Alcohol-Related Cognitions: The Role of Positive and Negative Reinforcement

by

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ABSTRACT OF DISSERTATION

Background

Attentional bias towards alcohol stimuli and craving for alcohol are clinically relevant cognitive factors contributing to ongoing alcohol misuse. Previous studies have demonstrated that heightened positive or negative affect can increase alcohol attentional bias and craving for alcohol in social drinkers. Yet, considerable variability in responsivity has been reported. Experimental studies with social drinkers can increase our understanding of the pathways to dependence and so these inconsistent findings warrant further investigation. Mood induction studies conducted in laboratory type settings have enabled researchers to examine “in vivo” specific hypotheses that may enhance our understanding of the influence of mood state on alcohol-related cognitions in “real world” settings. Surprisingly, very few mood induction studies also measure relevant individual trait characteristics, such as reward sensitivity and tolerance of negative affect, which may assist in explaining the individual variability reported in response to positive and negative affect in these studies. Furthermore, given the important role of drinking motives in social drinkers, very few mood induction studies have examined how variation in these motives may influence responding to positive and negative affect. In order to enhance current knowledge, the present dissertation will address the following research questions: (1) Are alcohol attentional bias and craving for alcohol mutually exacerbated in the context of heightened positive or negative affect in social drinkers? (2) Do positive or negative mood inductions increase alcohol attentional bias and craving for alcohol
in social drinkers? (3) Do individual differences in trait characteristics (i.e. reward sensitivity and tolerance of negative affect) and drinking motives account for variability in responsivity to heightened positive and negative mood in social drinkers? (4) Do individual trait characteristics (i.e. reward sensitivity and tolerance of negative affect) and drinking motives interact with positive and negative mood to enhance attentional bias towards alcohol stimuli and craving for alcohol in social drinkers?

Method

In order to address the key research questions of this thesis, an experimental study was designed and implemented utilising mood induction procedures and eye tracking technology. The two primary dependent variables (DVs) were alcohol attentional bias (measured by initial orientation towards alcohol stimuli and maintenance of attention towards alcohol stimuli) and subjective craving for alcohol (self-report measure). A within-subject design was employed where the DVs were collected at baseline, followed by the positive mood induction and negative mood induction. Participants were randomly allocated to one of two groups to counterbalance the order of positive and negative mood inductions. The predictor variables examined were drinking motives (social, enhancement, coping, conformity), sensitivity to reward and tolerance of negative affect. The moderating variables included reported level of positive and negative mood following mood induction procedures. The sample consisted of 99 social drinkers (mean age = 35.3 years, 67% female) with varying levels of alcohol use (mean AUDIT score = 8.56).
Results

The key findings were:

Alcohol attentional bias and craving for alcohol were positively associated under positive and negative mood conditions, but not the baseline condition. Heightened positive mood (via mood induction) significantly enhanced craving for alcohol, but not attentional bias towards alcohol stimuli, relative to baseline measures. Negative mood induction did not significantly enhance attentional bias towards alcohol stimuli or craving for alcohol, relative to baseline measures. Social drinking motives, enhancement drinking motives and heightened reward sensitivity were positively associated with attentional bias towards alcohol stimuli, across each of the three mood conditions (i.e. positive mood, negative mood and baseline). Social drinking motives and heightened trait reward sensitivity were positively associated with craving for alcohol, under the positive mood and baseline conditions. Enhancement motives for drinking held no significant associations with craving for alcohol in the present sample of social drinkers, irrespective of mood state. Conformity motives for alcohol use were significantly associated with attentional bias under baseline and negative mood conditions. Conformity motives were not significantly associated with craving for alcohol, irrespective of mood state. Coping motives and tolerance of negative affect were not significantly associated with greater alcohol attentional bias or craving for alcohol, across each of the three conditions (i.e. positive mood, negative mood and baseline). Reported level of positive and negative mood did not moderate associations between the predictor variables (i.e. drinking motives, reward sensitivity and tolerance of negative affect) and the DVs (attentional bias and craving) following positive and negative mood inductions.
Conclusions

Taken together, the findings of the present dissertation are broadly consistent with positive and negative reinforcement models of alcohol use in understanding cognitive responses to alcohol cues. Alcohol attentional bias and craving for alcohol were mutually exacerbated in the context heightened positive and negative mood (but not baseline measures), indicating that increases in positive or negative affect may enhance alcohol-related cognitions in some social drinkers. However, the present findings demonstrate greater support for positive reinforcement models of alcohol use in social drinkers, as positive mood induction significantly enhanced craving for alcohol (but not attentional bias), relative to baseline measures. In contrast, negative mood induction was not significantly associated with greater attentional bias or craving for alcohol, relative to baseline measures. Collectively, the findings indicate variability in alcohol-related cognitions in response to increases in positive and negative affect in social drinkers. Extending on these findings, individual variation in reward sensitivity, tolerance of negative affect and drinking motives (coping motives, conformity motives, enhancement motives, social motives) did not account for variability in responsivity to heightened positive and negative mood. Moreover, reported levels of positive and negative affect did not interact with trait characteristics (i.e. reward sensitivity and tolerance of negative affect) or drinking motives to influence alcohol attentional bias and craving for alcohol following mood induction. The null findings may be attributed to low variation on measures of trait characteristics and drinking motives, low mean scores for reported level of craving, and substantial variation in attentional bias scores.
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OVERVIEW

Alcohol is a widely used substance that has the potential to cause significant individual and societal problems, due to its disinhibitory effects and various physical and mental health complications that occur as a function of excessive use. In order to reduce the risk associated with alcohol misuse and improve treatment outcomes for problematic drinking, it is necessary to enhance understanding of factors that influence and maintain drinking behaviour. To this end, previous research has demonstrated that attentional bias towards alcohol stimuli and craving for alcohol are important cognitive correlates of problematic alcohol use (Bruce & Jones, 2004; Chakravorty, Kuna, Zaharakis, O'Brien, Kampman, & Oslin, 2010; Cox, Yeates & Regan, 2003; Day, Celio, Lisman & Spear, 2014; Field, Mogg, Zetteler & Bradley, 2004; Johnsen, Laberg, Cox, Vaksdal & Hugdahl, 1994; Jones Bruce, Livingstone & Reed, 2006; Lusher, Chandler & Ball, 2004; MacKillop et al., 2010; Stetter, Ackermann, Bizer, Straube & Mann, 1995; Townshend & Duka, 2001; Sharma, Albery & Cook, 2001) and relapse following treatment (Cox, Hogan, Kristian & Race, 2002; Garland, 2011; Ramo & Brown, 2008; Zywiak, Stout, Trefry, Glasser, Connors, Maisto & Westerberg, 2006). Moreover, craving for alcohol has recently been added to the diagnostic criteria of alcohol use disorders in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), indicating that craving is a key component of problematic drinking behaviour. Interestingly, these alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) are not circumscribed to problematic levels of alcohol use, as previous research indicates that social drinkers also experience attentional bias towards alcohol stimuli and craving for alcohol (e.g.
However, these cognitive processes are likely to be qualitatively different for problematic and social drinkers. Given that social drinking is likely to precede the development of more problematic levels of alcohol use, it is important to enhance knowledge regarding cognitive factors that are associated with drinking behaviour in social drinkers. To this end, the focus of the present dissertation is to examine circumstances that influence alcohol attentional bias and craving for alcohol in social drinkers.

Of particular interest in the present dissertation is the influence of heightened positive and negative affect on attentional bias towards alcohol stimuli and craving for alcohol in social drinkers. Experimental mood induction studies have enabled researchers to examine the influence of positive and negative affect on alcohol attentional bias and craving for alcohol in situations that are analogous to “real world” settings. To this end, previous research has demonstrated that experimental manipulation of positive and negative mood increases attentional bias towards alcohol stimuli in social drinkers (Birch, Stewart, Wiers, Klein, Maclean & Berish, 2008; Grant, Stewart & Birch, 2007; Field & Powell, 2007; Field & Quigley, 2009). However, there is variability across existing research regarding responsivity to positive and negative affect, with some studies indicating that increases in positive and negative mood does not result in increases in alcohol attentional bias in social drinkers (Birch et al., 2008; Emery & Simons,
Moreover, a wealth of research has demonstrated that negative mood induction subsequently enhances craving for alcohol in dependent drinkers (Coffey, Saladin, Drobes, Brady, Dansky & Kilpatrick, 2002; Coffey, Schumacher, Stasiewicz, Henslee, Baillie, & Landy, 2010; Coffey, Stasiewicz, Hughes & Brimo, 2006; Cooney, Litt, Morse, Bauer & Gaupp, 1997; Kwako et al., 2015; Litt, Cooney, Kadden & Gaupp, 1990; Saladin, Drobes, Coffey, Dansky, Brady, & Kilpatrick, 2003; Stasiewicz, Gulliver, Bradizza, Rohsenow, Torris & Monti, 1997). However, previous experimental research examining the influence of heightened negative affect on craving for alcohol in social drinkers is limited and inconsistent (Bailey & Baillie, 2013; Field & Powell, 2007). Additionally, there are currently no known experimental studies that have examined the influence of heightened positive affect (via mood induction) on craving for alcohol in social drinkers. Given the inconsistency in previous findings, one aspect of the present dissertation will examine whether heightened positive or negative mood (via mood induction) enhances alcohol attentional bias and craving for alcohol in social drinkers. Moreover, theoretical accounts suggest that attentional bias and craving may be mutually exacerbated in the context of heightened positive and negative affect (Kavanagh, Andrade & May, 2005). However, very little previous research has examined the influence of mood state on the association between attentional bias towards alcohol stimuli and craving for alcohol in social drinkers. Therefore, another focus of the present dissertation is to investigate whether alcohol attentional bias and craving for alcohol are positively associated in the context of heightened positive or negative mood (via mood induction) in social drinkers.
The reported variability in response to positive and negative mood induction in previous experimental studies may be explained by certain factors associated with the individual, such as variation in trait characteristics or motivation to consume alcohol. To date, very little empirical attention has been directed towards examining individual difference factors that may account for variability in associations between mood state and alcohol-related cognitions in social drinkers. This is surprising, given the implications for understanding alcohol misuse, and the potential to identify factors associated with the individual that may enhance vulnerability to alcohol-related cognitions in the context of heightened positive and negative mood. A review of the existing literature indicates that differential drinking motives and trait characteristics, including reward sensitivity and tolerance of negative affect, have well-established connections with affect regulation and alcohol use. Thus, it is reasonable to assume that these individual difference factors may also influence alcohol attentional bias and craving for alcohol. The present dissertation will make a unique contribution to the existing literature by examining whether certain factors associated with the individual, including variation in trait reward sensitivity (Gray, 1970), tolerance of negative affect (Simons & Gaher, 2005) and drinking motives (Cooper, 1994), influence alcohol attentional bias and craving for alcohol in the context of heightened positive and negative mood in social drinkers. Moreover, the present dissertation will examine whether the association between these individual difference factors (i.e. reward sensitivity, tolerance of negative affect, drinking motives) and alcohol-related cognitions (attentional bias and craving) is strongest in those who report higher levels of positive or negative mood following mood induction.
Chapter one of the present dissertation will present a comprehensive review of the relevant literature in order to provide a theoretical framework for current investigations, and highlight important gaps in the existing research that will be addressed by the current thesis. Chapter two will discuss important methodological considerations and measurement issues related to assessment of alcohol attentional bias and craving for alcohol. Chapter three will evaluate whether alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive or negative affect (via mood induction) in social drinkers. Chapter four will examine the influence of positive mood induction on alcohol attentional bias and craving for alcohol in social drinkers. Moreover, chapter four will investigate whether positively reinforced drinking motives (i.e. social and enhancement motives) and heightened reward sensitivity are significantly associated with alcohol attentional bias and craving for alcohol in the context of heightened positive mood, relative to other mood conditions (i.e. negative mood and baseline measures). Additionally, chapter four will examine whether the association between these individual difference factors (reward sensitivity, social motives, enhancement motives) and alcohol-related cognitions is strongest in those who report higher levels of positive mood following the positive mood induction. Chapter five will examine the influence of negative mood induction on alcohol attentional bias and craving for alcohol in social drinkers. Moreover, chapter five will investigate whether negatively reinforced drinking motives (i.e. coping and conformity motives) and low tolerance of negative affect are significantly associated with alcohol-related cognitions in the context of heightened negative mood, relative to other mood conditions (i.e. positive mood and baseline measures). Furthermore, chapter five will examine
whether the association between these individual difference factors (tolerance of negative affect, coping motives, conformity motives) and alcohol-related cognitions is strongest in those who report higher levels of negative mood following negative mood induction. Finally, chapter six will review the findings, with study limitations and clinical implications discussed, and conclusions regarding alcohol attentional bias and craving for alcohol in social drinkers tendered.
Chapter 1
INTRODUCTION

1.1. Physiological and Psychological Effects of Alcohol Use

Alcohol is a widely used substance that produces varying physiological, psychological and behavioural changes in the individual. It acts as a central nervous system depressant, affecting neurological functioning in a dose-dependent manner (Dry, Burns, Nettleback, Farquharson & White, 2012). Alcohol intoxication is associated with changes in subjective mood states, impairments in psychomotor performance and deficiencies in cognitive processes such as memory, attention and planning (Holloway, 1995; Eckardt et al., 1998; Weissenborn & Duka, 2003). When consumed in moderation, alcohol produces a feeling of wellbeing and euphoria through dis-inhibitory and stimulating effects. However, excessive alcohol use is associated with a variety of negative health problems including mental health issues (Grant & Harford, 1995; Fergusson, Boden & Horwood, 2009; Boden & Fergusson, 2011; Boschloo et al., 2012) and physical complications, such as heart disease, stroke and brain damage (De Looper & Bhatia, 2001). Immune mechanisms may also be suppressed with severe and repeated alcohol intoxication, predisposing individuals to infections and increasing the risk for developing cancers (American Psychiatric Association, 2013). Thus, excessive alcohol consumption is associated with a number of significant physiological and psychological difficulties that compromise the health and wellbeing of the individual.
1.2. Increased Risk of Harm and Societal Burden Associated with Alcohol Use

Excessive alcohol consumption and associated dis-inhibition increases risk of harm to both the individual alcohol user and other members of the community. For example, an extensive body of research has demonstrated associations between alcohol intoxication and risk taking behaviours including high risk sexual behaviour (Temple, Leigh & Schafer, 1993; Kaly, Heesacker, & Frost, 2002; Griffin, Umstatt & Usdan, 2010; Zetola, Modongo, Olabiyi, Ramogola-Masire, Collman & Chao, 2014), criminal behaviour (Murdoch, Pihl & Ross, 1990; Greenfield & Weisner, 1995; Miller, Levy, Cohen & Cox, 2006) and deliberate self-harm (Haw, Hawton, Casey, Bale & Shepherd, 2005; Tuisku, Pelkonen, Kiviruusu, Karlsson & Marttunen, 2012; Moller, Tait & Byrne, 2013). A strong connection has been demonstrated between excessive alcohol consumption and suicidality, with both chronic patterns of alcohol use and acute alcohol intake being associated with substantially greater risk of suicidal behaviours. To this end, the rate of suicide in alcohol-dependent individuals has been estimated to be six times the expected rate of the general population (Harris & Barraclough, 1997). Moreover, a meta-analysis of descriptive reports concluded that acute alcohol use preceded an average of 40% of suicide attempts and an average of 37% of completed suicides (Cherpitel, Borges & Wilcox, 2004). In light of the risks associated with alcohol misuse, it is imperative that treatment efforts focus on developing effective interventions for alcohol use to reduce the risk of harm to vulnerable individuals.
In addition to the personal risk associated with drinking behaviour, alcohol use significantly increases the risk of harm to other members of the community. For example, alcohol use has been found to increase the likelihood of traffic hazards due to impairment of motor skills, reaction time and judgment, and continues to be the major cause of motor vehicle accidents (Cornwell et al., 1998). Further to this, excessive alcohol consumption can result in a combination of poor emotional control and impairment of regulatory processes that inhibit behaviour, leading to aggression and increasing the likelihood of physical assault (Scott, Schafer, & Greenfield, 2009). The alarming rates of alcohol-fuelled violence, including incidents of “king hit” assaults, have recently been a focus of media attention, highlighting the potentially devastating impact of alcohol misuse. Pilgrim and colleagues (2014), suggest that alcohol is often a key factor in “king hit” incidents, with most assaults occurring at licensed alcohol outlets. The researchers also emphasize that intoxication can substantially increase the risk of victimisation by causing cognitive impairment, difficulty interpreting social cues and reduced ability to respond adequately to assault. This is an important finding and one that reiterates the potential danger associated with alcohol misuse for both the individual and society as a whole. Overall, the available evidence provides a clear indication of the risk associated with alcohol misuse, and the potential for significant consequences for both the individual alcohol user and other members of the community.

The physiological and psychological consequences of excessive alcohol use, as well as associated risk of harm, indicate that excessive alcohol use carries a high level of societal burden. Taking into account premature death, disability,
suffering and social harm arising from alcohol misuse, excessive alcohol consumption is considered to be the most harmful form of substance use in young and middle aged adults in developed countries (Murray & Lopez, 1997). Moreover, alcohol misuse is a major cause of illness and social disorder in Australia (Miller et al., 2011), with an estimated 15.3 billion dollars spent on alcohol related problems in the 2004/05 financial year (Collins & Lapsely, 2008). Despite efforts to increase awareness of the detrimental effects associated with excessive alcohol use, the number of people drinking alcohol in risky quantities escalated from 3.5 million in 2007 to 3.7 million in 2010 (AIWH, 2010). These statistics are concerning and highlight the need for further research to determine whether this trend has continued in more recent years. Given that alcohol misuse causes significant societal burden through increasing risk of harm to both the individual alcohol user and other members of the community, excessive alcohol use is a costly community health problem that needs to be addressed.

1.3. Prevalence of Alcohol Use Disorders and Treatment Outcomes

Alcohol use disorders have been the focus of large-scale epidemiological studies across the world. The most recent surveys use the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 2000) criteria, which distinguishes between alcohol abuse and alcohol dependence to indicate prevalence estimates. Research indicates that Alcohol Use Disorders are common and are associated with major public health consequences. In the more recent surveys using DSM-IV criteria, the lifetime prevalence of alcohol use disorders range from 8.3% to 30.3%. Categorically, the estimated prevalence of alcohol use disorders over the lifetime
is between 4.5% to 17.8% for alcohol abuse and 3.8% to 13.3% for alcohol dependence (Andrews, Hall, Henderson & 2001; Grant, Dawson, Stinson, Chou, Dufour & Pickering, 2004; Hasin, Stinson, Ogburn & Grant, 2007). Teeson and colleagues (2010) provided the most recent information on 12-month prevalence estimates and lifetime rates of alcohol use disorders in Australia, using data from the 2007 National Survey of Mental Health and Wellbeing (NSMHWB). The researchers found that in Australia in 2007, 4.3% of adults had an alcohol use disorder in the previous 12 months (2.9% abuse, 1.4% dependence) and 22.1% experienced alcohol use disorders over their lifetime (18.3% abuse and 3.9% dependence). The results from the 2007 NSMHWB indicate that Australia’s rates of alcohol use disorders are amongst the highest in the world and are comparable to other western countries including the United States (4.4%; Kessler, Wai, Demler & Walters, 2005) and New Zealand (3.9%; Wells et al., 2006). Moreover, Teeson and colleagues (2010) found that individuals with alcohol use disorder were more than four times more likely to experience other co-morbid psychological disorders. However, due to the cross-sectional nature of their research, the authors were unable to examine hypotheses regarding casual relationships between co-morbid disorders. Finally, Teeson and colleagues’ (2010) study revealed that only one five Australians with an alcohol use disorder reported seeking treatment. Contributing to this low treatment response is a reported lack of confidence in current treatment options (Proudfoot & Teeson, 2002). It is estimated that 40-60% of individuals who seek professional assistance for excessive alcohol use relapse within the first few months following treatment, and between 60 to 70% relapse within one year (Bradizza et al., 2006; McKay et al., 2006; Walitzer and Dearing, 2006). These high relapse rates are concerning.
especially considering that heavy alcohol users readily acknowledge the negative consequences of their drinking and appear strongly motivated to cease use (Fadardi & Cox, 2009). Thus, it is imperative that advances in alcohol-related research are aimed at understanding drinking behaviour and identifying predictors of alcohol use that are clinically relevant and amenable to therapeutic intervention. To this end, a growing body of evidence indicates that “implicit” and “explicit” cognitive processes, such as biases in attention directed towards alcohol-related stimuli and craving for alcohol, are associated with problematic alcohol use (e.g. Bruce & Jones, 2004; Cox, Blount, & Rozak, 2000; Chakravorty, Kuna, Zaharakis, O'Brien, Kampman, & Oslin, 2010; Cox, Yeates & Regan, 1999; Day Celio, Lisman, & Spear, 2014; Field, Mogg, Zetteler & Bradle, 2004; Jones, Bruce, Livingstone & Reed, 2006; Lusher, Chandler & Ball, 2004; Townshend & Duka, 2001; Sharma et al., 2001) and relapse following treatment (Cox et al., 2002; Garland, 2011; Ramo & Brown, 2008; Zywiak et al., 1996). Given the potential implications for treatment and preventing relapse, the following section will review the theoretical underpinnings of alcohol attentional bias and craving for alcohol, as well as report on studies examining these alcohol-related cognitions.

