2012) sought to investigate whether hazardous drinking was related to elevated reward sensitivity and rash impulsiveness in a sample of university students ($n = 124$). To test the hypothesis that rash impulsiveness and reward sensitivity would predict scores on the AUDIT, the Barratt Impulsiveness Scale and the SR subscale of the SPSRQ were administered. In step one of the regression analysis age and gender were entered, which accounted for 9% variance in AUDIT scores. In step two, rash impulsiveness scores accounted for a further 14% variance, while in step three the addition of both reward sensitivity and punishment sensitivity (i.e., BIS) accounted for a further 7% variance. Importantly, when controlling for the variance due to other variables, rash impulsiveness and reward sensitivity made the strongest unique contributions to explaining AUDIT scores (Lyvers et al., 2012).

Furthermore, using suggested cut-off scores for the AUDIT, Lyvers et al. (2012) found that young adults who were classified as harmful drinkers scored significantly higher than low risk and hazardous drinking groups on measures of rash impulsiveness and reward sensitivity. These findings converged with an earlier study by Lyvers, Duff, and Hasking (2011), where the same measures of reward sensitivity and rash impulsiveness were positively associated with risky drinking as defined by the AUDIT cut off scores.

In the third study utilising hierarchical regression analysis, Willem et al. (2010) found that BAS Fun Seeking uniquely predicted age of first alcohol use and quantity of alcohol consumed in a high school sample ($n = 284$). Willem et al. also found that BAS Drive and BAS Fun Seeking were significantly positively associated with quantity of alcohol consumed, and negatively associated with age
of first alcohol use. However, BAS Reward Responsiveness, a measure of reward sensitivity, was not significantly associated with any alcohol use variables in Willem et al.’s study.

Using a differential statistical methodology, Gullo, Dawe, et al. (2010) tested a structural equation model examining the cognitive mechanisms through which rash impulsiveness and reward sensitivity represent risk factors for alcohol misuse. An equivalent model was tested within a sample of young adults ($n = 342$) and a sample of individuals seeking treatment for substance misuse ($n = 121$). It was found that rash impulsiveness, as measured by the Impulsiveness subscale of the I7, and reward sensitivity, as measured by BAS Drive, and the SR subscale of the SPSRQ, were directly related to distinct cognitive mechanisms (i.e., drinking refusal self-efficacy and positive alcohol expectancy, respectively), which were related to hazardous alcohol use.

The findings of Gullo, Dawe, et al. (2010) provide support for the hypothesis that both facets of impulsivity differentially relate to substance misuse (Dawe et al., 2004; Dawe & Loxton, 2004). Furthermore, this finding adds strength to the contention that rash impulsiveness and reward sensitivity are distinct facets of impulsivity, both of which should be included in empirical research to capture the multidimensional nature of impulsivity.

In another study included in the review, Ibáñez et al. (2010) administered a Spanish version (Gutierrez-Zotes et al., 2004) of the Novelty Seeking subscale of the Temperament Character Inventory (Cloninger, Przybeck, Svrakic, & Wetzel, 1994), and the SR subscale of the SPSRQ, to examine personality traits that are involved in the onset of alcohol consumption. Based on a principal components analysis, which included several personality measures, four factors
were identified. Specifically, one factor included the measure of rash impulsiveness and another factor included the measure of reward sensitivity, both of which predicted alcohol consumption in a Spanish sample of undergraduate students ($n = 539$). Unfortunately, the analyses combined a series of personality measures, making it difficult to ascertain the unique role of each facet of impulsivity in predicting alcohol consumption (Ibáñez et al., 2010). In spite of this, the findings of Ibáñez et al. (2010) converge with the findings of a series of other studies (e.g., Quilty & Oakman, 2004; Zelenski & Larsen, 1999), which have consistently demonstrated that measures of impulsivity are heterogeneous and tend to load on two distinct factors in factor analytic and principal components analyses.

Only one study included in the present review utilised a measure of alcohol ingestion to examine the relationship between heart rate, alcohol intoxication, and personality (Brunelle et al., 2004). Specifically, participants ($n = 37$) ingested one millilitre of alcohol per kilogram of body weight (Brunelle et al., 2004). Using a physiological measure of heart rate response, it was found that those with a high heart rate response to alcohol reported significantly higher reward sensitivity, as measured by the SR subscale of the SPSRQ, and higher Sensation Seeking scores, as measured by the Substance Use Risk Profile Scale (Woicik, Stewart, Pihl, & Conrod, 2009), than those with low heart-rate responses to alcohol. Although Brunelle et al. utilised cross-sectional methodology, their overall findings provide preliminary support to etiological hypotheses, which posit that sensitivity to the rewarding properties of alcohol place individuals at higher risk of developing alcohol use problems (see Conrod, Pihl, & Vassileva, 1998).
Overall, studies that utilised the AUDIT tended to find that hazardous drinkers reported significantly higher levels of rash impulsiveness and reward sensitivity than non-hazardous drinkers (Hamilton, Sinha, & Potenza, 2012; Lyvers et al., 2011; Lyvers et al., 2012). A recent study by Kabbani and Kambouropoulos (2013) similarly utilised the AUDIT as a measure of alcohol misuse, and found a significant direct effect of reward sensitivity, as measured by the SR subscale of the SPSRQ, on alcohol misuse. However, contrary to hypotheses, Kabbani and Kambouropoulos failed to find a significant direct effect of rash impulsiveness, as measured by the Impulsiveness subscale of the I7, on alcohol misuse. However, it was noted that their sample was relatively small (n = 132), which may account for this unexpected finding.

Similarly, Hamilton et al. (2012) and Lyvers et al. (2011) reported findings inconsistent with their hypotheses. Specifically, Hamilton et al. found no significant differences between hazardous and non-hazardous drinking groups on measures of BAS Drive but found significant differences between groups on BAS Reward Responsiveness (n = 446). Similarly, Lyvers et al. (2011) reported that rash impulsiveness scores, which were measured using the Barratt Impulsiveness Scale, contributed little to the prediction of AUDIT scores, whereas the relationship between disinhibition and drinking behaviour was partially mediated by the SR subscale of the SPSRQ. Importantly, both Hamilton et al. and Lyvers et al. carried out their studies in community samples, which were comprised of a relatively low rate of hazardous drinkers. Hence, this limits the capacity to generalise their findings to clinical samples.
Two-facet conceptualisation of impulsivity in drug misuse.

Two studies included in the present review specifically examined rash impulsiveness and reward sensitivity in samples of individuals who reported using illicit drugs. In both studies, which were carried out in divergent samples, similar findings were reported. Firstly, in an adult community sample \((n = 207)\), Egan, Kambouropoulos, and Staiger (2010) compared ecstasy users and non-ecstasy using controls. Egan et al. administered the Impulsiveness subscale of the \(I^7\) as a measure of rash impulsiveness, and the SR subscale of the SPSRQ as a measure of reward sensitivity. Consistent with hypotheses, there were significantly higher levels of reward sensitivity \((\eta^2 = .08)\) and rash impulsiveness \((\eta^2 = .05)\) among ecstasy users.

Similarly, Loxton, Wan, et al. (2008) compared a sample of club-drug users \((n = 360)\) and non-drug users from Hong Kong. Loxton, Wan, et al. (2008) used the Sensation Seeking Scale (Zuckerman, 1994), and BAS Fun Seeking scale as measures of rash impulsiveness, and the BAS Drive and BAS Reward Responsiveness subscales as measures of reward sensitivity. It was found that club-drug users scored significantly higher on the Sensation Seeking, BAS Fun Seeking, and BAS Drive subscales. Consistent with a number of the abovementioned findings, there were no significant effects for BAS Reward Responsiveness.

Two-facet conceptualisation of impulsivity in alcohol and drug misuse.

Lastly, studies that utilised measures of both alcohol and drug misuse will be discussed. Franken and Muris (2006a) found that BAS Drive and BAS Fun Seeking were positively correlated with the number of illicit drugs used in a
sample of undergraduate university students \((n = 276)\). Further, BAS Fun Seeking was positively correlated with binge drinking and drinking quantity. Inconsistent with hypotheses, but consistent with the findings of other studies in the present review, Franken and Muris (2006a) found that BAS Reward Responsiveness was not significantly correlated with any substance misuse variables.

Similarly, Voigt et al. (2009) utilised the abovementioned measures of impulsivity in a sample of undergraduate university students \((n = 1014)\) and found that BAS Fun Seeking was significantly correlated with alcohol, tobacco and drug use. However, in this sample BAS Drive failed to reach significance. Furthermore, inconsistent with hypotheses, Voigt et al. reported that BAS Reward Responsiveness was significantly negatively correlated with alcohol, tobacco, and drug use. The conflicting findings associated with the BAS Reward Responsiveness subscale will be discussed in detail in the review conclusion.

Only two studies included in the present review conducted their study in a clinical sample of substance users and compared these findings with a control group (Franken, Muris, & Georgieva, 2006; Meda et al., 2009). Although both studies used different measures of rash impulsiveness and reward sensitivity they both reported similar findings. Specifically, Meda et al. (2009) found that participants with a family history of alcohol abuse, and drug dependent participants, scored significantly higher than controls on the Barratt Impulsiveness Scale and the SR subscale of the SPSRQ.

Similarly, Franken et al. (2006) reported that there were significant differences between drug misuse inpatients, alcohol misuse inpatients, and controls, on the BAS Fun Seeking and BAS Drive subscales. Consistent with the findings of other studies included in this review, there were no significant
differences across groups on the BAS Reward Responsiveness subscale (e.g., Franken & Muris, 2006a; Loxton, Wan, et al., 2008; Willem et al., 2010). It is important to note that both Franken et al. and Meda et al. (2009) used substance use status (e.g., inpatient, family history) as an indicator of substance misuse. That is, no measure of substance use frequency or severity was administered.

The last study to be discussed in the present review was carried out by Gullo and colleagues (2011). This study specifically evaluated the utility of the two-facet conceptualisation of impulsivity over the well-established one-facet conceptualisation of impulsivity, which has long been assumed in empirical research (e.g., Masse & Tremblay, 1997; Fergusson et al., 2008). Considering the relevance of this study to the present thesis, the methodology and findings will be discussed in detail.

In the study of Gullo et al. (2011), it was hypothesised that the two-facet conceptualisation of impulsivity would provide a better fit to the data than a one-facet conceptualisation. Specifically, a one-facet conceptualisation of impulsivity predicts a direct relationship between a single measure of impulsivity (i.e., either rash impulsiveness or reward sensitivity) and substance misuse. It was also hypothesised that both rash impulsiveness and reward sensitivity would account for unique variance in the prediction of substance misuse.

Among Australian ($n = 271$) and British ($n = 183$) young adults who completed several self-report questionnaires pertaining to reward sensitivity, rash impulsiveness, and hazardous substance use, the results of a series of structural equation modelling analyses were consistent with hypotheses (Gullo et al., 2011). That is, a two-facet conceptualisation of impulsivity was a better fit to the data than the one-facet conceptualisation. In the British sample, the hypothesised
model accounted for 26% of the variance in hazardous alcohol use and 27% of the variance in illicit drug use. In the Australian sample, the hypothesised model accounted for 14% of the variance in hazardous alcohol use and 6% of the variance in illicit drug use.

To verify the abovementioned findings Gullo et al. (2011) contrasted their hypothesised model with two alternative models. As previously mentioned, the first comparison model included a single facet of impulsivity directly predicting substance misuse. Based on an examination of the chi-square and goodness of fit indices, the results indicated that this model was a poor fit to the data. The second comparison model was similar to the hypothesised model, but removed the direct relationship between reward sensitivity and illicit drug use, as this is a more recent conceptualisation of impulsivity based on factor analytic studies (e.g., Quilty & Oakman, 2004). Whilst this model provided a reasonable fit to the data, the goodness of fit statistics (e.g., Akaike’s Information Criterion) and the chi-square test indicated that the hypothesised model, whereby the two facets of impulsivity directly predicted substance misuse, was the best fit to the data. This recent study carried out by Gullo et al. (2011) provides strong evidence to suggest that the two facets of impulsivity uniquely contribute to the prediction of substance misuse.

**Review conclusion.**

Overall, the findings of the review suggest that rash impulsiveness and reward sensitivity have strong utility in predicting various aspects of substance misuse. In particular, measures of rash impulsiveness and reward sensitivity were consistently positively associated with a range of substance use variables, including hazardous alcohol use (Gullo, Dawe, et al., 2010; Gullo, Jackson,
Dawe, 2010; Gullo et al., 2011; Kabbani & Kamboutopoulos, 2013; Lyvers et al., 2011; Lyvers et al., 2012; Voigt et al., 2009), quantity of alcohol consumed (Willem et al., 2010), illicit drug use (Gullo et al., 2011; Voigt et al., 2009), and number of illegal substances used (Franken & Muris, 2006a). Consistent with these findings, both measures of impulsivity were significantly negatively correlated with age of first alcohol use (Lyvers et al., 2012; Willem et al., 2010). Moreover, measures of rash impulsiveness and reward sensitivity were consistently shown to be significantly higher among hazardous substance users, when compared to non-substance using individuals, or substance users fitting criteria for non-hazardous substance use (Egan et al., 2010; Franken et al., 2006; Hamilton et al., 2012; Kabbani & Kambouropoulos, 2013; Loxton, Wan, et al., 2008; Lyvers et al., 2012; Meda et al., 2009; Willem et al., 2010).

For those studies that reported the eta squared ($\eta^2$) measure of effect size, it was found that $\eta^2$ ranged from .04 to .14 for measures of rash impulsiveness (Egan et al., 2010; Hamilton et al., 2012; Lyvers et al., 2012), and from .01 to .10 for measures of reward sensitivity (Egan et al., 2010; Hamilton et al., 2012; Lyvers et al., 2012; Lyvers et al., 2011) in relation to the measurement of substance misuse. Loxton, Wan, et al. (2008) reported a population based measure of effect size and found that omega squared ($\omega^2$) ranged from .06 to .08 for two measures of rash impulsiveness, and from .00 to .02 for two measures of reward sensitivity in contrasting club-drug users and non-drug users. Overall these findings suggest that effect sizes for rash impulsiveness ranged from small to large, whereas effect sizes for reward sensitivity ranged from small to medium in the prediction of substance misuse (see Morse, 1999). Notably, the scale reporting an effect size of $\omega^2 = .00$ was the BAS Reward Responsiveness subscale, which is
not surprising given several inconsistent findings have been reported using this subscale within the present review (i.e., Franken & Muris, 2006a; Franken et al., 2006; Hamilton et al., 2012; Loxton, Wan, et al., 2008; Voigt et al., 2009; Willem et al., 2010).

Indeed, the findings of this review indicate that the BAS Reward Responsiveness subscale often failed to differentiate hazardous substance users from controls (Franken et al., 2006; Loxton, Wan, et al., 2008). Further, this measure was found to be unrelated to substance use variables (Franken & Muris, 2006a; Willem et al., 2010). Paradoxically, one study found a significant negative relationship between BAS Reward Responsiveness and substance misuse (Voigt et al., 2009), whereas another study found a positive relationship (Hamilton et al., 2012). In light of this finding, the two studies reported in this thesis will utilise the SR subscale of the SPSRQ, as the present review demonstrated greater consistency with this measure of reward sensitivity. It would be advantageous for future research to examine individual items on the BAS Reward Responsiveness subscale to determine whether this measure accurately captures the construct of reward sensitivity. Such research may explain why this measure is inconsistently related to substance misuse.

Furthermore, the findings were remarkably consistent across a diverse range of clinical and non-clinical samples and demonstrated preliminary evidence that findings are cross-culturally applicable (Ibáñez et al., 2010; Loxton, Wan, et al., 2008). Cross-cultural validation adds further credence to the contention that impulsivity is a biologically based personality trait.

It is important to acknowledge that the minor inconsistencies evident across studies may be related to differential methodological approaches. For
example, substance misuse measures varied largely across studies, with some studies using diagnosis, frequency of use, ingestion or quantity measures. Furthermore, there are other considerations, such as age of the sample or whether the sample comprised of university students, which limits generalisability.

One important limitation of the studies included in the present review is that all studies used cross-sectional research designs. Although there have been a number of longitudinal studies examining one facet of impulsivity in the prediction of substance misuse (e.g., Fergusson et al., 2008; Sher et al., 2000) there have been no longitudinal studies examining the two facets of impulsivity. It is important for future empirical studies to consider these methodologies.

Although the above systematic review focused on research examining the two-facet conceptualisation of impulsivity in substance misuse, studies have begun to examine the involvement of rash impulsiveness and reward sensitivity in the etiology of comorbidity (i.e., the co-occurrence of two psychiatric diagnoses or the co-occurrence of a psychiatric diagnosis and a substance use disorder). Such research is of specific relevance to the present thesis as the two studies reported in this thesis are investigating the involvement of rash impulsiveness and reward sensitivity in the co-occurrence of social anxiety and substance misuse. Considering that little is known about the relationship between social anxiety, impulsivity and substance misuse, the following review may inform the rationale for the two studies reported in this thesis. Therefore, the following section will systematically review all studies that have utilised the two-facet conceptualisation of impulsivity to examine comorbidity.
Systematic Review: Two Facets of Impulsivity in Comorbidity Research

A review of the literature sought to systematically review all studies that have examined the involvement of rash impulsiveness and reward sensitivity in the co-occurrence of two psychiatric diagnoses, or the co-occurrence of a psychiatric diagnosis and a substance use disorder. Consistent with the previous systematic review reported in this thesis, the present review included peer-reviewed journal articles, which were written in the English language. There were no limitations on methodological quality, age of participants, type of study (i.e., cross-sectional, prospective or experimental), type of sample (i.e., community or clinical), or date of publication. Exclusion criteria included animal studies and studies investigating one-facet of impulsivity.

A database search was conducted on PsycARTICLES, PsychINFO, Academic Search Complete, Psychology and Behavioural Sciences Collection, MEDLINE Complete, and Science Direct (Social Sciences and Humanities Collection). Articles were obtained using permutations of the following key words: comorbidity, rash impulsiveness and reward sensitivity. The reference lists of retrieved articles were scanned for additional relevant publications. Refer to Appendix B for a detailed method of the review, inclusion and exclusion criteria, search terms (see Table B1), and a flowchart depicting the flow of information through different phases of the review (Figure B1). The review found three articles relevant to the aim of the review (see Table B2 for the characteristics of the included studies).

The review indicated that all three studies examined the two-facet conceptualisation of impulsivity in psychiatric diagnoses that co-occur with substance misuse. Each of the three studies examined different psychiatric
diagnoses, including bulimia nervosa (Kane et al., 2004), bipolar disorder (Alloy et al., 2009), and psychopathy (Hopley & Brunelle, 2012). In the study of Alloy et al. (2009) and Kane et al. (2004) it was proposed that rash impulsiveness and reward sensitivity may represent a shared personality vulnerability underlying the co-occurrence of both disorders. In contrast, Hopley and Brunelle (2012) measured a range of different personality variables to investigate the relationship between psychopathy and substance misuse. Hence, Hopley and Brunelle did not specifically examine the two-facet conceptualisation of impulsivity in psychopathy and substance misuse comorbidity; rather they sought to use an exploratory approach by measuring a range of potentially relevant personality variables. As there are only three studies in the present review, the findings of each study will be discussed in detail below.

Kane et al. (2004) sought to investigate the utility of the two-facet conceptualisation of impulsivity in explaining the comorbidity between alcohol misuse and bulimia nervosa. As previously discussed, impulsivity has been found to predict the onset of substance misuse (Fergusson et al., 2008). Similarly, impulsivity is associated with symptoms of bulimia nervosa, including binge eating (Kemps & Wilsdon, 2009). Kane et al. tested the hypothesis that measures of rash impulsiveness and reward sensitivity would be elevated among those suffering from comorbid bulimia nervosa and alcohol misuse \( (n = 23) \), compared to those with bulimia nervosa alone \( (n = 22) \), and controls \( (n = 21) \). To test these hypotheses, the Impulsiveness subscale of the I7 and BAS Fun Seeking subscale were administered as measures of rash impulsiveness, and the BAS Drive and Reward Responsiveness subscales were administered as measures of reward sensitivity. Further, the Card Arranging Reward Responsiveness Objective Test...
(CARROT; Powell, al-Adawi, Morgan, & Greenwood, 1996) was administered as a behavioural measure of reward sensitivity.

The findings of Kane et al. (2004) indicated that there were significant differences across all measures of impulsivity, excluding the BAS Fun Seeking subscale, across the three subgroups. Planned comparisons found that the comorbid group reported significantly higher levels of rash impulsiveness, as measured by the Impulsiveness subscale, and non-significantly higher levels of reward sensitivity, as measured by the CARROT, than those with bulimia nervosa alone. However, it is important to note that the power (.52) to detect a significant difference between groups was compromised by the small sample size (Kane et al., 2004). Despite this, the findings of Kane et al. provide preliminary evidence to suggest that elevated rash impulsiveness and reward sensitivity may underlie the co-occurrence of bulimia nervosa and alcohol misuse. These findings warrant replication in a larger sample.

In a similar study, Alloy et al. (2009) utilised the two-facet conceptualisation of impulsivity to enhance current knowledge about the etiological mechanisms underlying co-occurring bipolar disorder and substance use disorders. Consistent with the study carried out by Kane et al. (2004), impulsivity was posited to be a shared characteristic underlying both co-occurring disorders. Akin to bulimia nervosa, which is characterised by an impulsive symptom profile (Kemps & Wilsdon, 2009), impulsivity is a characteristic that underlies the appetitive component of mania in bipolar disorder (Corr, 2008).

With regard to specific hypotheses, Alloy et al. (2009) sought to examine reward sensitivity and rash impulsiveness as predictors of bipolar and substance use diagnosis, and as predictors of the comorbidity between the disorders, in a
sample of young adults with bipolar spectrum disorders \(n = 132\) and demographically matched controls \(n = 153\). Self-report measures of reward sensitivity (i.e., BAS Reward Drive and BAS Reward Responsiveness subscales) and rash impulsiveness, including the BAS Fun Seeking subscale and the Impulsive Nonconformity Scale (Chapman et al., 1984), were administered to participants.

Consistent with hypotheses, higher reward sensitivity and rash impulsiveness predicted bipolar diagnosis and substance misuse at one-year follow-up (Alloy et al., 2009). Further, reward sensitivity and rash impulsiveness mediated the association between bipolar diagnosis and prospective substance use problems. Consistent with the assumptions of mediation (see Frazier, Tix, & Barron, 2004), these findings suggest a temporal, causal relationship between bipolar disorder, impulsivity, and the onset of substance use disorders. Further longitudinal research is warranted to verify this contention (i.e., the temporal precedence of diagnoses and personality characteristics). On the basis of their findings, Alloy and colleagues (2009) concluded that reward sensitivity and rash impulsiveness may partly explain the comorbidity between these diagnoses.

In spite of these promising findings reported by Alloy et al. (2009), it is important to consider some of the limitations of their study. Firstly, Alloy and colleagues (2009) used the BAS total score as a measure of reward sensitivity; hence this measure included BAS Fun Seeking, which is widely considered a measure of rash impulsiveness (Dawe et al., 2004). When subscales were examined individually, all impulsivity measures significantly distinguished between the bipolar and control group and were significantly associated with diagnostic status. However, BAS Reward Responsiveness and BAS Drive
subscales did not individually mediate or predict prospective substance misuse. Further, although the Impulsive Nonconformity scale (Chapman et al., 1984) was used as a measure of rash impulsiveness, this measure has not been validated as a measure of rash impulsiveness in factor analytic studies. These limitations should be taken into account in future studies examining the two-facet conceptualisation of impulsivity in comorbidity.

More recently, Hopley and Brunelle (2012) used an exploratory approach to examine which personality variables underlie the relationship between psychopathy and substance misuse in male offenders ($n = 92$). Aligned with the previous studies reported in this review, impulsivity is known to be a key feature of psychopathy, which is a serious personality disorder (Morgan, Gray, & Snowden, 2011).

To examine which personality variables mediated the relationship between psychopathy and substance misuse, two personality inventories were administered. Firstly, the SPSRQ was administered to measure behavioural inhibition and reward sensitivity, the two components of Gray’s (1987) original RST. The second measure administered was the Substance Use Risk Profile Scale. This scale measures a motivational model of substance misuse that has been proposed by Conrod, Pihl, Stewart and Dongier (2000). Subscales include, Anxiety Sensitivity, Introversion-Hopelessness, Sensation Seeking and Impulsivity (Woicik et al., 2009). Based on the items included in measures, the present review considered Sensation Seeking and Impulsivity subscales to be measures of rash impulsiveness.

Hopley and Brunelle (2012) argued that although the relationship between psychopathy and substance misuse is well-established, the personality based
mechanisms underlying these relationships are poorly understood. Hence, they used an exploratory approach to examine the potential role of both personality models in mediating the relationship between psychopathy and substance misuse.

Whilst rash impulsiveness and reward sensitivity were significantly correlated to psychopathy, only those personality constructs that were significantly related to both psychopathy and substance dependence were examined as possible mediators. Based on statistically significant correlations, the Impulsivity and Sensation Seeking subscales of the Substance Use Risk Profile Scale were examined as potential mediators of the relationship between psychopathy and stimulant use, and psychopathy and hallucinogen dependence. Findings of mediational analyses provided evidence for the role of rash impulsiveness mediating the relationship between psychopathy and substance misuse (i.e., stimulant and hallucinogen use).

Surprisingly, Hopley and Brunelle (2012) found that the SR subscale of the SPSRQ was not significantly correlated with substance misuse, meaning this measure could not be examined as a potential mediator of the relationship between psychopathy and substance misuse. This is consistent with the criteria for mediation as outlined by Barron and Kenny (1986). With regard to the Substance Use Risk Profile Scales future studies should consider including these in factor-analytic studies to determine whether the Sensation Seeking and Impulsivity subscales reflect the measurement of rash impulsiveness.

Review conclusion.

Overall, the three studies included in the present review provide preliminary evidence to suggest that rash impulsiveness and reward sensitivity may represent a shared personality vulnerability underlying the co-occurrence of
diagnoses that are characterised by shared impulsive symptomatology. Given the limited number of studies that have examined this shared-vulnerability model, the findings of this review suggest that more research is warranted so that substantive conclusions can be made, which may have implications for the treatment of co-occurring disorders that are characterised by shared impulsive symptomatology.

There are some important limitations of the abovementioned studies, including limited power due to sample size concerns (Kane et al., 2004) and methodological concerns regarding the measurement of rash impulsiveness (Alloy et al., 2009; Hopley & Brunelle, 2009). This thesis will utilise a validated measure of rash impulsiveness to address this limitation.

It is important to note that the studies included in the present review investigated comorbidity where psychiatric symptoms and behaviours are appetitive in nature (i.e., binge-eating and substance use; Kane et al., 2004), and in which impulsivity is deemed an important diagnostic and clinical characteristic of both disorders. In contrast, SAD tends to be associated with aversive motivation (Gray, 1987), and impulsivity has only recently been identified among a subset of SAD sufferers (e.g., Kashdan et al., 2009).

Despite the counterintuitive nature of the relationship between impulsivity and anxiety, this is an important avenue for research due to the high prevalence of co-occurring anxiety disorders and substance use disorders (Slade et al., 2009). Additionally, it has been posited that anxiety and impulsivity may be dimensional (Corr, 2004), and hence, it is possible that elevated levels of these traits may co-occur within an individual. Based on the findings of the above review, no previous studies have specifically examined the two-facet conceptualisation of impulsivity in the co-occurrence of an anxiety disorder with another diagnosis.
characterised by impulsive symptomatology (e.g., substance misuse). Considering the relevance of such research to the rationale for the two studies reported in this thesis, the following section consists of a review of two studies, which have examined the co-occurrence of an anxiety disorder with another disorder characterised by impulsive symptomatology.

**The Co-occurrence of Anxiety and Impulsivity**

The relationship between anxiety and impulsivity has previously been described as “controversial” (Askénazy et al., 2003, p. 220). In part, this is due to Barratt (1965) and Gray’s (1987) descriptions of anxiety and impulsivity as orthogonally related, and the inconsistent relationship observed between these variables in the clinical literature. For example, there is a high comorbidity between anxiety disorders and disorders characterised by impulsive symptomatology (e.g., substance use disorders; Slade et al., 2009), yet several studies have reported no correlation between anxiety and impulsivity (Askénazy, Caci, Myquel, Darcourt, & Lecrubier, 2000; Mobini, Pearce, Grant, Mills, & Yeomans, 2006). Perugi et al. (2011) postulated that anxiety and impulsivity may only be related in certain circumstances, which may be related to the presence of comorbidity.

Perugi et al. (2011) specifically examined this proposition in the co-occurrence of anxiety disorders and cyclothymia, which is a chronic and fluctuating mood disorder that is characterised by periods of hypomanic and depressive symptoms (APA, 2000). Notably, several symptoms of hypomania are characterised by elevated impulsivity (Richardson & Garavan, 2010). Participants were 47 individuals with a diagnosis of any anxiety disorder and 45 demographically matched controls. The Barratt Impulsiveness Scale was
administered as a measure of rash impulsiveness and the Immediate and Delayed Memory Task (Dougherty, Marsh, & Mathias, 2002) was administered as a measure of behavioural impulsivity.

Consistent with hypotheses, the findings of a series of one-way Analyses of Variance (ANOVA) indicated that those with co-occurring anxiety and cyclothymia scored significantly higher on self-report and behavioural measures of impulsivity, when compared to those with anxiety alone, and controls (Perugi et al., 2011). Although preliminary, Perugi et al. (2011) concluded that impulsivity may not be directly related to the anxiety disorder diagnosis, but to the co-occurrence with cyclothymia.

The findings of Perugi et al. (2011) shed light on the potential role of impulsivity underlying the relationship between co-occurring anxiety and cyclothymia there are some limitations that need to be considered. Firstly, their clinical sample was divided into two smaller sub-samples, comparing those with an anxiety diagnosis in isolation ($n = 21$), and those with co-occurring anxiety and cyclothymia ($n = 26$). Hence, their findings warrant replication in a larger sample to enhance generalisability. Further, Perugi et al. did not consider recent research advocating the measurement of two facets of impulsivity, with the Barratt Impulsiveness Scale capturing rash impulsiveness and the Immediate and Delayed Memory Task capturing the general construct of behavioural impulsivity (Dougherty et al., 2002). It would be advantageous to examine this question in future research as similar patterns of findings may not hold for reward sensitivity.

Similarly, Booth and Hasking (2009) examined the involvement of a single facet of impulsivity in the co-occurrence of anxiety and impulsive symptomatology. Specifically, Booth and Hasking examined the moderating role
of reward sensitivity, alongside alcohol expectancies, in the co-occurrence of social anxiety and alcohol consumption. In a community sample of young adults ($n = 454$), Booth and Hasking (2009) found evidence for three-way relationships between two measures of reward sensitivity (i.e., BAS Reward Responsiveness and BAS Drive), alcohol expectancies, and symptoms of social anxiety, in the prediction of alcohol consumption. Using separate anxiety and avoidance subscales in the measurement of social anxiety symptoms, it was found that for those with elevated reward sensitivity (i.e., elevated BAS Drive), there was a positive relationship between social anxiety (anxiety subscale) and drinking, for those with strong tension reduction expectancies (Booth & Hasking, 2009). Whilst similar findings were not found for the social anxiety avoidance subscale, this is not surprising given individuals in community samples with subclinical symptoms are more likely to experience anxiety in social situations but not avoid them (i.e., they lack the significant impairment associated with a full-threshold diagnosis; Crum & Pratt, 2001).

Additionally, similar findings were not found for the BAS Reward Responsiveness subscale. Specifically, it was found that for those with low levels of BAS Reward Responsiveness there was a positive relationship between social anxiety (anxiety subscale) and drinking for those with strong tension reduction expectancies (Booth & Hasking, 2009). Whilst this is in contrast to the previous finding using the BAS Drive subscale, this is not surprising given the inconsistent findings demonstrated with the BAS Reward Responsiveness subscale in several studies included in a previous systematic review of the literature (see pp. 57-58 for an overview). Indeed, Voigt et al. (2009) found that BAS Reward
Responsiveness was significantly negatively correlated with alcohol, tobacco, and drug use.

Despite some inconsistencies with regard to different measures, the findings of Booth and Hasking (2009) provide preliminary evidence to suggest that elevated levels of reward sensitivity may play an important moderating role in the co-occurrence of social anxiety and alcohol consumption. This is an important finding, as Booth and Hasking were the first to examine whether a personality trait, namely reward sensitivity, moderates the comorbidity between social anxiety and substance misuse. In contrast, several studies have previously examined the moderating role of cognitive variables in isolation, such as alcohol expectancies (e.g., Eggleston et al., 2004; Kushner, Sher, Wood, & Wood, 1994; Tran, Haaga, & Chambless, 1997).

Whilst it is difficult to delineate the unique role of reward sensitivity in the co-occurrence of social anxiety and alcohol consumption due to the three-way relationships observed between alcohol expectancies, reward sensitivity and social anxiety, the findings of Booth and Hasking (2009) suggest that reward sensitivity warrants further examination regarding the role it plays in social anxiety and substance misuse comorbidity. In particular, the second study reported in this thesis will extend on the findings of Booth and Hasking by investigating the moderating role of reward sensitivity and rash impulsiveness in a clinical sample of socially anxious individuals with co-occurring substance use disorders.

Taken together, the abovementioned studies provide evidence to suggest that elevated anxiety and impulsivity can exist concomitantly, and that this may underlie the co-occurrence of an anxiety disorder with a disorder characterised by
impulsive symptomatology. Consistent with Perugi et al.’s (2011) contention regarding the relationship between anxiety, impulsivity and cyclothymia, SAD itself may not represent a risk for the co-occurrence of substance misuse but a personality style characterised by elevated impulsivity may be involved in etiology of such comorbidity. The first study reported in this thesis will examine this contention in a community sample.

**Summary**

It has been demonstrated that a subset socially anxious individuals are characterised by impulsive-like traits. It was argued that this atypical symptom profile may explain the relationship between co-occurring social anxiety and substance misuse. The clinical and theoretical significance of impulsivity was reviewed and the evidence supporting a two-facet conceptualisation of impulsivity was presented.

Two systematic reviews of the literature demonstrated the utility of the two-facet conceptualisation of impulsivity in research examining substance misuse, and provided preliminary evidence to suggest that these traits may underlie the comorbidity between diagnoses characterised by shared impulsive symptomatology. In contrast, it was argued that for a subset of socially anxious individuals, a personality profile characterised by elevated impulsivity may underlie the co-occurrence of substance misuse. The following chapter will review the gaps in the clinical literature before presenting the overall aim of this thesis and the two studies that will be conducted to address this aim.
CHAPTER THREE

Aims of this Thesis

Following a comprehensive review of the clinical literature in the previous chapter, it was argued that elevated levels of rash impulsiveness and reward sensitivity may underlie the relationship between co-occurring social anxiety and substance misuse. The present chapter provides an overview of the gaps evident in the clinical literature and presents the overall aim of this thesis. Lastly, the two studies that will be carried out to address this overall aim will be outlined.

Limitations of Prior Research

There are a number of important gaps in the clinical literature that this thesis aims to address. Firstly, previous research has failed to examine personality-based differences that may account for the high prevalence of co-occurring SAD and substance misuse. For example, the self-medication (Khantzian, 1985) and tension-reduction (Conger, 1956) hypotheses do not make reference to personality-based differences that may explain why a subset of socially anxious individuals develop substance use problems while others do not. Moreover, research examining the role of cognitive variables (such as alcohol expectancies; see Eggleston et al., 2004; Kushner et al., 1994; Tran et al., 1997) in social anxiety and substance misuse comorbidity may be enhanced through research examining personality-based differences. For example, it is possible that personality-based mechanisms influence the development of alcohol expectancies (e.g., the expectation that alcohol consumption will enhance social interaction; Eggleston et al., 2004), which are posited to play a role in the development of substance misuse among a subset of socially anxious individuals (Gilles et al., 2006). Hence, personality-based research may inform the development of
preventative and treatment interventions that target the mechanisms underlying the co-occurrence of social anxiety and substance misuse. The present thesis will contribute to the literature by utilising a two-facet conceptualisation of impulsivity to examine etiological mechanisms that may underlie the relationship between social anxiety and substance misuse.

Secondly, as reviewed in chapter two, a series of studies have examined heterogeneity among socially anxious individuals by measuring a range of impulsive-like traits and behaviours, including hostile interpersonal problems, aggression, novelty seeking and risk-taking (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan & Hofmann, 2008; Kashdan et al., 2008; Kashdan et al., 2009). Although rash impulsiveness (i.e., novelty seeking; Kashdan et al., 2009) has previously been identified among a subset of SAD sufferers no previous studies have utilised measures of reward sensitivity to examine heterogeneity among socially anxious individuals. It is argued that the measurement of both facets of impulsivity will enhance consistency in future research and capture the multidimensional nature of impulsivity, which will ultimately enhance knowledge regarding how each facet of impulsivity conveys risk for the co-occurrence of social anxiety and substance misuse. Specifically, the present thesis will utilise impulsivity measures based on the findings of factor-analytic studies (e.g., Quilty & Oakman, 2004), and two systematic reviews of the literature, which were carried out in chapter two.

Moreover, the studies reported in this thesis will include participants with subthreshold symptoms of social anxiety. This is consistent with research suggesting that co-occurring substance misuse is more prevalent among those with subthreshold social anxiety symptomatology (Crum & Pratt, 2001;
Merikangas et al., 2002; Robinson et al., 2011). Further, there are a paucity of studies in the clinical literature that have utilised a clinical sample of individuals seeking treatment for their substance use disorder to examine the co-occurrence of social anxiety and substance misuse. Hence, the second study in the thesis will add to the literature by describing the clinical and demographic characteristics of the sample.

Lastly, this thesis will address measurement issues evident in previous studies by utilising validated measures of substance use severity. For example, previous studies examining heterogeneity among socially anxious individuals relied on clinician-rated severity of substance use (Kashdan & Hofmann, 2008), self-reported substance use over a three-month period (Kashdan et al., 2008), and responses to seven binary questions derived from a comorbidity dataset (Kashdan et al., 2009). Hence, the use of validated measures will enable the studies in this thesis to comment on the severity of substance misuse (i.e., abuse or dependence, hazardous or non-hazardous) among participants.

Overall Aim of the Present Thesis

It has been argued that elevated rash impulsiveness and reward sensitivity may characterise a subset of socially anxious individuals with co-occurring substance use problems. Furthermore, it has been argued that the interaction between social anxiety and both facets of impulsivity may predict substance misuse.

The overall aim of this thesis is:

1. To investigate the utility of a two-facet conceptualisation of impulsivity in understanding the relationship between social anxiety and substance misuse.
Two studies will be carried out to investigate this overall aim. The first study will expand on a series of previous studies (i.e., Kachin et al., 2001; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009) by examining whether individuals in the community with social anxiety symptomatology are characterised by qualitatively distinct personality profiles. Specifically, a latent class analysis will be carried out on symptoms typically associated with SAD, including social anxiety symptom severity and behavioural inhibition, and symptoms proposed to be involved in co-occurring social anxiety and substance misuse; including reward sensitivity, rash impulsiveness and risk-taking. Consistent with the findings of previous studies it is expected that there will be two distinct subgroups of socially anxious sufferers. The two social anxiety subgroups will then be compared on measures of substance use frequency and dependence to examine whether significant differences can be identified across the two subgroups.

The second study will investigate the moderating role of reward sensitivity and rash impulsiveness in the relationship between social anxiety and substance misuse. This study will be carried out in a clinical sample of individuals with social anxiety symptomatology and a co-occurring diagnosis of substance abuse or dependence. It will be argued the relationship between social anxiety symptoms and substance misuse is stronger among those with elevated rash impulsiveness and reward sensitivity. A secondary aim of this study is to describe the demographic and clinical characteristics of the sample as there are a paucity of studies examining the relationship between social anxiety and substance misuse in a clinical sample seeking treatment for their substance use disorder.
Summary

To date, a two-facet conceptualisation of impulsivity has not been examined in co-occurring social anxiety and substance misuse. Considering previous findings (e.g., Booth & Hasking, 2009; Kashdan et al., 2009), it is possible that a subset of socially anxious individuals are characterised by elevated levels of rash impulsiveness and reward sensitivity, and that the interaction between social anxiety and each facet of impulsivity predicts co-occurring substance misuse. This thesis will expand on previously reviewed studies and address a number of gaps evident in the clinical literature.
CHAPTER FOUR

Study One: When Social Anxiety Co-occurs with Impulsivity and Risk-Taking: Does Substance Misuse Characterise this Subset of Socially Anxious People?

Overview

The preceding chapter identified the gaps evident in the clinical literature, which followed from a comprehensive review of the literature in chapter two. The overall aim of this thesis was presented and the two studies that will address this aim were outlined. This chapter presents the rationale, methodology, results, and discussion of the first study. The primary aim of this study is to expand on a series of studies that were reviewed in chapter two (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan & Hofmann, 2008; Kashdan et al., 2008; Kashdan et al., 2009) by utilising a two-facet conceptualisation of impulsivity to investigate heterogeneity among socially anxious individuals. It is argued that the measurement of both facets of impulsivity will enhance current knowledge regarding a specific personality profile, which may characterise individuals with co-occurring social anxiety symptomatology and substance use problems. Specifically, it is hypothesised that rash impulsiveness and reward sensitivity, alongside risk-taking, will distinguish individuals with social anxiety symptoms into two qualitatively distinct subgroups. Further, it is hypothesised that substance use problems will differentiate the two socially anxious subgroups.

Rationale

According to the literature, individuals suffering from SAD can generally be described as behaviourally inhibited and risk-avoidant (APA, 2000; Lorian & Grisham, 2010; Stein & Stein, 2008). As discussed in chapter two, recent
empirical research has identified a subset of socially anxious individuals who are characterised by a paradoxical personality profile, including a series of impulsive-like traits (Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009). To date, this profile has been infrequently discussed in the clinical literature with only five empirical papers identifying this atypical presentation of social anxiety (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), of which the majority are from the same research group.

Although each of the aforementioned studies utilised different measures to examine impulsive-like traits among socially anxious individuals, the findings have been consistent. Specifically, the studies found that individuals with symptoms of social anxiety can be classified into two qualitatively distinct subgroups. One subgroup, which has been termed the “typical social anxiety” subgroup, are characterised by a prototypical SAD profile, including risk-aversion (Kashdan et al., 2008; Kashdan et al., 2009), and interpersonal problems characterised by unassertiveness and exploitability (Kachin et al., 2001). Conversely, the “atypical social anxiety” subgroup are characterised by risk-taking (Kashdan et al., 2009), novelty seeking (Kashdan & Hofmann, 2008), aggression (Kachin et al., 2001; Kashdan et al., 2009), and hostile interpersonal problems (Kachin et al., 2001).

Three of the aforementioned studies examining heterogeneity in social anxiety suggested that substance use problems may differentiate the two socially anxious subgroups (i.e., Kashdan & Hofmann, 2008; Kashdan et al., 2008; Kashdan et al., 2009), yet this contention was only specifically investigated in one of these studies (Kashdan et al., 2009). As previously discussed, a limitation of
the abovementioned studies was their failure to utilise validated measures to establish the severity of substance misuse among the atypical social anxiety subgroup. Hence, this study will utilise validated measures of alcohol and drug misuse to examine the severity of substance misuse among the typical and atypical social anxiety subgroups.

Consistent with the findings of a systematic review of the literature, which was reported in chapter two (see p. 47), it has been demonstrated that the two-facet conceptualisation of impulsivity has strong utility in substance misuse research. Furthermore, it has been argued that future research examining impulsivity should employ the two-facet conceptualisation of impulsivity, which will ultimately enhance knowledge regarding how each facet of impulsivity conveys risk for specific diagnoses and behaviours. As previously discussed, rash impulsiveness and reward sensitivity have been found to predict substance use through differential pathways (Gullo, Dawe, et al., 2010; Kabbani & Kambouropoulos, 2013). Hence, if both of these facets are implicated in SAD and substance misuse comorbidity there will be distinct preventative and treatment implications. Whilst Kashdan and Hofmann (2008) found evidence to suggest that rash impulsiveness characterises the atypical social anxiety subgroup, the present study will expand on this finding by examining whether reward sensitivity similarly characterises this subset of socially anxious individuals.

With regard to statistical analysis, three of the aforementioned studies utilised cluster analysis (Kachin et al., 2001; Kashdan et al., 2008; Kashdan & Hofmann, 2008), whereas the other study utilised latent class analysis (Kashdan et al., 2009). The data analytic procedure used in this study will align with Kashdan et al. (2009), as latent class analysis is superior to cluster analytic procedures
An additional aim of this study is to replicate the findings of Kashdan and Hofmann (2008) and Kashdan et al. (2009), who found that the atypical and typical social anxiety subgroups did not differ on measures of social anxiety severity. Consistent with this finding, the present study will administer a measure of social anxiety severity, alongside a measure of behavioural inhibition (i.e., BIS sensitivity), which is hypothesised to be the biological substrate for anxiety (Gray, 1987). Whilst it has previously been argued that anxiety and impulsivity are orthogonal traits (Barratt, 1965; Gray, 1987), it is possible that these traits are dimensional in nature (Corr, 2004). Hence, a subset of socially anxious individuals may be characterised by elevated reward sensitivity and BIS concomitantly.

Although a measure of BIS sensitivity has not previously been used in research examining the atypical and typical social anxiety subgroups, it is expected that scores on a measure of BIS will be equivalent across classes. This contention is consistent with the abovementioned findings, which suggest that there is no difference in severity and impairment of social anxiety symptoms across the two social anxiety subgroups (Kashdan & Hofmann, 2008; Kashdan et al., 2009).

Lastly, it is important to comment on the present research being carried out in a community sample, akin to the study carried out by Kashdan et al. (2008). Consistent with the findings of Kashdan et al. (2008), it is expected that there will be at least one subgroup in the dataset that is not characterised by elevated symptoms of social anxiety. Arguably, individual subgroups characterised by
minimal levels of anxiety can be used as a point of comparison and to
demonstrate that the two social anxiety subgroups can be differentiated from
individuals in the community.

In summary, this study argues that a two-facet conceptualisation of
impulsivity, which has been supported by a series of factor-analytic studies (see p.
32), may help conceptualise the relationship between co-occurring social anxiety
and substance misuse. In particular, this research may help identify personality
dimensions that underlie the comorbidity between these diagnoses.

Hypotheses

1) Consistent with the findings of Kachin et al. (2001), Kashdan et al. (2008),
Kashdan and Hofmann (2008), and Kashdan et al. (2009) it is
hypothesised that two classes with elevated symptoms of social anxiety
will be present in the dataset;

a) It is hypothesised that the two social anxiety classes will be
characterised by elevated levels of social anxiety and behavioural
inhibition but divergent patterns of rash impulsiveness, reward
sensitivity, and risk-taking behaviour.

2) It is hypothesised that there will be significant differences on substance
use variables across the two social anxiety classes. Specifically, it is
hypothesised that the atypical social anxiety class will report significantly
more substance use problems than the typical social anxiety class.
Method

Participants

Three hundred and fifty one adult participants ranging in age from 18 to 74 years ($M = 34.17$, $SD = 12.94$) completed a battery of self-report questionnaires. All participants met the study inclusion criteria, which required participants to be 18 years of age or older. There were 249 females (70.9%), 91 males (26%) and 11 participants (3.1%) who chose not to specify their gender. All participants completed the questionnaires electronically (see Appendix C for a copy of the online questionnaires). Participant demographic information is presented in Table 4.1.
Table 4.1

Participant Demographics for Study One

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>Australian</td>
<td>75.8%</td>
<td>New Zealand</td>
<td>6%</td>
<td>United Kingdom</td>
<td>5.4%</td>
<td>Other</td>
<td>12.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Some high school</td>
<td>5.4%</td>
<td>High school</td>
<td>20.5%</td>
<td>Certificate/trade qualification</td>
<td>16%</td>
<td>University qualification</td>
<td>58%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for SAD</td>
<td>Yes</td>
<td>26%</td>
<td>No</td>
<td>74%</td>
<td>Therapy only</td>
<td>54.9%</td>
<td>Medication only</td>
<td>13.2%</td>
<td>Therapy and medication</td>
<td>29.7%</td>
</tr>
<tr>
<td>Treatment type</td>
<td>Therapy only</td>
<td>54.9%</td>
<td>Medication only</td>
<td>13.2%</td>
<td>Therapy and medication</td>
<td>29.7%</td>
<td>Unspecified</td>
<td>2.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How long ago?</td>
<td>Currently in treatment</td>
<td>25%</td>
<td>Less than 6 months ago</td>
<td>8.7%</td>
<td>Between 6 and 12 months ago</td>
<td>15.2%</td>
<td>More than 12 months ago</td>
<td>51.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for alcohol misuse</td>
<td>Yes</td>
<td>5.1%</td>
<td>No</td>
<td>94.3%</td>
<td>Therapy only</td>
<td>44.4%</td>
<td>Medication only</td>
<td>11.1%</td>
<td>AA</td>
<td>16.7%</td>
</tr>
<tr>
<td>Treatment type</td>
<td>Therapy only</td>
<td>44.4%</td>
<td>Medication only</td>
<td>11.1%</td>
<td>AA</td>
<td>16.7%</td>
<td>Combined treatment</td>
<td>27.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How long ago?</td>
<td>Currently in treatment</td>
<td>26.7%</td>
<td>Less than 6 months ago</td>
<td>13.3%</td>
<td>Between 6 and 12 months ago</td>
<td>26.7%</td>
<td>More than 12 months ago</td>
<td>33.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for drug misuse</td>
<td>Yes</td>
<td>3.7%</td>
<td>No</td>
<td>95.7%</td>
<td>Detox</td>
<td>15.4%</td>
<td>Combined treatment</td>
<td>23.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment type</td>
<td>Therapy</td>
<td>53.8%</td>
<td>Medication</td>
<td>7.7%</td>
<td>Detox</td>
<td>15.4%</td>
<td>Combined treatment</td>
<td>23.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How long ago?</td>
<td>Currently in treatment</td>
<td>0%</td>
<td>Less than 6 months ago</td>
<td>18.2%</td>
<td>Between 6 and 12 months ago</td>
<td>18.2%</td>
<td>More than 12 months ago</td>
<td>63.6%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measures

**Demographic information.**

A set of self-report demographic questions were included pertaining to age, gender, ethnicity and education. Participants were also asked to indicate whether they had ever received treatment for SAD, alcohol use or drug use problems. If participants responded “yes” to any of these questions they were asked to provide information about their treatment history.

**The Alcohol Use Disorders Identification Test.**

The AUDIT (Saunders et al., 1993) is a 10-item self-report measure with three subscales. It was developed in conjunction with the World Health Organisation to assess hazardous alcohol consumption. In addition to a total score, which reflects alcohol-risk, the AUDIT can be scored to reflect three subscales, including (1) alcohol consumption (three items that assess quantity and frequency of alcohol consumption), (2) alcohol-dependence (three items that assess cognitive and behavioural symptoms associated with dependence on alcohol), and (3) adverse consequences of drinking (four items that assess the frequency of negative events resulting from alcohol consumption; Saunders et al., 1993). For the purposes of this study, the three subscales were utilised. The first eight items are scored on a 5-point Likert scale (0 = never to 4 = 4 or more times a week, for the first question; 0 = 1 or 2 to 4 = 10 or more, for the second question; 0 = never to 4 = daily or almost daily, for items 3 to 8). The last two questions are scored on a 3-point scale (from 0 = No, 2 = Yes, but not in the last year, and 4 = Yes, during the past year). Total scores on the AUDIT range from 0 to 40, and scores of 8 or above have been used to identify individuals who may be at risk, or may be experiencing problems related to their alcohol use (Conigrave,
Hall, & Saunders, 1995). It has been demonstrated that the AUDIT has good internal consistency ($\alpha = .82$) in a community sample (Bergman & Källmén, 2002). Cronbach’s alpha was .87 in the present study.

**Drug Abuse Screening Test.**

The Drug Abuse Screening Test (DAST-10; Bohn, Babor, & Kranzler, 1991) is a 10-item version of the original DAST (Skinner, 1982) that was designed to identify problems related to drug misuse in the previous year. The DAST-10 is self-report and dichotomously scored with yes/no items. Before commencing the questionnaire participants were informed that “drug” refers to use of prescription drugs not prescribed to them, or used in a manner not intended by the prescribing clinician, or the use of illicit drugs (e.g., marijuana, cocaine, ecstasy). Participants who responded “yes” to the first question indicating that they had used drugs in the past 12 months were asked to respond to the remaining questions (e.g., “are you always able to stop using drugs when you want to?”). Research suggests that if a respondent positively endorses three or more DAST-10 items this is considered a “positive screening result”, which is indicative of possible drug abuse or dependence (French, Roebuck, McGeary, Chitwood, & McCoy, 2001; Maisto, Carey, Carey, Gordon, & Gleason, 2000). The original DAST and DAST-10 have been used in clinical and non-clinical samples to detect drug misuse (Bohn et al., 1991; McCabe, 2008; Skinner, 1982). Cronbach’s alpha was .81 in this study.

**Drug use frequency measure.**

A measure of drug use frequency was developed for the purposes of this study. This measure obtained information regarding the use of substances other than alcohol (e.g., cannabis, cocaine, opioids) over the past 12 months. Questions
were rated on a 5-point Likert scale where 0 = not at all and 4 = four or more times per week.

**The Sensitivity to Punishment and Sensitivity to Reward Questionnaire.**

The SPSRQ (Torrubia et al., 2001) is a 48-item scale with dichotomous yes/no items. A 35-item version (O’Connor, Colder, & Hawk, 2004), which was developed to enhance factor structure and item properties, was administered in this study. The SPSRQ was selected for the present study because the two subscales, termed SR and Sensitivity to Punishment, were developed to assess reward sensitivity and BIS functioning, respectively (Torrubia et al., 2001). The Sensitivity to Punishment subscale consists of 18 items (e.g., “Comparing yourself to people you know, are you afraid of many things?”), and the SR subscale consists of 17 items (e.g., “Do you often do things to be praised?”). The 35-item version of the SPSRQ has demonstrated good reliability (Simons, Dvorak, & Lau-Barraco, 2009). In this study, the Cronbach’s alpha was .89 and .80 for the Sensitivity to Punishment and SR subscales, respectively.

**The Eysenck Impulsiveness Questionnaire.**

The I’ (Eysenck et al., 1985) is a 54-item dichotomously scored yes/no questionnaire with three subscales; Impulsiveness (19 items), Venturesomeness (16 items), and Empathy (19 items). In this study the Impulsiveness subscale was administered as a measure of rash impulsiveness. This subscale measures impulsivity related to decision making without consideration of the potential risks involved (e.g., “Do you usually make up your mind quickly?”). This subscale has been used in other non-clinical samples and has demonstrated good reliability ($r =$
Cronbach’s alpha for the Impulsiveness subscale was .87 in this study.

**The Reckless Behaviour Questionnaire.**

The Reckless Behaviour Questionnaire (RBQ; Arnett, 1989) is a 10-item self-report measure of reckless behaviour in the past year. This measure was utilised as a measure of risk-taking in the present study. Behaviours were selected for inclusion in the questionnaire if they had the potential for immediate and/or dire negative consequences (e.g., use of alcohol while driving, vandalism and shoplifting). Each item is responded to using a 5-point Likert scale (0 = never to 4 = more than 10 times), yielding one overall score. For the purposes of this study participants were given the option of responding “Not Applicable” to question two which asked participants to rate whether they had “had sex without using contraceptives” in the past 12 months. This option recognises that participants may be trying to fall pregnant, may have reached menopause, or may be in a long-term relationship. Strong test-retest reliability of the RBQ with a college sample has been demonstrated (r = 0.80; Shaw, Wagner, Arnett, & Aber, 1992). Cronbach’s alpha was .87 in this study.

**The Liebowitz Social Anxiety Scale: Self-report version.**

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) is a commonly used measure of social anxiety. The LSAS requires participants to rate their fear/anxiety and avoidance of 24 social interaction and performance situations. Participants were asked to indicate their level of anxiety or fear for each situation, in the past week, based on a four-point Likert scale (from 0 = no fear to 3 = severe fear). Similarly, participants rated their level of avoidance of each situation on a four-point Likert scale (0 = never avoid to 3 = usually avoid).
Scores range from 0 to 144, with scores of 30 or above indicative of non-generalised SAD, and scores of 60 or higher indicative of generalised SAD (Mennin et al., 2002). It has been found that the LSAS is reliable and internally consistent in both clinical ($\alpha = .95$) and non-clinical ($\alpha = .94$) samples (Fresco et al., 2001). Cronbach’s alpha was .97 in the present study.