1.4. Attentional Bias towards Alcohol-Related Stimuli and Craving for Alcohol

1.4.1. Theoretical Underpinnings of Attentional Bias

Implicit cognitive processes associated with drinking behaviour have received considerable attention in contemporary alcohol-related research. Implicit cognitions involve learned associations in memory that are spontaneously
activated under various conditions, and that influence behaviour in the absence of conscious processing (Stacey & Weirs, 2010). To this end, alcohol users typically demonstrate activation of implicit cognitive processes by preferentially attending to alcohol-related cues, relative to other stimuli in the environment (Field & Cox, 2008). The incentive sensitisation model of addiction (Robinson & Berridge, 1993; 2001) proposes that this “attentional bias” towards alcohol stimuli develops through a classical conditioning process, whereby alcohol-related cues are repeatedly paired with the rewarding effects of alcohol. In turn, the alcohol stimuli acquire incentive motivational properties, which increase the likelihood that the individual will attend to these cues in the environment. The central tenet of this theory is that repeated exposure to alcohol-related cues can produce progressive and persistent changes to the mesolimbic-dopamine system in the brain that normally regulate the attribution of incentive salience to reward. This process causes hypersensitivity to the motivational properties of alcohol, resulting in a bias of attention directed towards alcohol-related stimuli and a pathological motivation for alcohol use. Moreover, with repeated alcohol use, the dopaminergic reward system becomes increasingly sensitized to stimuli predicting the availability of alcohol, such that alcohol-related cues acquire heightened incentive salience and are disproportionately desired compared with neutral stimuli (Robinson & Berridge, 1993; 2001). In support of this theoretical proposition, a neurobiological study conducted by Vollstadt-Klien and colleagues (2011) used functional magnetic resonance imaging (fMRI) to measure the association between alcohol attentional bias and neural cue-reactivity. The authors concluded that alcohol cue induced activation of the mesocorticolimbic reward system triggers focusing of attention towards alcohol-related cues in alcohol
dependent individuals. This neurobiological evidence provides support for Robinson and Berridge’s (1993; 2001) assertion that alcohol-related cues activate motivational-rewards systems in the brain, which increase the likelihood of alcohol users attending to such cues at the expense of others in the environment.

1.4.2. The Influence of Motivation on Alcohol Attentional Bias

According to Robinson & Berridge’s incentive sensitization theory (1993; 2001), an individual’s motivation to consume alcohol is a key influential factor in attentional bias towards alcohol-related stimuli. This line of reasoning is substantiated by research indicating that the magnitude of attentional bias towards alcohol stimuli typically corresponds with level of alcohol use (for review, see Field & Cox, 2008). For example, a collection of previous studies has demonstrated that heavy and dependent alcohol users display greater attentional bias towards alcohol-related stimuli, relative to lighter drinkers (Bruce & Jones, 2004; Cox et al., 2000; Field et al., 2004; Johnsen, Laberg, Cox, Vaksdal & Higdahl, 1994; Jones et al., 2006; Lusher et al., 2004; Sharma et al., 2001; Townshend & Duka, 2001; Stetter, Ackerman, Bizer, Straube & Mann, 1995). To this end, heavier alcohol users are likely to have a higher motivation to engage in alcohol use, perhaps due to a greater number of experiences with the rewarding effects of alcohol, and therefore display greater attentional bias towards alcohol stimuli relative to lighter drinkers. Furthermore, previous studies indicate that attentional bias towards alcohol stimuli may be attenuated following alcohol consumption, due to a satiation effect whereby the individual is less motivated to drink alcohol (Schoenmakers & Wiers, 2010; Weafer & Fillmore, 2013). For
example, a study conducted by Weafer and Fillmore (2013) demonstrated that ingesting acute doses of alcohol subsequently reduces attentional bias towards alcohol stimuli in heavy drinkers. Similarly, Schoenmakers and Wiers (2010) conducted a field study whereby participants who had reportedly consumed the most alcohol after drinking at a bar, also displayed the least attentional bias for alcohol-related stimuli. Extending on these findings, Roberts and Fillmore (2015) recently demonstrated that as one’s blood alcohol concentration (BAC) reduces and the alcohol satiety effect begins to diminish, attentional bias towards alcohol related stimuli is evident. However, Roberts and Fillmore (2015) found no correlation between self-reported motivation to drink and attentional bias towards alcohol stimuli, indicating that alcohol attentional bias may be influenced by motivational factors that exert influence without conscious awareness. Collectively, these findings suggest that alcohol attentional bias is contingent upon motivational influences, which may be diminished following alcohol consumption due to a satiety effect. Additionally, previous research indicates that motivation to attend to alcohol-related stimuli may be heightened by expectations of receiving alcohol in some alcohol user (Field, Hogarth, Bleasdale, Wright, Fernie & Christiansen, 2011). To this end, Field and colleagues (2011) demonstrated that attentional bias for alcohol-related stimuli is sensitive to expectancy of receiving alcohol in light social drinkers. That is, light social drinkers are more inclined to attend to alcohol-related cues when the anticipation of imminently receiving an alcoholic beverage is greater. Field et al.’s (2011) study also demonstrated that heavy and light social drinkers were differentially sensitive to the expectation of receiving alcohol, with heavy social drinkers displaying attentional bias for alcohol-related stimuli independent of current level
of expectation. One possible explanation for this effect is that given the heightened incentive value of alcohol amongst heavy drinkers relative to light drinkers, attentional bias towards alcohol stimuli in this instance may be constrained by a ceiling effect rendering alcohol attentional bias insensitive to alcohol availability information in heavier drinkers. That is, Field et al.’s (2011) study indicates that heavier drinkers may be inherently more motivated to attend to alcohol stimuli due to greater incentive value of alcohol, whilst light social drinkers may be more motivated to attend to alcohol stimuli when expectancy of receiving alcohol is greater. Finally, a study conducted by Noel and colleagues (2006) demonstrated that individuals who are attempting to abstain from alcohol use, and are therefore motivated to avoid alcohol consumption, do not display attentional bias towards alcohol-related stimuli. This finding again demonstrates that alcohol attentional bias is likely to coincide with an individual’s motivation to consume alcohol at a given point in time. Collectively, the existing studies indicate that motivation is instrumental in alcohol attentional bias, and will therefore be a focus of the present dissertation. Another important alcohol-related cognitive process that is contingent upon motivational processes, is craving for alcohol. Craving is defined as a “subjectively experienced motivational state that fluctuates over time” (Field, Munafò, & Franken, 2009), and is considered to be an explicit cognitive process that is associated with alcohol misuse. Given the potential for understanding drinking behaviour, the following section will review literature regarding craving for alcohol.
1.4.3. Craving for Alcohol

Craving for alcohol reflects an individual’s subjective desire to consume alcohol at a given point in time, and has been well established within the literature as an important cognitive correlate of problematic drinking (Chakravorty et al., 2010; Day et al., 2014; O’Malley, Krishnan-Sarin, Farren, Sinha, & Kreek, 2002; MacKillop et al., 2010; Ramo & Brown, 2008). Moreover, craving for alcohol has recently been identified as central feature of alcohol addiction and has been included in the diagnostic criterion of Alcohol Use Disorders (AUDs) in the newly revised DSM-5 (APA, 2013). To this end, previous studies have demonstrated that craving for alcohol is positively associated with severity of AUD symptoms (MacKillop et al., 2010) and heavy drinking in alcohol dependent individuals (Chakravorty et al., 2010). The cognitive processing model of craving (Tiffany, 1990) asserts that craving is a non-automatic process that is intention dependent, requires mental effort, and is limited by a person’s cognitive capacity. In this sense, craving for alcohol is considered to be an explicit cognitive process. It has been proposed that craving reflects the underlying processes that motivate continued substance use in active users, whilst also contributing to relapse in individuals who are attempting to abstain from substance use (Tiffany, 1990). In support of this assertion, previous research has demonstrated that craving for alcohol is associated with in vivo alcohol consumption in the laboratory (O’Malley et al., 2002) and relapse to alcohol use following treatment (Bottlender & Soyka, 2004; Papachristou, Nederkoorn, Giesen & Jansen, 2014; Schneekloth et al., 2012; Sinha, Fox, Hong, Hansen, Tuit & Kreek, 2011). Moreover, it has been suggested that a bidirectional relationship between craving and alcohol use may contribute to the development or maintenance of heavy drinking (Fazzino et
al., 2013). Additionally, contemporary research by Naqvi and colleagues (2015), suggests that alcohol dependence is associated with deficits in cognitive regulation of cue-induced craving. That is, alcohol dependent individuals are likely to experience impaired ability to effectively manage cognitions associated with alcohol craving in the context of alcohol-related cues, consequently leading to alcohol use. Taken together, these existing studies demonstrate that craving for alcohol is an important cognitive factor contributing to ongoing problematic alcohol use and relapse following treatment. Thus, enhancing knowledge regarding alcohol craving is imperative to understanding drinking behaviour, and advancing clinical interventions for alcohol misuse.

The existing literature indicates that both implicit (i.e. attentional bias) and explicit (i.e. craving) alcohol-related cognitions are instrumental in alcohol misuse. However, previous research indicates that these alcohol-related cognitions are not exclusive to problematic drinking behaviour, as alcohol attentional bias and craving for alcohol are also experienced by social drinkers (e.g. Birch et al., 2008; Cox, Brown & Rowlands, 2003; Field & Powell, 2007; Field, Munafò & Franken, 2009; Field & Quigley, 2009; Field, Hogarth, Bleasdale, Wright, Fernie & Christiansen, 2011; Kabbani, Kambouropoulos, Loxton, & Bunker, 2014; Naqvi, Ochsner, Kober, Kuerbis, Feng, Wall, & Morgenstern, 2015). Theoretical accounts (Franken, 2003; Kavanagh et al., 2005; Ryan, 2002) explain the influence of alcohol attentional bias and craving for alcohol on drinking behaviour by suggesting that these alcohol-related cognitions interact with one another to influence alcohol use. This contention is somewhat supported by previous research indicating that alcohol attentional bias and craving for alcohol are
mutually exacerbated in both dependent and social drinkers (for review, see Field et al., 2009). Given that social drinking is likely to precede problematic alcohol use, enhancing knowledge regarding alcohol attentional bias and craving for alcohol in social drinkers is clinically relevant and important for understanding potential pathways to dependence. Therefore, the following section will review existing literature regarding the association between attentional bias towards alcohol stimuli and craving for alcohol in social drinkers.

1.5. The Association between Attentional Bias and Craving in Social Drinkers

Drawing on Robinson and Berridge’s incentive sensitization theory (1993; 2001), Franken (2003) proposes that attentional bias towards substance-related stimuli and subjective craving are mutually exacerbated cognitive processes that index substance-seeking behaviour. Specifically, Franken (2003) argues that initial attention directed towards substance-related cues increases subjective craving, which subsequently strengthens attentional bias towards the substance-related stimuli. Consequently, a feedback loop ensues that maintains high levels of craving, and ultimately results in substance-seeking behaviour and self-administration. Analogous to Franken’s (2003) argument, Ryan (2002) also proposes a model describing a reciprocal relationship between attentional bias and subjective craving, whereby preferential attentional processing of substance-related cues is suggested to be a major determinant of subjective craving in response to these stimuli. Moreover, increases in craving further enhance attention directed towards substance-related cues and vice versa (Ryan, 2002). Thus, Franken (2003) and Ryan (2002) both suggest that attentional bias towards
alcohol stimuli and craving for alcohol are mutually exacerbated cognitive processes that may be consequences of repeated alcohol use, as well as contributing factors to ongoing drinking behaviour. Similar to the theoretical accounts of Franken (2003) and Ryan (2002), the Elaborated Intrusion (EI) theory of desire (Kavanagh et al., 2005) asserts that learned associations in relation to both internal and external cues underpin spontaneous intrusive thoughts about a target of desire (e.g. alcohol), which then trigger further cognitive elaboration (e.g. craving) and increase attentional allocation towards target-related information (e.g. alcohol stimuli). However, an important point of difference is that according to the EI theory of desire (Kavanagh et al., 2005), it’s not only a matter of cognitive processes moderating the impact of external cues, such as alcohol-related stimuli, but rather that the cues themselves can be internally generated via emotional processes. For example, individuals who associate alcohol use with affect-regulation may find that some emotional experiences precipitate craving for alcohol and attentional allocation towards alcohol-related stimuli. Thus, according to the EI theory of desire (Kavanagh et al., 2005), attending to external cues, such as alcohol-related stimuli, or experiencing internally derived cues, such as changes in mood state, may precipitate a reciprocal relationship between alcohol attentional bias and craving for alcohol.

In line with theoretical perspectives (Franken, 2003; Kavanagh, 2005; Ryan, 2002), Field and colleagues (2009) conducted a comprehensive meta-analytic review examining the association between attentional bias and craving in substance users. Field et al.’s (2009) review included 12 independent data sets investigating the association between alcohol attentional bias and craving for
alcohol in social drinkers. According to the review, social drinkers generally exhibit weak or non-significant correlations between alcohol attentional bias and craving for alcohol. Interestingly however, the association between alcohol attentional bias and craving for alcohol is strengthened in the context of experimental manipulations (Field et al., 2009). For example, a study conducted by Field and colleagues (2004) demonstrated that alcohol attentional bias and craving for alcohol were significantly associated ($r = .34$) when priming doses of alcohol were delivered. Moreover, Field and Powell (2007) found a significant positive association between alcohol attentional bias and craving for alcohol ($r = 0.58$) when craving was experimentally induced via stress induction. Additionally, a recent study by Ramirez and Miranda (2014) demonstrated that in vivo alcohol cue exposure strengthened the association between alcohol craving and alcohol attentional bias ($r = .27$) in a sample of underage college student drinkers. Taken together, the existing studies broadly support theoretical perspectives of Franken (2003), Kavanagh (2005) and Ryan (2002), in that some previous studies have found significant associations between alcohol attentional bias and craving for alcohol in social drinkers (for review, see Field et al., 2009). Moreover, the available evidence is consistent with the proponents of the EI theory of desire (Kavanagh, 2005), which asserts that internal (i.e. mood) or external cues (i.e. alcohol cues) may precipitate a reciprocal relationship between alcohol attentional bias and craving for alcohol in social drinkers. Alternatively, it is important to consider that the association between alcohol attentional bias and craving for alcohol may be artificially inflated due to a common ‘third variable’ of experimental manipulation. Nevertheless, the available evidence indicates that the association between alcohol attentional bias and craving for alcohol is greatest
under conditions of increased stress (Field & Powell, 2007). This suggests that changes in mood state (i.e. via stress induction) may stimulate alcohol attentional bias and craving for alcohol in social drinkers. That is, social drinkers may be more inclined to attend to alcohol related stimuli and experience craving for alcohol in the context of heightened emotional experiences. Given the implications for understanding alcohol misuse, it is important to establish whether alcohol attentional bias and craving for alcohol vary as a function of mood state in social drinkers. To this end, the following section will review experimental studies examining the influence of positive and negative mood on alcohol attentional bias and craving for alcohol in social drinkers.

1.6. Experimental Studies Examining Mood State and Alcohol-Related Cognitions

Various theoretical models propose that a common motivational basis for consuming alcohol is to regulate one’s emotional experience, either via enhancing positive affect (Cooper, Frone, Russell, & Mudar, 1995), or avoiding negative affect (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Cooper et al., 1995). Thus, according to theoretical models (Baker et al., 2004; Cooper et al., 1995), alcohol use is likely to be influenced by positive and negative reinforcement systems. To this end, it is suggested that the affect-response combinations that characterize positive and negative reinforcement systems are likely to be strengthened through repeated pairings, and become internalised cues that trigger alcohol-seeking behaviour (Baker, Morse & Sherman, 1986). As such, increases in positive affect may activate the positive reinforcement system and increase pursuit of alcohol-related stimuli. Similarly, increases in negative affect may activate the negative reinforcement system, resulting in enhanced alcohol seeking
behaviour. This contention is supported by a wealth of literature indicating that positive mood (Crooke et al., 2013; Dvorak et al., 2014; Simons, Gaher, Oliver, Bush, & Palmer, 2005; Simons, Dvorak, Batien, & Wray, 2010) and negative mood (Colder & Chassin, 1993; Dvorak, Sargent, Kilwein, Stevenson, Kuvaas & Williams, 2014; Kuvaas Dvorak, Pearson, Lamis, & Sargent, 2014; Wills, Walker, Mendoza, & Ainette, 2006; Witkiewitz Bowen & Donovan, 2011; Wray, Simons, Dvorak, & Gaher, 2012) are associated with problematic alcohol use.

One of the ways in which mood state may influence alcohol use, is through its effects on cognitive correlates of alcohol use, including alcohol attentional bias and craving for alcohol. To this end, experimental mood induction studies conducted in a laboratory setting have enabled researchers to examine “in vivo” the influence of positive and negative mood states on alcohol attentional bias and craving for alcohol, in circumstances that are relatively analogous to “real world” experiences. These experimental studies provide important and clinically relevant information regarding the influence of mood state on alcohol-related cognitions, and thus will be reviewed in the following sections.