**Procedure**

An online questionnaire was advertised via the use of paid online advertisements (Facebook), as well as snowballing techniques, whereby participants were invited to pass on information about the study to contacts whom they deemed appropriate (Lovatt, Mason, Brett, & Peters, 2010). These multiple methods of data sampling were carried out to ensure that all participants did not come from the one subject pool. The method of online data collection was utilised due to the ease of administration, convenience for participants, and improved confidentiality, which is especially important for participants when disclosing information regarding illicit drug use (Miller & Sønderlund, 2010). Moreover, substantial research now suggests that delivering traditional psychological measures in an online format is a reliable method of data collection (Jones, Fernyhough, de-Wit, & Meins, 2008; Riva, Teruzzi, & Anolli, 2003).

Prior to completing the questionnaire, participants were required to read the plain language statement, which is presented in Appendix D. The plain language statement provided information regarding the purpose of the study and consent, which was indicated when participants submitted their online questionnaire. Furthermore, participants were informed that they had the opportunity to enter a draw to win one of six $50 Coles-Myer vouchers. Participants were instructed to enter their email address upon completing the
online questionnaire if they would like to enter the draw. The plain language statement also provided participants with contact details for Beyond Blue and Directline in case they felt distressed in response to any of the items on the questionnaire. The questionnaire was untimed but it was expected that it would take approximately 20 minutes to complete.

**Data Analysis**

To meet the aims of the present investigation latent class analysis (LCA) was used to identify latent, or unobserved, subgroups within the data. Classes were derived based on observed response patterns on continuous measures of social anxiety, behavioural inhibition, rash impulsiveness, reward sensitivity and risk-taking. This approach is conceptually similar to cluster analysis but is probabilistic, which offers several advantages over traditional cluster analytic procedures (Magidson, & Vermunt, 2002). For example, the LCA approach provides fit and classification indices to help researchers determine the number of classes present in the data (Nylund, Bellmore, Nishina, & Graham, 2007). Furthermore, this approach allows outcome variables to be included simultaneously (i.e., distal outcomes; Nylund, Bellmore, et al., 2007).

Analyses were conducted for a series of latent classes, beginning with the most parsimonious (i.e., one class) and then increasing successively up to five latent classes. Consistent with the literature, the optimal number of latent classes was evaluated using both statistical and substantive theory (Nagin, 2005; Nylund, Asparouhov, & Muthén, 2007; Weich et al., 2011). This dual approach is recommended because a solution with a large number of latent classes may statistically discriminate between classes without adding practical value.
In terms of statistical evaluation, there is no single statistical indicator of model fit (Nylund, Bellmore, et al., 2007). Accordingly, the classes were compared using a range of goodness-of-fit statistics, including the Bayesian Information Criterion (BIC), the Bootstrapped Parametric Likelihood Ratio Test (BLRT), and the Lo-Mendell-Rubin Test (LMR). In general, lower BIC values are indicative of a better model. Both the BLRT and LMR are likelihood-based tests, which provide a p-value that can be used to determine whether the k-1 model should be rejected in favour of the k class model (Nylund, Asparouhov, & Muthén, 2007). That is, whether there is a significant improvement in fit for the addition of one more class.

In a recent simulation study, Nylund, Asparouhov, and Muthén (2007) examined the performance of likelihood-based tests (i.e., LMR and BLRT) and conventionally used information criterion (i.e., BIC) for determining the number of classes in mixture modelling. Across all mixture models, including LCA, the BIC performed the best of the information criteria and the BLRT was the most consistent indicator of the optimal number of classes (Nylund, Asparouhov, & Muthén, 2007). However, it was noted that the BLRT has its disadvantages. In particular, the BLRT depends on model assumptions (Nylund, Asparouhov, & Muthén, 2007). Hence, if the data in the class are skewed or there are outliers within a class, the p-value estimate for the BLRT may be incorrect.

Conversely, the LMR is based on the variance of parameter estimates, which are robust under a variety of model and distributional assumptions. Ultimately, Nylund, Asparouhov, and Muthén (2007) recommended that researchers use the BLRT and LMR alongside the BIC to determine the optimal number of classes. Consistent with these recommendations the present study
compared the BIC, LMR and BLRT across classes to help determine the optimal number of classes.

Moreover a measure of classification quality, termed entropy, was compared across classes (perfect entropy = 1.0). This value helps determine how well latent classes can be distinguished, with higher values indicating a clearer separation of classes (Celeux & Soromenho, 1996). Moreover, successful convergence and high posterior probabilities (near 1.0) for most likely class membership are important statistical considerations (Jung & Wickrama, 2008). To avoid problems with local maxima 1000 iterations were performed on each of the final models.

It is important to note that LCA does not rely on traditional modelling assumptions including; linearity, normality and homogeneity of variance (Magidson & Vermunt, 2002). Consistent with this assumption, the Maximum Likelihood with Robust Standard Errors and Chi-square estimator was used, which is robust to normality violations. Latent class analysis was performed using Mplus, Version – 6.12 (Muthén & Muthén, 2010).

Results

Data Screening

Preliminary data analyses were conducted on measures of social anxiety, substance use, rash impulsiveness, reward sensitivity, behavioural inhibition and risk-taking. Variables were examined for out of range values, univariate outliers and missing values. One participant only completed one of eight scales and was deleted from the dataset, leaving a total of 350 cases for further analyses. Table 4.2 below depicts scale range, means, standard deviations and minimum and maximum scores for all measured variables.
Table 4.2

Scale Range, Mean, Standard Deviation, Minimum and Maximum Scores of all Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scale Range</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Anxiety Symptoms</td>
<td>0-144</td>
<td>0</td>
<td>126</td>
<td>38.70 (25.85)</td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td>0-19</td>
<td>0</td>
<td>19</td>
<td>5.52 (4.51)</td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>0-17</td>
<td>0</td>
<td>17</td>
<td>5.61 (3.72)</td>
</tr>
<tr>
<td>Behavioural Inhibition</td>
<td>0-18</td>
<td>0</td>
<td>18</td>
<td>8.78 (5.07)</td>
</tr>
<tr>
<td>Risk-taking</td>
<td>0-40</td>
<td>0</td>
<td>35</td>
<td>7.51 (8.45)</td>
</tr>
<tr>
<td>AUDIT Total</td>
<td>0-40</td>
<td>0</td>
<td>33</td>
<td>8.43 (6.75)</td>
</tr>
<tr>
<td>Alcohol Consumption</td>
<td>0-12</td>
<td>0</td>
<td>12</td>
<td>4.80 (2.71)</td>
</tr>
<tr>
<td>Alcohol Dependence</td>
<td>0-12</td>
<td>0</td>
<td>10</td>
<td>1.11 (1.78)</td>
</tr>
<tr>
<td>Alcohol Consequences</td>
<td>0-16</td>
<td>0</td>
<td>15</td>
<td>2.52 (3.13)</td>
</tr>
<tr>
<td>DAST-10</td>
<td>0-10</td>
<td>0</td>
<td>10</td>
<td>1.33 (1.98)</td>
</tr>
<tr>
<td>Drug Frequency</td>
<td>0-28</td>
<td>0</td>
<td>15</td>
<td>2.32 (3.26)</td>
</tr>
</tbody>
</table>

*Note.* Participant responses on the AUDIT indicated that 97.5% of the sample consumed alcohol in the past 12 months, whereas responses on the DAST-10 indicated that 52% of the sample consumed drugs in the past 12 months.

Analyses were conducted to determine whether missing values were missing completely at random. Little’s Missing Completely at Random (MCAR) test ($\chi^2 [18050.93] = 177784$, $p = .08$) was non-significant, indicating that data was missing completely at random. Examination of the missing values determined that there were 1.13% missing values across the dataset and less than 5% missing data on any single item. Subsequently, expectation maximisation was utilised to impute missing values.
According to Tabachnick and Fidell (2007), univariate outliers are cases with standardised scores exceeding 3.29 (p < .001). Utilising this criteria there were nineteen univariate outliers in the dataset. Specifically, six outliers were from the AUDIT, eight were from the DAST-10, three were from the drug frequency measure, and two were from the LSAS.

Akin to the approach taken by Wu, Zumbo and Siegel (2011) outliers were retained for the final analyses. This approach is consistent with the theoretical underpinnings of LCA, as this procedure classifies individuals from a heterogeneous population into smaller homogenous subgroups (Klonsky, & Olino, 2008; Muthén & Muthén, 2000). Hence, within each class the distribution of scores is assumed to be normal (Wu et al., 2011). Furthermore, this assumption is consistent with the present research question, which is investigating an atypical presentation of social anxiety. Hence, the outliers across measures were deemed relevant and legitimate cases sampled from the population.

**Latent Class Analysis**

The relative fit and classification indices were examined for one, two, three, four and five-class models. All solutions successfully converged in 1000 iterations. Table 4.3 shows the overall fit and classification indices. As shown in Table 4.3, the LMR statistic indicated that the k class model was significantly better than the k-1 model until a five-class solution was examined (p = .17). That is, the LMR statistic indicated that the five-class model was not a significantly better fit than the four-class model (p = .04). Further, the entropy value (.88) demonstrated optimal classification in the four-class solution.

In contrast, the BLRT did not distinguish between classes in the present sample, as demonstrated by its continued significance in the five-class solution.
With regard to the BIC value, it can be seen that this continued to reduce as parsimony increased. However, relative to the five-class model the four-class model provided a very similar BIC value (BIC difference = 58.13). Based on the statistics presented in Table 4.3 the LMR and entropy favoured the four-class model.

To help validate the selection of the four-class model, four and five-class models were compared on a theoretical basis. On examination, the four-class solution was more interpretable and clinically informative than the five-class solution with the theoretically relevant classes remaining consistent in both solutions. Consistent with recommendations (Nagin, 2005; Nylund, Asparouhov, & Muthén, 2007; Weich et al., 2011), the four-class model was selected based on both statistical and theoretical considerations.

Table 4.3

*Model Fit and Entropy of Latent Class Models with Increasing Numbers of Classes*

<table>
<thead>
<tr>
<th>Classes</th>
<th>BIC</th>
<th>LMR</th>
<th>BLRT</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5019.86</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>4716.86</td>
<td>0.00</td>
<td>0.00</td>
<td>0.86</td>
</tr>
<tr>
<td>3</td>
<td>4615.96</td>
<td>0.00</td>
<td>0.00</td>
<td>0.84</td>
</tr>
<tr>
<td>4</td>
<td>4528.04</td>
<td>0.04</td>
<td>0.00</td>
<td>0.88</td>
</tr>
<tr>
<td>5</td>
<td>4469.91</td>
<td>0.17</td>
<td>0.00</td>
<td>0.86</td>
</tr>
</tbody>
</table>

*Note.* LMR, BLRT and entropy values cannot be calculated for a one-class model.

Average latent class probabilities for most likely latent class membership are shown in Table 4.4. Class one comprises 12% of participants, class two is the
largest class with 57% of all participants, whilst class three has 20% of participants, and class four has 11% of participants.

Table 4.4

*Posterior Probabilities for Most Likely Class Membership*

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>(n = 42)</em></td>
<td><em>(n = 201)</em></td>
<td><em>(n = 69)</em></td>
<td><em>(n = 38)</em></td>
</tr>
<tr>
<td>1</td>
<td>.90</td>
<td>.07</td>
<td>.00</td>
<td>.03</td>
</tr>
<tr>
<td>2</td>
<td>.02</td>
<td>.94</td>
<td>.04</td>
<td>.00</td>
</tr>
<tr>
<td>3</td>
<td>.00</td>
<td>.08</td>
<td>.92</td>
<td>.00</td>
</tr>
<tr>
<td>4</td>
<td>.04</td>
<td>.00</td>
<td>.02</td>
<td>.95</td>
</tr>
</tbody>
</table>

Table 4.5 shows the descriptive data concerning the indicator variables for each class. Standardised mean scores on indicator variables are graphically displayed in Figure 4.1. Based on the information presented in Table 4.5 and Figure 4.1, class one was termed the “minimal anxiety/risk prone class”, class two the “normative class”, class three the “typical social anxiety class” and class four was termed the “atypical social anxiety class”. It is important to note that these names were selected to be consistent with prior research and with the patterns of observed responses across latent classes.
Table 4.5  

*Descriptive Statistics of Indicator Variables for each Latent Class*

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>Social Anxiety</th>
<th>Rash Impulsiveness</th>
<th>Reward Sensitivity</th>
<th>Behavioural Inhibition</th>
<th>Risk-taking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SE</td>
<td>M</td>
<td>SE</td>
<td>M</td>
</tr>
<tr>
<td>1</td>
<td>23.71</td>
<td>3.59</td>
<td>6.72</td>
<td>0.90</td>
<td>7.56</td>
</tr>
<tr>
<td>2</td>
<td>25.89</td>
<td>1.66</td>
<td>3.83</td>
<td>0.27</td>
<td>4.70</td>
</tr>
<tr>
<td>3</td>
<td>66.69</td>
<td>5.92</td>
<td>6.07</td>
<td>0.63</td>
<td>5.58</td>
</tr>
<tr>
<td>4</td>
<td>69.57</td>
<td>5.43</td>
<td>11.98</td>
<td>1.11</td>
<td>8.26</td>
</tr>
</tbody>
</table>

*Note.* LSAS scores (i.e., Social Anxiety) over 30 are indicative of non-generalised SAD and scores over 60 are indicative of generalised SAD (Mennin et al., 2002). M = Mean and SE = Standard Error.

*Figure 4.1.* Standardised mean scores on indicator variables for each class.
Examining distal outcomes.

Figure 4.2 depicts mean differences on substance use variables across the four classes. Table 4.6 shows the mean values and standard errors on substance use variables across the four classes, whereas Table 4.7 depicts the significance values, based on chi-square difference scores, comparing the different classes across substance use variables. As can be seen in Table 4.7 the atypical social anxiety class and minimal anxiety/risk-prone class reported significantly more substance use problems than the normative class and the typical social anxiety class. Whilst the minimal anxiety/risk-prone class and the atypical social anxiety class reported similar levels of alcohol consumption, the atypical social anxiety class reported significantly higher scores on all other substance use measures. The normative and typical social anxiety class reported similar levels of substance use problems, with non-significant differences across all variables.

Exploratory analysis: Age as a distal outcome.

Given the wide age range of participants in the present study (see p. 82) it was decided to conduct an exploratory analysis to examine the influence of age across the four latent classes. It was found that participants in the normative class ($M = 36.74, SE = 1.00$) were significantly older ($p < .05$) than participants in the minimal anxiety/risk prone class ($M = 30.00, SE = 1.38$), the typical social anxiety class ($M = 31.80, SE = 1.62$), and the atypical social anxiety class ($M = 30.34, SE = 1.66$). All other classes did not significantly differ with regard to age ($p > .05$).
Figure 4.2. Mean differences across the four classes on substance use variables.

Table 4.6

Means and Standard Errors Across the Four Classes on Substance Use Variables

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>Alcohol Consumption M</th>
<th>SE</th>
<th>Alcohol Dependence M</th>
<th>SE</th>
<th>Alcohol Problems M</th>
<th>SE</th>
<th>DAST-10 SE</th>
<th>Drug Frequency M</th>
<th>SE</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.65</td>
<td>0.41</td>
<td>1.84</td>
<td>0.29</td>
<td>4.04</td>
<td>0.49</td>
<td>2.49</td>
<td>0.32</td>
<td>4.25</td>
<td>0.58</td>
</tr>
<tr>
<td>2</td>
<td>4.30</td>
<td>0.17</td>
<td>.59</td>
<td>0.07</td>
<td>1.60</td>
<td>0.16</td>
<td>0.77</td>
<td>0.09</td>
<td>1.34</td>
<td>0.16</td>
</tr>
<tr>
<td>3</td>
<td>3.89</td>
<td>0.32</td>
<td>.86</td>
<td>0.20</td>
<td>2.05</td>
<td>0.35</td>
<td>0.86</td>
<td>0.20</td>
<td>1.44</td>
<td>0.26</td>
</tr>
<tr>
<td>4</td>
<td>7.07</td>
<td>0.50</td>
<td>3.50</td>
<td>0.48</td>
<td>6.54</td>
<td>0.72</td>
<td>3.82</td>
<td>0.53</td>
<td>6.96</td>
<td>0.78</td>
</tr>
</tbody>
</table>
Table 4.7

Chi-Square Significance Values Comparing Classes Across Substance Misuse Variables

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>Alcohol Consumption</th>
<th>Alcohol Dependence</th>
<th>Alcohol Problems</th>
<th>DAST-10</th>
<th>Drug Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chi-Square</td>
<td>P-value</td>
<td>Chi-Square</td>
<td>P-value</td>
<td>Chi-Square</td>
</tr>
<tr>
<td>1 vs. 2</td>
<td>27.34</td>
<td>.00***</td>
<td>17.41</td>
<td>.00***</td>
<td>22.18</td>
</tr>
<tr>
<td>1 vs. 3</td>
<td>28.69</td>
<td>.00***</td>
<td>7.80</td>
<td>.01*</td>
<td>11.15</td>
</tr>
<tr>
<td>1 vs. 4</td>
<td>.41</td>
<td>.52</td>
<td>8.58</td>
<td>.00**</td>
<td>7.89</td>
</tr>
<tr>
<td>2 vs. 3</td>
<td>1.16</td>
<td>.28</td>
<td>1.65</td>
<td>.20</td>
<td>1.30</td>
</tr>
<tr>
<td>2 vs. 4</td>
<td>27.89</td>
<td>.00***</td>
<td>36.19</td>
<td>.00***</td>
<td>44.48</td>
</tr>
<tr>
<td>3 vs. 4</td>
<td>28.48</td>
<td>.00***</td>
<td>25.76</td>
<td>.00***</td>
<td>30.99</td>
</tr>
</tbody>
</table>

Note. * = p < .05, ** = p < .01, *** = p < .001
Discussion

The primary aims of the present study were to examine whether two qualitatively distinct social anxiety subgroups could be identified by utilising a two-facet conceptualisation of impulsivity, and to investigate whether these subgroups could be differentiated on the basis of co-occurring substance use problems. Specifically, the first hypothesis expected that individuals with symptoms of social anxiety could be meaningfully separated into two distinct classes based on characteristics typically associated with SAD, including social anxiety symptom severity and behavioural inhibition, and those posited to characterise the atypical subset of socially anxious individuals; including rash impulsiveness, reward sensitivity and risk-taking. The data supported this hypothesis. The second hypothesis expected that the two social anxiety classes would report significantly different levels of substance use. The data supported this hypothesis.

Heterogeneity in Social Anxiety

The findings of this study align with a series of studies investigating the clinical characteristics of a distinct subgroup of individuals characterised by atypical social anxiety symptomatology (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009). In particular, the findings are consistent with Kashdan et al. (2009) who classified individuals with SAD into distinct subgroups using risk-prone behaviour items. In this study, risk-taking clearly distinguished between the atypical and typical social anxiety subgroups.

The findings of this study are also consistent with the findings of Kashdan and Hofmann (2008), who used a measure of rash impulsiveness (i.e., novelty
seeking) to differentiate between SAD subgroups. The present study adds to the clinical literature by utilising a two-facet conceptualisation of impulsivity, with findings suggesting that both facets of impulsivity distinguished between the atypical and typical social anxiety subgroups.

Furthermore, both social anxiety subgroups reported similar levels of social anxiety symptom severity and behavioural inhibition, which is consistent with hypotheses. This finding provides further evidence to suggest that the atypical and typical social anxiety subgroups report similar levels of social anxiety symptomatology (Kashdan & Hofmann, 2008; Kashdan et al., 2009). Moreover, this finding is consistent with Gray’s (1987) RST, which posits that BIS is the biological substrate of anxiety.

The findings of this study also add strength to Corr’s (2004) contention that BIS and reward sensitivity are dimensional traits. This was especially prominent in the atypical social anxiety class, where individuals were characterised by elevated levels of BIS and reward sensitivity. Hence, these findings suggest that it is possible for a subset of socially anxious individuals to be characterised by elevated reward sensitivity and BIS concomitantly.

Notably, the findings of exploratory analyses indicated that the atypical and typical social anxiety classes were comprised of individuals who were of a similar age. This finding suggests that age did not confound the differential symptom profiles identified among social anxious individuals. Future research in this area should attempt to replicate this novel finding.

Interestingly, the data suggested that there were two classes in the dataset with minimal social anxiety symptomatology. The normative class aligns with the findings of Kashdan et al. (2008) who found a subgroup of participants with
below average scores on all variables of interest. Notably, the normative class comprised of participants who were significantly older than participants in the other three classes, suggesting that symptoms of social anxiety, substance misuse, and the comorbidity of these symptoms, may decrease with age. Indeed there is research to support this contention (see Kerfoot, Petrakis, & Rosenheck, 2011).

In contrast to the findings of Kashdan et al. (2008), the present study also found evidence for another subgroup, termed the minimal anxiety/risk prone class, who reported minimal levels of social anxiety, elevated levels of rash impulsiveness, reward sensitivity and risk-taking. This finding is not surprising considering that impulsive traits do not solely co-occur with SAD and often occur in those with substance use disorders in isolation (e.g., Bornovalova, Daughters, Hernandez, Richards, & Lejuez, 2005a). This is consistent with the findings of the present study, with the minimal anxiety/risk prone class reporting elevated levels of substance use.

Moreover, the two classes with minimal levels of social anxiety and differential patterns across latent class indicator variables provide evidence of specificity. This is consistent with Kashdan et al. (2009) who extended their LCA to include individuals without elevated symptoms of social anxiety, and Kashdan et al. (2008) who carried out their research in a community sample with one class reporting minimal levels of social anxiety. Hence, consistent with the approaches taken by these studies, it can be said that the differential patterns identified across the four latent classes provide evidence that the pattern of symptoms identified among those with elevated social anxiety symptoms does not hold for the general population.
Atypical Social Anxiety and Co-occurring Substance Use Problems

The findings of this study were consistent with hypotheses and support the contention that substance use problems may characterise the atypical subset of socially anxious individuals. Whilst the role of substance use was implicated in previous studies (Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), appropriate measures had not been used to investigate the severity of substance misuse among the atypical social anxiety subgroup.

Worryingly, the atypical social anxiety subgroup reported a mean of more than three on the DAST-10, which is indicative of a “positive screening result”, denoting risk for possible drug abuse or dependence (French et al., 2001; Maisto et al., 2000). Consistent with this finding, the results indicated that the atypical social anxiety subgroup reported the highest frequency of drug use. Similarly, the combined alcohol use score on the AUDIT was well above the cut-off score of eight, which has been used as an indicator of significant alcohol-related harm (Conigrave et al., 1995).

In contrast, the typical social anxiety subgroup was characterised by prototypical SAD symptoms, including behavioural inhibition and risk-aversion, with minimal levels of self-reported substance use across all measures. Consistent with hypotheses, the atypical social anxiety subgroup reported significantly higher levels of substance use problems than the typical social anxiety subgroup.

Whilst the aforementioned findings are indicative of significant substance use problems characterising the atypical social anxiety subgroup, two competing hypotheses should be considered. Firstly, as researchers have previously contended, SAD tends to precede the onset of co-occurring mental health problems, including substance misuse (Buckner, Schmidt, et al., 2008; Lipsitz &
Schneier, 2000). In this circumstance, it is possible that socially anxious individuals, who are characterised by an impulsive personality profile, are at greater risk of developing co-occurring substance use problems. Whilst this is a plausible explanation of the abovementioned findings, it is also possible that substance use precedes the development of social anxiety symptomatology in a subset of cases (see Bakken et al., 2005; Buckner et al., 2012; Ross, Glaser, & Germanson, 1988; Schneier et al., 2010).

As previously discussed, research suggests that substance use can lead to increased impulsivity (de Wit, 2009), which may explain why impulsivity, a paradoxical clinical characteristic, characterises the atypical social anxiety subgroup. A longitudinal study would be needed to determine whether there are differential pathways through which social anxiety and substance misuse co-occur to examine differences in temporal precedence of social anxiety symptoms, impulsivity, and substance misuse.

**Future Directions**

The findings of this study, taken together with the findings of previous research, may have implications for the development of treatment protocols. For example, evidence based treatment for SAD does not incorporate specific strategies or modules to reduce impulsivity, risk-taking behaviour and address co-occurring substance use problems. It is possible that the individuals who dropout or fail to improve over the course of treatment for SAD or substance misuse have a distinct symptom profile from those who demonstrate improvement in symptomatology.

Furthermore, considering the present study has provided evidence to suggest that reward sensitivity and rash impulsiveness characterise those with co-
occurring social anxiety and substance misuse this could have specific preventative and treatment implications. For example, Dawe and Loxton (2004) propose that reward sensitivity is involved in the initiation of substance misuse, whereas rash impulsiveness is involved in the maintenance of substance misuse. Hence, preventative interventions for individuals with subthreshold symptoms of social anxiety might incorporate strategies specifically targeted at reward sensitivity, whereas individuals presenting with co-occurring social anxiety and substance misuse in clinical settings may require specific interventions targeting both aspects of impulsivity. Indeed it has previously been argued that matching interventions to relevant personality traits is likely to improve treatment outcomes (Staiger et al., 2007).

To date, only one randomised controlled study has attempted to develop a treatment for individuals with co-occurring SAD and alcohol misuse (see Randall et al., 2001), however this study was met with equivocal findings. Hence, further research elaborating on this topic will play an important role in informing the development of effective treatments.

Limitations

There are some important limitations that should be taken into account when interpreting the findings of this study. Firstly, the method of this research was cross-sectional in nature and limited to self-report questionnaires. Although this methodology has provided important preliminary insights into the relationship between social anxiety and substance misuse, experimental and longitudinal designs are needed to infer causality.

With regard to the self-report questionnaires utilised in the present study it is possible that the different time frames used for reference had an impact on the
overall findings. Specifically, the LSAS required participants to reflect on the past week regarding symptomatology, whereas the DAST and the AUDIT required participants to reflect on the past 12 months. Therefore, it is possible that participants who experienced symptoms of social anxiety in the past twelve months, but not in the past week, were not reflected in the atypical social anxiety subgroup. In contrast, participants who experienced substance misuse symptomatology in the past 12 months are likely to have been reflected in the atypical social anxiety subgroup. It would be advantageous for future studies to take this into consideration when selecting questionnaires for inclusion in research examining the co-occurrence of social anxiety and substance misuse.

Moreover, the two social anxiety classes that were identified in this study were limited to the variables that were included in the analyses. Although similar findings have been found in other clinical and non-clinical samples (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009) it is important to acknowledge that additional variables may be important in conceptualising the relationship between social anxiety and substance misuse.

Furthermore, all the participants in this study were self-selected, which has the potential to limit generalisability. Indeed, it is possible that the individuals who self-selected to participate in this research study were qualitatively distinct from those who did not. Future research should consider using a different sampling methodology to address this limitation.

Lastly, it is important to acknowledge that although this study drew on the findings of Kashdan and Hofmann (2008) and Kashdan et al. (2006, 2008, 2009), this research does not contend that the current DSM-IV-TR (APA, 2000)
diagnostic criteria insufficiently characterises different subgroups of people with SAD (see Kashdan & McKnight, 2010). Conversely, the current study contends that the atypical symptoms identified among socially anxious individuals may be conceptualised within a model of co-occurring social anxiety and substance misuse. To verify this contention identification of these patterns in clinical samples would be useful.

**Conclusion**

On the basis of the data there is evidence to suggest that high levels of rash impulsiveness, reward sensitivity, and risk-taking may characterise a subset of socially anxious individuals with co-occurring substance use problems. These findings have implications for future studies examining the co-occurrence of these disorders and may inform the development of treatment protocols in future research.
CHAPTER FIVE

Study Two: Co-occurring Social Anxiety and Substance Misuse: Evaluating the Moderating Effects of Rash Impulsiveness and Reward Sensitivity

The previous chapter presented findings, which indicated that a subset of socially anxious individuals are characterised by elevated rash impulsiveness, reward sensitivity, risk-taking and substance use problems. Drawing from the findings of the first study, alongside the findings of several studies reviewed in chapter two (i.e., Booth & Hasking, 2009; Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), it is argued here that socially anxious individuals who misuse substances may be characterised by elevated rash impulsiveness and reward sensitivity. That is, the interaction between social anxiety and both facets of impulsivity may underlie co-occurring substance misuse. Hence, the primary aim of this study is to examine whether rash impulsiveness and reward sensitivity moderate the relationship between social anxiety and substance misuse in a clinical sample. As a dearth of empirical studies have utilised a clinical sample of individuals suffering from co-occurring social anxiety and substance misuse, a secondary aim of this study is to describe the clinical and demographic characteristics of the sample.