1.6.1. The Role of Negative Mood in Craving for Alcohol

Learning-based models assert that when individuals learn that alcohol can alleviate negative emotions, the experience of negative affect can trigger alcohol craving, which then motivates the individual to seek out and consume alcohol in order to reduce negative affect (Stasiewicz & Maisto, 1993). Consistent with this assertion, cue-reactivity studies conducted in a laboratory setting have demonstrated that experimental manipulation of negative mood increases craving
for alcohol in alcohol dependent individuals (Coffey, Saladin, Drobes, Brady, Dansky & Kilpatrick, 2002; Coffey, Schumacher, Stasiewicz, Henslee, Baillie, & Landy, 2010; Coffey, Stasiewicz, Hughes & Brimo, 2006; Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Field & Powell, 2007; Kwako et al., 2015; Litt, Cooney, Kadden, & Gaupp, 1990; Saladin, Drobes, Coffey, Dansky, Brady & Kilpatrick, 2003; Stasiewicz, Gulliver, Bradizza, Rohsenow, Torris & Monti; 1997). For example, five studies have demonstrated that trauma-cue-elicited negative affect increases craving for alcohol in individuals with co-occurring post-traumatic stress disorder (PTSD) and alcohol dependence (Coffey et al., 2002; Coffey et al., 2010; Coffey et al., 2006; Kwako et al., 2015; Saladin et al., 2003). Furthermore, three studies have established that negative mood induction increases craving for alcohol in dependent drinkers (Cooney et al., 1997; Litt et al., 1990; Stasiewicz, 1997). Collectively, the available studies demonstrate that negative mood enhances craving for alcohol in alcohol dependent individuals. However, only two studies have examined whether heightened negative affect increases craving for alcohol in social drinkers (Bailey & Baillie, 2013; Field & Powell, 2007). To this end, Field and Powell (2007) established that stress induction subsequently increases craving for alcohol in heavy social drinkers. On the other hand, Bailey & Baillie (2013) found that negative mood induction did not enhance craving for alcohol in social drinkers. Therefore, previous research examining the influence of heightened negative affect on craving for alcohol in social drinkers is limited and inconsistent. Moreover, these previous studies (Bailey & Baillie, 2013; Field & Powell, 2007) have examined the influence of negative mood induction on alcohol craving in samples of university students, which may not generalize to a larger and more varied population of adult social drinkers. Thus, further
1.6.2. The Role of Positive Mood in Craving for Alcohol

Existing research has generally focused on the association between negative mood and craving, with only one experimental mood induction study examining the influence of heightened positive mood on craving for alcohol. To this end, Mason and colleagues (2008) demonstrated a significant association between experimentally induced positive affect and craving for alcohol in non-treatment seeking alcohol-dependent individuals. However, mood manipulation checks included in Mason et al.'s (2008) study reveal that despite increased craving strength following the positive mood induction, the participants' mood state remained unchanged. Moreover, the images used to induce positive affect may have triggered alcohol craving due to associations with drinking behaviors (e.g. sporting events). Therefore, the positive mood induction utilised in Mason et al.'s (2008) study, may have inadvertently stimulated craving for alcohol rather than positive affect, thereby limiting study findings. Two other studies have examined the influence of positive mood on craving for alcohol (Kabbani, Kambouropoulos, Loxton & Bunker, 2014; Schlauch, Gwynn-Shapiro, Stasiewicz, Molnar, & Lang, 2013), albeit not in the context of an *in vivo* mood induction paradigm. For example, Kabbani and colleagues (2014) recently found that self-reported measures of positive affect were positively associated with craving for alcohol in young social drinkers, both prior to and following alcohol consumption. However, Kabbani et al.'s (2014) study asked participants to rate
how excited and lively they felt as an indicator of positive affect, thus providing only a narrow conceptualization of positive mood. Moreover, as Kabbani et al.’s (2014) study utilised a sample of first year university students, the findings may be confined to this cohort of alcohol users exclusively. In consideration of these limitations, it is unclear whether the findings of Kabbani et al.’s (2014) study would generalize more broadly. On the other hand, Schlauch, and colleagues (2013) examined individuals with various substance use disorders in an inpatient detoxification unit and found that self-reported positive affect negatively predicts cue-elicited craving for alcohol. The observed negative association between positive mood and craving for alcohol in this instance may be because recently detoxified substance users may be more motivated to avoid alcohol consumption, and positive affect could potentially enhances access to adaptive coping strategies or greater self-regulation (Schlauch, et al., 2013). Taken together, the existing literature indicates that the relationship between positive mood and craving for alcohol is currently unclear and requires further investigation. Moreover, there are currently no known experimental studies that have examined the influence of positive mood induction on craving for alcohol in social drinkers. Thus, there is a significant paucity in the existing literature regarding the influence of positive mood on craving for alcohol in social drinkers that will be addressed by the present dissertation.

1.6.3. The Influence of Mood State on Alcohol Attentional Bias

Existing experimental studies indicate that increases in positive or negative mood may influence attentional bias towards alcohol-related stimuli in
social drinkers. For example, two experimental studies have demonstrated that positive mood induction increases alcohol attentional bias in social drinkers who drink to enhance positive affect (Birch, Stewart, Wiers, Maclean & Berish, 2008; Grant, Stewart, & Birch, 2007). Similarly, three studies have demonstrated that negative mood induction enhances alcohol attentional bias in social drinkers who drink to cope with negative affect (Field & Powell, 2007; Field & Quigley 2009; Grant et al., 2007). However, two other existing experimental studies have indicated that alcohol attentional bias is not exacerbated in the context of heightened positive (Emery & Simons, 2015) and negative (Birch et al., 2008; Emery & Simons, 2015) affect in social drinkers. Thus, whilst there is indication that increases in positive or negative mood may enhance attentional bias towards alcohol stimuli in social drinkers, the available evidence remains equivocal and requires further investigation. Given the implications for understanding drinking behaviour, one aspect of the present dissertation will focus on examining the influence of positive and negative mood states (via mood induction) on attentional bias towards alcohol stimuli in social drinkers.

Collectively, previous experimental mood induction studies indicate that heightened positive or negative affect may increase alcohol attentional bias and craving for alcohol in social drinkers. However, current research regarding the influence of mood state on alcohol-related cognitions in social drinkers is limited and inconsistent. Moreover, previous mood induction studies indicate that not all individuals respond equally to increases in positive and negative mood. That is, there is variability in the extent to which individuals experience alcohol attentional bias and craving for alcohol following positive and negative mood.
induction. Surprisingly, very little research has examined factors associated with the individual that may account for the variability observed in mood induction paradigms. This is an important line of investigation, given the potential clinical implications of identifying individual risk factors that may be associated with enhanced vulnerability to alcohol-related cognitions in the context of heightened positive or negative mood. To this end, the literature indicates that individual variation in trait characteristics that are associated with affect regulation and alcohol use, such as reward sensitivity (Gray, 1970) and tolerance of negative affect (Simons & Gaier, 2005), may account for the variability in responsivity to heightened positive and negative mood, respectively. That is, the literature suggests that individuals who are more highly sensitised to rewarding stimuli (Gray, 1970) may experience enhanced alcohol attentional bias and craving for alcohol in the context of heightened positive mood. Furthermore, individuals with lower tolerance of negative affect (Simons & Gaier, 2005), may be more likely to engage in alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) in the context of heightened negative mood. Moreover, previous research has indicated that differential drinking motives may also influence responsivity to positive and negative mood induction in social drinkers (Birch et al., 2008; Grant et al., 2007; Field & Powell, 2007). However, despite the important role of drinking motives in social drinkers, current research regarding drinking motives and alcohol-related cognitions in mood induction paradigms is limited. In light of the potential for understanding variability in responsivity to heightened positive and negative mood, the following section will report on research regarding individual trait characteristics (i.e. reward sensitivity and tolerance of negative affect) and differential drinking motives, as they relate to alcohol-related
cognitions and drinking behaviour.

1.7. Individual Trait Characteristics and Drinking Motives: Associations with Alcohol-Related Cognitions in Social Drinkers

1.7.1 Trait Reward Sensitivity

Gray’s Reinforcement Sensitivity Theory (RST; 1970, 1987) is a prominent theory of personality, which suggests that some individuals possess heightened sensitivity to rewarding stimuli in the environment. Moreover, individuals with heightened reward sensitivity are more likely to respond to conditioned reward cues (e.g. alcohol stimuli) with positive affect and approach behaviour towards the potentially rewarding object. As such, Gray’s RST (1970; 1987) indicates that alcohol users with heightened sensitivity to reward may be predisposed to engaging in appetitive motivational behaviours, such as attending to alcohol-related cues or experiencing craving for alcohol. Moreover, given that positive mood is ostensibly intertwined in this process, it is reasonable to suggest that heightened positive mood may potentially enhance alcohol attentional bias or craving for alcohol in reward sensitive individuals. That is, the affect-response combination that follow exposure to reward cues may become internalized so that increases in positive mood triggers appetitive motivational behaviours (i.e. alcohol attentional bias and craving for alcohol) in reward sensitive individuals. The existing literature indicates that reward sensitivity has well-established connections with alcohol use, with a collection of studies demonstrating that reward sensitivity is consistently associated with alcohol consumption (Booth & Hasking, 2009; Gullo, Dawe, Kambouropoulos, Staiger & Jackson, 2010; Gullo, Jackson & Dawe, 2010; Ivory & Kambouropoulos, 2012; Kabbani &
Kambouropoulos, 2013; Loxton & Dawe, 2001; Morgan, Bowen, Moore, & van Goozen, 2014; Lyvers, Czerzyk, Follent, & Lodge 2009; O’Connor & Colder, 2005; Tapper, Baker, Jiga-Boy, Haddock & Maio, 2015). Moreover, three studies have demonstrated that reward sensitive individuals report increased craving for alcohol following exposure to alcohol-related cues (Franken, 2002; Kambouropoulos & Staiger, 2001; 2004. Firstly, a study conducted by Kambouropoulos and Staiger (2001) demonstrated that heightened sensitivity to reward was positively associated with cue-elicited urge to drink and positive affect in heavy drinkers. Extending on this finding, Kambouropoulos and Staiger (2004) found that heightened reward sensitivity was positively associated with urge to drink for positive reinforcement in social drinkers, following exposure to an alcohol cue. Similarly, Franken (2002) demonstrated that individuals with heightened sensitivity to reward reported increased craving for alcohol and greater intention to drink following exposure to alcohol-related cues. Whilst these three studies indicate that reward sensitivity is associated with craving for alcohol, it is not yet currently known whether this relationship is exacerbated in the context of increased positive mood.

Previous research regarding reward sensitivity and alcohol attentional bias is limited, with only one study examining the association between these variables in adolescent alcohol users (van Helmer-Ruiter et al., 2015). To this end, van Hemel-Ruiter and colleagues (2015) recently found that heightened reward sensitivity was not significantly associated with attentional bias towards alcohol related stimuli in adolescent drinkers. However, given the young age of the participants included in van Hemel-Ruiter’s (2015) study (mean age= 14.86),
these findings are limited in their generalizability to adult alcohol users. Additionally, it is not yet known how heightened positive mood may influence the association between reward sensitivity and attentional bias towards alcohol stimuli. Therefore, the present dissertation will make a valuable contribution to the existing literature by examining whether trait reward sensitivity is positively associated with attentional bias towards alcohol stimuli and craving for alcohol in the context of heightened positive mood (via mood induction). Extending on this, the present dissertation will also examine whether the association between reward sensitivity and alcohol-related cognitions is strongest in those who report higher levels of positive mood following the positive mood induction.

1.7.2. Tolerance of Negative Affect and Alcohol Use

Negative reinforcement models of alcohol use (Baker et al., 2004) indicate that the motivational basis for engaging in alcohol use and associated alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol), may be to reduce or avoid negative emotions. To this end, the consistent use of alcohol to reduce or avoid negative affect is suggested to indicate difficulty in tolerating negative emotions (Simons & Gaher, 2005). As such, the capacity to tolerate negative emotions, rather than the experience of negative affect per se, may influence whether an individual attends to alcohol-related cues or experiences craving for alcohol in the context of heightened negative mood. Researchers have utilized a measure of distress tolerance to assess an individual’s ability to experience and tolerate negative emotions (Simons & Gaher, 2005). It is suggested that individuals with low distress tolerance, may be especially attracted
to engaging in emotion-focused coping strategies, such as alcohol use, which are likely to result in immediate attenuation of negative emotions, rather than withstanding negative affect (Kiselica, Rojas, Bornovalova, & Dube, 2015; Simons & Gafer, 2005). Consistent with this assertion, several studies have demonstrated that low distress tolerance is associated with greater alcohol-related problems in young adult social drinkers (Buckner, Keough & Schmidt, 2007; Dennhardt & Murphy, 2011; Simons & Gafer, 2005). Moreover, distress tolerance has been found to both mediate (Buckner et al., 2007) and moderate (Gorka, Ali & Daughters, 2012) the relationship between depression and alcohol use. That is, depressed individuals who also report low tolerance of negative affect (i.e. distress tolerance) are more likely to engage in alcohol use. Taken together, these previous studies indicate that individual differences in tolerance of negative affect may increase vulnerability to alcohol misuse. As the focus of the current study is on alcohol-related cognitive processes in social drinkers, examining whether low tolerance of negative affect is associated with greater alcohol attentional bias and craving in the context of heightened negative mood, provides a unique contribution to the literature. Additionally, the present dissertation will examine whether the association between tolerance of negative affect and alcohol-related cognitions is greatest in social drinkers who report higher levels of negative mood following negative mood induction.

1.7.3. Drinking Motives

Motivational models assert that differential drinking motives are the most proximal antecedent of alcohol use, and represent a subjectively derived decisional framework based on the perceived affective rewards of consuming
alcohol (Cox & Klinger, 1988). To this end, Cooper (1994) developed a motivational model of alcohol use that identifies differential motivations for consuming alcohol across two primary domains: type of reinforcement (positive or negative) and source of desired effect (internal or external). According to this model, internal drinking motives, including *enhancement motives* (positively reinforced, drinking to enhance positive emotions), and *coping motives* (negatively reinforced, drinking to avoid/reduce negative emotions) for alcohol use, are directly associated with affect regulation. On the other hand, external drinking motives, including *social motives* (positively reinforced, drinking to socialise with friends) and *conformity motives* (negatively reinforced, drinking to fit in with a group) for alcohol use, are indirectly related to affect regulation through other incentives (i.e. pursuit of enhanced positive affect through social affiliation, or avoidance of negative emotions associated with social exclusion). It is proposed that the affect-response combinations that characterise positive and negative reinforcement systems are strengthened through repeated pairings and become internalised cues that activate alcohol-seeking behaviours (Baker et al., 1986). Moreover, recent research indicates that inhibiting emotional states associated with an individual’s motivational disposition for drinking may result in the devaluation of alcohol (Ralston, Palfai & Rinck, 2013). To this end, it is suggested that the strength of positive and negative motivational systems in any given individual, becomes an important source of variability that determines how one responds to alcohol-related cues in the context of heightened positive and negative emotions (Ralston et al., 2013). Therefore, it is reasonable to assert that individuals who more strongly endorse positive or negative motivational systems
are more likely to experience alcohol-related cognitions, in the context of corresponding mood states.

As previously discussed, two existing studies have demonstrated that individuals who report drinking alcohol to enhance positive mood display greater attentional bias towards alcohol stimuli following musically induced positive mood, relative to anxious mood induction (Grant et al., 2007; Birch et al., 2008). Similarly, Grant et al. (2007) demonstrated that individuals who report drinking to cope with negative affect (i.e. anxiety) display greater attentional bias towards alcohol-related cues following musically induced negative mood, relative to positive mood induction. In comparatively similar studies, Field and Powell (2007) and Field and Quigley (2009) subdivided participants into those with high and low coping motives for drinking, and found that only those who endorsed high levels of coping motives produced significant attentional bias towards alcohol stimuli in response to a laboratory stressor task. Collectively, these existing findings indicate that positively and negatively reinforced drinking motives (i.e. enhancement and coping motives, respectively) increase alcohol attentional bias in the context of corresponding heightened positive and negative mood. However, there is variation in the existing literature, as Birch and colleagues (2008) found that coping-motivated drinkers did not display enhanced attentional processing of alcohol cues following negative mood induction. Moreover, a recent study conducted by Emery & Simons (2015) found that enhancement and coping drinking motives did not significantly moderate associations between positive and negative mood states and alcohol attentional bias. Thus, there is some discrepancy within current literature regarding the
influence of enhancement and coping motives on alcohol attentional bias in the context of heightened positive and negative mood, which warrants further investigation. Additionally, previous studies investigating drinking motives and alcohol attentional bias have examined the association between these variables using samples of undergraduate university students exclusively (Emery & Simons, 2015; Birch et al., 2008; Field & Powell, 2007; Grant et al., 2007). As such, study findings may potentially be influenced by extraneous factors that are circumscribed to university students. Therefore, it is unclear whether findings of previous studies would generalize to other cohorts of alcohol users, such as older adult social drinkers.

As existing studies have been limited to the examination of internal drinking motives exclusively, it is not yet known how external drinking motives influence alcohol attentional bias in social drinkers. External drinking motives including drinking to socialise with others (social motives) and drinking to fit in with a group (conformity motives) are proposed to be indirectly associated with affect regulation. Individuals who endorse these drinking motives may have a tendency towards consuming alcohol for positive or negative reinforcing effects. As such, social and conformity motives for alcohol use may be associated with greater attentional bias towards alcohol stimuli in the context of heightened positive and negative mood, respectively. Moreover, as external drinking motives are socially orientated, these motives may be particularly relevant to social drinkers. Given the implications for understanding social drinking, examining the association between external drinking motives and attentional bias in the context of enhanced positive and negative mood induction is warranted.
Only two experimental studies have investigated the influence of drinking motives on craving for alcohol in the context of heightened negative mood in social drinkers. Field and Powell (2007) found that heightened stress (via a laboratory stress task) significantly enhanced craving for alcohol, irrespective of whether participants reported high or low levels of coping motives for alcohol use. More recently, Bailey and Baillie (2013) found that individuals who identify with coping motives for alcohol use did not experience increased craving for alcohol following negative mood induction. However, Bailey and Baillie (2013) administered a placebo alcohol prior to the mood induction, which did not effectively assist in reducing negative affect. As such, participants’ may not have desired a further drink to cope with negative affect in this instance. Once again, these previous studies (Bailey & Baillie, 2013; Field & Powell, 2007) included samples of undergraduate university students exclusively and thus, it is unclear whether results would generalise to older adult social drinkers. To date, there are no known studies that have examined the influence of drinking motives on craving for alcohol in the context of heightened positive mood. Therefore, due to the limited number of experimental studies, it is not clear whether differential drinking motives account for variability in craving for alcohol in response to heightened positive and negative mood in social drinkers. The present study will make a significant contribution to existing literature by examining whether internal and external drinking motives are positively associated with alcohol attentional bias and craving for alcohol in the context of heightened positive and negative mood in social drinkers. Additionally, the present dissertation will examine whether the association between drinking motives and alcohol-related cognitions (i.e. attentional bias and craving) is strongest in those who report
higher levels of positive and negative mood following mood induction.

1.8. Summary

Theoretical models propose that repeated alcohol use produces changes to the dopaminergic reward system of the brain, which enhances the incentive salience of alcohol-related cues, resulting in attention towards alcohol stimuli at the expense of other stimuli in the environment (Robinson & Berridge, 1993; 2001). This attentional bias towards alcohol-related stimuli is considered to reflect implicit cognitive processes associated with alcohol use. Similarly, craving for alcohol is considered to be an explicit cognitive correlate of alcohol use, and represents subjective desirability to consume alcohol at a given moment. These alcohol-related cognitions are deemed to be proximal precursors to alcohol use and hence can be readily examined with clear implications for understanding drinking behaviour. To this end, the clinical relevance of alcohol attentional bias and craving for alcohol is highlighted by studies demonstrating that these alcohol-related cognitions are associated with problematic alcohol use (Bruce & Jones, 2004; Cox et al., 2000; Chakravorty et al., 2010; Cox et al., 1999; 2003; Day et al., 2014; Field et al., 2004; Johnsen et al., 1994; Jones et al., 2006; Lusher et al., 2004; MacKillop et al., 2010; Stetter et al., 1995; Townshend & Duka, 2001; Sharma et al., 2001) and relapse following treatment (Cox et al., 2002; Garland, 2011; Ramo & Brown, 2008; Zywiak et al., 1996). Interestingly, these implicit and explicit cognitive processes are not exclusive to problematic alcohol use, as previous research indicates that social drinkers also experience alcohol attentional bias and craving for alcohol (for review, see Field et al., 2009). Given that social drinking is likely to precede problematic alcohol use, examining attentional bias
and craving for alcohol in social drinkers provides clinically relevant information regarding cognitive factors that may contribute to the development and maintenance of alcohol misuse.

Of further interest to this dissertation are the theoretical propositions (Franken, 2003; Kavanagh, 2005; Ryan, 2002) and empirical research suggesting that a reciprocal relationship exists between alcohol attentional bias and craving for alcohol in both dependent and social drinkers (for review, see Field et al., 2009). Importantly, the association between these alcohol-related cognitions appears to be enhanced by changes in mood state (i.e. via stress induction) in social drinkers (Field & Powell, 2007). This finding is consistent with positive and negative reinforcement models of alcohol use, which assert that individuals are motivated to consume alcohol in order to enhance positive affect or to reduce or avoid negative affect (Baker et al., 2004; Cooper, 1995). Experimental mood induction studies have enabled researchers to examine in vivo the influence of positive and negative mood states on alcohol-related cognitions in settings that are analogous to real world experiences. To this end, numerous mood induction studies have demonstrated that negative mood induction increases craving in alcohol dependent individuals (Coffey et al., 2002; Coffey et al., 2010; Coffey et al., 2006; Cooney et al., 1997; Field & Powell, 2007; Kwako et al., 2015; Litt et al., 1990; Rubonis et al., 1994; Saladin et al., 2003, Stasiewicz et al., 1997). However, only two experimental studies have examined the influence of heightened negative mood (via mood induction) on craving for alcohol in social drinkers (Bailey & Baillie, 2013; Field & Powell, 2007), with inconsistent findings. Moreover, there are currently no known existing studies that have
examined the influence of heightened positive mood on craving for alcohol in social drinkers within a mood induction paradigm. Other previous studies examining the influence of positive mood on craving for alcohol have produced inconsistent findings (Kabbani et al., 2014; Mason et al., 2008; Schlauch et al., 2013), indicating that the association between positive mood and craving for alcohol remains unclear. With regards to alcohol attentional bias, previous experimental mood induction studies demonstrate that increases in positive affect or negative affect may enhance attentional bias towards alcohol related stimuli (Birch et al., 2008; Grant et al., 2007; Field & Powell, 2007; Field & Quigley, 2009). However, inconsistency within the existing literature (Birch et al., 2008; Emery & Simons, 2015) indicates that further examination regarding the influence of positive and negative mood states on alcohol attentional bias in social drinkers is warranted. Therefore, one aspect of the present dissertation will examine whether heightened positive and negative mood (via mood induction) enhances alcohol attentional bias and craving for alcohol in social drinkers.