Rationale

The rationale for the second study is based on a series of studies reviewed in chapter two (i.e., Booth & Hasking, 2009; Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), and the findings of the first study of this thesis. Firstly, a series of studies have consistently demonstrated that a subset of socially anxious individuals are characterised by impulsive-like traits (Kachin et al., 2001; Kashdan et al., 2006;
Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009). This finding was confirmed in the first study, where a subset of socially anxious individuals were characterised by elevated rash impulsiveness, reward sensitivity, risk-taking and substance misuse. This finding was in stark contrast to a subgroup of socially anxious individuals who were characterised by minimal levels of impulsivity, risk-taking and substance use.

Thus, a subset of individuals with elevated symptoms of social anxiety may be more likely to misuse substances if they also have elevated levels of rash impulsiveness and reward sensitivity, suggesting these traits may play a moderating role. For moderation to be evident, the interaction between social anxiety and each facet of impulsivity would need to significantly improve prediction of substance misuse, after first accounting for the variance in outcome directly attributable to reward sensitivity, rash impulsiveness, and social anxiety separately (Barron & Kenny, 1986). Considering the high prevalence of co-occurring SAD among those seeking treatment for substance misuse (Bakken et al., 2005; Staiger et al., 2008; Thomas et al., 1999), the present study will test this hypothesis in a sample of individuals who are seeking treatment for substance misuse and report co-occurring social anxiety symptomatology.

The argument for moderation is consistent with the findings of a recent study, which was carried out by Booth and Hasking (2009). Specifically, Booth and Hasking found evidence to suggest that reward sensitivity, in conjunction with alcohol expectancies, moderated the relationship between social anxiety symptoms and alcohol consumption. Although these findings are promising, Booth and Hasking’s study was carried out in a community sample making it difficult to generalise their findings to clinical samples. Whilst there are
advantages of using community samples in research examining clinical disorders, it is equally important to investigate whether the findings of community based research can be generalised to clinical samples. Further, Booth and Hasking did not examine the moderating role of rash impulsiveness despite the involvement of this trait in the onset and maintenance of substance misuse (Dawe et al., 2004; Fergusson et al., 2008; Gullo et al., 2011; Sher et al., 2000). Hence, the present study will extend the findings of Booth and Hasking by utilising a clinical sample to examine whether rash impulsiveness and reward sensitivity moderate the relationship between social anxiety and substance misuse.

Surprisingly, previous studies have tended to focus on the relationship between social anxiety and alcohol use in isolation (e.g., Booth & Hasking; see Morris et al., 2005 for a review), despite evidence suggesting that SAD co-occurs with a number of different substances of abuse (Bakken et al., 2005; Darke & Ross, 1997; Myrick & Brady, 1997). For this reason, the present study will examine substance misuse more generally, including individuals who suffer from a range of different substance use diagnoses. In summary, this study argues that the interaction between social anxiety and both facets of impulsivity may predict substance misuse.

Hypotheses

Consistent with the findings of the first study reported in this thesis, and the findings of Booth and Hasking (2009), it is hypothesised that;

1) Rash impulsiveness will moderate the relationship between social anxiety and substance misuse. Specifically, it is hypothesised that the relationship between social anxiety and substance misuse will be strongest when rash impulsiveness is elevated.
2) Reward sensitivity will moderate the relationship between social anxiety and substance misuse. Specifically, it is hypothesised that the relationship between social anxiety and substance misuse will be strongest when reward sensitivity is elevated.

Whilst it has been argued here that reward sensitivity and rash impulsiveness moderate the relationship between social anxiety and substance misuse, it is important to acknowledge that these variables may serve as mediators. As previously mentioned, moderation explains when variables are related, whereas mediation explains why variables are related (Baron & Kenny, 1986). This dual approach, whereby variables are examined as both moderators and mediators, is consistent with studies broaching new areas of research in the clinical literature (e.g., Alloy et al., 2009; Bleil, Ramesh, Miller, & Wood, 2000; Eggleston et al., 2004; Vanhalst, Luyckx, Raes, & Goossens, 2012).

In particular, this approach is often taken where the relationship between variables has been established but the pathways through which the relationship exists have not been identified (Bleil et al., 2000). Consistent with the relatively unexplored nature of the relationships between social anxiety, impulsivity and substance misuse, an exploratory approach will be taken to examine whether rash impulsiveness and reward sensitivity mediate the relationship between social anxiety and substance misuse.

Method

Participants

As part of larger study 74 adult participants were recruited from Odyssey House, an addiction treatment facility located in Melbourne, Australia. A total of 45 males (60.8%) and 29 females (39.2%) ranging in age from 21 to 56 (M =
32.89, \( SD = 7.43 \) participated in the study. See Table 5.1 for participant demographic data. All individuals who applied for inclusion in the residential rehabilitation treatment program provided through Odyssey House were eligible to participate in the study if they met the inclusion criteria, which is detailed below.

**Inclusion and exclusion criteria.**

Study inclusion criteria included: 1) meeting the criteria for a substance use disorder as defined by the DSM-IV (APS, 1994), 2) identifying at least one moderate symptom of social anxiety on the LSAS (utilised as an indicator of subthreshold symptoms of social anxiety), and 3) being deemed eligible by Odyssey House clinicians for inclusion into the Therapeutic Community treatment program.

Participants were excluded if: 1) they were under the age of 18 years, 2) they were experiencing symptoms of a current and active psychotic episode based on the DSM-IV (APS, 1994) criteria, 3) they reported active suicidal ideation, 4) they were unable to read English, or 5) they became ineligible for admission to the Therapeutic Community as judged by Odyssey House clinicians. Participants were advised that their participation was optional and would not affect their time on the wait list nor their eligibility to partake in the residential rehabilitation program. Two hundred and ninety-five participants were excluded from participation in the study on the basis of the abovementioned inclusion and exclusion criteria.
Table 5.1

**Participant Demographics for Study Two**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
<th>Grouping</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>Australian</td>
<td>82.4%</td>
<td>New Zealand/Oceania</td>
<td>5.4%</td>
<td>Asia</td>
<td>4.1%</td>
<td>Other</td>
<td>8.1%</td>
</tr>
<tr>
<td>Education</td>
<td>Some high school</td>
<td>54.1%</td>
<td>Competed VCE or equivalent</td>
<td>12.2%</td>
<td>Certificate/trade qualification</td>
<td>27%</td>
<td>University qualification</td>
<td>6.8%</td>
</tr>
<tr>
<td>Relationship status</td>
<td>Single (never married)</td>
<td>48.6%</td>
<td>Married/living with partner</td>
<td>9.5%</td>
<td>Separated/divorced</td>
<td>27%</td>
<td>In a relationship but not living together</td>
<td>14.9%</td>
</tr>
<tr>
<td>Employment status</td>
<td>Unemployed</td>
<td>89.2%</td>
<td>Part-time/casual employment</td>
<td>5.4%</td>
<td>Employed full-time</td>
<td>2.7%</td>
<td>Other</td>
<td>2.7%</td>
</tr>
<tr>
<td>Usual occupation</td>
<td>Technician/trade worker</td>
<td>20.3%</td>
<td>Sales</td>
<td>14.9%</td>
<td>Community/personal services worker</td>
<td>10.8%</td>
<td>Other</td>
<td>54%</td>
</tr>
<tr>
<td>Place of residence</td>
<td>Rented</td>
<td>24.3%</td>
<td>Public housing</td>
<td>12.2%</td>
<td>Parents or other family members house</td>
<td>44.6%</td>
<td>Other</td>
<td>19%</td>
</tr>
<tr>
<td>Welfare payments</td>
<td>Yes</td>
<td>73%</td>
<td>No</td>
<td>27%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measures

Assessment information was obtained from semi-structured clinical interviews and self-report questionnaires. Clinician-administered questionnaires included demographic information, a diagnostic assessment tool, and two standardised substance misuse questionnaires. Registered psychologists and doctoral-level psychology students, who had received training in the administration of all measures, administered all clinician-administered questionnaires at assessment. A copy of the clinician-administered demographic and substance misuse questionnaires are presented in Appendix E. Self-report questionnaires included a social anxiety measure, rash impulsiveness, and reward sensitivity measure. The self-report questionnaires used in this study were described in detail in study one so they are only briefly described here. Each participant completed an initial intake assessment with the intake team at Odyssey House as well as an assessment with the Deakin University research team.

Clinician-administered measures.

Demographic information.

A set of self-report demographic questions was included pertaining to age, gender, ethnicity, country of birth, marital status, level of education achieved, occupation, employment status, access to welfare payments, sources of social support, and living conditions. Furthermore, information was obtained regarding primary substance of abuse (i.e., the most frequently used substance), age at onset of substance use problems, duration of problematic alcohol or drug use, most problematic substance of abuse in the past three months (i.e., the substance perceived to be the most problematic in terms of social, occupational or
psychological functioning), previous treatment attempts, and mental health history.

**Mini International Neuropsychiatric Interview – Screen.**

The Mini International Neuropsychiatric Interview – Screen (MINI-Screen; Sheehan et al., 1998) is a clinical screening measure that was administered at entry to the service by Odyssey House clinicians as part of their normal intake procedures. This is a shortened version of the full MINI and was used to guide diagnosis of SAD, substance use disorders and other relevant mental health disorders as outlined in the DSM-IV (APA, 1994).

**Mini International Neuropsychiatric Interview Version 6.0.0.**

The MINI (Sheehan et al., 1998) is a short, structured diagnostic interview, which is used to diagnose a number of mental health disorders as described in the DSM-IV (APA, 1994). Notably, the diagnostic criteria outlined in the current DSM-IV-TR (APA, 2000) are equivalent with criteria outlined in the DSM-IV (APA, 1994). The MINI takes approximately 15 minutes to administer and demonstrates high reliability and good concordance with other diagnostic measures, including the Composite International Diagnostic Interview and Structured Clinical Interview DSM-III-R-Patients (Lecrubier et al., 1997; Sheehan et al., 1997). The MINI was administered at assessment to clinically assess all potential diagnoses identified from the MINI-Screen. All participants were administered the sections assessing SAD, alcohol use disorders, illicit substance use disorders (i.e., abuse and dependence on substances other than alcohol), and antisocial personality disorder.
**Alcohol, Smoking and Substance Involvement Screening Test.**

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; World Health Organisation [WHO] ASSIST Working Group, 2002) is a reliable and valid screening test that was developed to assess problematic and risky substance use. For the purposes of this study the ASSIST was used as a measure of substance misuse. Eight dichotomous yes/no questions assess lifetime use of alcohol, tobacco, cannabis, cocaine, amphetamines, inhalants, sedatives, hallucinogens, opiates, and other miscellaneous drugs. For those drugs endorsed with a “yes” response to lifetime use, a series of questions are asked concerning the perceived impact of each drug on general health and lifestyle. For the purposes of this study the global continuum of substance risk score was obtained by summing the scores for each item, across all substances (Newcombe, Humeniuk, & Ali, 2005). The ASSIST has a maximum score of 208. Australian (Newcombe et al., 2005) and international studies (Humeniuk et al., 2008) indicate that the ASSIST is a valid screening tool for substance misuse in a diverse range of individuals who report varying degrees of substance use. Cronbach’s alpha was .77 in this study.

**Timeline Followback Method.**

The Timeline Followback Method (TLFB; Sobell & Sobell, 1992) is an established calendar-based assessment tool that was created to gather retrospective estimates of substance use over a desired time period. In this study, the TLFB was used to ascertain quantity and frequency of alcohol use, and frequency of drug use, over the 90 days preceding each participant’s initial assessment. Studies of the psychometric properties of the TLFB have shown high temporal stability, convergent and discriminant validity with other substance
misuse measures, and concordance with information obtained from informants regarding patient substance use (Fals-Stewart, O'Farrell, Freitas, McFarlin, & Rutigliano, 2000; Robinson, Sobell, Sobell, & Leo, 2012).

**Self-report measures.**

*The Sensitivity to Punishment and Sensitivity to Reward Questionnaire.*

The short form of the SPSRQ (O’Connor et al., 2004) consists of 35 dichotomous yes/no items. This measure has two subscales, termed the Sensitivity to Punishment and SR subscale, which were developed to assess BIS and BAS functioning, respectively (Torrubia et al., 2001). For the purposes of this study the SR subscale was utilised as a measure of reward sensitivity. Cronbach’s alpha was .73 in the present study.

*The Eysenck Impulsiveness Questionnaire.*

The I7 (Eysenck et al., 1985) is a 54 item dichotomously scored yes/no questionnaire with three subscales: Impulsiveness (19 items), Venturesomeness (16 items), and Empathy (19 items). In this study the Impulsiveness subscale was used as a measure of rash impulsiveness. Cronbach’s alpha for the Impulsiveness subscale was .79 in this study.

*The Liebowitz Social Anxiety Scale.*

The LSAS (Liebowitz, 1987) is a commonly used measure of social anxiety. The LSAS requires participants to evaluate their fear or anxiety and avoidance of 24 social interaction and performance situations. Participants completed the LSAS twice; once during their intake assessment with Odyssey House staff to determine eligibility for the study, and secondly when they attended their assessment with the Deakin University research team. Cronbach’s alpha was .94 in this study.
Procedure

Odyssey House intake staff administered the nominated screening tool (i.e., the LSAS) to all potential clients of Odyssey House during their standard intake assessment. Those who marked one or more situations in the fear/anxiety column of the LSAS as moderate or severe, and indicated that they avoided one or more situations were invited to participate in the study (i.e., the minimum LSAS score required was three). Subsequently, Deakin University researchers contacted potential participants who had given their permission to be contacted regarding the study. During this phone call potential participants were informed about the nature of the study including the requirements for participation and reimbursement for travel expenses and study participation. If verbal consent was provided, potential participants were invited to attend a structured interview at Odyssey House, with Deakin University researchers, which they were advised would take approximately two hours. Upon attending the interview, participants were invited to read and sign the consent form if they agreed to participate in the study. The consent form is displayed on the final page of the plain language statement, which is presented in Appendix F. At this point participants engaged in the clinician-administered component of the interview and subsequently completed the self-report questionnaire. Participants were reimbursed with a train ticket to cover their travel expenses and were given a $20 Coles-Myer voucher to reimburse them for their time. Lastly, participants were thanked for their involvement and invited to ask the researcher any questions about the study.

Data Analysis

To meet the aims of the present investigation, SPSS 19.0 was used to conduct mediation and moderation analyses. Consistent with the
recommendations prescribed by Aiken and West (1991) and Frazier et al. (2004), moderation analysis was conducted using hierarchical multiple regression. As recommended, continuous variables entering into interactions (i.e., social anxiety, rash impulsiveness and reward sensitivity) were centered. Specifically, centering refers to the process of subtracting the mean from a variable so that the mean of the centred variable is equal to zero (Aiken & West, 1991). Importantly, this procedure does not alter scores in the intercorrelation matrix and hence does not alter the relationships between variables. When interaction terms are uncentred, this may introduce multicollinearity to the regression matrices, leading to difficulties in the estimation of regression coefficients (Aiken & West, 1991; Frazier et al., 2004).

With regard to mediation analysis, hypothesised mediation models were tested through multiple regression using the Barron and Kenny (1986) approach. The first step involved in testing mediation requires that there is a significant relationship between the independent (IV) and dependent variable (DV). The second and third steps specify that there must be a relationship between the IV (i.e., social anxiety) and the proposed mediating variables (i.e., rash impulsiveness and reward sensitivity), and between the proposed mediating variables and the DV (i.e., substance misuse), respectively (Barron & Kenny, 1986). The final step involves evaluating the relationship between the IV and DV, while controlling for the variance accounted for by the proposed mediators. If this equation results in a non-significant effect for the IV, the mediator is said to mediate the relationship between the IV and the DV (Barron & Kenny, 1996).

Power analysis was carried out using recommendations made by Cohen, Cohen, West, and Aiken (2003). The results of the power analysis indicated that
for a medium effect size of .15 with a power of .80, a total of 70 participants were required for a moderation analysis using hierarchical multiple regression.

**Results**

**Psychiatric and Substance Misuse Diagnoses**

Fifty-nine participants (79.7%) met DSM-IV (APA, 1994) criteria for SAD, with a majority of participants (77%) meeting the criteria for the generalised form of SAD. Hence, the remaining participants reported subthreshold symptoms of social anxiety. Thirty-eight participants (51.4%) met the criteria for alcohol dependence while five met the criteria for alcohol abuse (6.8%). Fifty-nine participants (79.7%) met the criteria for illicit substance dependence and four participants (5.4%) met the criteria for illicit substance abuse. Overall, 25 (34%) participants met the criteria for both alcohol and illicit substance abuse or dependence. Furthermore, it is important to note that the entire sample met the criteria for one form of dependence (i.e., either alcohol or illicit substance dependence). See Table 5.2 for an overview of additional psychiatric diagnoses, which were identified among participants using the MINI-Screen and MINI diagnostic interview.
Table 5.2

*Psychiatric Comorbidity*

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>% of sample meeting diagnostic criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antisocial Personality Disorder</td>
<td>52.7%</td>
</tr>
<tr>
<td>Bipolar Disorder</td>
<td>4.1%</td>
</tr>
<tr>
<td>Current Major Depressive Episode</td>
<td>44.6%</td>
</tr>
<tr>
<td>Generalised Anxiety Disorder</td>
<td>28.4%</td>
</tr>
<tr>
<td>Obsessive-Compulsive Disorder</td>
<td>16.2%</td>
</tr>
<tr>
<td>Panic Disorder</td>
<td>20.3%</td>
</tr>
<tr>
<td>Past Psychotic Disorder</td>
<td>20.3%</td>
</tr>
<tr>
<td>Post-Traumatic Stress Disorder</td>
<td>21.6%</td>
</tr>
</tbody>
</table>

**Participant Substance Misuse**

The average age that participants reported they first tried any substance (including alcohol) was 11.82 ($SD = 3.30$). The average age participants reported that substances began to interfere with daily activities was 20.07 ($SD = 7.33$), whereas the average age participants first sought treatment was 25.25 ($SD = 8.01$). Based on the TLFB, the average number of standard drinks consumed, per person, per day, in the 90 days preceding their assessment was 10.33 ($SD = 10.90$). On the basis of the ASSIST, all participants ($n = 74$) in the present sample reported a past (i.e., lifetime) and recent history (i.e., past three months) of using drugs and/or alcohol. See Table 5.3 for an overview of the substance participants identified as most problematic in the three months preceding their assessment.
Table 5.3

*Substance Identified as Most Problematic in the Past Three Months*

<table>
<thead>
<tr>
<th>Class of Drug</th>
<th>% of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>29.7%</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>18.9%</td>
</tr>
<tr>
<td>Cannabis</td>
<td>13.5%</td>
</tr>
<tr>
<td>Opiates</td>
<td>28.4%</td>
</tr>
<tr>
<td>Polysubstance Use</td>
<td>6.8%</td>
</tr>
<tr>
<td>Prescription Medication</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

**Data Screening**

Preliminary data analyses were conducted on measures of social anxiety, substance misuse, rash impulsiveness, and reward sensitivity. Consistent with the assumptions of multiple regression analyses, variables were examined for out of range values, univariate outliers, missing values, deviations from normality and multivariate outliers (Tabachnick & Fidell, 2007). Table 5.4 depicts scale range, means, standard deviations, and minimum and maximum scores for all measured variables.
Table 5.4

Scale Range, Mean, Standard Deviation, Minimum and Maximum Scores on Measures of Social Anxiety, Rash Impulsiveness, Reward Sensitivity and Substance Misuse

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scale Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Anxiety</td>
<td>0-144</td>
<td>6</td>
<td>132</td>
<td>75.58 (25.58)</td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td>0-19</td>
<td>2</td>
<td>18</td>
<td>10.79 (4.12)</td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>0-17</td>
<td>0</td>
<td>16</td>
<td>7.99 (3.41)</td>
</tr>
<tr>
<td>Substance Misuse</td>
<td>0-208</td>
<td>41</td>
<td>197</td>
<td>99.19 (34.06)</td>
</tr>
</tbody>
</table>

Analyses were conducted to determine whether missing values were missing completely at random. Little’s MCAR statistic ($\chi^2 [975] = 416.79$, $p = 1.00$) was non-significant, indicating that data was missing completely at random. Examination of the missing values determined that there were 1.43% missing values across the dataset and less than 3% missing data on any single item. Subsequently, expectation maximisation was utilised to impute missing values.

According to Tabachnick and Fidell (2007), univariate outliers are cases with standardised scores exceeding 3.29 ($p < .001$). Utilising this criteria there were no univariate outliers present in the dataset. Low absolute values for skewness (ranging from -.45 to .62) and kurtosis (ranging from -.58 to .22) indicated that these statistics did not violate the assumption of normality. Further, the normal probability plot of standardized residuals and the scatterplot were
examined to check normality, linearity and homoscedasticity. No major deviations from normality were identified on visual examination of both plots.

Examination of Mahalanobis distance with four independent variables and a critical value of 18.47 ($p < .001$) revealed that there were no multivariate outliers present in the dataset. To verify this finding, Cook’s values were examined. According to Tabachnick and Fidell (2007), cases with values larger than 1 are a potential problem. In the present sample the maximum value for Cook’s distance was .38 suggesting no major problems with influence.

Correlations among variables were less than $r = .9$, which is indicative of no major problems with multicollinearity (Tabachnick & Fidell, 2007). Further, tolerance values (ranging from .69 to .94) and Variance Inflation Factor (VIF) values (ranging from 1.06 to 1.46) for each variable were above the cut off of .10 and below the cut off of 10, respectively. Singularity was not deemed a problem as individual scales were used in all analyses.

**Bivariate Correlations between Independent and Dependent Variables**

Correlations were examined to provide an indication of the relationships between the independent and dependent variables. As can be seen in Table 5.5, the relationship between rash impulsiveness and reward sensitivity ($r = .35, p < .01$), and between rash impulsiveness and social anxiety ($r = .43, p < .01$) were statistically significant. No other correlations were statistically significant.

---

2 Table 5.5 shows that there is a non-significant relationship between social anxiety and substance misuse. Hence, the underlying assumption of a relationship between the independent and dependent variable, which is necessary for mediation, is not met (Barron & Kenny, 1986). Therefore, a mediation analysis was not carried out.
Table 5.5

Correlations Between Social Anxiety, Rash Impulsiveness, Reward Sensitivity and Substance Misuse

<table>
<thead>
<tr>
<th>Variable</th>
<th>Social Anxiety</th>
<th>Rash Impulsiveness</th>
<th>Reward Sensitivity</th>
<th>Substance Misuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Anxiety</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td>.43**</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>-.02</td>
<td>.35**</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Substance Misuse</td>
<td>.16</td>
<td>.20</td>
<td>.13</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note. ** = p <.01.

Moderation Analysis

To examine the first two hypotheses, a hierarchical regression analysis was performed. Consistent with recommendations, the predictor and moderator variables were centered to reduce multicollinearity (Aiken & West, 1991; Frazier et al., 2004; Tabachnick & Fidell, 2007). The dependent variable in the moderation analysis was substance misuse and the independent variables were social anxiety, rash impulsiveness, reward sensitivity, and the interactions of Social Anxiety x Rash Impulsiveness and Social Anxiety x Reward Sensitivity. Consistent with recommendations, the variables were entered in two stages (Frazier et al., 2004). In stage one the main effects of each interaction term were entered, and in stage two each of the interaction terms were entered. As can be
seen in Table 5.6, there were no significant main effects or moderator effects. Therefore, no post-hoc analyses were carried out to examine the nature of moderator effects.

Table 5.6

Hierarchical Multiple Regression Analysis with Centred Variables to Test Whether Rash Impulsiveness and Reward Sensitivity Moderate the Relationship Between Social Anxiety and Substance Misuse

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Substance Misuse</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>adj. $R^2$</td>
<td>$R^2$ change</td>
<td>Beta</td>
</tr>
<tr>
<td><strong>STEP 1</strong></td>
<td>.01</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>.12</td>
<td>.16</td>
<td></td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td>.12</td>
<td>.97</td>
<td></td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>.10</td>
<td>.97</td>
<td></td>
</tr>
<tr>
<td><strong>STEP 2</strong></td>
<td>-.00</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>.14</td>
<td>.94</td>
<td></td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td>.11</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>.10</td>
<td>1.05</td>
<td></td>
</tr>
</tbody>
</table>

Interactions

<table>
<thead>
<tr>
<th></th>
<th>$R^2$ change</th>
<th>Beta</th>
<th>$B$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Anxiety x Rash Impulsiveness</td>
<td>-.01</td>
<td>-.00</td>
<td></td>
</tr>
<tr>
<td>Social Anxiety x Reward Sensitivity</td>
<td>.12</td>
<td>.05</td>
<td></td>
</tr>
</tbody>
</table>

*Note. All effects were non-significant, $p = .05$.*

3 Exploratory analyses were conducted to examine whether the non-significant moderator effects were a result of including participants who did not meet the LSAS cut off score for SAD (i.e., scores <30; Mennin et al., 2002). Excluding those with LSAS scores of <30 did not change the nature of the results (i.e., moderator effects remained non-significant). Therefore, specific results will not be reported here.
Post-hoc Analyses

Separating alcohol and drug misuse.

To examine whether the non-significant moderator effects were a result of combining participants who misuse drugs and alcohol concomitantly, where studies typically examine alcohol misuse in isolation (e.g., Booth & Hasking, 2009; see Morris et al., 2005 for a review), it was decided to conduct post-hoc analyses using separate drug and alcohol misuse scores. Specifically, a separate alcohol and illicit drug risk score was derived from the ASSIST for those who reported either alcohol or illicit drugs as their primary substance of misuse (refer to Table 5.2). Subsequently, equivalent analyses (i.e., correlation and moderation analyses) were conducted which yielded findings equivalent to those reported above. That is, there were no significant moderator effects and equivalence was observed regarding statistically significant correlations. Therefore, specific results will not be presented here.

Discussion

The primary aim of this study was to examine whether rash impulsiveness and reward sensitivity moderated the relationship between social anxiety and substance misuse in a clinical sample. Specifically, the first two hypotheses expected that the relationship between social anxiety and substance misuse would be strongest when rash impulsiveness and reward sensitivity were elevated. The data did not support these hypotheses. Furthermore, an exploratory approach was taken to examine whether rash impulsiveness and reward sensitivity mediated the relationship between social anxiety and substance misuse. The data did not support this tentative hypothesis. A secondary aim of this study was to describe
the demographic and clinical characteristics of the sample. These characteristics will be discussed with reference to other studies in the clinical literature.

**Rash Impulsiveness and Reward Sensitivity as Moderators**

The findings of this study are inconsistent with the contention that social anxiety interacts with rash impulsiveness and reward sensitivity to predict substance misuse. This contention was based on the findings of a series of studies (i.e., Booth & Hasking, 2009; Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), including the first study reported in this thesis. In particular, the findings of this study are inconsistent with those of Booth and Hasking (2009), who found that reward sensitivity, in conjunction with alcohol expectancies, moderated the relationship between social anxiety and alcohol consumption. Whilst the present findings were unexpected, it is possible that sample differences account for these inconsistent findings.

Specifically, Booth and Hasking (2009) carried out their study in a community sample, which included a large number of undergraduate university students. Conversely, the present study attempted to generalise these findings to a clinical sample suffering from co-occurring social anxiety and substance misuse. Hence, it is likely that there are significant differences between these samples in terms of psychiatric and substance use symptomatology. For example, Booth and Hasking (2009) utilised a measure of alcohol consumption, which was reported as annual intake of alcohol in millilitres. Importantly, community samples tend to include participants who report substance use ranging from abstinence through to clinical levels of alcohol use, as was demonstrated in Booth and Hasking’s study and study one of this thesis. In contrast, this study utilised a sample presenting for
treatment of substance misuse, which may have resulted in restriction in range.
Indeed, the standard deviation in proportion to the mean ($M = 4346.11, SD = 5842.20$), which was reported for the measurement of alcohol consumption in Booth and Hasking’s study, was larger than the standard deviation in proportion to the mean reported in the present study ($M = 99.19, SD = 34.06$). Therefore, although scores on the ASSIST were normally distributed in this study, there was greater variability in range observed in Booth and Hasking’s study.

Secondly, Booth and Hasking (2009) focused specifically on alcohol consumption, whereas this study administered a measure of global substance misuse. Whilst separate effects of alcohol and drug misuse were examined in post-hoc analyses, it is possible that the sample size of those who reported that alcohol was their primary substance of abuse (29.7% of the sample) was too small to detect a significant effect.

Alternatively, it is possible that studies utilising community samples, and clinical samples of individuals presenting for treatment with a single substance use diagnosis (e.g., alcohol misuse in isolation), are examining a more homogenous population. Indeed, individuals within community samples are likely to have lower levels of comorbidity than individuals in clinical populations (Gum & Cheavens, 2008; Wagner, Cole, & Schwartzman, 1996). Furthermore, those in clinical samples who are dependent on more than one substance are known to have more psychosocial problems, physical health problems, and comorbid psychiatric diagnoses than those who are dependent on either illicit drugs or alcohol in isolation (Colpaert, Vanderplasschen, De Maeyer, Broekaert, & De Fruyt, 2012; Colpaert, Vanderplasschen, Van Hal, Broekaert, & Schuyten, 2008;
Indeed it has been noted that relatively little is known about individuals who are diagnosed with a concomitant drug and alcohol use disorder (Colpaert et al., 2012). This type of comorbidity, where an individual is diagnosed with two disorders within the same diagnostic class, has been termed “homotypic comorbidity” (Angold, Costello, & Erkanli, 1999, p. 58). Within the present sample, 34% of participants were characterised by homotypic comorbidity. Therefore, this may have impeded the capacity to examine the specific mechanisms underlying the co-occurrence of social anxiety and substance misuse.

Unfortunately, it was not possible to conduct post-hoc comparisons between those suffering from distinct comorbidity profiles due to sample size restrictions. Hence, it would be advantageous for future research to examine the co-occurrence of social anxiety and substance misuse within specific classes of substance abuse or dependence, rather than individuals presenting with homotypic comorbidity, due to the additional complexities associated with their presentation.

Furthermore, it is important to note that Booth and Hasking (2009) found evidence for three way relationships between social anxiety, reward sensitivity, and alcohol expectancies, in the prediction of alcohol consumption. Whilst it was beyond the scope of this thesis to examine the moderating role of alcohol or drug use expectancies, it would be advantageous to replicate the findings of Booth and Hasking in a clinical sample in future research.

Lastly, it is important to acknowledge that social anxiety and impulsivity may not interact to predict substance misuse. Although this was the primary contention of this study, these relationships have not previously been examined in
a clinical sample. In fact, prior to the present study, only one clinical sample had examined impulsivity in SAD (i.e., Kashdan & Hofmann, 2008). Specifically, Kashdan and Hofmann (2008) examined impulsivity among a subset of SAD sufferers using cluster analysis, as opposed to examining relationships between variables. Hence, consistent with the findings of the first study, it is possible that elevated levels of rash impulsiveness and reward sensitivity characterise those with social anxiety and substance misuse comorbidity but do not interact with social anxiety to predict substance misuse.

To examine some of the questions that have been raised in the above discussion it was decided to conduct a post-hoc moderation analysis utilising the community sample reported in study one of this thesis. In particular, it is possible that moderating role of rash impulsiveness and reward sensitivity can be identified in a community sample. These analyses and a summary of findings will be reported in the following chapter to enhance interpretability of the findings of this study and inform the general discussion.

**Rash Impulsiveness and Reward Sensitivity as Mediators**

The findings of this study indicated that there was a non-significant relationship between social anxiety and substance misuse. Hence, consistent with the assumptions of mediation (Barron & Kenny, 1986), a mediation analysis was not carried out. Further, there was a non-significant relationship between the proposed mediators (i.e., rash impulsiveness and reward sensitivity) and substance misuse. Therefore, there was no evidence for a mediating role of rash impulsiveness and reward sensitivity in this study. Whilst several non-significant relationships were observed between variables, which impeded the capacity to conduct a mediation analysis, significant relationships were observed between
social anxiety and rash impulsiveness and between both facets of impulsivity.

Considering the dearth of clinical literature examining the relationships between social anxiety, impulsivity and substance misuse, the relationships observed between these variables will be discussed below.

Although social anxiety and substance misuse have been inconsistently related in community samples (e.g., Buckner, Eggleston, & Schmidt, 2006; Gilles, Turk, & Fresco, 2006; Stewart, Morris, Mellings, & Komar, 2006), it is surprising that these variables were not related in the present study considering the use of a clinical sample (Strahan, Panayiotou, Clements, & Scott, 2011). Indeed, studies using clinical samples of individuals with substance use disorders have consistently found that SAD is a significant predictor of polysubstance dependence (Bakken et al., 2005), alcohol use disorders (Schneier et al., 2010), and cannabis dependence (Buckner et al., 2012). Notably, however, all of the abovementioned studies failed to examine correlations between variables. In fact, no clinical studies could be identified within the literature that had reported correlations between measures of social anxiety severity and substance misuse.

That is, whilst evidence suggests that SAD and substance use disorders frequently co-occur (i.e., Bakken et al., 2005; Buckner et al., 2012; Schneier et al., 2010), these findings do not necessarily indicate that within a clinical sample, severity of social anxiety symptomatology is associated with severity of substance misuse. If this finding is confirmed in future clinical research, this would provide further evidence to suggest that rash impulsiveness and reward sensitivity do not mediate the relationship between social anxiety and substance misuse due to the requirement of a significant relationship between the IV and the DV (Barron & Kenny, 1986). Alternatively, it is possible that this relationship is explained by a
moderating variable, such as rash impulsiveness. Indeed, rash impulsiveness was significantly correlated with social anxiety in this study; however, as previously discussed, the restricted range with regard to the measurement of substance misuse may have inhibited the capacity to examine this hypothesis in this study. Whilst this is a plausible explanation of the findings, it is important to acknowledge that these correlational relationships would need to be examined in longitudinal research in order to make substantive conclusions about causality.

Surprisingly, the present study also found that both facets of impulsivity did not significantly correlate with substance misuse. Although this finding was unexpected, similar findings have been reported in the clinical literature (e.g., Brotchie, Finch, Marsden, & Waller, 2003; Gullo, Dawe, et al. 2010). For example, Brotchie et al. (2003) found that contrary to their hypotheses, a measure of rash impulsiveness was not significantly related to drug or alcohol dependence in a clinical sample of substance using offenders. Brotchie et al. (2003) postulated that once patients reached clinical levels of substance misuse, impulsivity may play a central role in the prevalence of co-occurring axis one and two symptomatology, rather than the substance misuse itself. It is possible that this hypothesis explains the present findings.

Similarly, Gullo, Dawe, et al. (2010) found a non-significant relationship between both facets of impulsivity and a measure of alcohol misuse (i.e., the AUDIT) within a sample of individuals seeking treatment for their alcohol use disorder. As a point of comparison, Gullo, Dawe, et al. examined equivalent relationships within a community sample. In contrast to the findings reported within the clinical sample, the relationships between both facets of impulsivity and alcohol misuse were statistically significant in the community sample. Whilst
Gullo, Dawe, et al. did not comment on why the relationship between impulsivity and substance misuse was non-significant in their clinical sample there are a series of potential reasons.

Firstly, it is possible that the significant relationship commonly observed between impulsivity and substance misuse does not hold in clinical samples. This may be due to the high rate of impulsivity that already exists among individuals presenting for treatment of their substance use disorder. Thus, restriction in range may explain this finding in clinical samples. Alternatively, consistent with the above discussion (e.g., Brotchie et al., 2003), the non-significant findings may be related to the complexities associated with the presentation of patients in clinical samples. That is, impulsivity may underlie substance use initiation and subsequent exacerbation of substance misuse problems, but not explain the relationship once the diagnosis has reached the diagnostic threshold. At this point other variables (e.g., symptom severity, psychosocial problems, comorbidity) may inhibit the capacity to find significant effects.

Moreover, these findings may also be explained by reviewing the three lines of evidence that are typically used to indicate that impulsivity and substance misuse are related (Moeller & Dougherty, 2002). Firstly, evidence commonly demonstrates that children and adolescents with higher impulsivity are at greater risk of developing a prospective substance use diagnosis (e.g., Fergusson et al., 2008). Secondly, it has been repeatedly shown that individuals with a substance use diagnosis report higher levels of impulsivity than controls (e.g., Coffey et al., 2003; Kjome et al., 2010). Lastly, a plethora of cross-sectional studies carried out in community samples have related impulsivity to a series of substance use variables (e.g., Franken & Muris, 2006a; Voigt et al., 2009).
Hence, whilst impulsivity has been shown to characterise substance-using populations, and to play a role in the onset of substance misuse, there is little evidence to suggest that these variables are significantly correlated in clinical samples. In fact, only one study could be identified that had reported a positive relationship between impulsivity and substance misuse in a clinical sample of substance dependent patients. Specifically, Moeller et al. (2001b) found that rash impulsiveness was significantly correlated with average daily cocaine use and severity in a sample of cocaine dependent individuals (n = 50). Importantly, Moeller et al. (2001b) excluded individuals with a past or current history of another axis one diagnosis. This adds further credence to the contention that psychiatric and homotypic comorbidity may hinder the capacity to examine significant effects in clinical samples. Future research should examine these questions in clinical samples with and without additional comorbidity to test the veracity of this contention.

Demographic and Clinical Characteristics

A secondary aim of this study was to describe the clinical characteristics of the sample. This is particularly important, as few previous studies have examined the co-occurrence of social anxiety and substance misuse in a clinical sample of individuals seeking treatment for their substance use disorder. Based on the findings of the present study, the clinical and demographic characteristics of the sample largely converged with other clinical studies in the literature.

Specifically, it has consistently been found that a majority of patients presenting for treatment of their substance use disorder are male and unemployed (Colpaert et al., 2012; Fabricius, Langa, & Wilson, 2008; Torrens, Gilchrist, & Domingo-Salvany, 2011). Notably, the rate of unemployment within the present
sample was higher than that of comparable samples, with unemployment rates typically reported between 40 and 50% (Colpaert et al., 2012; Henkel, 2011). Whilst welfare rates were consistent with unemployment rates, treatment in a residential rehabilitation facility typically involves stays of nine to twelve months (Enos, 2011). Hence, patients seeking treatment in this type of facility are likely to be overrepresented with regard to unemployment statistics.

In terms of concomitant psychiatric diagnoses, the findings of this study were largely consistent with international studies (i.e., Colpaert et al., 2012; Fabricus et al., 2008; Torrens et al., 2011). Specifically, it was found that more than half the sample met the criteria for another axis one diagnosis. In particular, mood and anxiety disorders were the most common concomitant diagnoses that were reported, which is consistent within the literature (Fabricus et al., 2008).

With regard to axis two diagnoses, Colpaert et al. (2012) similarly found that over half of their sample seeking treatment for substance misuse met the criteria for antisocial personality disorder. This finding is in keeping with rates reported in other substance misusing samples (Messina, Wish, & Nemes, 1999; Verheul, 2001). Whilst this is a high proportion, this finding is not surprising, considering a diagnosis of antisocial personality disorder is based on a series of behavioural criteria, which overlap with behaviours that are commonly reported among individuals who are substance dependent. In fact, it has been argued that there are overlapping diagnostic criteria and features with regard to substance misuse and antisocial personality disorder diagnoses (Verheul, van den Bosch, & Ball, 2005).

Considering the abovementioned findings it is unsurprising that Emmelkamp and Vedel (2006, p.12) stated that “comorbidity is the rule, rather
than the exception” among those seeking treatment for substance misuse. Despite the frequency of psychiatric comorbidity in clinical samples, it is important to acknowledge that this may serve as a confounding variable in being able to delineate the specific mechanisms underlying the co-occurrence of social anxiety and substance misuse. However, this is the challenge facing all clinical samples, in particular those researching social anxiety or substance misuse diagnoses, as both of these diagnoses are known to co-occur with other diagnoses at a high rate (Ruscio et al., 2008; Torrens et al., 2011).

**Future Directions**

Although there is strong evidence to suggest that SAD precedes the onset of substance misuse in a majority of cases (Buckner et al., 2012; Magee et al., 1996 Schneier et al., 2010), it seems that social anxiety symptomatology is secondary to substance misuse in a proportion of cases (i.e., substance induced; Torrens et al., 2011). Indeed, research suggests that substance misuse precedes SAD in approximately 18 to 40% of cases (Bakken et al., 2005; Buckner et al., 2012; Ross et al., 1988; Schneier et al., 2010). It is possible that order of onset is related to specific substances of abuse, or where the individual seeks treatment. Arguably, those seeking treatment for substance misuse may not recognise social anxiety symptoms as their primary concern. Hence, it is possible that treatment seeking is related to the primary diagnosis. Therefore, it would be advantageous for future research to examine the present research question in a sample of individuals seeking treatment for social anxiety who report co-occurring substance use problems. Furthermore, future research should endeavour to distinguish between those with substance induced SAD, and those with an independent SAD diagnosis.
Moreover, future research should consider an examination of gender differences with regard to social anxiety and substance misuse comorbidity. This is an important avenue for future research considering some studies have found gender differences with regard to the relationship between social anxiety symptoms and substance use (e.g., Buckner, Heimberg, & Schmidt, 2011; Buckner & Turner, 2009; Buckner & Vinci, 2013; Norberg, Norton, & Olivier, 2009). Unfortunately, this was not possible in the present sample due to the uneven proportion of males and females. Further, the correlational research design limits conclusions regarding causality. For this reason, future research should consider longitudinal methodology to enhance knowledge regarding the temporal precedence of social anxiety and substance misuse diagnoses, alongside personality traits, such as rash impulsiveness and reward sensitivity.

Lastly, considering that a large proportion of the present sample met diagnostic criteria for comorbid psychiatric diagnoses, such as major depressive disorder (44.6% of the sample), it would be advantageous for future research to include measures to ascertain the severity of comorbid symptoms. For example, future studies could include measures of depressive symptoms in order to statistically control for the possible confounding influence of depression on the hypothesised effects.

Limitations

The findings of the current study need to be considered in light of several limitations. Firstly, the data was collected from a convenience sample of participants seeking treatment for substance misuse in a residential rehabilitation facility. Consequently, the results are only generalisable to those with similar circumstances. Nonetheless, this limitation should be considered in light of the
difficulties associated with recruiting clinical populations, such as those suffering from social anxiety and substance misuse comorbidity, for research (Torrens et al., 2011).

An additional limitation of the present study is the reliance on self-report measures of impulsivity. Whilst the scales that were used are known to be reliable and consistent with behavioural measures, this study may have been limited by participant insight (Bornovalova, Lejuez, Daughters, Zachary Rosenthal, & Lynch, 2005b; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001a). Hence, it would be beneficial to consider behavioural measures of impulsivity in future studies.

Furthermore, it should be noted that although a power analysis was conducted to obtain an estimate for the required sample size, it is possible that the sample size in this study was not large enough to detect significant effects. Future research in this area should take this limitation into account.

**Conclusion**

The findings of this study shed doubt on the contention that social anxiety interacts with rash impulsiveness and reward sensitivity to predict substance misuse in a clinical sample of individuals seeking treatment for their substance use disorder. It is possible that sample differences or qualitative differences between clinical and community samples explain these unexpected findings. It is important that future studies consider the limitations of this study when developing future research designs.
CHAPTER SIX

Post-hoc Moderation Analysis

The previous chapter presented the findings of study two, which indicated that rash impulsiveness and reward sensitivity did not moderate the relationship between social anxiety and substance misuse in a clinical sample. A series of potential explanations for the findings were discussed and it was decided to conduct post-hoc analyses to test whether (a) rash impulsiveness and (b) reward sensitivity moderate the relationship between social anxiety and substance misuse, utilising the community sample reported in study one of this thesis.

Specifically, it was argued that sample differences (e.g., range restriction) or qualitative differences (e.g., multiple comorbidities) between clinical and community samples may explain why these relationships do not hold in clinical samples. Hence, it was postulated that these relationships may be identified in community samples. This chapter will replicate the analyses conducted in chapter two to examine whether the relationship between social anxiety and substance misuse is strongest when rash impulsiveness and reward sensitivity are elevated. As there was no evidence to suggest that rash impulsiveness and reward sensitivity mediated the relationship between social anxiety and substance misuse in study two (i.e., the underlying assumption of a relationship between the independent and dependent variable, which is necessary for mediation was not met; Barron & Kenny, 1986), an exploratory mediation analysis will not be conducted. In the following section the results will be presented, followed by a brief summary of the findings. This will inform the general discussion presented in the following chapter.
Data Analysis

For details regarding the data analytic strategy see chapter five (p. 118).

Method

In this study the total score on the DAST-10 will be utilised as a measure of drug misuse and the total score on the AUDIT will be utilised as a measure of alcohol misuse. For further details regarding the method see chapter four (p. 82).

Results

Data Cleaning

Following on from preliminary analyses conducted in study one (see p. 91), additional data cleaning strategies were carried out to meet the assumptions of moderation analysis using hierarchical multiple regression. As previously reported, there were nineteen univariate outliers in the dataset (i.e., cases with standardised scores exceeding 3.29, \( p < .001 \); Tabachnick & Fidell, 2007). Specifically, six outliers were from the AUDIT, eight were from the DAST-10, three were from the drug frequency measure, and two were from the LSAS. To reduce the influence of the outliers, each of the outlying cases were rescaled to one unit larger than the next most extreme score in the distribution (Tabachnick & Fidell, 2007).

Low absolute values for skewness (ranging from .55 to 1.22) and kurtosis (-.39 to 1.40) indicated that these statistics did not violate the assumption of normality. Further, the normal probability plot of standardized residuals and the scatterplot were examined to check normality, linearity and homoscedasticity. No major deviations from normality were identified on visual examination of both plots.
Examination of Mahalanobis distance with four independent variables and a critical value of 18.47 ($p < .001$) revealed that there was one multivariate outlier present in the dataset. This case was deleted leaving a further 349 cases for analysis. Subsequently, Cook’s values were examined to identify the presence of influential cases in the dataset. According to Tabachnick and Fidell (2007), cases with values larger than 1 are a potential problem. In the present sample the maximum value for Cook’s distance was .23 suggesting no major problems with influence.

Correlations among variables were less than $r = .9$, which is indicative of no major problems with multicollinearity (Tabachnick & Fidell, 2007). Further, tolerance values (ranging from .54 to .89) and VIF values (ranging from 1.12 to 1.87) for each variable were above the cut off of .10 and below the cut off of 10, respectively. Singularity was not deemed a problem as individual scales were used in all analyses.

**Bivariate Correlations Between Independent and Dependent Variables**

Correlations were examined to provide an indication of the relationships between the independent and dependent variables. As can be seen in Table 6.1, the relationship between social anxiety and reward sensitivity was not statistically significant ($r = .03, p > .05$). The relationship between all other variables were statistically significant.
Table 6.1

**Correlations Between Social Anxiety, Rash Impulsiveness, Reward Sensitivity, Alcohol Misuse and Drug Misuse Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Social Anxiety</th>
<th>Rash Impulsiveness</th>
<th>Reward Sensitivity</th>
<th>Alcohol Misuse</th>
<th>Drug Misuse</th>
<th>Drug Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Anxiety</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rash</td>
<td>.29**</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulsiveness</td>
<td></td>
<td></td>
<td>.49**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td>.03</td>
<td>.49**</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td></td>
<td>.51**</td>
<td>.45**</td>
<td>.45**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Misuse</td>
<td>.13*</td>
<td>.51**</td>
<td>.45**</td>
<td>.45**</td>
<td>.52**</td>
<td>1.0</td>
</tr>
<tr>
<td>Misuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.52**</td>
<td></td>
</tr>
<tr>
<td>Drug Misuse</td>
<td>.19**</td>
<td>.38**</td>
<td>.26**</td>
<td>.26**</td>
<td>.52**</td>
<td>1.0</td>
</tr>
<tr>
<td>Drug Frequency</td>
<td>.20**</td>
<td>.41**</td>
<td>.22**</td>
<td>.22**</td>
<td>.57**</td>
<td>.70**</td>
</tr>
</tbody>
</table>

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

**Moderation Analysis**

To replicate the analyses carried out in the previous chapter a hierarchical regression analysis was performed using centred predictor and moderator variables (Aiken & West, 1991; Frazier et al., 2004; Tabachnick & Fidell, 2007). The dependent variable in the moderation analysis was alcohol misuse\(^4\) and the independent variables were social anxiety, rash impulsiveness, reward sensitivity, and the interactions of Social Anxiety x Rash Impulsiveness and Social Anxiety x Reward Sensitivity. Consistent with recommendations, the variables were entered

\(^4\) Equivalent analyses were conducted using both the AUDIT and the DAST-10 as the dependent variable, as these are both validated measures of substance misuse. Statistically significant effects (including the form of the interaction and probing of the significant interaction) were equivalent in both models. Due to the conceptually similar nature of the findings only the results for the AUDIT will be reported here.
in two stages (Frazier et al., 2004). In stage one the main effects of each
interaction term were entered and in stage two each of the interaction terms were
entered.

After the main effects were entered in stage one the adjusted $R^2 = .31$ was
statistically significant, $F(3, 345) = 52.17, p < .001$. After the interaction terms
were entered in stage two these added to the prediction of alcohol misuse,
adjusted $R^2 = .34, F(5, 343) = 36.28, p < .001$. The addition of the interaction
terms in stage two added a substantial and significant increase in $R^2, F_{\text{change}} =
8.87, p < .001$. As can be seen in Table 6.2 only one interaction term was
statistically significant.
Table 6.2

*Hierarchical Multiple Regression Analysis with Centred Variables to Test Whether Rash Impulsiveness and Reward Sensitivity Moderate the Relationship Between Social Anxiety and Alcohol Misuse*

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Alcohol Misuse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>adj. $R^2$</td>
</tr>
<tr>
<td><strong>STEP 1</strong></td>
<td></td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>.31**</td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td></td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td></td>
</tr>
<tr>
<td><strong>STEP 2</strong></td>
<td></td>
</tr>
<tr>
<td>Social Anxiety</td>
<td></td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
<td></td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td></td>
</tr>
<tr>
<td><strong>Interactions</strong></td>
<td></td>
</tr>
<tr>
<td>Social Anxiety x Rash Impulsiveness</td>
<td>.01</td>
</tr>
<tr>
<td>Social Anxiety x Reward Sensitivity</td>
<td>-.00</td>
</tr>
</tbody>
</table>

*Note.* * = $p < .05$, ** = $p < .01$. 
Post-hoc probing of significant interaction between social anxiety and rash impulsiveness in the prediction of alcohol misuse.

To examine the nature of the Social Anxiety x Rash Impulsiveness interaction in the prediction of alcohol misuse, Aiken and West’s (1991) recommendations were followed. Predicted values were estimated using the mean, one standard deviation above the mean, and one standard deviation below the mean of the variables in the interaction term (i.e., social anxiety and rash impulsiveness). The slopes of the regression lines were then probed in order to examine which of the slopes were statistically significant. Probing of effects indicated that there was a significant effect for LSAS when rash impulsiveness scores were in the low range, $b = -.05$, $t(343) = -2.72$, $p < .05$ and in the high range $b = .04$, $t(343) = 2.27$, $p < .05$. There was no evidence of a statistically significant effect when rash impulsiveness scores were in the average range $b = -.00$, $t(343) = -0.33$, $p > .05$. A plot of the Social Anxiety x Rash Impulsiveness interaction at different levels of the mean is visually depicted in Figure 6.1.

![Figure 6.1](image.png)

*Figure 6.1.* Plot of the Social Anxiety x Rash Impulsiveness interaction in the prediction of alcohol misuse. RI = Rash Impulsiveness. Note. * = $p < .05$. 

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Summary of Findings

The primary aims of the additional analyses were to examine whether (a) rash impulsiveness and (b) reward sensitivity moderated the relationship between social anxiety and substance misuse in a community sample. The data supported the hypothesis that expected rash impulsiveness to moderate the relationship between social anxiety and substance misuse. In particular, post-hoc probing suggested that social anxiety was positively associated with substance misuse for those characterised by elevated rash impulsiveness, whereas social anxiety was negatively associated with substance misuse for those characterised by low levels of rash impulsiveness. This finding exemplifies the importance of research examining moderators; as such research sheds light on equivocal findings within the clinical literature, such as the inconsistent relationship between social anxiety symptoms and substance use variables (e.g., Buckner et al., 2006; Gilles et al., 2006; Stewart et al., 2006). Furthermore, rash impulsiveness was significantly correlated with social anxiety in this study, which is consistent with the findings of study two. In contrast, there was no evidence to suggest that reward sensitivity was correlated with social anxiety, or that this trait moderated the relationship between social anxiety and substance misuse.

A secondary finding indicated that rash impulsiveness and reward sensitivity were significantly correlated with all substance misuse variables. The findings and overall implications of the post-hoc analyses carried out in this chapter will be discussed in detail in the general discussion.

Conclusion

The analyses reported in the present chapter provide evidence to suggest that rash impulsiveness moderates the relationship between social anxiety and
substance misuse in a community sample. The overall findings, implications, limitations, and future research directions will be discussed in detail in the general discussion.
CHAPTER SEVEN

General Discussion

The primary aim of this thesis was to investigate the utility of a two-facet conceptualisation of impulsivity in understanding the relationship between social anxiety and substance misuse. It was argued that these two facets of impulsivity may underlie the co-occurrence of social anxiety and substance misuse for two primary reasons. Firstly, a small series of studies have found that impulsive-like traits characterise a subset of socially anxious individuals (i.e., Kachin et al., 2001; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), and secondly, a personality profile characterised by elevated impulsivity is involved in the onset and maintenance of substance misuse (Anokhin et al., 2011; Dawe & Loxton, 2004; Fergusson et al., 2008; Moeller & Dougherty, 2002). Hence, it was argued that the impulsive-like traits found to characterise a subset of socially anxious individuals may provide an etiological explanation as to why some individuals with SAD develop co-occurring substance use disorders while others do not.

Drawing on previous research (e.g., Franken, & Muris, 2006b; Quilty & Oakman, 2004), a two-facet approach to the measurement of impulsivity was employed to overcome the limitations of previous studies (e.g., Booth & Hasking; Kashdan & Hofmann, 2008), which had used a unidimensional approach in the measurement of impulsivity. It was argued that employing the two-facet conceptualisation of impulsivity enhances consistency in research and expands current knowledge regarding how these distinct facets of impulsivity may convey risk for specific behaviours and diagnoses. Hence, a major contribution of this thesis was to examine the involvement of rash impulsiveness and reward
sensitivity in the co-occurrence of social anxiety and substance misuse within both a community and clinical sample.

The following section will summarise the results of the two studies reported in this thesis, in addition to the findings of post-hoc analyses. This includes a discussion of the aims, hypotheses and primary findings from each study, followed by an integrated discussion of the overall findings of this thesis. The clinical and research implications will be discussed, followed by a discussion of the limitations and directions for future research.

Summary of Results

Study One: When Social Anxiety Co-occurs with Impulsivity and Risk-taking: Does Substance Misuse Characterise this Subset of Socially Anxious People?

Study one was designed to expand on a series of studies (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009) by utilising a two-facet conceptualisation of impulsivity to investigate heterogeneity among socially anxious individuals in the community. It was argued that this research may help identify a specific personality profile that characterises a subset of socially anxious individuals with co-occurring substance use problems. Specifically, it was expected that individuals with symptoms of social anxiety could be meaningfully separated into two distinct subgroups based on characteristics typically associated with SAD, including social anxiety symptom severity and behavioural inhibition, and those posited to characterise the atypical social anxiety subgroup; including rash impulsiveness, reward sensitivity and risk-taking. The data supported this hypothesis. The second hypothesis
expected that the two social anxiety classes would report significantly different levels of substance misuse. The data supported this hypothesis.

Whilst one previous study (i.e., Kashdan & Hofmann, 2008) had identified elevated rash impulsiveness among a subset of SAD sufferers, this was the first study to demonstrate that reward sensitivity may similarly characterise this atypical social anxiety subgroup. Furthermore, this was the first study to examine the severity of substance misuse among atypical social anxiety sufferers using validated measures.