Finally, previous mood induction studies indicate that individuals vary in their responsivity to increases in positive and negative affect. That is, not all individuals respond to heightened positive and negative mood with enhanced craving for alcohol and/or greater attention directed towards alcohol stimuli. Surprisingly, very few studies have examined whether certain factors associated with the individual may account for the variability observed in response to positive and negative affect in mood induction paradigms. Therefore, the present dissertation will make an important and unique contribution to the existing literature by investigating whether certain trait characteristics (i.e. reward
sensitivity and tolerance of negative affect) and drinking motives account for variability in alcohol attentional bias and craving for alcohol in response to positive and negative mood induction in social drinkers.

1.9. Proposed Study

The primary aim of the current dissertation is to examine the role of positive and negative mood on alcohol-related cognitions in social drinkers, and whether certain theoretically derived factors associated with the individual account for variability in responsivity to heightened positive and negative affect. To this end, the present dissertation aims to measure alcohol attentional bias and craving for alcohol amongst social drinkers along two key lines of investigation: (1) examining associations with influential factors consistent with positive reinforcement of alcohol-related cognitions, and (2) examining associations with influential factors consistent with negative reinforcement of alcohol-related cognitions. To address limitations within the current literature, the present dissertation will firstly investigate whether alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive or negative mood (via mood induction) in social drinkers. Next, the present dissertation will examine whether positive and negative mood inductions are associated with enhanced alcohol attentional bias and craving for alcohol, relative to baseline measures. Furthermore, the present dissertation will investigate whether positively reinforced drinking motives (i.e. social and enhancement motives) and trait reward sensitivity are positively associated with alcohol attentional bias and craving for alcohol in the context of heightened positive mood, relative to
negative mood and baseline measures. Additionally, the present dissertation will examine whether associations between these positively reinforced individual difference factors (reward sensitivity, social motives, enhancement motives) and alcohol-related cognitions are strongest in those who report higher levels of positive mood following positive mood induction. Moreover, the present dissertation will examine whether negatively reinforced drinking motives (i.e. coping and conformity motives) are positively associated with alcohol attentional bias and craving for alcohol in the context of heightened negative mood, relative to positive mood and baseline measures. Additionally, it will also be investigated whether tolerance of negative affect is negatively associated with alcohol attentional bias and craving for alcohol in the context of heightened negative affect, relative to positive mood and baseline measures. Finally, the present dissertation will examine whether the association between these negatively reinforced individual difference factors (tolerance of negative affect, coping motives, conformity motives) and alcohol-related cognitions are strongest in those who report higher levels of negative mood following negative mood induction. In order to test these associations a large experimental study design is adopted utilising state of the art measurement of attentional bias (eye tracking methodology) and standardised measures of craving. Mood induction procedures are used to elicit positive and negative mood states. For ease of presentation, the findings will be presented in four distinct sections that examine specific objectives of the present dissertation:
1. The first section (chapter two) presents the methodological considerations associated with alcohol attentional bias, subjective craving and mood induction procedures. This section clearly articulates the rationale behind the choices of the measurement of the alcohol-related cognitions and the mood induction procedures selected.

2. The second section (chapter three) reports on the findings related to tests of whether alcohol attentional bias and craving for alcohol are positively associated in the context of heightened positive and negative mood in social drinkers.

3. Section three (chapter four) reports on tests of (a) whether positive mood induction significantly enhances alcohol attentional bias and craving for alcohol in adult social drinkers, (b) whether positively reinforced drinking motives (i.e. enhancement and social motives) and heightened trait reward sensitivity, are positively associated with attentional bias towards alcohol stimuli and craving for alcohol in the context of heightened positive mood, and (c) whether the association between individual difference factors (i.e. drinking motives and reward sensitivity) and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) is strongest in those who report higher levels of positive mood following the positive mood induction.

4. Section four (chapter five) reports on tests of whether (a) negative mood induction significantly enhances alcohol attentional bias and craving for
alcohol in social drinkers, (b) whether negatively reinforced drinking motives (i.e. coping and conformity motives) are positively associated with alcohol attentional bias and craving for alcohol in the context of heightened negative mood, (c) whether tolerance of negative affect is negatively associated with alcohol-related cognitions in the context of heightened negative mood, and (d) whether the association between individual difference factors (i.e. drinking motives and tolerance of negative affect) and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) is strongest in those who report higher levels of negative mood following negative mood induction.
Chapter 2

METHODOLOGICAL ISSUES AND STUDY METHOD

The purpose of this chapter is to present the methodological considerations associated with examining attentional bias towards alcohol stimuli, subjective craving for alcohol, and experimental manipulation of positive and negative mood states. This chapter clearly articulates the rationale behind the choices of measurement of the alcohol-related cognitions, cravings assessment and mood induction procedures selected in the present dissertation.

2.1. Measurement of Attentional Bias and Subcomponents of Attention

2.1.1. Indirect Measures of Attention

Attentional bias towards alcohol stimuli has been studied using both direct and indirect measures of attention. Indirect measures of attentional bias are the most frequently used and include the modified addiction Stroop task and the visual probe task. The addiction Stroop task consists of two sets of words (e.g. alcohol-related and neutral) that are matched on variables such as word length, number of syllables and frequency of occurrence in the language (Cox, Fadardi & Pothos, 2006). On each trial of the task, participants are presented with a word of coloured font and are instructed to name the colour of the word as quickly and accurately as possible, while attempting to ignore the semantic content of the word. Attentional bias is conceptualised as the difference between the mean colour-naming reaction time on trials with alcohol-related words, relative to neutral words. Slower colour naming of alcohol-related words are assumed to
indicate involuntary automatic processing of the semantic content of the word. A review of alcohol-related Stroop studies indicates that heavier drinkers are generally slower to name the colour of alcohol-related words, compared to light and social drinkers (for review, see Cox et al., 2006). The visual probe task (Ehrman, Robbins, Bromwell, Lankford, Monterosso, & O’Brien, 2002) involves alcohol-related stimuli (picture or word) presented alongside matched neutral stimuli on a computer screen for a short period of time. The stimuli is then removed from the display and immediately replaced by a visual probe that appears on either the left or the right of the screen, in the location of one of the stimuli. Participants are instructed to respond to the probe as rapidly as possible and reaction times to the probe that replace alcohol-related stimuli are compared with those that replace neutral stimuli. Attentional bias for alcohol-related cues is inferred if participants are consistently faster to respond to probes that replace alcohol-related stimuli, compared to neutral stimuli. This is due to the fact that individuals generally respond faster to probes that appear in regions of visual display to which they are attending, relative to regions that they are not attending to (Posner, Snyder & Davidson, 1980). Research using the visual probe task has indicated that heavy drinkers display attentional bias for alcohol related cues, whilst light drinkers show no attentional bias for the alcohol stimuli (e.g. Noel et al., 2006). Whilst the addiction Stroop and visual probe tasks are widely used in alcohol attentional bias research, both tasks rely on the measurements of manual reaction time to draw inferences regarding attentional allocation. As such, these indirect measures may be somewhat limited in their capacity to accurately measure attentional processes. For example, some researchers (e.g. De Ruiter & Brosschot, 1994) have argued that colour-naming latencies in the addiction Stroop
task may arise from attempts to ignore emotionally salient words, rather than attention being directed towards them. Additionally, slower colour-naming latencies may also reflect a non-specific freeze response to stimuli that are perceived as threatening (Algom, Chajut, & Lev, 2004; Greenaway, Mogg, & Bradley, 2012). Furthermore, it is suggested that colour-naming latencies may reflect individual differences in inhibitory control (Crunelle, Veltman, Booij, van Emmerik-van Oortmerssen, & van den Brink, 2012). Indirect measures provide only a crude indicator of attention and are expected to yield an overall smaller correlation between attentional bias and other measured constructs (see Field et al., 2009). Finally, previous research suggests that both the Stroop task and visual probe task are characterized by low internal reliability (Ataya, Adams, Mullings, Cooper, Attwood, & Munafò, 2012). As such, existing literature regarding attentional bias towards alcohol stimuli may be compromised by the use of indirect measures of attention, including the addiction Stroop and visual probe tasks.

2.1.2. Allocated Time for Stimulus Presentation

Another important consideration when examining attentional bias for alcohol stimuli is the amount of time allocated for stimulus presentation. Studies have varied in the duration of stimulus presentation and have obtained different findings depending on whether the stimulus was presented for a relatively short (e.g. less than 200ms) or relatively long (500-2000ms) period of time (Field & Cox, 2008). For example, heavy drinkers have been found to display greater attentional bias towards alcohol-related cues compared to light social drinkers, when the stimuli were presented for 500ms or 2000ms, but not when the pictures...
were presented for 200ms (Field et al., 2004). Conversely, abstinent alcohol
dependent individuals demonstrate greater attentional bias for alcohol-related
pictures relative to social drinkers, when the stimuli were presented for 50ms, but
not when the stimuli were presented for 500ms (Noel et al., 2006). To this end,
the addiction literature indicates that a stimulus duration time of between 50ms
and 200ms is generally used to detect biases in initial orientation towards stimuli
when using indirect measures of attentional bias, such as the addiction Stroop or
visual probe tasks. The rationale for using these parameters is based on basic
perceptual research suggesting that when a simple visual cue is presented,
individuals typically require approximately 50ms to shift their attention towards
the cue (Duncan, Ward & Shapiro, 1994). Furthermore, individuals generally
require at least 150ms to disengage their attention away from the cue and redirect
it towards another one presented in a different spatial location (Theeuwes, 2005).
Taken together, these findings suggest that when complex visual stimuli are
presented together for less than 200ms, observed attentional bias reflects initial
orientation of attention towards the stimulus, because a second shift of attention is
not possible within 200ms. According to this logic, stimulus presentation longer
than 200ms is sufficient to allow multiple shifts in attention between the different
stimuli. In light of this assertion, researchers have generally utilised a stimulus
presentation time of greater than 500ms to infer maintenance or delayed
disengagement of attention (Field et al., 2009). Given the variability in findings
involving different stimulus presentation times, distinguishing between
subcomponents of attention (i.e. initial orientation and maintenance of attention)
provides important information regarding cognitive processes associated with
alcohol misuse. To this end, different cognitive mechanisms are thought to
underlie the initial shifting of attention towards stimuli and the subsequent maintenance or disengagement of attention (Allport, 1989). Moreover, it has been suggested that maintenance of attention, rather than initial orientation towards stimuli, is more likely to be influenced by motivational variables (LaBerge 1995). However, indirect measures of attention including the addiction Stroop and visual probe tasks are limited in their assessment of subcomponents of attention, as these measures can only provide inferences of biases in initial orientation and maintenance of attention, based on variation in stimulus presentation times.

2.1.3. Direct Monitoring of Eye Movements

The direct monitoring of one’s eye movements via eye-tracking equipment is a superior method for examining attentional bias towards alcohol stimuli. Contemporary eye-tracking equipment is non-intrusive and includes infrared reflectance cameras that measure corneal reflections of emitted infrared light (Blondon, Wipfli, & Lovis, 2015). Eye-tracking equipment provides quantitative measures of gaze behaviour during task execution, allowing researchers to gather information regarding attentional allocation over time. Recorded eye movements include fixations (when the eye stops and focuses) and saccades (when the eye moves between fixation points). Eye-tracking technology records a number of metrics, including: fixation count (number of fixations), fixation duration (length of fixations in milliseconds), total fixation duration (fixation count times fixation duration), and time to first fixation (in milliseconds). As such, monitoring one’s eye movements (via eye-tracking equipment) enables researches to directly examine differential subcomponents of attention, including biases in initial orientation (latency to first fixation) and maintenance of attention (total fixation duration).
duration) towards alcohol stimuli. Moreover, it has been recommended that researchers use direct measures (i.e. eye movement monitoring), to examine attentional bias, as this approach appears to be more sensitive than other indirect measures (see Field et al., 2009). Therefore, in order establish an accurate measure of attentional bias towards alcohol stimuli, it is imperative that further investigation is conducted using direct measures of attention. As such, the present dissertation will use eye-tracking equipment to directly examine attentional bias towards alcohol stimuli, including biases in initial orientation and maintenance of attention towards alcohol stimuli.

2.1.4. The Influence of Mood State on Subcomponents of Attention

Of further interest to the present dissertation is the influence of positive and negative mood on attentional bias towards alcohol stimuli in social drinkers. Previous experimental studies have generally focussed on the influence of positive and/or negative mood on biases in maintenance of attention exclusively (Birch et al., 2008; Emery & Simons, 2005; Field & Powell, 2007; Grant et al., 2007). Only one existing study has examined the influence of mood state on biases in both initial orientation and maintenance of attention in social drinkers (Field & Quigley, 2009). To this end, Field and Quigley (2009) used a visual probe task (indirect measure of attention) to demonstrate that increases in stress (via laboratory stress induction) resulted in greater biases in initial orientation (stimuli presented for 100ms) and maintenance of attention (stimuli presented for 500ms) towards alcohol stimuli in social drinkers. However, Field and Quigley’s (2009) study used indirect measures of attention (i.e. visual probe task) to
examine attention, which only enable researchers to infer biases in initial orientation and maintenance of attention based on stimulus presentation time. On the other hand, the direct monitoring of one’s eye movements enables accurate assessment of initial orientation and maintenance of attention towards alcohol stimuli, and is a superior method for examining differential subcomponents of attention (Field et al., 2009). Therefore, previous research examining the influence of positive and negative mood on biases in initial orientation and maintenance of attention is extremely limited and warrants further investigation.

2.1.5. Solutions

The existing research indicates that the direct measurement of attention via eye movement monitoring is a superior method for examining biases in initial orientation and maintenance of attention towards alcohol stimuli. Very few existing studies have used direct measures to examine differential subcomponents of attention, likely due to the high cost of eye-tracking equipment and other direct measures of attention. As such, a substantial proportion of the attentional bias literature includes studies that have utilised indirect measures of attention, such as the addiction Stroop and visual probe tasks, to examine biases in maintenance of attention exclusively, without consideration of biases in initial orientation. As discussed previously, the examination of both subcomponents of attention provides valuable information regarding different cognitive processes involved in drinking behaviour. Therefore, current understanding of attentional bias towards alcohol stimuli has been somewhat impeded by a relatively narrow investigation of attentional processes. To address this issue, the present dissertation used eye-
tracking equipment to directly monitor eye movements in order to examine biases in both initial orientation and maintenance of attention towards alcohol-related stimuli. Initial orientation biases were measured by examining latency in gaze towards alcohol stimuli relative to neutral stimuli, whilst biases in maintenance in attention were measured by assessing total fixation time towards alcohol stimuli, relative to neutral stimuli. In line with previous research (see Field et al., 2009), stimuli were presented for a total of 2000 milliseconds to enable sufficient examination of biases in both subcomponents of attention. Collectively, the measurement considerations regarding alcohol attentional bias in the present dissertation enable an accurate and thorough evaluation of biases in initial orientation and maintenance of attention towards alcohol stimuli.

2.2. Measurement of Subjective Craving for Alcohol

Subjective craving is frequently measured with self-report measures that aim to capture the momentary motivational state of the individual by rating the strength of their current craving, or level of endorsement of items that reflect craving. To this end, a number of multi-item questionnaires have been developed that assess subjective craving for alcohol (Bohn, Krahn & Staehler, 1995; Drobes & Thomas, 1999; Love, James & Willner, 1998; Singleton, Tiffany & Henningfield, 1994). However, several methodological issues have been identified in relation to use of multi-item measures of subjective craving. For example, it is proposed that responding to multiple questions regarding craving may lead to rumination, which could increase the strength of reported craving (Sayette, Shiffman, Tiffany, Niaura, Martin, & Shadel, 2000). Moreover, in an
attempt to appear consistent, individuals may deliberately respond in a similar way to all questionnaire items, or use responses to initial items to guide subsequent responses, which may contribute to the apparent high reliability of multi-item scales (Sayette et al., 2000). Given the limitations associated with multi-item questionnaires, other available measures may be preferential to assess subjective craving for alcohol. To this end, another prevalent method for assessing subjective craving is the use of single-item visual analogue scales (VAS) that include items such as “I am craving alcohol right now,” “I have an urge to drink alcohol right now,” or “I have a desire to drink alcohol right now” (Field et al., 2009). However, a number of limitations have also been identified in relation to single-item measures of craving. For example, it is proposed that single-item ratings may lack the breadth required to capture the various semantic dimensions used by people to describe craving (Tiffany & Drobes, 1991). Additionally, it is suggested that the choice of terminology used in single-item scales (e.g. “craving” vs. “urge” or “desire”) may be interpreted as having differential meanings for individuals (Sayette et al., 2000). Interestingly, studies indicate that combined scores on multi-item questionnaires tend to correlate highly with single-item VAS measures of craving (e.g., Rosenberg & Mazzola, 2007; Sussner, Smelson, Rodrigues, Kline, Losonczy, & Ziedonis, 2006), indicating that both methods are likely to measure the same construct. Therefore, selecting the most appropriate measure of subjective craving will largely be determined by study design (Sayette et al., 2000). Given that the present dissertation used a within-subject study design including measures of cue-elicited craving for alcohol (via mood induction and presentation of alcohol stimuli) over multiple occasions, a single-item VAS scale was utilised to measure subjective craving for alcohol in the present dissertation.
2.3. Mood Induction Procedures

Experimental studies involving mood induction procedures enable researchers to examine “in vivo” the influence of positive and negative mood states on alcohol-related cognitions. A variety of techniques have been developed to experimentally induce positive and negative mood states, with significant disparity in the types of mood induction procedures used to manipulate emotional experiences. For example, positive and negative mood has been experimentally induced using methods such as autobiographical recall, imagination, real-life manipulations, film-clips, music, and picture presentations. Several reviews have been conducted on positive and negative mood induction procedures and have generally concluded that most available techniques are effective in eliciting positive and negative mood states (Gerrards-Hesse, Spies, & Hesse, 1994; Lench, Flores & Bench et al., 2011; Westermann, Spies, Stahl, & Hesse, 1996). The most recent meta-analytic review conducted by Lench and colleagues (2011), examined the efficacy of a wide range of mood induction procedures, and found that the presenting participants with pictures is the most effective technique for eliciting emotions. Moreover, Lench et al. (2011) demonstrated that presenting pictures is the most effective mood induction procedure for studies that specifically examine happy and sad mood states. According to Lench and colleagues (2011), the presentation of pictures is an advantageous mood induction procedure as pictures are intuitively powerful, easily accessible and the procedure for viewing pictures can be standardized across participants. Existing studies examining the influence of mood state on alcohol craving have largely included autobiographical recall (e.g. via personalised trauma scripts and negative emotional experiences) to experimentally induce negative mood amongst participants (Coffey et al., 2010;
Coffey et al., 2006; Coffey et al., 2002; Cooney et al., 1997; Saladin et al., 2003). Whilst, Lench and colleagues’ (2011) meta-analytic review indicates that autobiographical recall is an effective mood induction procedure, there was no evidence that recall of autobiographical events is more effective than mood induction procedures that did not involve personal experience. Moreover, a potential disadvantage of this method is that participants must be willing to engage in the recollection of past events, and the emotional reactions elicited by autobiographical recall may not be equivalent to previous emotional experiences (Lench et al., 2011). According to Lench and colleagues (2011), another effective method for eliciting positive and negative mood states is via music induction procedures. To this end, existing studies examining the influence of mood state on alcohol attentional bias have successfully used music elicitations to induce positive and negative mood states (Birch et al., 2008; Grant et al., 2007). Moreover, Emery and Simons (2015) recently examined the influence of mood states on alcohol attentional bias and found that combining picture slides with non-verbal mood congruent music was effective in eliciting positive and negative mood states. Similarly, other studies examining mood state and alcohol-related cognitive processes (e.g. alcohol expectancy) have found that simultaneously presenting pictures and mood congruent music effectively stimulates positive and negative mood states (Bailey & Baillie, 2013; Treloar & McCarthy, 2012; Wardell, Read, Curtin & Merrill 2012). Therefore, previous studies indicate that combining music and picture presentations is a successful technique for inducing positive and negative mood states in alcohol users (Emery & Simons, 2015; Treloar & McCarthy, 2012; Wardell et al., 2012). To this end, the present
dissertation combined picture presentations and mood congruent non-verbal music to experimentally induce positive and negative mood states.