**Study Two: Co-occurring Social Anxiety and Substance Misuse: Evaluating the Moderating Effects of Rash Impulsiveness and Reward Sensitivity**

Study two was designed to examine the specific mechanisms through which social anxiety conveys risk for substance misuse within a clinical sample. The sample comprised of individuals seeking treatment for their substance use disorder who reported co-occurring social anxiety symptomatology. Specifically, it was predicted that rash impulsiveness and reward sensitivity would moderate the relationship between social anxiety and substance misuse. The data did not support these hypotheses. Furthermore, an exploratory approach was taken to examine whether rash impulsiveness and reward sensitivity mediated the relationship between social anxiety and substance misuse. Surprisingly, the findings of these analyses indicated that there was a non-significant relationship between social anxiety and substance misuse. Hence, consistent with the assumptions of mediation (Barron & Kenny, 1986), a mediation analysis was not carried out. Moreover, there was a non-significant relationship between the proposed mediators (i.e., rash impulsiveness and reward sensitivity) and substance misuse. Despite the non-significant relationships observed between
several variables, which inhibited the capacity to conduct a mediation analysis, a significant relationship was observed between social anxiety and rash impulsiveness and between both facets of impulsivity.

A secondary aim of study two was to contrast the clinical characteristics of the sample with other studies in the clinical literature. The findings demonstrated that the clinical and demographic characteristics converged with other samples of individuals seeking treatment for their substance use disorder. Notably, the clinical sample reported high levels of unemployment, homotypic comorbidity and additional psychiatric comorbidity.

With regard to the non-significant moderator effects, several explanations for the findings were proposed, which informed subsequent post-hoc analyses. Specifically, it was argued that range restriction within the clinical sample may have limited the capacity to find significant moderator effects. Alternatively, it was proposed that the presence of multiple comorbidities and the severity of substance use symptomatology may have limited the capacity to examine the specific mechanisms underlying the co-occurrence of social anxiety and substance misuse. Hence, it was postulated that the hypothesised moderator effects may be identified in a community sample where there are lower levels of psychiatric comorbidity and greater variability in range with regard to substance misuse.

**Post-Hoc Analyses**

Post-hoc analyses were carried out to examine the moderating role of rash impulsiveness and reward sensitivity in the community sample reported in study one of this thesis. It was found that rash impulsiveness moderated the relationship between social anxiety and substance misuse. Specifically, social anxiety was
positively associated with substance misuse for those characterised by elevated rash impulsiveness, whereas social anxiety was negatively associated with substance misuse for those characterised by low levels of rash impulsiveness. Further, rash impulsiveness was significantly correlated with social anxiety, which was consistent with the significant relationship observed between these constructs in the clinical sample. In contrast, there was no evidence for a moderating role of reward sensitivity, nor was there a significant relationship between social anxiety and reward sensitivity. A secondary finding indicated that in contrast to the clinical sample, social anxiety, reward sensitivity and rash impulsiveness were all significantly correlated with substance misuse. The overall findings of this thesis will be discussed in detail in the following section.

**Discussion of Integrated Findings**

The two studies reported in this thesis, alongside additional post-hoc analyses, contribute to an expanding body of knowledge regarding an atypical presentation of social anxiety. Although these findings are in contrast to prototypical descriptions of SAD (e.g., APA, 2000; Lorian & Grisham, 2010; Stein & Stein, 2008), the findings both converge with and expand on a small series of empirical studies examining heterogeneity among socially anxious individuals (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009). Taken together, the overall findings of this thesis are threefold. Firstly, the findings suggest that reward sensitivity and rash impulsiveness play important but differential roles in the co-occurrence of social anxiety and substance misuse. Secondly, the shared clinical characteristics observed between participants in the clinical and community sample, who were suffering from social anxiety and substance misuse
comorbidity, confirm the presence of the atypical social anxiety subgroup, which was identified in study one. Thirdly, the overall findings raised important questions about the capacity to examine the specific mechanisms through which social anxiety conveys risk for substance misuse in a clinical sample of individuals seeking treatment for their substance use disorder. These three central findings will be discussed in detail in the following sections.

**The role of rash impulsiveness and reward sensitivity in social anxiety and substance misuse comorbidity.**

Taken together, the findings of this thesis suggest that rash impulsiveness may play a central role in the co-occurrence of social anxiety and substance misuse. Specifically, social anxiety was significantly correlated with rash impulsiveness in both the clinical and community sample, suggesting that despite the complexities prevalent within the clinical sample, including co-occurring psychiatric symptomatology, the relationship between social anxiety and rash impulsiveness could still be identified. Importantly, it was found that rash impulsiveness moderated the relationship between social anxiety and substance misuse in post-hoc analyses, which were conducted in a broad community sample. However, this finding did not hold in the clinical sample and will be discussed in detail in a later section.

Surprisingly, reward sensitivity was not significantly correlated with social anxiety, nor did this variable moderate the relationship between social anxiety and substance misuse in the community or clinical sample. These findings were in contrast to hypotheses and were also inconsistent with the findings of study one, which found that elevated levels of reward sensitivity characterised the atypical social anxiety subgroup. Whilst these findings may initially appear
contradictory, Dawe and Loxton’s (2004) theory regarding the role of rash impulsiveness and reward sensitivity in substance misuse may shed light on these findings.

According to Dawe and Loxton (2004), reward sensitivity conveys risk for substance use initiation. Specifically, individuals with elevated reward sensitivity are more likely to approach novel stimuli (Dawe & Loxton, 2004). Hence, it is possible that socially anxious individuals characterised by elevated levels of reward sensitivity are more likely to use approach strategies in response to their social anxiety symptoms, as opposed to prototypical social anxiety sufferers with minimal levels of reward sensitivity. Therefore, the atypical social anxiety sufferers may be more likely to seek out rewarding environments (e.g., a party) where they may be exposed to novel stimuli, such as alcohol and drugs. Worryingly, evidence suggests that reward sensitive individuals may be more susceptible to peer pressure (Knyazev, Slobodskaya, Kharchenko, & Wilson, 2004), which may be particularly problematic for reward sensitive social anxiety sufferers who feel pressured to use substances in social contexts. Furthermore, elevated reward sensitivity is posited to increase the reinforcing effects of substances (Dawe et al., 2004), and in conjunction with social anxiety symptomatology, may reinforce substance misuse.

In contrast, rash impulsiveness is posited to relate to an inability to stop engaging in approach behaviour despite the presence of negative consequences (Dawe & Loxton, 2004). Hence, once substance use has commenced, elevated rash impulsiveness is involved in the exacerbation and maintenance of substance misuse. Therefore, it is possible that once an individual starts misusing substances on a regular basis, social anxiety and reward sensitivity no longer interact to
predict substance misuse. Conversely, the ongoing interaction between social anxiety and rash impulsiveness may relate to the subsequent increase in rash impulsiveness following the onset of substance misuse. Indeed, the findings of several studies indicate that the misuse of substances leads to neurobiological changes that influence the functioning of the orbitofrontal cortex (see Goldstein & Volkow, 2002; Schoenbaum & Shaham, 2008), which is a region of the brain that is posited to underlie rash impulsiveness (Dawe et al., 2004). In particular, these changes within the orbitofrontal cortex are believed to play a role in loss of control over drug use (Schoenbaum & Shaham, 2008). In contrast, the mesolimbic dopaminergic pathway, which is involved in reward sensitivity (Dawe et al., 2004), does not influence several of the key processes involved in addiction, including the transition from controlled to compulsive substance use (Schoenbaum & Shaham, 2008).

Thus, although reward sensitivity may specify risk for the onset of substance misuse among a subset of socially anxious individuals, this trait may become less important in predicting substance misuse once an individual starts abusing substances on a regular basis. Consistent with this contention, in the first study of this thesis, the atypical social anxiety sufferers reported elevated levels of rash impulsiveness, reward sensitivity, and substance misuse in comparison to typical social anxiety sufferers, yet only rash impulsiveness interacted with social anxiety to predict substance misuse in post-hoc analyses.

Furthermore, Dawe and Loxton’s (2004) theory regarding substance use initiation and maintenance may explain the discrepancy between the findings reported in this thesis and those of Booth and Hasking (2009). Specifically, Booth and Hasking found that reward sensitivity, in conjunction with alcohol
expectancies, moderated the relationship between social anxiety and alcohol misuse, whereas the findings of this thesis found no evidence to suggest that reward sensitivity moderated the relationship between social anxiety and substance misuse. Notably, the participants in Booth and Hasking’s study comprised of 50% undergraduate university students with a mean age of 21.4 ($SD = 6.3$). In contrast, the participants in the community sample reported in this thesis had a mean age of 34.17 ($SD = 12.94$). Hence, the moderating role of reward sensitivity in Booth and Hasking’s study may relate to the age of the sample, with substance misuse onset peaking in early adulthood (McGorry et al., 2011). Consistent with this contention, the clinical sample in the present thesis reported that substances began to interfere with daily activities at the age of 20.07 ($SD = 7.33$), which converges with the findings of other Australian studies (Mo, Deane, Lyons, & Kelly, in press). Alternatively, an examination of other potential moderators in future research (e.g., alcohol expectancies; Booth & Hasking, 2009) may illuminate three-way moderator relationships that underlie the relationship between reward sensitivity, social anxiety and substance misuse.

In summary, it is possible that elevated reward sensitivity is involved in the onset of substance misuse, whereas rash impulsiveness may play a more prominent role in the exacerbation and maintenance of substance misuse. Hence, elevated levels of both of these traits may be used to delineate a risk profile for social anxiety and substance misuse comorbidity. Whilst this is a plausible explanation for the findings of this thesis, it is important to acknowledge that these findings are based on cross-sectional research, therefore these contentions would need to be confirmed using longitudinal methodology.
Shared clinical characteristics between the community and clinical sample.

Whilst the findings reported in the first study of this thesis converged with a series of studies examining heterogeneity among socially anxious individuals (i.e., Kachin et al., 2001; Kashdan et al., 2006; Kashdan et al., 2008; Kashdan & Hofmann, 2008; Kashdan et al., 2009), these findings are strengthened by the similar clinical characteristics observed between the participants in the clinical sample and participants in the atypical social anxiety subgroup, which was identified in the community sample. Specifically, both the clinical sample and the atypical social anxiety subgroup reported scores of over 60 on the LSAS, which has been shown to be indicative of generalised SAD (Mennin et al., 2002). Furthermore, where the clinical sample comprised of individuals suffering from substance use disorders, the atypical social anxiety subgroup reported a mean of more than three on the DAST-10, which is indicative of probable drug abuse or dependence (French et al., 2001; Maisto et al., 2000; Skinner, 1982). Similarly, the atypical social anxiety sufferers reported a mean score on the AUDIT that was well above the cut-off score of eight, which has been used as an indicator of significant alcohol-related harm (Conigrave et al., 1995). Moreover, scores on measures of rash impulsiveness and reward sensitivity were comparable across the atypical social anxiety subgroup and clinical sample, with both samples reporting means on these measures that differed by less than one. Arguably, these consistencies confirm the presence of the atypical social anxiety subgroup, which was identified in the LCA conducted in the first study of this thesis.

Although there were several similarities observed across samples, it is equally important to highlight some of the clinical differences. Firstly,
participants in the clinical sample were seeking treatment for substance misuse, whereas a majority of individuals in the community sample had not sought treatment. For those that had sought treatment in the community sample, a majority had sought treatment for SAD (26%), with a smaller number seeking treatment for substance misuse (3.7% for drug misuse and 5.1% for alcohol misuse). It is possible that these differences influenced the findings of this thesis. For example, considering that individuals tend to seek treatment several years after the onset of substance misuse, and severity of symptoms are related to treatment seeking (Kessler et al., 2001), it is likely that the clinical sample suffered from increased symptom severity across a range of domains. This was observed with regard to psychiatric comorbidity. Unfortunately psychiatric comorbidity was not measured in the community sample, however, consistent with the literature, those who participate in community studies typically suffer from lower levels of comorbidity (Gum & Cheavens, 2008; Wagner et al., 1996). Furthermore, considering participants in the clinical sample were seeking treatment for substance misuse, this sample may have included more individuals with substance induced social anxiety symptomatology, which may have impeded the capacity to examine the hypothesis that the interaction between social anxiety and both facets of impulsivity predict substance misuse.

Overall, the similarities observed between the clinical sample and atypical social anxiety subgroup strengthen the findings of study one. However, there were also some important clinical differences between these samples, which may have contributed to the limited capacity to examine relationships between variables and moderating effects in the clinical sample. Potential explanations for the differential findings observed across the two samples will be discussed in
greater detail in the following section.

**Examining the co-occurrence of social anxiety and substance misuse in clinical and community samples.**

One of the central findings of this thesis was the limited capacity to examine moderating effects and relationships between variables in a clinical sample seeking treatment for substance misuse. Although it was postulated that the moderator effects and relationships between variables may not exist as hypothesised, post-hoc analyses carried out in the community sample provided evidence to suggest that sample or qualitative differences may underlie these non-significant findings. Specifically, within the clinical sample there was no evidence to suggest that rash impulsiveness or reward sensitivity moderated the relationship between social anxiety and substance misuse. Moreover, rash impulsiveness and reward sensitivity were not significantly correlated with substance misuse, despite the well-established relationship between impulsivity and substance misuse within the clinical literature (Gullo et al., 2011; Moeller & Dougherty, 2002). In contrast, post-hoc analyses carried out in the community sample found evidence for the moderating role of rash impulsiveness in social anxiety and substance misuse comorbidity, and demonstrated a significant relationship between both facets of impulsivity and substance misuse.

One explanation for these inconsistent findings is that these relationships do not hold in clinical samples (e.g., Brotchie et al., 2003; Gullo, Dawe, et al., 2010). That is, once substance misuse has reached a level of severity where the diagnosis meets criteria for substance abuse or dependence, the interaction effect and relationships between variables cannot be identified. There are a series of potential explanations for this. Firstly, those who present for treatment, and are
often included in clinical research studies, are generally characterised by more severe symptoms than those who do not seek treatment (Angold et al., 1999; Angold et al., 1998; Compton, Thomas, Stinson, & Grant, 2007; Ray, Primack, Chelminski, Young, & Zimmerman, 2011). Indeed, it has been postulated that individuals who present for treatment may not be representative of a majority of individuals who meet diagnostic criteria for diagnoses but are not seeking treatment (Sher & Trull, 1996). This was demonstrated in the clinical sample reported in this thesis, where one third of participants were characterised by homotypic comorbidity, in addition to several other axis one and two psychiatric diagnoses. In contrast, those in community samples are typically characterised by lower levels of psychiatric comorbidity (Gum & Cheavens, 2008; Wagner et al., 1996) and may be more representative of the intended population of study (i.e., those suffering from co-occurring social anxiety and substance misuse to the exclusion of other psychiatric diagnoses).

Hence, in a clinical sample suffering from multiple comorbidities, it may be difficult to examine the mechanisms specifically underlying the co-occurrence of social anxiety and substance misuse. That is, the influence of other comorbidities cannot be separated from the target disorders being studied (Sher & Trull, 1996). Considering the severity of symptomatology in clinical samples seeking treatment, it is also possible that the characteristics identified may be indicative of the long-term consequences of psychiatric disturbance, which may inhibit the delineation of the etiological mechanisms underlying the disorders of interest (Sher & Trull, 1996). It is possible that this explains the findings of the present thesis and those of others (e.g., Brotchie et al., 2003; Gullo, Dawe, et al., 2010) who failed to find significant relationships between impulsivity and
substance misuse in clinical samples of substance users characterised by complex clinical profiles.

Alternatively, the high rate of substance misuse already prevalent in a clinical sample seeking treatment for substance misuse may explain the non-significant effects demonstrated in the clinical sample. That is, the inclusion of individuals who had a substance use diagnosis may have restricted the range of scores on these measures. Although analyses indicated there was variability in range, this differs from individuals in community samples where scores tend to vary significantly (i.e., ranging from abstinence through to diagnostic levels of substance misuse). Therefore, the absence of a moderating effect may not mean that these relationships do not exist, but rather that these relationships may not be statistically observable in clinical samples of individuals with substance use disorders. Salyers and Mueser (2001) raised similar concerns regarding their non-significant findings in a sample of individuals with co-occurring schizophrenia and substance misuse. Specifically, participants were required to have a minimum level of substance misuse, therefore excluding those with schizophrenia who were abstinent from substance use.

The abovementioned explanations for the findings of this thesis raise important questions regarding the generalisation of findings from community to clinical samples. This is particularly important because the findings of community-based studies are prevailing in psychology and are frequently used to inform treatment strategies. Therefore, if the development of treatment interventions are based on the findings of community samples, which have not been replicated in clinical samples, it is important to investigate whether mechanisms, such as rash impulsiveness and reward sensitivity, are still important
to address in treatment. Such questions will need to be examined in future research.

In summary, the overall findings of this thesis highlight the utility of examining the involvement of rash impulsiveness and reward sensitivity in the co-occurrence of social anxiety and substance misuse. Specifically, these findings emphasise the differential roles that these traits may play in this complex comorbidity. These findings have several clinical and research implications, which will be discussed in detail in the following two sections.

**Implications of This Thesis**

**Clinical implications.**

The findings of this thesis suggest that it is important to consider screening for impulsive traits to enhance assessment, preventative and treatment efforts among those with social anxiety symptomatology. Although it is not common practice to screen for personality traits in clinical practice, it has previously been postulated that such screening may have a positive impact on therapeutic alliance and treatment selection, which may ultimately enhance outcomes (Costa, & McCrae, 1992; Krueger & Eaton, 2010; Widiger & Smith, 2008).

Firstly, enhancing knowledge among clinicians regarding the atypical presentation of social anxiety may be particularly important in terms of improving assessment and prevention. In terms of assessment, clinician education may prevent misdiagnosis, which may occur due to the paradoxical symptom profile that individuals with SAD may present with. This is particularly important for clinicians in substance misuse treatment settings considering the high rate of co-occurring SAD among those seeking treatment for their substance use problem.
(e.g., Bakken et al., 2005; Thomas et al., 1999; Tomasson, & Vaglum, 1995; Staiger et al., 2008). Worryingly, failure to identify those with co-occurring social anxiety symptomatology in substance misuse treatment settings may lead to treatment dropout due to the focus on group-based treatment (Book et al., 2009).

In terms of prevention, increased knowledge regarding the mechanisms underlying social anxiety and substance misuse comorbidity will enhance opportunities to prevent the development of co-occurring substance misuse among those who are at risk. For clinicians working with adolescents and young adults who present with subthreshold social anxiety symptomatology, part of the preliminary assessment could involve administering self-report measures of reward sensitivity, rash impulsiveness, and risk-taking.

By identifying the atypical presentation of social anxiety early in treatment, this would provide an opportunity to employ specific strategies to reduce the behavioural expression of impulsivity with regard to substance misuse. One preventative treatment intervention, which has been proposed to prevent the onset of substance misuse, encourages individuals to seek out alternative novel activities, such as extreme sports (D'Silva, Harrington, Palmgreen, Donohew, & Lorch, 2001). This may influence the expression of reward sensitivity; given reward sensitive individuals are more likely to approach novel stimuli (Dawe & Loxton, 2004).

However, it is important to acknowledge that such interventions have been proposed for the prevention of substance misuse, rather than the prevention of substance misuse among socially anxious individuals. Indeed, the findings of this thesis suggest that it may be useful to develop treatments that are known to address psychiatric or substance use symptomatology in the context of an
individual’s personality profile. This approach is consistent with the theory of pathoplasticity (Klein et al., 1993; Widiger & Smith, 2008), and may enhance outcomes for individuals who do not conform to prototypical descriptions of SAD.

To illuminate this point, the findings of Randall et al. (2001) will be briefly discussed, as this research team examined the effectiveness of a treatment targeting co-occurring SAD and alcohol misuse. Specifically, Randall and colleagues conducted a randomised controlled trial, which assigned individuals with co-occurring SAD and alcohol misuse to one of two treatment conditions; either a treatment addressing alcohol misuse only, or a treatment addressing both SAD and alcohol misuse. Both treatments were delivered as an individual treatment and were based on principles of cognitive behavioural therapy.

Following the intervention, both treatment groups reported modest improvements in symptomatology for both disorders (Randall et al., 2001). However, participants in the alcohol-only treatment condition reported significantly greater improvement with regard to frequency and quantity of alcohol consumed during the 3-month follow-up period (Randall et al., 2001). That is, those receiving treatment for SAD and alcohol misuse concurrently reported poorer outcomes with regard to their alcohol use. It is possible that these findings are related to Randall et al.’s decision to segregate the treatment of the two disorders because “alcoholism and social phobia are more “distinct” disorders” (p. 211) thereby failing to address mechanisms, such as elevated impulsivity, underlying the co-occurrence of these diagnoses.

Notably, cognitive behavioural therapy for SAD, which was used in Randall et al.’s (2001) study, is known as the “gold standard” psychological
intervention for SAD sufferers (Doehrmann et al., 2013, p. 87). However, this intervention has been developed for the prototypical, behaviourally inhibited SAD sufferer. Hence, for those with an atypical presentation of SAD, engaging in exposure tasks, which are a primary component of treatment, are likely to involve attending social engagements (e.g., attending a party or social gathering to address SAD symptoms). Such exposure to feared social situations may be counterproductive for those with co-occurring SAD and substance misuse who have an impulsive disposition, as this may lead to exposure to alcohol and drugs. Hence, the traditional cognitive behavioural treatment model used in Randell et al.’s (2001) study may have contributed to the poorer treatment outcome among those receiving simultaneous treatment targeting SAD and alcohol misuse.

In light of the abovementioned findings, it is possible that a treatment addressing the co-occurrence of SAD and substance misuse, in the context of an impulsive personality profile, may enhance both preventative and treatment efforts for this comorbidity. This argument converges with that of other researchers who contend that interventions should be matched to personality traits to enhance outcomes (e.g., Staiger et al., 2007; Watt et al., 2008). For example, it is possible that a mindfulness-based interventions may be of particular benefit in the treatment of co-occurring SAD and substance misuse, as this therapeutic modality has been shown to reduce impulsivity (Margolin et al., 2007) and address symptoms of social anxiety (Kocovski, Fleming, & Rector, 2009).

Specifically, mindfulness training enhances the capacity of individuals to think before acting by becoming aware of the present moment (Kabat-Zinn, 1994). Hence, such training increases the capacity for self-regulation of arousal, affect and behaviour, thus decreasing impulsivity (Segall, 2005; Stratton, 2006).
Importantly, the utility of this therapeutic modality in reducing impulsivity, and the behavioural expression of this trait, has recently been demonstrated in clinical research (e.g., Margolin et al., 2007).

For example, Margolin et al. (2007) examined the utility of a mindfulness-based intervention in reducing impulsivity, substance misuse, and other related behaviours, in a sample of substance dependent patients \((n = 38)\). In contrast to the levels of rash impulsiveness reported prior to the 12-week intervention, which were initially consistent with the levels reported by other substance dependent populations, scores decreased to levels that are typically found in non-clinical samples by the end of the intervention (Margolin et al., 2007). Further, relative to a standard care control group, participants who completed the mindfulness-based intervention reported greater decreases in substance misuse. With regard to long-term outcomes, it has been proposed that mindfulness-based therapies may influence neurobiological circuits involved in impulsivity, which may minimise the potential for relapse among substance users (see Witkiewitz, Lustyk, & Bowen, 2012).

There is also preliminary evidence to suggest that mindfulness-based interventions are effective in treating social anxiety symptomatology (Kocovski et al., 2009). Specifically, Kocovski et al. (2009) reported that following a 12-week mindfulness-based intervention, participants with SAD who completed treatment \((n = 29)\) reported significant reductions in social anxiety symptom severity, co-occurring depressive symptoms, and rumination. Considering that research suggests mindfulness-based interventions are effective in addressing SAD symptoms, impulsivity and the behavioural expression of this trait, it is possible that this intervention could be used in both preventative and treatment efforts.
Specifically, it would be advantageous for future research to examine the utility of a mindfulness-based intervention in the treatment of individuals suffering from co-occurring SAD and substance misuse. Furthermore, it is important for future research to examine the utility of mindfulness in addressing reward sensitivity; as to date there is only evidence to suggest that this intervention reduces rash impulsiveness (i.e., Margolin et al., 2007). Such research could inform the development of preventative efforts for those with symptoms of social anxiety who are at risk of developing comorbid substance misuse.

**Research implications.**

In addition to clinical implications, there are a series of research implications stemming from the findings of this thesis. Firstly, it is important to highlight that the findings of this thesis differ from several previous studies examining the two-facet conceptualisation of impulsivity in comorbidity (i.e., Alloy et al., 2009; Hopley & Brunelle, 2012; Kane et al., 2004). Specifically, previous studies have largely examined whether impulsivity underlies the relationship between two disorders that share biological substrates (Moeller et al., 2001a). That is, previous studies have examined the relationship between two disorders that are posited to co-occur in the context of shared-vulnerability, whereby the association between disorders is partly due to shared impulsive symptomatology. Such diagnoses include comorbidity of substance misuse with bulimia nervosa (Kane et al., 2004), bipolar disorder (Alloy et al., 2009) and psychopathy (Hopley & Brunelle, 2012).

In contrast, the findings of this thesis indicate that shared vulnerability may not be the only circumstance where impulsivity plays a role in the etiology of
comorbidity. Specifically, this thesis provides evidence to suggest that it is possible for impulsivity to co-occur with anxiety, emphasising the dimensional nature of these traits (Corr, 2004). Whilst these findings suggest that researchers should continue examining the involvement of impulsivity in social anxiety, as this is a relatively new line of research, the findings of this thesis also suggest that researchers should consider examining heterogeneity within other psychiatric conditions. For example, it may be valuable for researchers to examine subpopulations within diagnostic categories, which may enhance outcomes for those who do not receive benefit from traditional treatment models. The use of personality inventories to examine heterogeneity within psychiatric diagnoses may enhance the capacity to observe subpopulations of individuals presenting with atypical characteristics.

Furthermore, as demonstrated in this thesis, the multiple comorbidities that were identified in the clinical sample may have inhibited the capacity to examine the mechanisms specifically underlying the co-occurrence of social anxiety and substance misuse. Psychiatric comorbidity is not unique to SAD and substance misuse, but is a commonality in clinical research. Therefore, it is important for researchers to ensure that they screen for psychiatric comorbidity and are transparent in reporting this in their research so that findings can easily be compared across studies.

Finally, consistent with several lines of research, this thesis demonstrates the utility of employing a two-facet conceptualisation of impulsivity in research examining this trait. As reiterated throughout this thesis, previous researchers have demonstrated that these two facets of impulsivity are distinct (e.g., Quilty & Oakman, 2004; Zelenski & Larsen, 1999), and it has been argued that these
should be included in research to capture the multifaceted nature of this construct. Consistent with these contentions, it was found that rash impulsiveness was significantly correlated with social anxiety in both the clinical and community samples reported in this thesis. Furthermore, rash impulsiveness moderated the relationship between social anxiety and substance misuse in the community sample. In contrast, reward sensitivity was not correlated with social anxiety in either sample, nor did this variable moderate the relationship between social anxiety and substance misuse. In spite of these differential relationships, rash impulsiveness and reward sensitivity were significantly correlated with each other in both the community and clinical samples. The abovementioned findings regarding rash impulsiveness and reward sensitivity are consistent with the contention that these facets are distinct but related aspects of impulsivity (Franken & Muris, 2006b; Quilty & Oakman, 2004).

Arguably, if a unidimensional measure of impulsivity was utilised in the studies reported in this thesis, knowledge would not have been enhanced regarding how the different facets of impulsivity may convey risk for co-occurring social anxiety and substance misuse. Hence, the findings of this thesis provide further credence to the contention that researchers investigating impulsivity should no longer rely on a unidimensional conceptualisation of impulsivity (Dick et al., 2010).

Whilst several future research directions have been discussed throughout this chapter, the following section will briefly review some of the methodological limitations of both studies reported in this thesis, which point towards additional future research directions.
Limitations and Future Research Directions

The results of the studies reported in this thesis must be considered in conjunction with their limitations, which have implications for future research. As the limitations and future research directions pertaining to each study have already been discussed in previous chapters, those that were evident across both studies will be discussed here.

Firstly, due to the cross-sectional nature of the research designs it was not possible to examine the temporal presence of diagnoses or personality traits. To address this limitation, future research should consider including personality characteristics, such as rash impulsiveness and reward sensitivity, in longitudinal research examining the co-occurrence of SAD and substance misuse. In particular, it has been noted that substance misuse can exacerbate the presentation of impulsivity (de Wit, 2009; Verdejo-García et al., 2008). Hence, it is possible that substance misuse among SAD sufferers influences the expression of impulsivity. Through such research it will be possible to determine whether there are different pathways through which SAD and substance misuse comorbidity develop. For example, current evidence suggests that SAD precedes substance misuse in approximately 60 to 82% of cases (Bakken et al., 2005; Buckner et al., 2012; Ross et al., 1988; Schneier et al., 2010), suggesting that substance misuse precedes SAD in 18 to 40% of cases. For this reason, it is important to examine the circumstances in which this occurs, as these individuals may respond to different treatments due to distinct etiological pathways underlying the co-occurrence of diagnoses.

One of the primary limitations of the two studies presented in this thesis is the reliance on self-report measures. Whilst the first study enabled participants to
complete their questionnaire online, which has been recommended to ensure confidentiality for participants reporting substance misuse (Miller & Sønderlund, 2010), this was not possible in the clinical sample, which was only open to those presenting for treatment of their substance use disorder. Despite the differences in questionnaire administration, both studies did not control for social desirability beyond providing assurances that responses were confidential, which has the potential to mask the relationships between variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Furthermore, self-report measures depend on participant insight into their own personality style and symptoms (Moeller et al., 2001a). This may be particularly problematic among substance dependent participants who, due to the effects of long-term substance misuse, may lack the insight or cognitive capacity to provide an accurate report of their own behaviour (Bornovalova et al., 2005b). One way to address this limitation in future research is to consider utilising behavioural measures of rash impulsiveness (e.g., delayed discounting) and reward sensitivity (e.g., the CARROT), in conjunction with self-report measures.

Whilst the studies reported in this thesis specifically included individuals with subthreshold symptoms of social anxiety, it would be interesting for future research to examine differences between those who meet the diagnostic criteria for SAD and those who report subthreshold symptoms. It is possible that relationships between SAD, rash impulsiveness, reward sensitivity and substance misuse may differ if subthreshold symptoms of social anxiety pose a greater risk for the development of co-occurring substance misuse (Crum & Pratt, 2001; Merikangas et al., 2002; Robinson et al., 2011).

Lastly, the participants in the samples used in the present thesis were
ethnically homogeneous. Specifically, a majority of individuals were born in, and reside in Australia. Thus, results may not generalise to other ethnic groups. Future research should examine the cross-cultural validity of the current findings.

Conclusion

This thesis utilised a two-facet conceptualisation of impulsivity to examine etiological mechanisms that may underlie the co-occurrence of social anxiety and substance misuse. Expanding on the findings of previous research, there was evidence to suggest that elevated levels of rash impulsiveness, reward sensitivity, and risk-taking characterise a subset of socially anxious individuals with comorbid substance use problems. Novel findings suggested that elevated levels of rash impulsiveness and reward sensitivity may play important but differential roles in the co-occurrence of social anxiety and substance misuse. These findings add to an expanding body of literature that suggests impulsivity is a multidimensional construct comprised of two distinct but related facets.

Furthermore, the overall findings raised important questions about the capacity to examine the specific mechanisms through which social anxiety conveys risk for substance misuse in a clinical sample of individuals seeking treatment for their substance use disorder. This finding has implications for future research, with regard to assessing and reporting psychiatric comorbidity, and generalising research findings from community to clinical samples. The clinical implications of this thesis point towards enhanced knowledge for clinicians regarding an atypical presentation of social anxiety, and suggest that mindfulness-based approaches may be effective in the prevention and treatment of co-occurring social anxiety and substance misuse.

Although the findings of this thesis converge with and expand on previous
research, it is important to acknowledge that research examining the involvement of impulsive traits in the co-occurrence of social anxiety and substance misuse is in its infancy. Hence, further research needs to be conducted before substantive conclusions can be made regarding the specific roles that rash impulsiveness and reward sensitivity play in this comorbidity. Despite this, it is hoped that the findings of this thesis are incorporated into future research designs, which may ultimately enhance outcomes for those suffering from SAD and substance misuse comorbidity.
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Appendix A

Method and Results of Systematic Review Concerning Two-facet Conceptualisation of Impulsivity in Substance Misuse

The primary aim of the systematic review was to review all studies that have measured the two-facet conceptualisation of impulsivity in substance misuse. PsycARTICLES, PsychINFO, Academic Search Complete, Psychology and Behavioral Sciences Collection, MEDLINE Complete and Science Direct (Social Sciences and Humanities Collection) databases were reviewed using the search terms presented in Table A1. It was beyond the scope of the present review to have a second reviewer examine the literature as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Liberati et al., 2009) guidelines. Inclusion criteria included community samples of substance users, individuals who met a formal diagnosis of substance abuse or dependence, peer-reviewed journal articles, and articles written in the English language. Exclusion criteria included animal studies and studies investigating one-facet of impulsivity.

Initial searches identified 200 articles. After duplicates were removed 142 abstracts were screened and 24 potentially relevant articles were identified. After examination of full-text articles, studies where only one facet of impulsivity was measured \((n = 3)\), studies where neither rash impulsiveness nor reward sensitivity measures were administered \((n = 2)\), and studies that did not report outcomes related to impulsivity or substance use \((n = 3)\) were excluded, leaving a total of 16 articles to be included in the qualitative synthesis (see Figure A1 for the flow of information through different phases of the review). Refer to Table A2 for characteristics of included studies.
Figure A1. Flowchart of systematic review concerning two-facet conceptualisation of impulsivity in substance misuse.
### Table A1

**Search Terms used in Database Searches Pertaining to the Two-Facet Conceptualisation of Impulsivity in Substance Misuse**

<table>
<thead>
<tr>
<th>Search Terms</th>
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</thead>
<tbody>
<tr>
<td>Substance Misuse</td>
</tr>
<tr>
<td>Substance* OR Substance use OR Substance Misuse OR Substance Dependence* OR Substance Abuse OR Alcohol use OR Alcohol Misuse OR Alcohol Dependence OR Alcohol Abuse OR Drug use OR Drug Misuse OR Drug Depend* OR Drug Abuse OR cocaine OR crack OR op* OR heroin OR amphetamine OR methamphetamine OR MDMA OR ecstasy OR methylenedioxymethamphetamine OR cannabis OR marijuana OR psychedelic OR mushroom OR glue OR inhalant OR poly*</td>
</tr>
<tr>
<td>Rash Impulsiveness</td>
</tr>
<tr>
<td>Rash Impulsiv* OR Sensation Seeking OR Fun-seeking OR Novelty Seek* OR Barratt Impulsiveness Scale OR Impulsiv* OR Impuls*</td>
</tr>
<tr>
<td>Reward Sensitivity</td>
</tr>
<tr>
<td>Reward Drive OR Reward Sensitivity OR Sensitivity to Reward OR Reward Responsiv* OR BAS Drive</td>
</tr>
</tbody>
</table>

### Table A2

**Characteristics of the Included Studies Utilising the Two-Facet Conceptualisation of Impulsivity in Substance Misuse Research, Ordered by Year of Publication**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Design</th>
<th>Participants</th>
<th>Substance Use Measure</th>
<th>Rash Impulsiveness (RI) Measure</th>
<th>Reward Sensitivity (RS) Measure</th>
<th>Outcomes</th>
<th>Risk of Bias</th>
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<tr>
<td>Brunelle et al., 2004</td>
<td>Cross-sectional</td>
<td>19 male high heart-rate responders and 18 male low heart-rate responders from Canada (total n = 37)</td>
<td>Measured heart rate response to alcohol intoxication (1ml of 95% alcohol USP per kilogram of body weight)</td>
<td>Impulsivity and Sensation Seeking subscale of the Substance Use Risk Profile Scale (Woicik et al., 2009)</td>
<td>SR subscale of the SPSRQ (Tornubia et al., 2001)</td>
<td>High heart rate responders reported significantly higher RS and Sensation Seeking scores than low heart-rate responders. Scores on the Impulsivity subscale trended towards significance ($p = .08$).</td>
<td>Small sample (all male sample)</td>
</tr>
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</table>
Franken and Muris, 2006a | Cross-sectional | 276 undergraduate psychology students from the Netherlands | Quantity-Frequency-Variability Index of Alcohol Use (Lemmens, Tan, & Knibbe, 1992) | BAS Fun Seeking subscale (Carver & White, 1994) | BAS Drive and BAS Reward Responsiveness subscales (Carver & White, 1994) | BAS Drive was significantly correlated with number of illegal substances used and BAS Fun Seeking was significantly correlated with drinking quantity, binge drinking and number of illegal substances used. | Limited generalisability (student sample)

Franken et al., 2006 | Cross-sectional | 39 alcohol misuse inpatients, 71 drug misuse inpatients and 96 controls from the Netherlands (total n = 206) | Inpatient status used as measure of substance use. | BAS Fun Seeking subscale (Carver & White, 1994) | BAS Drive and BAS Reward Responsiveness subscales (Carver & White, 1994) | Significant differences between groups on BAS total, BAS Fun Seeking and BAS Drive. Post-hoc tests with Bonferroni correction showed that the group effects were the result of differences between the control group and drug misuse inpatients. | Selection bias

Loxton, Wan, et al., 2008 | Cross-sectional | 360 club-drug users and 303 non-drug users from Hong Kong | Developed for study purposes; frequency measure of substance use and polydrug use | Chinese version of Zuckerman’s Sensation Seeking Scale (SSS; Zuckerman, 1994) | BAS Fun Seeking subscale (Carver & White, 1994) | Club-drug users scored significantly higher than non-drug users on the SSS, BAS Fun Seeking and BAS Drive subscales. There was no significant effect of personality on drug preference. | Measurement bias (substance use measure)

Meda et al., 2009 | Cross-sectional | 36 individuals with a family history of alcohol abuse, 20 former and 31 current cocaine | Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Barratt) | Sensation Seeking Scale (Zuckerman, 1994) | SR subscale of the SPSRQ (Torrubia et al., 2001) | At risk and substance addicted participants scored significantly higher than controls on the Barratt Impulsiveness Scale and the SR subscale. | Self-selection bias
<table>
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<tr>
<th>Study</th>
<th>Design</th>
<th>Sample</th>
<th>Measure</th>
<th>Findings</th>
<th>Limitations</th>
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<tr>
<td>Williams, 2002</td>
<td>Cross-sectional</td>
<td>222 users and 89 controls (total n = 176)</td>
<td>Williams, 2002). Detailed substance use histories</td>
<td>Impulsiveness Scale (Patton et al., 1995)</td>
<td>BAS Reward Responsiveness subscales (Carver &amp; White, 1994)</td>
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<tr>
<td>Voigt et al., 2009</td>
<td>Cross-sectional</td>
<td>1014 college undergraduate students</td>
<td>Voigt et al., 2009</td>
<td>BAS Fun Seeking subscale (Carver &amp; White, 1994)</td>
<td>BAS Drive and BAS Reward Responsiveness subscales (Carver &amp; White, 1994)</td>
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<tr>
<td>Egan et al., 2010</td>
<td>Cross-sectional</td>
<td>A community sample of 102 ecstasy users and 105 non-ecstasy users (total n = 207)</td>
<td>Egan et al., 2010</td>
<td>Impulsiveness subscale of the I7 (Eysenck et al., 1985)</td>
<td>SR subscale of the SPSRQ (Torrubia et al., 2001)</td>
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<tr>
<td>Gullo, Jackson &amp; Dawe, 2010</td>
<td>Cross-sectional</td>
<td>165 university students</td>
<td>Gullo, Jackson &amp; Dawe, 2010</td>
<td>Impulsiveness subscale of the I7 (Eysenck et al., 1985)</td>
<td>SR subscale of the SPSRQ (Torrubia et al., 2001)</td>
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<td>Study</td>
<td>Sample Description</td>
<td>Measures</td>
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<td>Limited Generalisability</td>
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<tr>
<td>Gullo, Dawe, et al., 2010</td>
<td>Cross-sectional</td>
<td>Study 1: 342 young adults</td>
<td>AUDIT (Saunders et al., 1993)</td>
<td>Self-selection bias</td>
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<td></td>
<td></td>
<td>Study 2: 121 treatment seeking substance abusers</td>
<td>ASSIST (WHO ASSIST Working Group, 2002)</td>
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<td>Alcohol section of the Addiction Severity Index (McLellan, Cacciola, &amp; Zanis, 1997)</td>
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<td>Impulsiveness subscale of the I' (Eysenck et al., 1985)</td>
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<td>SR subscale of the SPSRQ (Torrubia et al., 2001)</td>
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<td>BAS subscale (Carver &amp; White, 1994)</td>
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<td>Study 1: RI and RS were directly associated with separate cognitive mechanisms (drinking refusal self-efficacy and positive alcohol expectancy, respectively) and related to hazardous alcohol use. Study 2: RI and RS were directly associated with separate cognitive mechanisms (drinking refusal self-efficacy and positive alcohol expectancy, respectively) and related to hazardous alcohol use.</td>
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<tr>
<td>Ibáñez et al., 2010</td>
<td>Cross-sectional</td>
<td>539 Spanish undergraduate students</td>
<td>Alcohol Consumption Scale (Grau &amp; Ortet, 1999)</td>
<td>Limited generalisability (student sample)</td>
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<td>Spanish version of the Novelty Seeking subscale of the Temperament and Character Inventory (Gutierrez-Zotzes et al., 2004)</td>
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<td>Sensitivity to Reward subscale of the SPSRQ (Torrubia et al., 2001)</td>
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<td>A hierarchical linear regression was carried out on personality factors, which included a series of personality variables. The findings suggested that two personality factors predicted alcohol use. One factor was termed disagreeable disinhibition and included the RS scale. The second factor was termed unconscious disinhibition and included the RI subscale.</td>
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<tr>
<td>Willem et al., 2010</td>
<td>Cross-sectional</td>
<td>284 high school students from Belgium</td>
<td>Teen Addiction Severity Index (Kaminer, Bukstein, &amp; Tarter, 1991)</td>
<td>Limited generalisability (student sample)</td>
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<td>BAS Fun Seeking subscale (Carver &amp; White, 1994)</td>
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<td></td>
<td>BAS Drive and BAS Reward Responsiveness subscales (Carver &amp; White, 1994)</td>
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<td>Age of first use and quantity of alcohol use were significantly related to BAS Drive and BAS Fun Seeking. In a hierarchical linear regression BAS Fun</td>
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<td>Study</td>
<td>Sample Description</td>
<td>Measures</td>
<td>Findings</td>
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<tr>
<td>Gullo et al., 2011</td>
<td>Cross-Sectional, 183 British and 271 Australian young adults</td>
<td>AUDIT (Saunders et al., 1993), ASSIST (WHO ASSIST Working Group, 2002), Impulsivity subscale of the I (Eysenck et al., 1985), BAS Fun Seeking subscale (Carver &amp; White, 1994)</td>
<td>Structural equation modelling demonstrated that a two-facet conceptualisation of impulsivity explains more variance in the prediction of substance misuse than a more parsimonious one-facet model. Limited generalisability to substance dependent individuals.</td>
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<td>Lyvers et al., 2011</td>
<td>Cross-sectional, 132 adults</td>
<td>AUDIT (Saunders et al., 1993), Barratt Impulsiveness Scale (Patton et al., 1995), SR subscale of the SPSRQ (Torrubia et al., 2001)</td>
<td>The relationship between disinhibition and drinking behaviour was partially mediated by RS. Conversely, RI scores contributed little to the prediction of AUDIT scores and did not mediate the extent to which disinhibition influenced AUDIT scores. Limited generalisability to substance dependent individuals.</td>
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<td>Hamilton et al., 2012</td>
<td>Cross-sectional, 446 adults</td>
<td>AUDIT (Saunders et al., 1993), Barratt Impulsiveness Scale (Patton et al., 1995), BAS Fun Seeking subscale (Carver &amp; White, 1994)</td>
<td>Hazardous drinkers significantly differed from non-hazardous drinkers on both measures of RI and BAS reward responsiveness. There were no significant differences on BAS Drive. Self-selection bias.</td>
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<tr>
<td>Study</td>
<td>Study Type</td>
<td>Sample Characteristics</td>
<td>Measures</td>
<td>Results</td>
<td>Limitations</td>
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<tr>
<td>Lyvers et al., 2012</td>
<td>Cross-sectional</td>
<td>124 university students who reported using alcohol at least occasionally</td>
<td>AUDIT (Saunders et al., 1993)</td>
<td>AUDIT defined harmful drinkers reported earlier age of onset of weekly drinking and scored higher on RI and RS measures than lower risk groups. Differences remained significant after controlling for duration of alcohol exposure.</td>
<td>Limited generalisability (student sample)</td>
</tr>
<tr>
<td>Kabbani and Kambouropoulos, 2013</td>
<td>Cross-sectional</td>
<td>132 adults</td>
<td>AUDIT (Saunders et al., 1993) Impulsiveness subscale of the I (Eysenck et al., 1985) SR subscale of the SPSRQ (Torrubia et al., 2001)</td>
<td>RS positively predicted drinking expectancies, which in turn positively predicted alcohol use. There was a significant direct effect of RS on alcohol use. RI positively predicted perceived impaired control, which in turn positively predicted alcohol use. There was not a significant direct effect of RI on alcohol use.</td>
<td>Gender generalisability (mainly female participants) Self-selection bias Small sample size</td>
</tr>
</tbody>
</table>
Appendix B

Method and Results of Systematic Review Concerning Two-Facet Conceptualisation of Impulsivity in Comorbidity

The primary aim of the systematic review was to review studies that have measured the two-facet conceptualisation of impulsivity in comorbidity. PsycARTICLES, PsychINFO, Academic Search Complete, Psychology and Behavioral Sciences Collection, MEDLINE Complete and Science Direct (Social Sciences and Humanities Collection) databases were reviewed using the search terms presented in table B1. It was beyond the scope of the present review to have a second reviewer examine the literature as per the PRISMA guidelines (Liberati et al., 2009). Inclusion criteria included peer-reviewed journal articles and articles written in the English language. Exclusion criteria included animal studies and studies investigating one-facet of impulsivity.

Initial searches identified 42 articles. After duplicates were removed 30 abstracts were screened and four potentially relevant articles were identified. After examination of full-text articles one study that examined impulsivity in psychopathy alone was excluded, leaving a total of three articles to be included in the qualitative synthesis (see Figure B1 for the flow of information through different phases of the review). Refer to Table B2 for characteristics of included studies.
Figure B1. Flowchart of systematic review concerning two-facet conceptualisation of impulsivity in comorbidity research.
Table B1

**Search Terms used in Database Searches Pertaining to the Two-Facet Conceptualisation of Impulsivity in Comorbidity**

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Measure</th>
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<tbody>
<tr>
<td>Rash Impulsiveness</td>
<td>Rash Impulsiv* OR Sensation Seeking OR Fun-seeking OR Novelty Seek* OR Barratt Impulsiveness Scale OR Impulsveness Scale OR Impuls*</td>
</tr>
<tr>
<td>Reward Sensitivity</td>
<td>Reward Drive OR Reward Sensitivity OR Sensitivity to Reward OR Reward Responsiv* OR BAS Drive</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>Comorb* OR Co-occurs* OR Dual Diagnosis OR Co-morb*</td>
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</table>

Table B2

**Characteristics of the Included Studies Utilising the Two-Facet Conceptualisation of Impulsivity in Comorbidity Research, Ordered by Year of Publication**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Design</th>
<th>Participants</th>
<th>Substance Use Measure</th>
<th>Rash Impulsiveness Measure</th>
<th>Reward Sensitivity Measure</th>
<th>Outcomes</th>
<th>Risk of Bias</th>
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</thead>
<tbody>
<tr>
<td>Kane et al., (2004)</td>
<td>Cross-sectional</td>
<td>23 women with co-occurring bulimia nervosa and alcohol abuse or dependence, 22 women with bulimia nervosa and 21 women who did not meet the criteria for either disorder (total n = 66)</td>
<td>AUDIT (Saunders et al., 1993)</td>
<td>Impulsiveness subscale of the I7 (Eysenck et al., 1985)</td>
<td>BAS Drive and BAS Reward Responsiveness subscales (Carver &amp; White, 1994) CARROT (Powell et al., 1996)</td>
<td>The comorbid and bulimic group scored significantly higher than controls on the CARROT, Impulsiveness subscale of the I7 and BAS Reward Responsiveness subscale. Further, comorbid women scored significantly higher than bulimic women on the Impulsiveness subscale of the I7 and non-significantly higher on the CARROT.</td>
<td>Small sample Gender generalisability</td>
</tr>
<tr>
<td>Alloy et al., (2009)</td>
<td>Longitudinal</td>
<td>132 participants with a bipolar spectrum disorder (98 Bipolar)</td>
<td>The Michigan Alcoholism Screening Test</td>
<td>BAS Fun Seeking subscale (Carver &amp; White, 1994)</td>
<td>BAS Drive and BAS Reward Responsiveness</td>
<td>BAS Total score, BAS Fun Seeking subscale and scores on the IN subscale prospectively</td>
<td>Limited generalisability (high functioning)</td>
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<tr>
<td>Reference</td>
<td>Study Design</td>
<td>Sample Description</td>
<td>Methods</td>
<td>Findings</td>
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Appendix C

Online Questionnaire

(Displayed on Webpage)

Demographic Information

1: What is your age? ____ years

2: Gender  o Male  o Female

3: Which country were you born in?________

4: Which country do you currently live in?_____________

5: What is the highest level of education you have completed?
  o Primary School
  o Some High School
  o Completed High School (i.e., VCE/HSC or equivalent)
  o Tafe Diploma/Certificate/Trade Qualification
  o University Qualification

6: Have you ever received treatment for social anxiety (e.g., counselling, medication, support groups)?
  o Yes
  o No

IF YES

6a) What type of treatment did you receive? ______________________

6b) How long ago did you receive treatment?
  o I am currently receiving treatment
  o Less than 6 months ago
  o Between 6 and 12 months ago
  o More than 12 months ago; please specify length of time________

6c) How long did you receive treatment for?
  Please specify in months_______

6d) At what age did you first notice symptoms of social anxiety?_______

7: Have you ever received treatment for alcohol problems (e.g., counselling, detox, residential rehabilitation, Alcoholics Anonymous, medication)?
  o Yes
  o No

IF YES

7a) What type of treatment did you receive? ________

7b) How long ago did you receive treatment?
1. How often do you have a drink containing alcohol?
   - Never
   - Monthly or less
   - 2-4 times a month
   - 2-3 times a week
   - 4 or more times a 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?
4. How often during the last 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 last year have you failed to do what is normally expected of you because of your drinking?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

6. How often during the last 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 last 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 last year have you been unable to remember what happened the night before because of your drinking?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

9. Have you or someone else been injured because of your drinking?

- No
- Yes, but not in the last 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?
The following questions concern information about your potential involvement with drugs, excluding alcohol and tobacco, during the past 12 months.

When the words “drug abuse” are used, they mean the use of prescribed or over-the-counter medications used in excess of the directions and any non-medical use of drugs. The various classes of drugs may include: cannabis (e.g., marijuana, hash), solvents, tranquilizers (e.g., Valium), barbiturates, cocaine, stimulants (e.g., speed), hallucinogens (e.g., LSD) or narcotics (e.g., heroin). Remember that the questions do not include alcohol or tobacco.

If you have difficulty with a statement, then choose the response that is mostly right.

These questions refer to the past 12 months only

1. Have you used drugs other than those required for medical reasons?
   - Yes  
   - No  

2. Do you abuse more than one drug at a time?
   - Yes  
   - No  

3. Are you always able to stop using drugs when you want to?
   - Yes  
   - No  

4. Have you had “blackouts” or “flashbacks” as a result of drug use?
   - Yes  
   - No  

5. Do you ever feel bad or guilty about your drug use?
   - Yes  
   - No  

6. Does your spouse (or parent) ever complain about your involvement with drugs?
   - Yes  
   - No  

7. Have you neglected your family because of your use of drugs?
   - Yes  
   - No  

8. Have you engaged in illegal activities in order to obtain drugs?
   - Yes  
   - No  

9. Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs?
   - Yes  
   - No  

10. Have you had medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, bleeding, etc.)?
Drug Use Frequency

Instructions: Please indicate if you have ever used any of the following substances

1. Tobacco: Cigarettes, Chewing, Cigars
   ○ Yes ○ No

2. Cannabis: Marijuana, Pot, Hash, Grass
   ○ Yes ○ No

3. Cocaine: Coke, Crack
   ○ Yes ○ No

4. Amphetamine type stimulants: Speed, Meth, Ice, Ecstasy
   ○ Yes ○ No

5. Sedatives: Valium, Serepax, Rohypnol
   ○ Yes ○ No

6. Opioids: Heroin, Morphine, Methadone, Codeine
   ○ Yes ○ No

7. Other: ___________
   ○ Yes ○ No

Instructions: Please indicate how often you have used the following substances over the past 12 months.

1. Tobacco: Cigarettes, Chewing, Cigars
   ○ Not at all
   ○ Monthly or less
   ○ 2-4 times a month
   ○ 2-3 times a week
   ○ 4 or more times a week

2. Cannabis: Marijuana, Pot, Hash, Grass
   ○ Not at all
   ○ Monthly or less
   ○ 2-4 times a month
   ○ 2-3 times a week
   ○ 4 or more times a week

3. Cocaine: Coke, Crack
   ○ Not at all
   ○ Monthly or less
   ○ 2-4 times a month
   ○ 2-3 times a week
   ○ 4 or more times a week

4. Amphetamine type stimulants: Speed, Meth, Ice, Ecstasy
   ○ Not at all
   ○ Monthly or less
5. Sedatives: Valium, Serepax, Rohypnol
   - Not at all
   - Monthly or less
   - 2-4 times a month
   - 2-3 times a week
   - 4 or more times a week

6. Opioids: Heroin, Morphine, Methadone, Codeine
   - Not at all
   - Monthly or less
   - 2-4 times a month
   - 2-3 times a week
   - 4 or more times a week

7. Other: ______________
   - Not at all
   - Monthly or less
   - 2-4 times a month
   - 2-3 times a week
   - 4 or more times a week

Impulsiveness Subscale of the I7

Instructions: Please answer each question by selecting the “Yes” or the “No” box. Work quickly and do not think too long about the exact meaning of each question. Please remember to answer each question.

Items:
1. Do you often buy things on impulse?
   - Yes  No
2. Do you generally do and say things without stopping to think?
   - Yes  No
3. Do you often get into a jam because you do things without thinking?
   - Yes  No
4. Are you an impulsive person?
   - Yes  No
5. Do you usually think carefully before doing anything?
   - Yes  No
6. Do you often do things on the spur of the moment?
   - Yes  No
7. Do you mostly speak before thinking things out?
   - Yes  No
8. Do you often get involved in things you later wish you could get out of?
   - Yes  No
9. Do you get so ‘carried away’ by new and exciting ideas that you never think of possible snags?
   o Yes o No

10. Do you need to use a lot of self-control to keep out of trouble?
    o Yes o No

11. Would you agree that almost everything enjoyable is illegal or immoral?
    o Yes o No

12. Are you often surprised at people’s reactions to what you do or say?
    o Yes o No

13. Do you think an evening out is more successful if it is unplanned or arranged at the last moment?
    o Yes o No

14. Do you usually work quickly, without bothering to check?
    o Yes o No

15. Do you often change your interests?
    o Yes o No

16. Before making up your mind, do you consider all the advantages and disadvantages?
    o Yes o No

17. Do you prefer to ‘sleep on it’ before making decisions?
    o Yes o No

18. When people shout at you, do you shout back?
    o Yes o No

19. Do you usually make up your mind quickly?
    o Yes o No

SRSRQ

Instructions: Please respond to each question by selecting the “Yes” or the “No” box.