METHOD

Study Design

A within-subject experimental study design was implemented, including mood induction procedures and eye tracking technology. The primary dependent variables (DVs) were attentional bias towards alcohol stimuli (measures by initial orientation and maintenance of attention) and subjective craving for alcohol (self-report measure). The DVs were measured at baseline (i.e. prior to mood induction) and following experimental manipulation of positive mood and negative mood. Participants were randomly allocated to one of two groups to counterbalance the order of positive and negative mood inductions. The independent variables examined included drinking motives (social, enhancement, coping, conformity), sensitivity to reward and tolerance of negative affect. Moderating variables included reported level of positive mood and negative mood following mood induction procedures.

Participants

A sample of 101 volunteers (35 male, 66 female) was recruited for the present study via a snowballing method involving personal contact and word of mouth. Participants were largely born in Australia (89.1%) and ranging in age from 19 to 80 years of age (mean= 35.3 years, SD= 17.11). Individuals were
excluded from the study if they were below 18 years of age, or self-reported insufficient eyesight to complete computer-based tasks. In relation to educational background, 18.8% had completed some secondary schooling, 26.7% had completed year 12 level of education, 24.8% had completed vocational education and training, 28.7% had completed a university degree (20.8% undergraduate, 7.9% postgraduate). Forty four per cent of participants reported scores below 8 on the Alcohol Use Disorders Identification Test (AUDIT), and 11% reported scores above 15 on the AUDIT. Seven per cent of participants were not current drinkers at the time of the study. On average, participants reported that they first consumed alcohol at approximately 16 years of age and engaged in regular alcohol use from approximately 20 years of age. Individuals were not excluded from the study if they reported to be current non-drinkers, as long as they consumed alcohol in the last 12 months. Participants received a $10 voucher as remuneration for their time.

**Materials and Apparatus**

*Demographics Questionnaire.* This is an author complied questionnaire that assesses participant demographic characteristics as well as information pertaining to recent use of alcohol, nicotine and caffeine prior to study participation.

*Alcohol Use Disorders Identification Test (AUDIT).* The AUDIT is a 10-item self-report instrument developed by the World Health Organisation (WHO) to identify harmful and hazardous drinking (Babor, Higgins-Biddle, Saunders, & Monterio, 2001). The AUDIT evaluates alcohol use over the past year and
includes questions related to alcohol consumption, drinking behaviour and consequences or problems related to drinking. Each item on the AUDIT is scored from 0-4, with an overall score ranging from 0-40. The suggested cut-offs are 1–7 for low risk drinking, 8–15 suggesting hazardous drinking, 16–19 suggesting harmful drinking and scores of 20 or more indicating alcohol dependence (Babor et al, 2001). The AUDIT has demonstrated high reliability and validity (Reinert & Allen, 2007).

**Visual Analog Scales (VAS).** Self-report VAS’s were used to measure level of subjective craving for alcohol. Participants’ were asked the question “how strong is your desire to drink alcohol right now?” The scale anchors “not at all” and “very” were connected by 100mm horizontal lines. Participants were instructed to indicate the point of the line which best reflected their current level of craving. Each item was scored as the distance in millimeters from the *not at all* anchor. Higher scores reflected greater level of subjective craving for alcohol.

Self-report VAS’s were also used to measure positive (e.g. cheerful, happy, glad, pleased) and negative (e.g. sad, depressed, blue, tense, distressed, gloomy) mood. The current VAS questions assessing mood state were a combination of those used in previous studies by Grant et al., (2007), Birch et al., (2008) and Kabbani et al, (2014). Participants were instructed to indicate the point of the 100mm horizontal line (anchored by “not at all and “very”) which best reflected their current mood state. Each item was scored as the distance in millimetres from the *not at all* anchor. Computing the average of the relevant item scores for each mood state derived positive and negative mood scores.
Mood Induction Procedure. A mood induction procedure was used to elicit heightened positive and negative mood amongst participants. During the positive mood induction, participants were asked to watch a four-minute video-clip comprised of non-lyrical music and a series of images, designed to provoke positive affect. The stimuli included in the positive mood induction were sourced from an internet-based search of “positive music” and “positive images”. Similarly, negative mood induction involved participants watching a four-minute video-clip containing non-lyrical music and a series of images, designed to prompt negative affect. The stimuli included in the negative mood induction were sourced from an internet-based search of “sad music” and “sad images”. This is comparable to previous studies that have used a combination of pictures and musical stimulus to induce both positive and negative mood amongst participants (Emery & Simons, 2015; Treloar & McCarthy, 2012; Wardell et al., 2012). Finally, a four-minute documentary involving a sports biography was also included in the study, to assist in returning participants mood to return to approximate baseline levels, following prior mood manipulation.

Pictorial Stimuli. The study included 40 alcohol-related pictures (e.g. beer, wine, cocktails) and 40 pictures of neutral stimuli (e.g. stapler, tape measure). Each of the alcohol pictures was paired with a neutral picture and matched according to image complexity and brightness. For each trial, these pictures were presented simultaneously on a computer monitor, so that one side of the screen occupied a picture of alcohol, whilst the other side of the screen occupied a picture of neutral stimuli. The alcohol-related stimuli were presented on the left-
hand side of the screen for half the trials, and on the right hand side of the screen for the remaining trials.

Eye-tracking task. An eye-tracking task was utilized to measure attention to the pictorial stimuli (alcohol and neutral). During each trial, a pair of alcohol and neutral pictures was presented simultaneously on a computer screen for 2000ms. Participants' eye movements were recorded during this period, providing an indication of attention allocated towards alcohol and neutral stimuli. Measures included latency to initial orientation and total fixation time (maintenance of attention) towards alcohol and neutral stimuli. Gaze direction was measured at a sampling rate of 120Hz (i.e., one every 8.3ms). Fixations were defined as eye movements stable to within 1° of visual angle for at least 100ms (Christiansen, Mansfield, Duckworth, Field & Jones, 2015). Attentional bias was calculated by comparing the proportion of observations to the alcohol picture, relative to the neutral picture (Christiansen et al., 2015). For example, attentional bias (maintenance of attention) towards alcohol was determined by the degree to which total fixation time was greater to the alcohol images than to the neutral images. Additionally, attentional bias (initial orientation) was also indicated by shorter initial orientation time towards alcohol related pictures, relative to the neutral pictures.

Drinking Motives Questionnaire-Revised (DMQ-R). The DMQ-R (Cooper, 1994) is a 20-item self-report measure that assesses individual motives for engaging in alcohol use. Participants rate how frequently they drink alcohol for the reason described in each item using a 5-point Likert-type scale (1= almost
never/never to 5= almost always/always). The measure contains four subscales: enhancement motives (positive/internal e.g. drink to improve positive mood state); coping motives (negative /internal e.g. drink to relieve negative mood state); conformity motives (negative /external e.g. drink to avoid social consequences); and social motives (positive /external e.g. drink to obtain social rewards). Computing the average ratings for relevant items derived social, enhancement, coping and conformity motives subscale scores. The DMQ-R has been shown to have good reliability and validity (Kuntsche, Stewart & Cooper, 2008).

Sensitivity to Punishment and Sensitivity to Reward Scale (SPSRQ). The SPSRQ (Torrubia, Ávila, Moltó, & Caseras, 2001) is a 48- item self-report measure that assesses appetitive and aversive motivational system functioning. The questionnaire comprises 24 items measuring sensitivity to reward and 24 items measuring sensitivity to punishment. Participants provide a yes or no response for each question. Scores can range from 0-24 for each of the scales, with higher scores reflecting higher sensitivity to either reward or punishment. Both subscales have demonstrated good construct validity and reliability (Torrubia et al, 2001).

Distress Tolerance Scale (DTS; Simons & Gaher, 2005) is a 15-item self-report measure in which respondents indicate, on a 5-point Likert-type scale (1= strongly agree to 5= strongly disagree), the extent to which they can tolerate feeling distressed or upset. The measure contains four subscales: perceived ability to tolerate emotional distress (e.g., I can’t handle feeling distressed or upset),
attention being absorbed by negative emotions (e.g., When I feel distressed or upset, I cannot help but concentrate on how bad the distress actually feels), subjective appraisal of distress (e.g., My feelings of distress or being upset are not acceptable), and regulation efforts to alleviate distress (e.g., When I feel distressed or upset I must do something about it immediately). As in previous studies (Anestis, Selby, Fink, & Joiner, 2007; Iverson, Follette, Pistorello & Fruzzetti, 2012; Lotan, Tanay & Bernstein, 2013), the total DTS score was evaluated in the present study, with higher scores indicating greater distress tolerance. The DTS scale has been found to demonstrate good internal consistency, good test-retest reliability, and discriminant validity with measures of negative affect (Simons & Gaher 2005).

Procedure

After initial screening to ensure that participants were eligible to partake in the study, participants met with the researcher and informed consent was established. Participants were tested individually during a single one-hour session in a laboratory type environment. Participants were initially asked to complete questionnaires regarding demographic information, alcohol use (AUDIT) and other measures.

Participants rated their current mood and level of craving for alcohol according to a series of VAS questions. Next, participants were asked to observe 40 pairs of alcohol and neutral stimuli that were presented simultaneously on a computer screen for 2000ms per trial, whilst their eye movements were directly
monitored and recorded. Following this, participants were again asked to rate their current mood and level of craving according to VAS questions. This phase of the study provided baseline measures of participants’ mood state, level of subjective craving, and attentional bias towards alcohol stimuli, prior to mood manipulation procedures. Subsequent to this, participants were randomly allocated to one of two groups, for the purpose of counterbalancing the order of the mood induction. As such, half of the participants were randomly allocated to experience the positive mood induction first, followed by the negative mood induction, and vice versa for the remaining participants. During the mood induction procedure, participants were instructed to use noise-cancelling headphones, whilst watching a video clip designed to stimulate either positive or negative affect. Participants were asked to rate their mood and level of subjective craving according to VAS questions, both pre and post mood induction, in order to establish whether the mood manipulation procedure had been successful in inducing the relevant mood state and the impact of the mood induction on level of craving. Next, participants were instructed to partake in another eye-tracking task, which again involved observing 40 pairs of alcohol and neutral stimuli presented simultaneously on the computer screen, whilst eye movements were monitored. Following the first mood induction and subsequent eye-tracking task, participants were asked to watch a brief documentary style video clip, for the purpose of assisting any residual affect changes to return to baseline levels. Participants then completed the alternate mood induction procedure (either positive or negative) and once more rated their mood and level of craving according to VAS questions, both pre and post mood induction. Following the second mood induction, participants were asked once again to observe 40 pairs of simultaneously presented alcohol and
neutral stimuli, whilst their eye movement were monitored and recorded. At the completion of the study, all participants were asked to watch a short comedy film clip, in order to reduce any heightened emotional responses, and were subsequently debriefed.

DATA ANALYSIS

All data were examined for errors, missing values, outliers and to assess whether distributional assumptions for normality were met. Trials with more than 30% missing eye-movement data across participants were discarded from analyses. Cases with missing eye-movement data across trials were retained and missing values replaced via Expectation Maximization (EM) method. Due to equipment failure, eye-movement data was completely missing from one participant and a substantially high rate of eye-movement data (89%) was missing from another participant, resulting in removal of this data. Therefore, data from 99 participants were retained for analyses. Mean and standard deviation scores for all independent variables included in the analyses are presented in Table 1.1. Mean and standard deviation scores for alcohol attentional bias and craving for alcohol are presented in Table 1.2.
Table 1.1.

*Mean and Standard Deviation Scores for Independent Variables Included in Analyses*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity to Reward</td>
<td>9.76</td>
<td>4.83</td>
</tr>
<tr>
<td>Distress Tolerance</td>
<td>3.72</td>
<td>0.78</td>
</tr>
<tr>
<td>Social Motives</td>
<td>3.41</td>
<td>1.42</td>
</tr>
<tr>
<td>Enhancement Motives</td>
<td>2.72</td>
<td>1.25</td>
</tr>
<tr>
<td>Coping Motives</td>
<td>1.72</td>
<td>0.66</td>
</tr>
<tr>
<td>Conformity Motives</td>
<td>1.48</td>
<td>0.55</td>
</tr>
<tr>
<td>AUDIT</td>
<td>8.51</td>
<td>5.46</td>
</tr>
</tbody>
</table>

Note. AUDIT = Alcohol Use Disorders Identification Test

Table 1.2.

*Descriptive Statistics for Attentional Bias and Craving under Baseline, Positive Mood and Negative Mood Conditions*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>AB Main</td>
<td>-207.26</td>
<td>323.60</td>
<td>-186.11</td>
</tr>
<tr>
<td>AB I.O</td>
<td>24.15</td>
<td>124.36</td>
<td>41.91</td>
</tr>
<tr>
<td>Craving</td>
<td>11.60</td>
<td>16.51</td>
<td>14.43</td>
</tr>
</tbody>
</table>

Note: AB Main = biases in maintenance of attention towards alcohol stimuli; AB I.O = biases in initial orientation towards alcohol stimuli; Craving = VAS level of subjective craving for alcohol

*Attentional Bias towards Alcohol Stimuli*

Attentional bias towards alcohol stimuli was measured along two distinct lines: biases initial orientation towards alcohol stimuli and biases in maintenance of attention towards alcohol stimuli. Biases in initial orientation of attention were
calculated for each participant by subtracting the mean time period of latency towards neutral stimuli from the mean time period of latency towards alcohol stimuli. Negative scores indicated an attentional bias towards alcohol-related cues and smaller scores indicated greater attentional bias (i.e. participants were quicker to direct attention towards alcohol-related cues). Alternatively, biases in maintenance of attention were calculated for each participant by subtracting the mean total fixation time towards neutral images, from the mean total fixation time towards alcohol images. As such, positive scores indicated attentional bias to alcohol-related cues and larger scores indicated greater magnitude of attentional bias.

*Mood Manipulation Check and Order Effects of Mood Induction*

To determine whether mood manipulation procedures were effective, participants’ self-reported VAS mood ratings pre and post mood induction were compared using paired samples t-test analyses (see Table 1.3). Positive mood ratings were calculated by averaging participants’ scores on the VAS questions that measuring positive mood. Similarly, negative mood ratings were calculated by averaging participants’ scores on the negative mood items of the VAS questions. The positive and negative mood rating scores (VAS) for participants in group one and group two were analysed separately, to account for counterbalancing of the order of positive and negative mood inductions. Group one participants were subject to positive mood induction initially, followed by negative mood induction. Conversely, group two participants were initially exposed to negative mood induction, followed by positive mood induction.
Positive Mood Induction

Group one participants demonstrated a statistically significant increase in VAS ratings of positive mood from pre mood induction ($M=69.62, SD=22.01$) to post mood induction ($M=76.30, SD=20.99$), $t(51)=3.27, p<.01$. The average increase in positive mood ratings scores following the positive mood induction was 6.68 with a 95% confidence interval ranging from 2.58 to 10.78. The eta squared statistic (0.17), indicated a large effect size. There was also a statistically significant increase in VAS ratings of positive mood for group two participants from pre mood induction ($M=61.26, SD=22.42$) to post mood induction ($M=66.26, SD=22.35$), $t(48)=2.64, p<.01$, with a moderate effect size indicated ($\eta^2=0.13$). The mean increase in positive mood ratings following positive mood induction for group two, was 5.0 with a 95% confidence interval ranging from 1.20 to 8.8. The paired samples t-test analyses revealed that the positive mood induction was successful in stimulating positive affect across both groups of participants, irrespective of order of mood induction. As such, VAS ratings of positive mood for participants in groups one and two could be combined for subsequent analyses (see Table 1.3.)

Negative Mood Induction

In relation to negative mood induction, group one participants demonstrated a statistically significant increase in VAS rating of negative mood from pre mood induction ($M=6.27, SD=9.06$) to post mood induction ($M=22.08, SD=18.37$), $t(51)=7.085, p<.01$. The mean increase in negative mood scores following the negative mood induction was 15.81, with a 95% confidence interval ranging from 11.33 to 20.29. Group two participants also displayed statistically
significant increases in VAS negative mood ratings from pre mood induction ($M = 11.26$, $SD = 13.96$) to post mood induction ($M = 30.58$, $SD = 22.07$), $t(48) = 6.89$, $p = < .01$. The average increase in negative mood rating following negative mood stimulation was 19.31, with a 95% confidence interval ranging from 13.68 to 24.96. Both group one and group two analyses of negative mood produced an eta-squared statistic of $0.49$, indicating a large effect size. The paired sample t-test analyses revealed that the negative mood manipulation was successful in stimulating negative affect across group one and group two participants. Therefore, the VAS negative mood ratings of participants in both groups could be combined for subsequent analyses (see Table 1.3).

Table 1.3.

Results for Paired-Samples t-tests for Comparison of Participants’ Reported Level of Mood Measured Pre and Post Mood Induction

<table>
<thead>
<tr>
<th>Mood induction</th>
<th>Pre</th>
<th>Post</th>
<th>95% CI for mean</th>
<th>T</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>69.62</td>
<td>22.01</td>
<td>52</td>
<td>76.30</td>
<td>20.99</td>
</tr>
<tr>
<td>Group 2</td>
<td>61.26</td>
<td>22.42</td>
<td>49</td>
<td>66.26</td>
<td>22.35</td>
</tr>
</tbody>
</table>

| Negative       |     |      |    |     |      |    |         |     |
|                |     |      |    |     |      |    |         |     |
| Group 1        | 6.27  | 9.06  | 52 | 22.08 | 18.37 | 52 | 11.33 - 20.29 | 7.08** | 51 |
| Group 2        | 11.26 | 13.96 | 49 | 30.58 | 22.07 | 49 | 13.68 - 24.96 | 6.89** | 48 |

Note. **indicates significance value of $p < .01$
Conclusions

To conclude, the present dissertation draws on the existing literature to ensure that the most appropriate and efficacious measures are used to examine attentional bias towards alcohol stimuli and craving for alcohol in social drinkers. Moreover, the present dissertation addresses a significant paucity within the existing literature by using direct monitoring of eye movements to examine two important subcomponents of attention, including biases in initial orientation and biases in maintenance of attention towards alcohol stimuli. Furthermore, counterbalanced mood induction procedures, including presentation of pictures and mood congruent music, were used to stimulate positive and negative mood states. Mood manipulation checks reveal that positive and negative mood induction procedures were successful in significantly increasing positive and negative mood in the present sample of social drinkers. The analyses indicate that on average, the present sample of social drinkers did not demonstrate biases in initial orientation or maintenance of attention towards alcohol-related stimuli. Previous studies indicate that the cognitive processes that underlie alcohol attentional bias are not sufficiently developed to be observed in lighter drinkers generally, but may be observed under certain circumstances (e.g. Cox et al., 2003; Field et al., 2004; Field et al., 2011; Townsend & Duka, 2001). Enhancing understanding of circumstances contributing to attentional bias towards alcohol stimuli in social drinkers will be a focus of the present dissertation.
Chapter 3

ALCOHOL ATTENTIONAL BIAS AND CRAVING FOR ALCOHOL

The purpose of this chapter is to report on findings that examine whether attentional bias towards alcohol stimuli and craving for alcohol are significantly associated in the context of heightened positive or negative mood in social drinkers.