1. Does the prospect of obtaining money motivate you strongly to do some things?
   o Yes o No

2. Do you prefer not to ask for something when you are not sure you will obtain it?
   o Yes o No

3. Are you often afraid of new or unexpected situations?
   o Yes o No

4. Is it difficult for you to telephone someone you do not know?
   o Yes o No

5. Do you often do things to be praised?
   o Yes o No

6. Do you like being the centre of attention at a party of a social meeting?
   o Yes o No
7. In tasks that you are not prepared for, do you attach great importance to the possibility of failure?
   o Yes o No

8. Do you spend a lot of time on obtaining a good image?
   o Yes o No

9. Are you easily discouraged in difficult situations?
   o Yes o No

10. Are you a shy person?
    o Yes o No

11. When you are in a group, do you try to make your opinions the most intelligent or funniest?
    o Yes o No

12. Whenever possible, do you avoid demonstrating your skills for fear of being embarrassed?
    o Yes o No

13. Do you often take the opportunity to pick up people you find attractive?
    o Yes o No

14. When you are with a group, do you have difficulties selecting a good topic to talk about?
    o Yes o No

15. As a child, did you do a lot of things to get people’s approval?
    o Yes o No

16. Does the possibility of social advancement move you to action, even if this involves not playing fair?
    o Yes o No

17. Do you think a lot before complaining in a restaurant if your meal is not well prepared?
    o Yes o No

18. Do you generally give preference to those activities that imply an immediate gain?
    o Yes o No

19. Do you often have trouble resisting the temptation of doing forbidden things?
    o Yes o No

20. Whenever you can, do you avoid going to unknown places?
    o Yes o No

21. Do you like to compete and do everything you can to win?
    o Yes o No

22. Are you often worried by things that you said or did?
    o Yes o No

23. Would it be difficult for you to ask your boss for a raise (salary increase)?
    o Yes o No

24. Do you generally try to avoid speaking in public?
    o Yes o No

25. Do you, on a regular basis, think that you could do more things if it was not for your insecurity or fear?
    o Yes o No
26. Do you sometimes do things for quick gains?
   ○ Yes □ No

27. Comparing yourself to people you know, are you afraid of many things?
   ○ Yes □ No

28. Does your attention easily stray from your work in the presence of an attractive stranger?
   ○ Yes □ No

29. Do you often find yourself worrying about things to the extent that performance in intellectual abilities is impaired?
   ○ Yes □ No

30. Are you interested in money to the point of being able to do risky jobs?
   ○ Yes □ No

31. Do you often refrain from doing something you like in order not to be rejected or disapproved by others?
   ○ Yes □ No

32. Do you like to be competitive in all of your activities?
   ○ Yes □ No

33. Would you like to be a socially powerful person?
   ○ Yes □ No

34. Do you often refrain from doing something because of your fear of being embarrassed?
   ○ Yes □ No

35. Do you like displaying your physical abilities even though this may involve danger?
   ○ Yes □ No

---

**LSAS**

**Instructions:** Please answer two questions for each situation listed below. The first question asks how anxious or fearful you feel in the situation. The second question asks how often you avoid the situation. If you come across a situation that you ordinarily do not experience, imagine "what if you were faced with that situation" and then, rate the degree to which you would fear this hypothetical situation and how often you would tend to avoid it. Make the fear or anxiety rating in the first column and the avoidance rating in the second column. Please base your ratings on the way that situations have affected you in the last week.

<table>
<thead>
<tr>
<th>Avoidance Rating</th>
<th>Fear or Anxiety Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Telephoning in public.</td>
<td></td>
</tr>
<tr>
<td>○ Never avoid this situation</td>
<td>○ No fear or anxiety in this situation</td>
</tr>
<tr>
<td>○ Occasionally avoid this situation (up to 33% of the time)</td>
<td>○ Mild fear or anxiety in this situation</td>
</tr>
<tr>
<td>○ Often avoid this situation (33 to 67% of the time)</td>
<td>○ Moderate fear or anxiety in this situation</td>
</tr>
<tr>
<td>○ Usually avoid this situation (67 to 100% of the time)</td>
<td>○ Severe fear or anxiety in this situation</td>
</tr>
<tr>
<td>2. Participating in small</td>
<td></td>
</tr>
<tr>
<td>○ Never avoid this situation</td>
<td>○ No fear or anxiety in this situation</td>
</tr>
<tr>
<td>○ Occasionally avoid this situation (up to 33% of the time)</td>
<td>○ Mild fear or anxiety in this situation</td>
</tr>
<tr>
<td></td>
<td>○ Moderate fear or anxiety in this situation</td>
</tr>
<tr>
<td>Situation</td>
<td>Avoidance Frequency</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>1. Talking to people in authority.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>2. Acting, performing or giving a talk in front of an audience.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>3. Eating in public places.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>4. Drinking with others in public places.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>5. Going to a party.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>6. Working while being observed.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>7. Writing while being observed.</td>
<td>oNever avoid this situation</td>
</tr>
<tr>
<td></td>
<td>oOccasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>oOften avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>oUsually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>10. Calling someone you don’t know very well.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>11. Talking with people you don’t know very well.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>12. Meeting strangers.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>13. Urinating in a public bathroom.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>14. Entering a room when others are already seated.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>15. Being the centre of attention.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td>16. Speaking up at a meeting.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>17. Taking a test.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>18. Expressing a disagreement or disapproval to people you don’t know very well.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>19. Looking at people you don’t know very well in the eyes.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>20. Giving a report to a group.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>21. Trying to pick up someone.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>22.Returning goods to a store.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
<tr>
<td>23. Giving a party.</td>
<td>Never avoid this situation</td>
</tr>
<tr>
<td></td>
<td>Occasionally avoid this situation (up to 33% of the time)</td>
</tr>
<tr>
<td></td>
<td>Often avoid this situation (33 to 67% of the time)</td>
</tr>
<tr>
<td></td>
<td>Usually avoid this situation (67 to 100% of the time)</td>
</tr>
</tbody>
</table>
### The Reckless Behaviour Questionnaire

**Instructions:** Please indicate how many times you have participated in the following types of behaviour during the past year.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Never</th>
<th>Once</th>
<th>2-5 times</th>
<th>6-10 times</th>
<th>More than 10 times</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven while under the influence of alcohol</td>
<td>Never</td>
<td>Once</td>
<td>2-5 times</td>
<td>6-10 times</td>
<td>More than 10 times</td>
<td>N/A</td>
</tr>
<tr>
<td>Had sex without using contraceptives (withdrawal and having sex at a “safe” time of the menstrual cycle doesn’t count as contraception). <strong>NB:</strong> Respond N/A to this question if it is not applicable to you (e.g., if you are trying to fall pregnant or if you are in a long-term relationship and have reached menopause).</td>
<td>Never</td>
<td>Once</td>
<td>2-5 times</td>
<td>6-10 times</td>
<td>More than 10 times</td>
<td>N/A</td>
</tr>
<tr>
<td>Damaged or destroyed public or private property</td>
<td>Never</td>
<td>Once</td>
<td>2-5 times</td>
<td>6-10 times</td>
<td>More than 10 times</td>
<td>N/A</td>
</tr>
<tr>
<td>Used marijuana</td>
<td>Never</td>
<td>Once</td>
<td>2-5 times</td>
<td>6-10 times</td>
<td>More than 10 times</td>
<td>N/A</td>
</tr>
<tr>
<td>Shopped indoors</td>
<td>Never</td>
<td>Once</td>
<td>2-5 times</td>
<td>6-10 times</td>
<td>More than 10 times</td>
<td>N/A</td>
</tr>
</tbody>
</table>
6. Driven a car at over 130 kilometres per hour.
   - Never
   - Once
   - 2-5 times
   - 6-10 times
   - More than 10 times

7. Had sex with someone you didn't know well.
   - Never
   - Once
   - 2-5 times
   - 6-10 times
   - More than 10 times

8. Used cocaine.
   - Never
   - Once
   - 2-5 times
   - 6-10 times
   - More than 10 times

9. Driven more than 30 kilometres per hour over the speed limit
   - Never
   - Once
   - 2-5 times
   - 6-10 times
   - More than 10 times

10. Used illegal drugs other than marijuana or cocaine.
    - Never
    - Once
    - 2-5 times
    - 6-10 times
    - More than 10 times

Please enter your email address if you wish to enter the draw to win one of six $50 Coles-Myer gift cards
Appendix D

Plain Language Statement

DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Participant

Plain Language Statement

Date: 17th of November 2011

Full Project Title: Co-occurring social anxiety and substance use Problems: The role of rash impulsivity and reward drive.

Principal Researchers: Dr Nicolas Kambouropoulos
Associate Professor Petra Staiger

Student Researcher: Julia Nicholls

1. Your Consent

Men and women who are aged 18 and above are invited to take part in this research project.

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Plain Language Statement carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to complete the following online questionnaire. Your consent will be indicated by electronically submitting your responses, following completion of the questionnaire, to the researchers’ anonymous database.

You can print a copy of the Plain Language Statement to keep as a record.

2. Purpose and Background

We are interested in learning more about the relationship between social anxiety and substance use. We believe that this is important because research suggests that a large proportion of individuals seeking treatment for their drug and alcohol problems also report social anxiety issues.
In particular, we are interested in examining the role that impulsivity, a personality characteristic, plays in this relationship. By investigating the personality characteristics associated with social anxiety and substance use it is hoped that researchers may be able to develop a targeted treatment intervention in the years to come.

This project is being conducted by a postgraduate student as part of the Doctor of Clinical Psychology degree at Deakin University, Burwood. It is hoped a total of 500 men and women will participate in this project. The results of this research may be used to help researcher Julia Nicholls to obtain a postgraduate degree.

3. Funding
This research is funded by Deakin University.

4. Procedures
Once you have understood and consented to participate in the research you will be asked to fill out an online questionnaire, which will take approximately twenty minutes to complete. You will be asked questions about drug and alcohol use, impulsivity, risk-taking and symptoms of social anxiety.

The following are examples of statements and questions which you will be asked to respond to:

- I am afraid that people will find fault with me
- Is it difficult for you to telephone someone you do not know?
- Do you often get involved in things you later wish you could get out of?
- Do you generally do and say things without stopping to think?
- How often do you have six or more drinks on one occasion?

Once you have completed the questionnaire you can submit your responses electronically. Your responses will be sent to the researchers’ anonymous database. You are reminded not to include any personal information that could identify you in your questionnaire responses.

5. Possible Benefits
The findings from this study might assist in the future development of treatment programs for individuals with substance use problems and social anxiety difficulties. We cannot guarantee or promise that you personally will receive any benefits from this project.

6. Possible Risks
No physical or psychological harms are expected as a result of participating in this study. However, it is possible that answering questions related to anxiety or your use of alcohol and/or illicit drugs may raise concerns. If you have any concerns about your health we suggest you contact your general practitioner, Beyond Blue (1300 22 4636 or www.beyondblue.org.au) or DirectLine (1800 888 236).

7. Privacy, Confidentiality and Disclosure of Information
Any information obtained in connection with this project is anonymous, and therefore cannot be used to identify you. Only the researchers will have access to the anonymous information obtained in the questionnaires, which will remain strictly confidential. To
maintain confidentiality, please ensure that you do not attach your name or any other information that could identify you when you complete your questionnaire. While the researchers cannot guarantee the complete security of information transmitted through the internet, individual participants will not be identifiable from completion of the anonymous questionnaire.

Your anonymous responses from this questionnaire will be stored within a locked file within the School of Psychology at Deakin University for a minimum or six years, after which all files will be destroyed. Again, only the researchers will have access to this data.

We plan to use the results from this study as part of the thesis requirements for a Doctoral degree. A report of the study may also be submitted for publication, however in any publication, information will be provided in such a way that individual participants cannot be identified as only aggregated data will be reported.

8. Results of Project
If you wish to find out the results of this study, please contact the researchers Dr Nicolas Kambouropoulos (nicolas.kambouropoulos@deakin.edu.au), Associate Professor Petra Staiger (petra.staiger@deakin.edu.au) or Julia Nicholls (jn@deakin.edu.au) and the details will be forwarded to you at the completion of the study. Please be advised that it will not be possible for us to provide you with individual feedback on your responses as your data is anonymous.

9. Participation is Voluntary
Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, do not submit your responses to the questionnaire.

Your decision whether to take part or not to take part, will not affect your relationship with Deakin University.

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Complete the questionnaire only after you have had a chance to ask your questions and have received satisfactory answers.

10. Ethical Guidelines
This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethics aspects of this research project have been approved by the Human Research Ethics Committee of Deakin University.

11. Complaints
If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact: The Manager, Office of Research Integrity, Deakin University, 221 Burwood Highway,
12. Reimbursement for your costs
You will have the opportunity to be entered into a draw to win one of six $50 Coles-Myer vouchers to thank you for your time and participation in our project. This will involve completing an entry form after you have completed the questionnaire in order to keep your responses anonymous. Winners will be randomly drawn and contacted via email.

13. Further Information, Queries or Any Problems
If you require further information or if you have any problems concerning this project (for example, any side effects), you can contact the principal researchers Dr Nicolas Kambouropoulos (nicolas.kambouropoulos@deakin.edu.au) or Associate Professor Petra Staiger (petra.staiger@deakin.edu.au). Alternatively you can contact the student researcher, Julia Nicholls (jn@deakin.edu.au).

If you wish to take part in this research please click the following button to indicate that you have read and understood the terms of the plain language statement and agree to participate. Pressing the Submit button at the conclusion of the questionnaire will indicate your consent. To maintain anonymity, please ensure that you do not attach your name or any other information that could identify you when you submit your completed questionnaire.

(I AGREE)

If you do not wish to take part, thank you for your time.
Appendix E

Clinician-Administered Questionnaires

The following section asks you some general questions about yourself.

1. Age in years: □ □

2. Gender: □ Male □ Female

3. Where were you born?
   □ Australia □ New Zealand/Oceania □ South America/Caribbean
   □ Africa □ Middle East □ North America
   □ Asia □ Europe □ Other (please specify) ________

4. Which ethnic/cultural group do you most identify with? (e.g. Australian) ________

5. Are you Aboriginal/Torres Strait Islander? □ Yes □ No

6. What is your current relationship status?
   □ Never married □ Married/Living with Partner □ Separated/Divorced
   □ Steady relationship (not living together) □ Widowed

7. What is the highest level of education you have completed?
   □ Primary School □ TAFE Diploma/Certificate/Trade Qualification
   □ Some High School □ University qualification
   □ Completed VCE/HSC

8. What is your usual occupation? ____________________________

9. What is your current employment status?
   □ Unemployed □ Employed – part-time/casual □ Employed – full-time
   □ Student □ Retired □ Other (please specify) _________

10. Do you receive any Centrelink benefits? □ Yes □ No

11. Who are your main social supports? (Tick all that apply)
    □ Parents □ Other family □ Organisational support (e.g. Odyssey staff)
    □ Partner □ Friends □ Other (please specify) _________

12. Where do you usually live?
    □ Rented house □ Public housing □ Parents’ or other family members’ house
    □ House you owned □ Homeless/No fixed address □ Other (please specify)
13. Which suburb do you live in? ________________________________

This section asks questions about your alcohol and drug use and treatment history.

14. At what age did you first try any drugs (including cigarettes or alcohol)? ______________

15. At what age did alcohol or drugs begin to interfere with your daily activities? ______________

16. Which drug has caused you the most problems or hassles in the past 3 months?
   (please nominate the most problematic) ________________________________

17. What age did you first seek treatment for your drug/alcohol problem? ________________

18. Please list the number of times that you have attended or used any of the following treatments:

   ☐ Residential rehabilitation: ______  ☐ Pharmacotherapy: ______

   ☐ Drug/Alchol counselling : ______  ☐ NA/AA: ______

   ☐ Detoxification: ______  ☐ Home based withdrawal____

19. Have you had problems with anxiety, depression or other mental health issues in the past?
   ☐ Yes  ☐ No

   If yes, which mental health issue(s) have you had problems with?

<table>
<thead>
<tr>
<th>Mental Health Issue</th>
<th>Y/N</th>
<th>How old were you when you first had problems with [mental health issue]?</th>
<th>Did you receive any treatment (Y/N)?</th>
<th>How many separate episodes of treatment did you receive?</th>
<th>Are you currently taking any prescribed medication for [mental health issue] on a regular basis? (Y/N)</th>
<th>What is it? (please list)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. Are you aware of any family members who have been diagnosed with:

   ☐ Anxiety  ☐ Depression  ☐ Alcohol/Drug problem

   If so, who? __________________________________________
20. Do you suffer from a chronic health condition?  
   Yes  No
If yes, what do you suffer from?  ________________________________ If yes, are you  
   taking any medication for this condition?  Yes  No
   If yes, what is it called?  ________________________________
Timeline Followback (only the first page of the ninety day calendar is presented here)

To help us evaluate your alcohol and drug use, we need to get an idea of what substance use was like in the past 90 days. To do this, we would like to fill out a timeline calendar.

Complete the following information:
Number of days to gather information: 90 days
Start date (day 1): ____________
End date (yesterday): ____________

Note: Record on the calendar which drugs were used, and when they were taken. Also record how many standard drinks were consumed on any drinking day (refer to standard drinks chart).

Period: __________________________
### ASSIST

#### Scheduling Form

**A. Tobacco:** Cigarettes, Chewing, Cigars

**B. Alcohol:** Beer, Wine, Spirits

**C. Cannabis:** Marijuana, Hash, Pot, Grass

**D. Cocaine:** Coke, Crack

**E. Amphetamine type stimulants:** Speed, Meth, Ice, Ecstasy

**F. Inhalants:** Glue, nitrous, petrol, paint, thinners

**G. Sedatives:** Valium, Serepax, Rohypnol

**H. Hallucinogens:** LSD, Acid, Mushrooms, trips, ketamine

**I. Opioids:** Heroin, morphine, methadone, codeine

**J. Other:** Prescription NOS, Over Counter, Caffeine

<table>
<thead>
<tr>
<th>Q1</th>
<th>In your life which of the following substances have you ever used?</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Circle Yes or No</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

Complete Q2 to Q8 for all substances answered "Yes"

**Q2** In the past 3 months, how often have you used ......?

<table>
<thead>
<tr>
<th></th>
<th>0 – Never</th>
<th>2 – Once/ twice</th>
<th>3 – Monthly</th>
<th>4 – Weekly</th>
<th>6 – Daily/ Almost Daily</th>
</tr>
</thead>
</table>

If "Never" go to Q6 for that substance

**Q3** During the past 3 months, how long have you had strong desires or urges to use......?

<table>
<thead>
<tr>
<th></th>
<th>0 – Never</th>
<th>3 – Once/ twice</th>
<th>4 – Monthly</th>
<th>5 – Weekly</th>
<th>6 – Daily/ Almost Daily</th>
</tr>
</thead>
</table>

**Q4** During the past 3 months, how often has your use of ...... led to health, social, legal or financial problems?

<table>
<thead>
<tr>
<th></th>
<th>0 – Never</th>
<th>4 – Once/ twice</th>
<th>5 – Monthly</th>
<th>6 – Weekly</th>
<th>7 – Daily/ Almost Daily</th>
</tr>
</thead>
</table>

**Q5** During the past 3 months how often have you failed to do what is normally expected of you

<table>
<thead>
<tr>
<th></th>
<th>0 – Never</th>
<th>5 – Once/ twice</th>
<th>6 – Monthly</th>
<th>7 – Weekly</th>
<th>8 – Daily/ Almost Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>Description</td>
<td>Scores</td>
<td></td>
<td></td>
<td></td>
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<td>----------</td>
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<tr>
<td>Q6</td>
<td>Has a friend, relative or any one else ever expressed concern at your use of......?</td>
<td>0 - Never, 6 - Yes in past 3 months, 3 - Yes not in past 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q7</td>
<td>Have you ever tried and failed to control, cut down or stop using......?</td>
<td>0 - Never, 6 - Yes in past 3 months, 3 - Yes not in past 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8</td>
<td>Have you ever used any drug by injection (non medical)</td>
<td>0 - Never, 2 - Yes in past 3 months, 1 - Yes not in past 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scores**

...
Plain Language Statement and Consent Form

DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM

TO: Participant

Plain Language Statement

Date: 12 August 2010
Full Project Title: Improving the retention rate for residential treatment of substance abuse by sequential intervention for social anxiety
Principal Researchers: Associate Professor Petra Staiger, Professor Mike Kyrios, Dr Nicolas Kambouropoulos
Associate Researchers: Dr Stefan Gruenert, Ms Caroline Long
Student Researchers: Julia Nicholls, Annette Raber

This Plain Language Statement and Consent Form is 7 pages long. Please make sure you have all the pages.

1. Your Consent
You are invited to take part in this research project.

This Plain Language Statement contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Plain Language Statement carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Plain Language Statement and Consent Form to keep as a record.

2. Purpose and Background
The purpose of this project is examine whether addressing a person’s social anxiety issues prior to entering residential drug and alcohol treatment means that it is more likely that the person will enter and remain in treatment.
Not completing residential drug and alcohol treatment is a common problem and it is possible that significant anxiety issues may contribute to this problem. We believe that addressing social anxiety symptoms before and/or at the early stages of residential treatment may help people stay in treatment, and therefore help them get the most from the residential treatment.

In order to see if helping people manage their social anxiety prior to entry into Odyssey House will help them stay in the program, we will be offering a widely used psychological treatment to randomly selected individuals and comparing their progress with people who have not had the social anxiety treatment.

A total of 90 people will participate in this project. As we want to see if including social anxiety treatment before entering the residential treatment is helpful, we need to have half the people go through the normal Odyssey House waitlist procedure and half the people receive the social anxiety treatment in addition to the normal Odyssey House waitlist procedures. You will not be able to choose which group you are in.

Forty-five individuals will receive the two individual and two small group sessions of social anxiety treatment while on the waitlist to enter the usual Odyssey House residential treatment program and a combination of therapeutic letters and telephone booster sessions in the first two weeks of entering Odyssey house. The other participants will follow the usual waitlist procedure (i.e. you will receive standard treatment preparing you for entry into Odyssey House – this may involve you attending one or two group preparation sessions). All participants will receive standard treatment once they have entered Odyssey House.

You are invited to participate in this research project because you are a client of Odyssey House Victoria and have reported experiencing issues with social anxiety.

3. Funding

This research is totally funded by the Australian Research Council Linkage Project Grant.

4. Procedures

The first component of this project will involve completing an initial assessment. At this time you will be asked to complete a written questionnaire and take part in a clinical interview. This will take approximately 90 minutes to complete. These questions will address social anxiety issues, general anxiety and depression, drug and alcohol use and overall well-being. All participants will be asked to complete further assessment sessions approximately 6 weeks later, then 3 and 12 months after TC entry.

At the end of this first assessment appointment you will be randomly assigned to one of two groups. One group will receive two individual and two small group therapy sessions targeting social anxiety issues, whilst they are on the normal waiting period for to enter Odyssey House residential treatment. Participants in this group will be asked to attend each session, which will be held at Odyssey House, 660 Bridge Road, Richmond. The sessions will be run by experienced senior therapists and there will be 2- to 4 participants in each group. Each session of the social anxiety intervention will be audio taped, in order to ensure quality of training and provide feedback and assistance to the therapists providing the training. The recordings will not be utilised for any data analysis and audiotapes will be destroyed at the completion of the project. Once they have entered the Therapeutic Community (TC), members of this group will also receive a combination of therapeutic letters or telephone booster sessions from the senior therapist reminding them of the skill and information received during the social anxiety program.
The therapy follows a widely used approach to treating social anxiety symptoms, including: thought challenging, shifting from critical internal focus to the social situation and facing feared situations in a gradual way. Those randomly assigned to the other group will commence at Odyssey House at the end of the normal waiting period. All participants will receive the usual treatment for their drug and alcohol use once they enter Odyssey House.

By consenting to take part in this project you are also giving us permission to access relevant clinical information from your first appointment (i.e. the intake interview) with Odyssey House. This information will involve any mental health information and previous treatment information. We are requesting access to this information so that we do not need to ask you again during the assessment interview conducted as part of this research.

You will be asked to complete several questionnaires at four separate points in time:

1. Initial baseline assessment interview
2. At the end of the final group therapy session
3. Three months after entering the TC.
4. Twelve months after entering the TC

Please note that if you do not enter the TC or if you are randomly assigned to the other group, you are still eligible to be included in the study and we will follow up with you at similar time points.

The questionnaires will take approximately 60 - 90 minutes to complete on each occasion and a random sample of 20% of participants will also be asked to provide a urine sample at the third interview (3 months after entering TC). The purpose of the urine sample is to confirm any self-reported alcohol and/or drug use. You are free to refuse to provide a sample.

Examples of questions asked at each point in time are:

Your background; for example “What was your employment status prior to treatment?” and “Do you receive any Centrelink benefits?”

Your anxiety symptoms; for example “Rate your levels of Fear or Anxiety in when 1. Telephoning in public 2. Eating in public places”)

Your alcohol and drug use; for example “In your life which of the following substances have you ever used?”

5. Possible Benefits

If you are randomly assigned to receive the social anxiety intervention it is possible that you will notice improvement in your social anxiety concerns. All participants will receive the regular treatment for substance abuse that is provided by Odyssey House Victoria.

The findings from this study might assist in future modification of substance abuse programs aimed to increase the effectiveness of these programs, and in particular, for people with social anxiety issues.

We cannot guarantee or promise that you personally will receive any benefits from this project.
6.  **Possible Risks**

It is possible that some people may find answering questions about any anxiety they are experiencing upsetting. If you experience any immediate distress as a result of your participation please speak with your Odyssey House Victoria clinician.

During treatment you will be asked to face potentially anxiety-provoking situations, as this has been found to be effective in overcoming anxiety. You will be able to choose these situations together with your clinician such that you experience only a manageable level of anxiety.

If you would like to speak with someone at a later stage you can contact beyondblue who will be able to assist you with any concerns and with finding appropriate support. Their phone number is 1300 22 4636.

You can suspend or end your participation in the project if distress occurs.

7.  **Privacy, Confidentiality and Disclosure of Information**

All information gathered from participants will be kept confidential and secure in accordance with Deakin University guidelines, and will not be used for any other purpose than that of this research. Information will not be released to any third party without full and informed consent of the participants, except as required by law. No identifiable details will be kept with the information that is stored. All information on clients collected during this research will be destroyed after 6 years.

It is possible that the results of this study will be published in a scientific journal however individual responses will not be identifiable as only group data will be submitted.

In accordance with the *Freedom of Information Act* 1982 (Vic), you have the right to access and to request correction of information held about you by Deakin University.

8.  **Results of Project**

At the completion of the study a summary of the project’s findings will be made available upon request. A summary of the result will be available in late 2013 by contacting Associate Professor Petra Staiger (pstaiger@deakin.edu.au or 03 9244 6876).

9.  **Further Information or Any Problems**

If you require further information or if you have any problems concerning this project (for example, feelings of distress), you can contact the A/Prof Petra Staiger or Dr Stefan Gruenert.

Associate Professor Petra Staiger  
School of Psychology  
Faculty of Health, Medicine, Nursing and Behavioural Sciences  
Deakin University  
221 Burwood Highway  
Burwood, 3125  
03 9244 6876  
pstaiger@deakin.edu.au

Dr Stefan Gruenert  
CEO  
Odyssey House Victoria  
660 Bridge Road  
Richmond 3121  
03 9420 7600

10.  **Complaints**

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:
11. Participation is Voluntary
Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment, your relationship with those treating you or your relationship with the researchers, Odyssey House Victoria, Deakin University or Swinburne University of Technology.

Before you make your decision, a member of the research team will be available so that you can ask any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from the project your participation will immediately cease and you may ask for any information obtained from you will not be used.

12. Reimbursement for your costs
You will not be paid for your participation in this trial. However, you will be reimbursed with Coles Group/MYER gift vouchers to compensate you for your time, for the interviews completed when not in residence at the TC. Due to the extra effort and time involved, participants who travel to Odyssey House head office in Richmond for their interview will receive a greater level of reimbursement. An initial reimbursement of $25 will be paid to all participants upon completion of the first (baseline) interview schedule in person, whilst participants who complete them over the phone will receive $15; following the same policy, subsequent interviews will be reimbursed either $20 or $10. Reimbursement will be made at the end of the final interview. We have not yet received funding to conduct the 12 month interview and we hope to include extra reimbursement for this component in the near future.

If you are selected to receive the social anxiety treatment, or if you complete an interview in person at Odyssey House Victoria head office, additional cost for reasonable expenses incurred to attend the training sessions will also be reimbursed upon presentation of valid receipt (eg: validated METCARD or 2 hr parking ticket).

13. Ethical Guidelines
This project will be carried out according to the National Statement on Ethical Conduct in Human Research 2007 produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Deakin University and Swinburne University of Technology.
DEAKIN UNIVERSITY
PLAIN LANGUAGE STATEMENT AND CONSENT FORM
TO: Participant

<table>
<thead>
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<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Project Title:</td>
</tr>
</tbody>
</table>

I have read and I understand the Plain Language Statement.
I have had an opportunity to ask questions and I am satisfied with the answers I have received.
I freely agree to participate in this project according to the conditions in the Plain Language Statement.
I will be given a copy of the Plain Language Statement and Consent Form to keep.
I understand that the researcher has agreed not to reveal my identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed) .................................................................
Signature                                                  Date

Name of Witness to Participant's Signature (printed) ..............
Signature                                                  Date