Attentional Bias and Craving for Alcohol

Theoretically, it is proposed that a reciprocal relationship between attentional bias and craving underlies substance use behaviour (Franken 2003; Kavanagh et al., 2005; Ryan, 2002). The Elaborated Intrusion (EI) theory of desire (Kavanagh et al., 2005) suggests that internally generated cues (i.e. changes in mood state) and external cues (i.e. alcohol stimuli) may precipitate craving and increased attentional processing of substance-related stimuli. In support of current theoretical perspectives (Franken 2003, Kavanagh et al., 2005, Ryan, 2002), Field and Eastwood (2005) established that heavy social drinkers who were trained to direct their attention towards alcohol-related cues, displayed significant increases in alcohol attentional bias and craving for alcohol, compared to individuals who were trained to direct their attention away from alcohol stimuli. Furthermore, individuals who were trained to attend to alcohol-related cues also consumed more alcohol in a subsequent taste test, indicating that increases in attentional bias towards alcohol stimuli and craving for alcohol are likely to influence drinking behaviour (Field & Eastwood, 2005). Moreover, a meta-analytic review of studies examining the association between attentional bias and subjective craving
supports this contention, indicating that attentional bias towards alcohol stimuli and craving for alcohol are mutually exacerbated cognitive processes in both dependent and social drinkers (Field et al., 2009). An important finding from Field et al.’s (2009) review is that for social drinkers in particular, the association between alcohol attentional bias and craving for alcohol is strengthened in the context of heightened negative mood (Field & Powell, 2007). To this end, a study conducted by Field and Powell (2007) demonstrated that experimentally inducing stress (via a laboratory stressor task) within a sample of heavy social drinkers resulted in a significantly greater association between alcohol attentional bias and craving for alcohol, relative to a control manipulation. Furthermore, Field and Powell’s (2007) study produced the strongest association between alcohol attentional bias and craving for alcohol ($r = .58$), relative to all other available studies that did not include a mood manipulation. Therefore, the association between alcohol attentional bias and craving for alcohol may vary considerably according to changes in mood state in social drinkers. To date, no other experimental studies have examined the influence of mood state on the association between alcohol attentional bias and craving for alcohol in social drinkers. In order to address this paucity in the existing literature, one of the objectives of the present dissertation is to examine whether alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive and negative affect in social drinkers.

_Differentiating Between Subcomponents of Attention_

Chapter two of the present dissertation highlights that a key consideration when investigating attentional bias towards alcohol-related stimuli is
distinguishing between differential subcomponents of attention, including initial orientation and maintenance of attention. The meta-analytic review conducted by Field and colleagues (2009) demonstrated that the association between subjective craving and biases in maintenance of attention towards substance-related cues \( r = .20, 4\% \) shared variance) is significantly larger than the relationship between subjective craving and biases in initial orientation towards substance-related cues \( r = .08, \text{less than } 1\% \text{ of shared variance} \). However, it is important to note only a small number of substance-related studies have employed measures of initial orientation, which may account for the failure of this attentional component to achieve statistical significance in relation to craving. Additionally, theoretical models propose that subjective craving should correlate with “controlled processes of search for target related information,” or rumination on alcohol-related cues (Kavanagh et al., 2005). To this end, alcohol attentional bias research indicates that heavier social drinkers display greater biases in maintenance of attention, but not biases initial orientation towards alcohol cues (Field et al., 2004). In light of the existing theory and research it is reasonable to expect that subjective craving should correlate with the maintenance of attention towards alcohol cues, rather than the rapid and impulsive initial orienting towards alcohol cues. However, there are currently no known studies that have investigated whether the relationship between subjective craving and attentional bias towards alcohol stimuli varies according to these differential subcomponents of attention. Moreover, it has been proposed that directly measuring eye movements provides a more sensitive measure of attention than indirect tasks (Field et al., 2009). This appears to be particularly pertinent to studies that have investigated the relationship between attentional bias and subjective craving. Field and colleagues’
(2009) meta-analysis demonstrated that the correlation between subjective craving and attentional bias for substance-related cues was significantly larger in studies that directly measured attention \( (r = .36, 13\% \text{ of shared variance}) \), compared to studies that utilised indirect measures to infer attentional processing such as the modified addiction Stoop and visual probe tasks \( (r = .18, 3\% \text{ of shared variance}) \).

However, current studies investigating the association between attentional bias towards alcohol stimuli and craving for alcohol have largely utilised indirect measures of attention, with only one known study employing a direct measure of attention to examine the relationship between these alcohol-related cognitions (Namkoong et al., 2004). Namkoong and colleagues used electrophysiological signals (as measured by ERP’s) to demonstrate that attentional bias towards alcohol stimuli is associated with subjective craving amongst alcohol dependent individuals. Moreover, eye movement monitoring is considered to be a particularly advantageous method of directly measuring attention, as it allows for the direct measurement of differential subcomponents of attention, including biases in initial orientation and maintenance of attention. To this end, existing studies examining alcohol attentional bias and craving for alcohol are somewhat limited in that they have generally focussed on only one aspect of attention (i.e. maintenance of attention), and have utilised indirect measures of attention to infer attentional bias towards alcohol-related stimuli. Therefore, a focus of this chapter will be to address these issues by examining associations between alcohol craving and biases in both initial orientation and maintenance of attention towards alcohol stimuli via direct monitoring of eye movements. As such, the findings presented in this chapter will provide a comprehensive evaluation of the relationship
between alcohol attentional bias and craving for alcohol under different mood conditions in social drinkers.

Summary

Consistent with theoretical perspectives (Franken, 2003; Kavanagh et al., 2005; Ryan, 2002), the existing literature demonstrates that a reciprocal relationship exists between alcohol attentional bias and craving for alcohol in dependent and social drinkers (for review, see Field et al., 2009). Moreover, according to the EI theory of desire (Kavanagh et al., 2005), alcohol attentional bias and craving for alcohol may be mutually exacerbated in the context of internally generated cues, such as heightened positive and negative mood states. Previous experimental research supports this contention by demonstrating that increases in stress (via a laboratory stress task) significantly enhances the association between alcohol attentional bias and craving for alcohol in social drinkers (Field & Powell, 2007). Surprisingly, there are currently no known experimental studies examining the influence of heightened positive affect on the association between alcohol attentional bias and craving for alcohol in social drinkers. Additionally, experimental studies examining the influence of increases in negative affect on the association between alcohol attentional bias and craving for alcohol in social drinkers has been confined to assessing stress exclusively (Field & Powell, 2007). Furthermore, a number of methodological limitations exists in studies examining the association between alcohol attentional bias and craving for alcohol. For example, despite research indicating that direct measures of attention (i.e. eye movement monitoring) are more efficacious in examining attentional bias (Field et al., 2009), there are currently no existing studies.
examining the association between attentional bias towards alcohol stimuli and craving for alcohol using direct measures of attention in social drinkers. Additionally, previous studies have neglected to examine whether alcohol craving is differentially associated with biases in initial orientation and biases in maintenance of attention towards alcohol-related cues in social drinkers. Given the implications for treatment, further investigation is warranted to examine whether alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive and negative affect, whilst addressing the identified methodological limitations.

Aims and Hypotheses

The primary focus of this chapter is to examine alcohol attentional bias craving for alcohol are significantly associated in the context of heightened positive and negative affect (via mood induction) in social drinkers.

Drawing on existing studies and theoretical perspectives the following hypotheses will be tested:

1. Attentional bias towards alcohol stimuli (i.e. biases in maintenance of attention and initial orientation) and craving for alcohol will be positively associated following positive mood induction.

2. Attentional bias towards alcohol stimuli (i.e. biases in maintenance of attention and initial orientation) and craving for alcohol will be positively associated following negative mood induction.
METHOD

Data from 99 participants were included in the analyses. Details regarding the sample of participants, materials and procedure utilised in the present dissertation were presented in chapter two (see p. 48 for method).

DATA ANALYSIS

See p. 56 for information regarding data screening and testing of assumptions. To test the hypotheses, partial correlation analyses were conducted using SPSS, to explore the relationships between subjective craving and biases in subcomponents of attention (initial orientation and maintenance of attention), at baseline measures (i.e. prior to mood induction), and following positive and negative mood induction, whilst controlling for participants’ level of alcohol use.

RESULTS

The Influence of Positive and Negative Mood Induction on the Association between Alcohol Attentional Bias and Craving for Alcohol

Baseline Measures

Partial correlation analyses were conducted to examine the association between subjective craving and biases in subcomponents of attention (initial orientation and maintenance of attention) at baseline (i.e. prior to mood induction). Participants’ AUDIT scores were entered as a covariate in the analyses to control for the effect of reported level of alcohol use. The analyses revealed a small, positive correlation between subjective craving and biases in maintenance of attention prior to the mood induction ($r= .16, n = 99$), however, this association
was not found to be significant \((p = .12)\). Similarly, partial correlation analyses indicated that subjective craving and biases in initial orientation were not significantly associated prior to the mood induction \((r = .03, n = 99, p = .75)\). Inspection of the zero-order correlations \((r = .19\) and \(r = -.02\), respectively), indicate that controlling for alcohol use had little impact on the strength of the relationship between these variables (see Table 2.1).

<table>
<thead>
<tr>
<th></th>
<th>Craving</th>
<th>Maintenance of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craving</td>
<td>Partial</td>
<td>Zero Order</td>
</tr>
<tr>
<td>Baseline</td>
<td>.16</td>
<td>.19</td>
</tr>
<tr>
<td>Positive Mood</td>
<td>.24*</td>
<td>.26*</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>.38**</td>
<td>.41**</td>
</tr>
<tr>
<td>Initial Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>.03</td>
<td>-.02</td>
</tr>
<tr>
<td>Positive Mood</td>
<td>.03</td>
<td>-.01</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>.02</td>
<td>.05</td>
</tr>
</tbody>
</table>

Note. * indicates significance value of \(p < .05\). ** Indicates significance value of \(p < .01\)

**Hypothesis 1**

Partial correlation analyses were conducted to test the hypothesis that alcohol attentional bias and craving for alcohol would be positively associated in the context of heightened positive mood (via mood induction). Participants’ AUDIT scores were entered as a covariate in the analyses to control for the
potential influence of self-reported level of habitual alcohol use. The analyses indicated a small, albeit significant, positive correlation between subjective craving and biases in maintenance of attention, following the positive mood induction \((r = .24, n = 99, p < .05)\). Inspection of the zero-order correlation \((r = .26)\) indicated that controlling for level of alcohol use had little impact on the association between these two variables. In contrast, partial correlation analyses indicated that subjective craving and biases in initial orientation were not significantly correlated following stimulation of positive mood \((r = .03, n = 99, p = .79)\). Furthermore, inspection of the zero-order correlation indicated that the relationship between these two variables was largely unaffected by controlling for level of alcohol use \((r = -.01)\). Taken together, the findings indicate that craving for alcohol is significantly associated with biases in maintenance of attention (but not initial orientation) towards alcohol stimuli in the context of heightened positive mood (see Table 2.1).

**Hypothesis 2**

Partial correlation analyses were conducted to test the hypothesis that alcohol attentional bias and craving for alcohol for would be positively associated in the context of heightened negative mood (via mood induction). The analyses revealed a moderate, positive correlation between subjective craving and biases in maintenance of attention, following negative mood induction \((r = .38, n = 99, p < .01)\). The zero-order correlation indicated that controlling for alcohol use had little influence on the association between these variables \((r = .41)\). Conversely, craving for alcohol was not significantly correlated with biases in initial orientation following stimulation of negative mood \((r = .02, n = 99, p = .86)\).
Inspection of the zero-order correlation indicated that controlling for alcohol use had little impact on this relationship \( (r = .05) \). Thus, the results indicate that craving for alcohol is significantly associated with biases in maintenance of attention (but not initial orientation) towards alcohol stimuli in the context of heightened negative mood (see Table 2.1).

**DISCUSSION**

The objective of the present chapter is to examine whether attentional bias towards alcohol stimuli (initial orientation and maintenance of attention) and craving for alcohol are mutually exacerbated in the context of heightened positive and negative mood (via mood induction) in social drinkers. The findings partially support the predictions made by hypothesis one and hypothesis two, in that biases in maintenance of attention and craving for alcohol were positively associated following positive and negative mood inductions. Interestingly, biases in maintenance of attention and craving for alcohol were not significantly associated prior to mood induction (i.e. baseline measures). In contrast to the predictions made by hypothesis one and hypothesis two, biases in initial orientation were not significantly associated with craving for alcohol under positive and negative mood conditions, or in the baseline condition.

*The Influence of Positive and Negative Mood on the Association between Alcohol Attentional Bias and Craving for Alcohol in Social Drinkers*

The main focus of the present chapter was to report on findings that examine whether attentional bias towards alcohol stimuli and craving for alcohol are mutually exacerbated in the context of heightened positive and negative mood (via mood induction) in social drinkers. Consistent with hypothesis one and
hypothesis two, the present findings demonstrate that alcohol attentional bias (maintenance of attention) and craving for alcohol are positively associated under positive and negative mood conditions in social drinkers. Interestingly, the present findings indicate that attentional bias towards alcohol stimuli and craving for alcohol were not significantly associated in the baseline condition (i.e. prior to mood induction). In the absence of mood manipulation, previous studies have found relatively weak or non-significant associations between alcohol attentional bias and craving for alcohol in social drinkers (for review, see Field et al., 2009). Collectively, the available evidence suggests that increases in positive and negative mood may be required to stimulate attentional bias towards alcohol stimuli and craving for alcohol in social drinkers. This is consistent with the doctrines of the EI theory of desire (Kavanagh et al., 2005), which asserts that internally generated cues, such as increases in positive or negative affect, may incite a reciprocal relationship between craving for alcohol and attentional allocation towards alcohol stimuli. That is, according to the EI theory of desire (Kavanagh et al., 2005), heightened positive or negative affect may stimulate intrusive thoughts regarding alcohol, which are then elaborated upon by the individual to create a sense of desire or craving for alcohol. In turn, subjective craving prompts the individual to seek out alcohol-related stimuli in the environment. Moreover, the findings reported in this chapter are somewhat consistent with previous research demonstrating that attentional bias towards alcohol stimuli and craving for alcohol are mutually exacerbated in the context of heightened stress (via stress induction) in social drinkers (Field & Powell, 2007). The present findings also provide support for positive and negative reinforcement models of alcohol use, which propose that individuals may be motivated to
consume alcohol either to enhance positive affect (Cooper, 1995) or to avoid negative affect (Baker et al., 2004). Whilst negative affect has long been identified as a precipitant of craving for alcohol in problem drinkers, the influence of mood state on craving for alcohol in social drinkers has not previously been well understood. Thus, the present findings are the first to indicate that craving for alcohol and biases in maintenance of attention towards alcohol stimuli are mutually exacerbated in the context of heightened positive and negative mood in social drinkers.

Subjective Craving for Alcohol and Biases in Initial Orientation vs Maintenance of Attention towards Alcohol Stimuli

The findings presented in this chapter provide valuable information regarding the association between craving for alcohol and biases in subcomponents of attention towards alcohol stimuli. Previous studies have rarely distinguished between biases in initial orientation and biases in the maintenance of attention towards alcohol-related cues and thus, have overlooked important considerations regarding differential cognitive and motivational processes that may index alcohol use. The present findings demonstrate that subjective craving was not found to be significantly associated with biases in initial orientation, irrespective of mood state. This is consistent with previous research indicating that social drinkers do not typically display biases in initial orientation towards alcohol cues (Field et al., 2004). The results presented in this chapter are also supportive of theoretical perspectives suggesting that subjective craving is more likely to correlate with controlled processing and search for alcohol-related information (Kavanagh et al., 2005), rather than the relatively rapid and automatic
processing involved in initial orientation towards alcohol cues. Furthermore, it has been suggested that biases in initial orientation towards stimuli are less likely to be influenced by motivational properties (La Berge, 1995), such as desire to drink. Other previous research has indicated that abstinent alcoholics display biases in initial orientation towards alcohol cues, but not biases in maintenance of attention towards such cues (Noel et al., 2006). This vigilance-avoidance pattern of attention is thought to reflect deliberate attempts to avoid alcohol related cues, perhaps as a strategy learned during treatment. The study by Noel and colleagues (2006) suggests that biases in initial orientation towards alcohol cues are unlikely to reflect cognitive control or motivational influences, and may be a consequence of excessive alcohol consumption. Thus, the present findings are consistent with previous research and theoretical perspectives proposing that consciously explicit motivational processes such as subjective craving are more likely to align with maintenance of attention towards alcohol stimuli, and less likely to be associated with biases in initial orientation towards alcohol-related cues in social drinkers.

Study limitations

The findings presented in this chapter may have been limited by low mean levels of craving for alcohol (as measured by self-reported VAS) reported by the present sample of social drinkers across each of the three investigated mood conditions (i.e. positive mood, negative mood and baseline conditions). Additionally, there was substantial variation in initial orientation and maintenance of attention scores (as indicted by large standard deviation scores relative mean scores) in the positive mood, negative mood and baseline conditions, which may have impeded the present findings. The large variation in alcohol attentional bias
scores may be due in part to the unconstrained head movement afforded by the eye-tracking equipment used in the present dissertation. To this end, there may have been variability in head movement amongst study participants whilst completing the attention task, which could have potentially impacted on the data obtained. Furthermore, naturally occurring differences in eye characteristics (e.g. eye colour, pupil dilation, pupil drift, eyelid occlusion of the pupil) may also account for the considerable variation in attentional bias scores across the present sample of social drinkers. Further limitations will be presented in the general discussion.

Conclusions

In conclusion, the findings reported in the present chapter indicate that attentional bias towards alcohol stimuli (maintenance of attention) and craving for alcohol are positively associated in the context of heightened positive and negative mood in social drinkers. Moreover, the present findings indicate that alcohol attentional bias and craving for alcohol were not significantly associated prior to mood induction (i.e. baseline measures). Importantly, the current findings suggest that social drinkers may be more vulnerable to experiencing alcohol-related cognitions in the context of heightened positive and negative affect. Additionally, craving for alcohol was not found to be significantly associated with biases in initial orientation towards alcohol across each of the investigated mood conditions in the present sample of social drinkers. Thus, subjective craving for alcohol is associated with aspects of attention that are thought to reflect greater conscious control, indicating that the relationship between these variables may be more malleable to treatment interventions. Therefore, the present findings hold
important clinical implications and indicate that therapeutic interventions would benefit from development of appropriate treatment strategies that specifically target emotion regulation, craving for alcohol, and attention directed towards alcohol stimuli.
Chapter 4

ALCOHOL-RELATED COGNITIONS IN SOCIAL DRINKERS: THE ROLE OF POSITIVE MOOD AND INFLUENTIAL FACTORS ASSOCIATED WITH POSITIVE REINFORCEMENT

This chapter reports on one of the primary research questions related to the role of positive mood in alcohol-related cognitions in social drinkers, and whether theoretically derived individual factors play a role in this relationship. This chapter reports on findings that test whether positive mood induction significantly enhances attentional bias towards alcohol stimuli and craving for alcohol in social drinkers, in comparison to baseline measures of mood state. Secondly, this chapter reports on findings that assess whether positively reinforced drinking motives (i.e. enhancement and social motives) and heightened trait reward sensitivity are positively associated with attentional bias towards alcohol stimuli and craving for alcohol in the context of heightened positive mood. Additionally, this chapter reports on findings examining whether the association between individual difference factors (i.e. drinking motives and reward sensitivity) and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) is strongest in those who report higher levels of positive mood following the positive mood induction.

Attentional Bias towards Alcohol Stimuli and Craving for Alcohol

Attentional bias towards alcohol stimuli and craving for alcohol are clinically relevant cognitive factors associated with drinking behaviour. To this end, regular alcohol users typically demonstrate enhanced attentional processing of alcohol-related cues relative to other stimuli in the environment, which has been shown to positively correspond with extent of alcohol use (for review, see
Field & Cox, 2008). Similarly, craving for alcohol has been identified as a central feature of problematic alcohol use and is a key diagnostic indicator of Alcohol Use Disorders (APA, 2013). Importantly, a wealth of previous research indicates that social drinkers also experience attentional bias towards alcohol stimuli and craving for alcohol (e.g. Birch et al., 2008; Cox et al., 2003; Field & Powell, 2007; Field, et al., 2009; Field & Quigley, 2009; Field, et al., 2011; Kabbani et al., 2014; Naqvi, et al., 2015), although these cognitive processes are likely to be qualitatively different for problematic and social drinkers. Given that social drinking is likely to precede problematic alcohol use, examining circumstances that influence alcohol attentional bias and craving for alcohol in social drinkers enhances understanding of cognitive processes that are likely to be implicated in pathways to dependence. To this end, previous experimental research indicates that alcohol attentional bias and craving for alcohol may vary according to mood state in social drinkers (Field & Powell, 2007). However, existing studies examining the influence of heightened positive affect on alcohol-related cognitions in social drinkers is limited. Theoretically, it is suggested that alcohol use is often motivated by appetitive processes seeking to enhance positive affect (Cooper et al., 1995). In line with theoretical accounts, a wealth of research indicates that positive mood is significantly associated with alcohol use in social drinkers (Crooke et al., 2013; Simons et al., 2005; Simons et al., 2010). Thus, it is reasonable to assume that increases in positive affect may also enhance attentional bias towards alcohol stimuli and craving for alcohol in social drinkers.
Experimental mood induction studies have enabled “in vivo” examination of the influence of heightened positive affect on alcohol-related cognitions in social drinkers. To this end, existing experimental research suggests that positive mood induction increases attentional bias towards alcohol stimuli in university students who report drinking alcohol to enhance positive affect (Birch et al., 2008; Grant et al., 2007). However, findings regarding the influence of positive affect on attentional bias towards alcohol stimuli are inconsistent, with previous research also indicating that positive mood induction does not enhance attentional bias towards alcohol stimuli in university students (Emery & Simons, 2015). These previous studies have examined the influence of heightened positive mood on alcohol attentional bias in university students exclusively, and thus it is not known whether the findings would generalise to older adult social drinkers. Moreover, previous experimental research has established that positive mood induction enhances cue-elicited craving for alcohol in non-treatment seeking alcohol dependent drinkers (Mason et al., 2008). Furthermore, Kabbani and colleagues (2014) found that self-reported positive mood was positively associated with craving for alcohol in first year university students both prior to and following alcohol consumption (Kabbani et al., 2014). However, Kabbani et al. (2014) did not use a mood induction paradigm to investigate the association between positive mood and craving, and thus there are currently no existing experimental mood induction studies examining the influence of heightened positive affect on craving for alcohol in social drinkers. In addition, positive mood has also been found to be negatively associated with cue-elicited craving for alcohol in a clinical sample of substance users attending an inpatient detoxification program (Sclauch et al.,
Therefore, whilst there is evidence to suggest that positive affect may be associated with craving for alcohol in certain cohorts of alcohol users, the existing findings are inconsistent, and do not include experimental studies examining the influence of positive mood induction on craving for alcohol in social drinkers. As such, further examination of the influence of heightened positive mood on alcohol attentional bias and craving for alcohol in adult social drinkers is warranted.

Chapter three demonstrated that alcohol attentional bias and craving for alcohol were mutually exacerbated in the context of heightened positive mood in social drinkers. This finding indicates that some individuals may be more vulnerable to experiencing alcohol-related cognitions in the context of heightened positive mood. However, not all social drinkers respond to increases in positive mood with equal propensity to engage in alcohol-related cognitions. As such, certain factors relevant to the individual, may account for variability in responsivity to heightened positive affect in social drinkers. One such factor supported by the literature, is motivation to engage in drinking behaviour.

Theoretically, it has been proposed that individuals vary in their reasons for consuming alcohol, and that certain drinking motives are associated (either directly or indirectly) with regulation of positive affect (Cooper, 1994). As such, social drinkers who endorse positively reinforced motives for alcohol use, such as social and enhancement motives, may be likely to experience increased alcohol attentional bias and craving for alcohol in the context of heightened positive mood. Additionally, the literature indicates that individual variation in trait reward sensitivity is another important factor that may account for variability in responsivity to heightened positive mood in social drinkers. To this end,
theoretical accounts suggest that individuals vary in their sensitivity to rewarding stimuli in the environment, and those who are more highly sensitive to rewarding stimuli (i.e. alcohol cues) are more likely to respond to cues that signal reward with increased positive affect and approach behaviour (Gray, 1970; 1987). As such, it is proposed that social drinkers with higher levels of trait reward sensitivity may also experience enhanced alcohol-related cognitions in the context of heightened positive mood.

**Social and Enhancement Drinking Motives and Alcohol Cognitions**

Cooper (1994) identified two differential motivations for consuming alcohol that reflect positive reinforcement contingencies: *enhancement* and *social* motives for alcohol use. According to Cooper (1994), enhancement motives are internally derived motivations for alcohol use that involve consuming alcohol to enhance positive affect, and are directly associated with affect regulation. On the other hand, *social motives* are externally derived motivations for alcohol use that involve drinking alcohol to socialise with friends and are indirectly related to emotion regulation through other incentives (i.e. pursuit of enhanced positive affect through social affiliation). Given that each of these drinking motives is associated with regulation of positive affect, it is reasonable to propose that increases in positive mood may enhance alcohol-related cognitions in social and enhancement motivated alcohol users. To this end, Birch et al. (2008) and Grant et al. (2007) conducted comparatively similar studies and demonstrated that enhancement-motivated drinkers display greater attentional bias towards alcohol stimuli in the context of heightened positive mood, relative to other emotional states (i.e. negative mood). However, a recent study by Emery and Simons (2015)
found that enhancement motives for drinking did not interact with positive mood to influence attentional bias towards alcohol-related cues. Thus, there is inconsistency within the literature regarding the association between enhancement motives and alcohol attentional bias in the context of heightened positive mood in social drinkers. Moreover, each of these existing studies (i.e. Birch et al., 2008; Emery & Simons, 2005; Grant et al., 2007) has examined associations between drinking motives, positive mood and alcohol attentional bias in university students exclusively. Therefore, it is unclear whether previous findings generalize to other cohorts of alcohol users, such as older adult social drinkers. Additionally, previous studies have been confined to the examination of internal drinking motives exclusively (i.e. enhancement motives). Thus, existing research has not yet considered how external motives for alcohol use (i.e. social motives) may influence alcohol-related cognitions in the context of heightened positive mood in social drinkers. Moreover, a recent study by Lingdren and colleagues (2015) found that social and enhancement motives for drinking are positively associated with craving for alcohol in university students. However, there are currently no known studies examining the influence of social and enhancement drinking motives on craving for alcohol in older adult social drinkers, or in the context of heightened positive mood. Given implications for understanding drinking behaviour, further research is required to determine whether individuals who endorse positively reinforced motives for alcohol use (i.e. enhancement and social motives) are more vulnerable to alcohol attentional bias and craving for alcohol in the context of heightened positive mood.
According to Gray’s Reinforcement Sensitivity Theory (RST; 1970, 1987), some individuals are more highly sensitive to reward, and are therefore more likely to respond to conditioned reward cues (e.g. alcohol stimuli) with positive affect and approach behaviour towards the potentially rewarding stimuli (e.g. attentional bias and alcohol craving). Furthermore, the affect-response combinations that occur in relation to the rewarding stimuli may become internalized cues that activate reward-seeking behaviour (Baker et al., 1986). For example, increases in positive affect may subsequently increase pursuit of rewarding stimuli in individuals who are highly sensitive to reward. To this end, it is proposed that alcohol users with heightened reward sensitivity may be more inclined to engage in alcohol-related cognitions in the context of heightened positive affect. Whilst reward sensitivity is yet to be empirically explored in relation to alcohol attentional bias, a number of existing studies have demonstrated that reward sensitive individuals report increased craving for alcohol following exposure to alcohol-related cues (Franken, 2002; Kambouropoulos & Staiger, 2001; 2004). Moreover, one of these studies also demonstrates individuals with heightened reward sensitivity respond to alcohol cues with increased positive affect (Kambouropoulos & Staiger, 2001). Taken together, the available evidence indicates that heightened reward sensitivity is positively associated with alcohol-related cognitive process (i.e. craving for alcohol) and positive affect. However, whether individuals with heightened reward sensitivity demonstrate enhanced alcohol attentional bias and craving for alcohol in the context of heightened positive mood remains to be investigated.
Summary

To summarise, alcohol attentional bias and craving for alcohol are important cognitive correlates of alcohol use that are experienced by both dependent and social drinkers. Importantly, previous experimental research indicates that these alcohol-related cognitions may vary according to mood state in social drinkers (Field & Powell, 2007). However, existing experimental studies examining the influence of heightened positive mood on alcohol attentional bias and craving for alcohol in social drinkers is limited and inconsistent. Chapter three of the present dissertation demonstrated that alcohol attentional bias and craving were positively associated in the context of heightened positive mood. Yet, not all social drinkers responded equally to increases in positive affect, indicating that certain factors associated with the individual may influence the propensity to engage in alcohol-related cognitions in the context of heightened positive mood. Surprisingly, very few studies have examined individual difference factors that may account for variability in responsivity to heightened positive affect in social drinkers. To this end, it is proposed that individual differences in trait reward sensitivity and positively reinforced drinking motives (i.e. social and enhancement) may provide insight into why some social drinkers are more inclined to experience increased alcohol-related cognitions following increases in positive mood. However, the existing literature has not yet examined whether heightened trait reward sensitivity and positively reinforced drinking motives (i.e. social and enhancement motives) are associated with enhanced alcohol attentional bias and craving for alcohol in the context of heightened positive mood in social drinkers. Moreover, previous research is yet to investigate whether these individual difference factors interact with positive mood to
influence alcohol-related cognitions in social drinkers. That is, whether the associations between social and enhancement drinking motives and alcohol-related cognitions is strongest in those who report higher levels of positive mood following positive mood induction. Similarly, whether associations between trait reward sensitivity and alcohol-related cognitions is strongest in those who report higher levels of positive mood following positive mood induction. Therefore, the existing literature provides limited understanding of the role of heightened positive mood on alcohol attentional bias and craving for alcohol, and the influence of factors consistent with positive reinforcement of alcohol-related cognitions in social drinkers.

Aims and Hypotheses

This aim of this chapter is to present findings that examine influential factors consistent with positive reinforcement of alcohol-related cognitions in social drinkers. To this end, findings regarding the influence of heightened positive mood (via mood induction) on attentional bias towards alcohol stimuli and craving for alcohol in social drinkers will be presented. An additional objective of this chapter is to examine whether social and enhancement drinking motives and heightened trait reward sensitivity account for variability in responsivity to heightened positive affect in social drinkers. This will be investigated along two key lines: The first will present findings that examine whether heightened trait reward sensitivity and positively reinforced drinking motives (i.e. social and enhancement motives) are associated with increased alcohol attentional bias and craving for alcohol following positive mood induction, relative to negative mood and baseline measures. Secondly, findings
will be presented that investigate whether the association between these individual difference factors (i.e. social and enhancement drinking motives and heightened reward sensitivity) and alcohol-related cognitions is strongest in those who report higher levels of positive mood following positive mood induction. Eye-tracking equipment will be used to measure biases in initial orientation and maintenance of attention towards alcohol stimuli, and a mood induction procedure will be used to experimentally stimulate both positive and negative mood states.

In consideration of previous research, the following hypotheses are proposed in relation to social drinkers:

1. Attentional bias towards alcohol stimuli (i.e. biases in initial orientation and maintenance of attention) and craving for alcohol will be significantly enhanced following positive mood induction, relative to baseline measures.

2. Social drinking motives will be positively associated with (a) biases in maintenance of attention, (b) biases in initial orientation, and (c) craving for alcohol following positive mood induction, but not in the baseline condition or following negative mood induction.

3. Enhancement drinking motives will be positively associated with (a) biases in maintenance of attention, (b) biases in initial orientation, and (c) craving for alcohol following positive mood induction, but not in the baseline condition or following negative mood induction.
4. Reward sensitivity will be positively associated with (a) biases in maintenance of attention, (b) biases in initial orientation, and (c) craving for alcohol following positive mood induction, but not in the baseline conditions or following negative mood induction.

5. The associations between social drinking motives and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of positive mood following positive mood induction.

6. The associations between enhancement drinking motives and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of positive mood following positive mood induction.

7. The associations between trait reward sensitivity and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of positive mood following positive mood induction.
METHOD

Data from a sample of 99 social drinkers were included in the analyses. Information pertaining to participants, materials and methodology of the present dissertation is presented in chapter two (see p. 48).

DATA ANALYSES

See p. 56 for a description of data screening and testing of assumptions. To test the hypotheses, a series of paired samples t-test analyses were first conducted to examine whether alcohol attentional bias and craving for alcohol were significantly enhanced following positive mood induction, relative to baseline measures. Next, bivariate (Pearson) correlation analyses were conducted to examine associations between individual difference factors (i.e. social and enhancement drinking motives and trait reward sensitivity) and alcohol-related cognitions (i.e. biases in initial orientation, biases in maintenance of attention and subjective craving for alcohol) following positive mood induction, negative mood induction and at baseline (i.e. prior to mood induction). Additionally, hierarchical regression analyses were conducted to examine associations between individual difference factors and alcohol-related cognitions, where participants’ reported level of alcohol use was found to influence the dependent variables. Moderation regression analyses were performed to examine whether reported level of positive mood moderates the association between drinking motives and alcohol-related cognitions, following positive mood induction. Finally, moderation regression analyses were performed to examine whether reported level of positive mood...
moderates the association between trait reward sensitivity and alcohol-related cognitions, following positive mood induction.

RESULTS

The Influence of Positive Mood Induction on Alcohol-Related Cognitions

Hypothesis 1

A series of paired samples t-test analyses were conducted to test the hypothesis that attentional bias (i.e. biases in initial orientation and maintenance of attention) and craving for alcohol would be significantly enhanced following positive mood induction, relative to baseline measures (see Table 3.1). The analyses indicated that positive mood induction significantly enhanced craving for alcohol, relative to baseline measures in social drinkers. In contrast, positive mood induction did not significantly enhance biases in initial orientation or maintenance of attention towards alcohol stimuli in social drinkers.

Table 3.1.

Results for Paired-Samples t-tests for Comparison of Alcohol-Related Cognitions Measured at Baseline and Following Positive Mood Induction

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline</th>
<th>Positive Mood</th>
<th>95% CI for mean</th>
<th>t</th>
<th>df</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>-84.61</td>
</tr>
<tr>
<td>AB Main</td>
<td>-207.26</td>
<td>323.61</td>
<td>-186.11</td>
<td>436.00</td>
<td>-42.32</td>
</tr>
<tr>
<td>AB I.O</td>
<td>24.16</td>
<td>124.36</td>
<td>41.91</td>
<td>155.58</td>
<td>-15.84</td>
</tr>
<tr>
<td>Craving</td>
<td>11.61</td>
<td>16.51</td>
<td>14.43</td>
<td>19.87</td>
<td>.16-5.50</td>
</tr>
</tbody>
</table>

Note. * indicates significance of p < .05. AB Main= biases in maintenance of attention, AB I.O = biases in initial orientation, Craving = craving for alcohol
Hypothesis 2(a)

Pearson’s correlation analysis was conducted to test the hypothesis that social drinking motives would be positively associated with biases in maintenance of attention following positive mood induction, but not at baseline measures or following negative mood induction. Initially the analysis revealed that participant’s reported level of alcohol use (as measured by the AUDIT), was not significantly associated with biases in maintenance of attention across each of the investigated mood conditions (baseline $r = .12, n = 99, p = .22$, positive mood $r = .10, n = 99, p = .31$, negative mood $r = .18, n = 99, p = .07$). Therefore, level of alcohol use was not entered as a covariate in the analysis. Pearson’s correlation analysis revealed moderate, positive correlations between social motives for alcohol use and biases in maintenance of attention towards alcohol stimuli across each of the mood conditions (baseline $r = .34, n = 99, p < .01$, positive mood induction $r = .29, n = 99, p < .01$, negative mood induction $r = .37, n = 99, p < .01$). These findings indicate that social drinking motives are positively associated with biases in maintenance of attention towards alcohol stimuli in the context of heightened positive mood, heightened negative mood, and in the baseline condition in social drinkers.

Hypothesis 2(b)

Pearson’s correlation analysis was conducted to test the hypothesis that social drinking motives would be positively associated with biases in initial orientation towards alcohol stimuli following positive mood induction, but not at baseline measures or following negative mood induction. The analysis initially
indicated that reported level of alcohol use (as measured by the AUDIT), was not significantly associated with biases in initial orientation following positive mood induction \( r = -.10, n = 99, p = .31 \), negative mood induction \( r = .09, n = 99, p = .36 \), or at baseline \( r = -.10, n = 99, p = .30 \). Therefore, level of alcohol use was not entered as a covariate in the following analyses. Pearson’s correlation analysis revealed there were no significant correlations observed between social drinking motives and biases in initial orientation towards alcohol across each of the investigated mood conditions (baseline \( r = .06, n = 99, p = .54 \), positive mood \( r = .02, n = 99, p = .87 \), negative mood \( r = -.01, n = 99, p = .95 \)). Thus, the analyses revealed that social drinking motives were not significantly associated with biases in initial orientation towards alcohol stimuli under positive mood, negative mood or baseline conditions in social drinkers.

**Hypothesis 2(c)**

Pearson’s correlation analysis was conducted to test the hypothesis that social drinking motives would be positively associated with craving for alcohol following positive mood induction, but not at baseline measures or following negative mood induction. The analysis revealed moderate, positive correlations between social motives for drinking and craving for alcohol following positive mood induction \( r = .48, n = 99, p = < .001 \), negative mood induction \( r = .37, n = 99, p < .001 \), and at baseline \( r = .46, n = 99, p = < .001 \). Taken together, the findings of the analysis indicated that social motives for alcohol use are associated with increased craving for alcohol across each of the investigated mood conditions. Pearson’s correlation analysis also indicated that reported level of alcohol use (as measured by the AUDIT) was significantly associated with
craving for alcohol across each of the mood conditions (baseline $r = .45$, $n = 99$, $p < .001$, positive mood $r = .32$, $n = 99$, $p < .01$, negative mood $r = .39$, $n = 99$, $p < .001$). As such, an additional hierarchical regression analysis was conducted to further examine the association between social drinking motives and craving for alcohol, whilst controlling for level of alcohol use. The hierarchical regression analysis revealed that when controlling for reported level of alcohol, social motives for drinking significantly contributed to the variance in craving for alcohol in the baseline and positive mood conditions (see Table 3.2). In contrast, the analysis indicated that social drinking motives did not significantly predict craving for alcohol in the negative mood condition when controlling for reported level of alcohol use. These findings indicate that when reported level of alcohol use is considered, social drinking motives are positively associated with craving for alcohol at baseline and in the context of heightened positive mood, but not in the negative mood condition.
### Table 3.2.
Hierarchical Regression Analyses Evaluating Alcohol Use and Social Drinking Motives as Predictors of Craving in Baseline, Positive Mood and Negative Mood Conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>T</th>
<th>$r^2$</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>.45**</td>
<td>5.02</td>
<td>.20</td>
<td>.45</td>
<td>.21</td>
<td>.21**</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
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<td>2.43</td>
<td>.04</td>
<td>.51</td>
<td>.26</td>
<td>.05*</td>
</tr>
<tr>
<td>Social Motives</td>
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<td>2.55</td>
<td>.05</td>
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<tr>
<td><strong>Positive mood</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Step 1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>.32**</td>
<td>3.36</td>
<td>.10</td>
<td>.32</td>
<td>.10</td>
<td>.10**</td>
</tr>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Alcohol use</td>
<td>.04</td>
<td>.35</td>
<td>.00</td>
<td>.48</td>
<td>.23</td>
<td>.12**</td>
</tr>
<tr>
<td>Social Motives</td>
<td>.45**</td>
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<td>.12</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>.39**</td>
<td>4.17</td>
<td>.15</td>
<td>.39</td>
<td>.15</td>
<td>.15**</td>
</tr>
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</tr>
<tr>
<td>Alcohol use</td>
<td>.26*</td>
<td>2.20</td>
<td>.04</td>
<td>.42</td>
<td>.18</td>
<td>.03</td>
</tr>
<tr>
<td>Social Motives</td>
<td>.21</td>
<td>1.74</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* * Indicates significance value of $p < .05$, ** indicates significance value of $p < .01$

**Hypothesis 3(a)**

Pearson’s correlation analysis was conducted to test the hypothesis that enhancement drinking motives would be positively associated with biases in maintenance of attention towards alcohol stimuli in following positive mood induction, but not at baseline measures or following negative mood induction. Participant’s reported level of alcohol use was not significantly associated with biases in maintenance of attention towards alcohol stimuli across each of the mood conditions (baseline $r = .12, n = 99, p = .22$, positive mood $r = .10, n = 99, p = .31$, negative mood $r = .18, n = 99, p = .07$), and therefore was not entered as a
covariate in the analysis. Pearson’s correlation analysis revealed small, albeit significant correlation between enhancement motives for drinking and biases in maintenance of attention at baseline \( r = .28, n = 99, p < .01 \) and following positive mood induction \( r = .24, n = 99, p < .05 \). Additionally, the analysis indicated a moderate, positive correlation between enhancement motives for drinking and biases in maintenance of attention following the negative mood induction, \( r = .36, n = 99, p < .01 \). Taken together, these findings suggest that enhancement drinking motives are positively associated with biases in maintenance of attention towards alcohol stimuli under positive mood, negative mood and baseline conditions in social drinkers.

**Hypothesis 3(b)**

Pearson’s correlation analysis was conducted to test the hypothesis that enhancement drinking motives would be positively associated with biases in initial orientation towards alcohol stimuli following positive mood induction, but not at baseline measures or following negative mood induction. Participant’s reported level of alcohol use was not significantly associated with biases in initial orientation towards alcohol stimuli across each of the mood conditions (baseline \( r = -.10, n = 99, p = .30 \), positive mood induction \( r = -.10, n = 99, p = .31 \), negative mood induction \( r = .09, n = 99, p = .36 \)), and therefore was not entered as a covariate in the analysis. Pearson’s correlation analysis revealed there were no significant correlations observed between enhancement drinking motives and biases in initial orientation towards alcohol at baseline, \( r = .04, n = 99, p = .69 \), following positive mood induction, \( r = -.08, n = 99, p = .42 \), or following negative mood induction, \( r = .09, n = 99, p = .36 \). Therefore, enhancement
drinking motives were not significantly associated with biases in initial orientation towards alcohol stimuli across each of the investigated mood conditions in social drinkers.

**Hypothesis 3(c)**

Pearson’s correlation analysis was conducted to test the hypothesis that enhancement drinking motives would be positively associated with craving for alcohol following positive mood induction, but not at baseline measures or following negative mood induction. The analysis revealed moderate, positive correlations between enhancement motives for drinking and craving for alcohol following positive mood induction $r = .34, n = 99, p < .01$, negative mood induction $r = .38, n = 99, p < .01$, and at baseline $r = .35, n = 99, p < .01$. As participants reported level of alcohol use (as measured by the AUDIT) was significantly associated with craving for alcohol across each of the mood conditions (baseline $r = .45, n = 99, p < .001$, positive mood $r = .32, n = 99, p < .01$, negative mood $r = .39, n = 99, p < .001$), an additional hierarchical regression analysis was conducted to further examine the association between enhancement drinking motives and craving for alcohol, whilst controlling for level of alcohol use. The hierarchical regression analysis indicated that when controlling for participants’ reported level of alcohol use, enhancement motives for drinking did not significantly contribute to the variance in craving for alcohol under positive mood, negative mood, or baseline conditions in social drinkers (see Table 3.3).
Table 3.3.
Hierarchical Regression Analyses Evaluating Alcohol Use and Enhancement Drinking Motives as Predictors of Craving in Baseline, Positive Mood and Negative Mood Conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
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<th>sr²</th>
<th>R</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
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<tbody>
<tr>
<td><strong>Baseline</strong></td>
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<tr>
<td>Step 1</td>
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<td></td>
<td></td>
</tr>
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Note. * Indicates significance value of p <.05, ** indicates significance value of p<.01

The Association between Trait Reward Sensitivity and Alcohol-Related Cognitions Following Positive Mood Induction

Hypothesis 4(a)

Pearson’s correlation analysis was conducted to test the hypothesis that trait reward sensitivity (as measured by the SPSRQ) would be positively associated with biases in maintenance of attention towards alcohol stimuli following positive mood induction, but not at baseline measures or following negative mood induction. Participants reported level of alcohol use (as measured by the AUDIT), was not significantly associated with biases in maintenance of
attention across any of the investigated mood conditions (baseline $r = .12$, $n = 99$, $p = .22$, positive mood $r = .10$, $n = 99$, $p = .31$, negative mood $r = .18$, $n = 99$, $p = .07$), and therefore was not entered as a covariate in the following analysis. Pearson’s correlation analysis revealed moderate, positive associations between trait reward sensitivity and biases in maintenance of attention towards alcohol stimuli following positive mood induction $r = .32$, $n = 99$, $p < .01$, negative mood induction $r = .32$, $n = 99$, $p < .01$, and at baseline (prior to mood induction), $r = .31$, $n = 99$, $p < .01$. Taken together, these findings indicate that reward sensitivity is positively associated with biases in maintenance of attention under positive mood, negative mood and baseline conditions in social drinkers.

**Hypothesis 4(b)**

Pearson’s correlation analysis was conducted to test the hypothesis that reward sensitivity would be positively associated with biases in initial orientation towards alcohol stimuli following positive mood induction, but not at baseline measures or following negative mood induction. Participant’s reported level of alcohol use (as measured by the AUDIT) was not significantly associated with biases in initial orientation across each of the three mood conditions (baseline $r = -.10$, $n = 99$, $p = .30$, positive mood induction $r = -.10$, $n = 99$, $p = .31$, negative mood induction $r = .09$, $n = 99$, $p = .36$), and therefore was not entered as a covariate in the analysis. Pearson’s correlation analysis revealed that reward sensitivity was not significantly associated with biases in initial orientation towards alcohol at baseline, $r = .10$, $n = 99$, $p = .30$. Similarly, there were no significant associations detected between sensitivity to reward and initial orientation towards alcohol stimuli following positive mood induction, $r = .11$, $n = 99$, $p = .30$, or following negative mood induction, $r = .15$, $n = 99$, $p = .13$. 

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Therefore, reward sensitivity was not significantly associated with biases in initial orientation towards alcohol stimuli across each of the investigated mood conditions.

**Hypothesis 4(c)**

Pearson’s correlation analysis was conducted to test the hypothesis that reward sensitivity would be positively associated with craving for alcohol following positive mood induction, but not at baseline measures or following negative mood induction. The analyses revealed moderate, positive correlations between reward sensitivity and craving for alcohol at baseline $r = .36, n = 99, p < .001$, and following negative mood induction, $r = .30 n = 99, p = < .01$. Additionally, Pearson’s correlation analysis revealed a moderate, positive correlation between reward sensitivity and craving for alcohol, following experimental manipulation of positive mood, $r= .34, n=99, p = < .01$. As participants reported level of alcohol use was significantly associated with craving for alcohol across each of the mood conditions (baseline $r = .45, n = 99, p < .001$, positive mood $r = .32, n = 99, p < .01$, negative mood $r = .39, n = 99, p < .001$), an additional hierarchical regression analysis was conducted to determine the extent to which heightened reward sensitivity predicts craving for alcohol across each of the mood conditions, whilst controlling for level of alcohol use (see Table 3.4).

The hierarchical regression analysis revealed that when participants’ reported level of alcohol use is controlled for in the analyses, reward sensitivity significantly predicted craving for alcohol following in the positive mood and baseline conditions. In contrast, reward sensitivity did not significantly predict craving for alcohol following negative mood induction, when controlling for
reported level of alcohol use. Taken together, the findings indicate that reward sensitivity is significantly associated with craving for alcohol at baseline measures and following positive mood induction, but not following negative mood induction.

Table 3.4. Hierarchical Regression Analyses Evaluating Alcohol Use and Reward Sensitivity as Predictors of Craving in Baseline, Positive Mood and Negative Mood Conditions

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Note. * Indicates significance value of p <.05, ** indicates significance value of p<.01
Hypothesis 5(a)

A moderation regression analysis was conducted to test the hypotheses that reported level of positive mood would moderate the association between social drinking motives and attentional bias towards alcohol stimuli following positive mood induction. Given that social drinking motives were not found to be significantly associated with biases in initial orientation, only biases in maintenance of attention were explored in this instance. To control for the effect of habitual level of alcohol use, participants’ AUDIT scores were entered at step one and accounted for 0.7% of the variance in biases in maintenance of attention following positive mood induction. When social drinking motives and reported level of positive mood were entered at step two, the model explained 10.4% of the variance in attentional bias following positive mood induction \( F(3, 95) = 3.68, p < .05 \). As such, the inclusion of social drinking motives and positive mood accounted for an additional 9.7% of the variance in attentional bias, \( R^2 \) change = .097, \( F(2, 95) = 5.13, p < .01 \). The interaction effect of social drinking motives and positive mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 11.0% of the variance in attentional bias following positive mood induction \( F(4, 94) = 2.90, p < .05 \). Thus, including the interaction between social drinking motives and positive mood only accounted for an additional 0.6% of the variance in attentional bias towards alcohol following positive mood induction \( R^2 \) change = 0.006, \( F(1, 94) = 0.60, p = .44 \). Inspection of the beta values revealed that the interaction between social motives and positive mood did not significantly contribute to biases in
These findings indicate that reported level of positive mood does not moderate the association between social drinking motives and biases in maintenance of attention following positive mood induction. That is, the association between social drinking motives and alcohol attentional bias is not strongest in social drinkers who report higher levels of positive mood following positive mood induction.

**Hypothesis 5(b)**

A moderation regression analysis was conducted to test the hypotheses that reported level of positive mood would moderate the association between social drinking motives and subjective craving following positive mood induction. To control for the effect of habitual level of alcohol use, participants AUDIT scores were entered at step one and accounted for 10.4% of the variance in craving for alcohol following positive mood induction. When social drinking motives and reported level of positive mood were entered at step two, the model explained 22.9% of the variance in subjective craving following positive mood induction $F(3, 95) = 9.38, p < .001$. As such, the inclusion of social drinking motives and positive mood accounted for an additional 12.4% of the variance in craving for alcohol, $R$ squared change = .12, $F(2, 95) = 7.66, p < .01$. The interaction effect of social drinking motives and positive mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 23% of the variance in subjective craving following positive mood induction $F(4, 94) = 7.03, p < .001$. Thus, including the interaction between social motives and positive mood only accounted for an additional 0.2% of the variance in craving for alcohol following positive mood induction $R$ squared change = .00, $F(1, 94) = .23, p = .65$. 

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Inspection of the beta values revealed that the interaction between social motives and positive mood did not significantly contribute to subjective craving following positive mood induction (beta = .04, p = .46). These findings indicate that reported level of positive mood does not moderate the association between social drinking motives and subjective craving for alcohol following positive mood induction. That is, the association between social drinking motives and craving for alcohol is not strongest in social drinkers who report higher levels of positive mood following positive mood induction.

*Positive Mood as Moderating Associations between Enhancement Drinking Motives and Alcohol-Related Cognitions Following Positive Mood Induction*

**Hypothesis 6(a)**

A moderation regression analysis was conducted to test the hypothesis that reported level of positive mood would moderate the association between enhancement drinking motives and attentional bias following positive mood induction. Given that enhancement motives were not significantly associated with biases in initial orientation, only biases in maintenance of attention were again explored in this instance. To control for the effect of habitual level of alcohol use, participants AUDIT scores were entered at step one and accounted for .07% of the variance in biases in maintenance of attention following positive mood induction. When enhancement drinking motives and reported level of positive mood were entered at step two, the model explained 7.6% of the variance in attentional bias following positive mood induction $F (3,95) = 2.60, p = .06$. As such, the inclusion of enhancement drinking motives and positive mood accounted for an additional 6.9% of the variance in attentional bias, $R^2$ squared change = .069, $F (2, 95) =$
The interaction effect of enhancement drinking motives and positive mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 8.4% of the variance in attentional bias following positive mood induction $F(4, 94) = 2.14, p = .08$. Thus, including the interaction between enhancement motives and positive mood only accounted for an additional 0.8% of the variance in attentional bias towards alcohol following positive mood induction $R^2$ change = 0.008, $F(1, 94) = 0.80, p = .37$. Inspection of the beta values revealed that the interaction between enhancement motives and positive mood did not significantly contribute to biases in maintenance of attention following positive mood induction (beta = .09, $p = .37$). These findings indicate that reported level of positive mood does not moderate the association between enhancement drinking motives and biases in maintenance of attention following positive mood induction. That is, the association between enhancement drinking motives and alcohol attentional bias is not strongest in those who report higher levels of positive mood following positive mood induction.

**Hypothesis 6(b)**

In light of the null finding regarding the association between enhancement motives for drinking and craving for alcohol following positive mood induction, further analyses were not conducted to determine whether reported level of positive mood moderates the association between enhancement drinking motives and craving for alcohol following positive mood induction.
Hypothesis 7(a)

A moderation regression analysis was conducted to test the hypothesis that reported level of positive mood would moderate the association between reward sensitivity and alcohol attentional bias following positive mood induction. Given that reward sensitivity was not found to be significantly associated with biases in initial orientation, only biases in maintenance of attention were explored in this instance.

To control for the effect of habitual level of alcohol use, participants’ AUDIT scores were entered at step one and accounted for 0.7% of the variance in biases related to maintenance of attention following positive mood induction. When sensitivity to reward and reported level of positive mood were entered at step two, the model explained 11.1% of the variance following positive mood induction $F (3, 95) = 3.97, p < .01$. As such, the inclusion of reward sensitivity and positive mood accounted for an additional 10.4% of the variance in attentional bias, $R^2$ change = .10, $F (2, 95) = 5.57, p < .01$. The interaction effect of sensitivity to reward and positive mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 11.3% of the variance in attentional bias following positive mood induction $F (4, 94) = 2.99, p < .05$. Thus, including the interaction between reward sensitivity and positive mood only accounted for an additional 0.2% of the variance in attentional bias towards alcohol following positive mood induction $R^2$ change = 0.00, $F (1, 94) = 0.18, p = .675$. Inspection of the beta values revealed that the
interaction between reward sensitivity and positive mood did not significantly contribute to biases in maintenance of attention following positive mood induction (beta = .04, \( p = .675 \)). These findings indicate that reported level of positive mood does not moderate the association between reward sensitivity and biases in maintenance of attention following positive mood induction. That is, the association between reward sensitivity and alcohol attentional bias is not strongest in social drinkers who report higher levels positive mood following positive mood induction.

**Hypothesis 7(b)**

A moderation regression analysis was conducted to test the hypotheses that reported level of positive mood would moderate the relationship between reward sensitivity and craving for alcohol following positive mood induction. To control for the effect of habitual level of alcohol use, participants AUDIT scores were entered at step one and accounted for 10.4% of the variance in craving for alcohol. When sensitivity to reward and reported level of positive mood were entered at step two, the model explained 16% of the variance in craving for alcohol, \( F(3, 95) = 6.04, p < .01 \). The interaction effect of sensitivity to reward and positive mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 16.4% of the variance in craving for alcohol, \( F(4, 94) = 4.61, p < .05 \). Thus, including the interaction between reward sensitivity and positive mood only accounted for an additional 0.4% of the variance in subjective craving for alcohol following positive mood induction, \( R^2 \) change = .00, \( F(1, 94) = 0.43, p = .52 \). Inspection of the beta values revealed that the interaction between reward sensitivity and positive mood did not significantly contribute to
craving for alcohol following positive mood induction (beta= -.06, p = .51). These findings indicate that reported level of positive mood does not moderate the association between reward sensitivity and craving for alcohol following positive mood induction. That is, the association between reward sensitivity and craving for alcohol is not strongest in social drinkers who report higher level of positive mood following the positive mood induction.

DISCUSSION

An experimental mood induction paradigm was used to investigate influential factors consistent with positive reinforcement of alcohol-related cognitions in social drinkers. To this end, hypothesis one was partially supported in that positive mood induction significantly enhanced craving for alcohol, but not attentional bias towards alcohol stimuli (initial orientation and maintenance of attention), relative to baseline measures in social drinkers. The findings did not support hypotheses two and three, which predicted that social and enhancement drinking motives would be positively associated with alcohol attentional bias (initial orientation and maintenance of attention) and craving for alcohol in the context of heightened positive mood exclusively (i.e. not under baseline or negative mood conditions). Similarly, the findings did not support hypothesis four, which predicted that trait reward sensitivity would be positively associated with attentional bias towards alcohol stimuli (initial orientation and maintenance of attention) and craving for alcohol in the context of heightened positive mood exclusively (i.e. not under baseline or negative mood conditions). Additionally, hypotheses five and six were not supported, as the findings indicated that
associations between positively reinforced drinking motives (i.e. social and enhancement drinking motives) and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) were not strongest in individuals who reported higher levels of positive mood following positive mood induction. Similarly, hypothesis seven was not supported, as the findings demonstrated that associations between trait reward sensitivity and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) were not strongest in individuals who reported higher levels of positive mood following positive mood induction.

The Influence of Heightened Positive Mood on Craving for Alcohol in Social Drinkers

A primary focus of this chapter was to present findings regarding the influence of heightened positive affect (via mood induction) on craving for alcohol in social drinkers. In line with expectations, the present findings provide the first experimental evidence that positive mood induction significantly enhances craving for alcohol in social drinkers. This finding is consistent with previous research by Mason and colleagues (2008) who found that positive mood induction significantly increased cue-elicited craving for alcohol in non-treatment seeking alcoholics. Moreover, the present findings extends on previous research by Kabbani and colleagues (2014), who found that self-reported measures of positive mood were positively associated with increased craving for alcohol in social drinkers. Taken together, the available evidence suggests that heightened positive affect enhances craving for alcohol in both social and dependent drinkers. Moreover, the present findings indicate that enhanced craving for alcohol in the context of heightened positive mood is an important process in social drinking.
Contrary to predictions, positive mood induction did not significantly enhance attentional bias towards alcohol stimuli in the present sample of social drinkers. This finding is consistent with recent research by Emery and Simons (2015), who found that positive mood induction did not influence attentional bias towards alcohol-related stimuli in a sample of university students. In contrast, previous research indicates that positive mood induction increases alcohol attentional bias in university students who drink to enhance positive affect (Birch et al., 2008; Grant et al., 2007). However, previous research by Birch et al., (2008) and Grant et al., (2007) examined the influence of heightened positive mood on alcohol attentional bias relative to heightened anxious mood, and did not include a comparison control condition. Therefore, it is not known whether the positive mood induction significantly enhanced attentional bias towards alcohol-related stimuli relative to baseline measures in these previous studies (Birch et al., 2008; Grant et al., 2007). This discrepancy in study design may account for why Birch et al. (2008) and Grant et al. (2007 obtained comparatively different outcomes to the present findings. Moreover, chapter three demonstrated that alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive mood in social drinkers. Collectively, these findings indicate that there is variability in responsivity to increases in positive affect in the present sample of social drinkers. The following sections will review findings regarding certain factors associated with the individual that were
proposed to influence alcohol attentional bias and craving for alcohol in the context of heightened positive mood.

*Social Drinking Motives and Alcohol-Related Cognitions*

An additional objective of this chapter was to present findings regarding the association between social drinking motives and alcohol-related cognitions in the context of heightened positive mood (relative to baseline and negative mood conditions). The present findings indicate that social drinking motives were positively associated with biases in maintenance of attention towards alcohol stimuli following positive mood induction. However, in contrast to the predictions made by hypothesis two, social drinking motives were also positively associated with biases in maintenance of attention towards alcohol stimuli in the baseline condition and following negative mood induction. On the other hand, social drinking motives were not significantly associated with biases in initial orientation towards alcohol stimuli across each of the investigated mood conditions in the present sample of social drinkers. Additionally, the findings indicate that social drinking motives were positively associated with craving for alcohol following increases in positive mood (via mood induction). However, in contrast to the predictions made by hypothesis two, the association between social drinking motives and craving for alcohol is not exclusive to the positive mood condition. That is, social drinking motives were also positively associated with craving for alcohol in the baseline condition (but not following negative mood induction). Taken together, the present findings indicate that whilst social drinking motives are positively associated with alcohol attentional bias and craving for alcohol, they do not significantly account for variability in these
alcohol-related cognitions in response to heightened positive mood in social drinkers.

The findings related to hypothesis two are somewhat consistent with existing research by Lingdren and colleagues (2015) who found that social drinking motives are significantly associated with craving for alcohol in university students. To this end, social drinking motives may be particularly prominent in university students, as alcohol-related social gatherings (i.e. attending parties) are a large component of university culture. As such, alcohol may be consumed to enhance sociability through inhibition and matching the drinking behaviour of others (Cooper et al, 1992). Consistent with this assertion, previous research demonstrates that social drinking motives are associated with problematic alcohol use in university students (Foster, Neighbors, & Prokhorov, 2014; Halim, Hasking & Allen, 2012; Van Damme, Maes, Clays, Rosiers, Van Hal & Hublet, 2013). Whilst previous studies regarding social drinking motives have been confined to samples of university students exclusively, the findings presented in this chapter demonstrate that social drinking motives are positively associated with alcohol-related cognitions in adult social drinkers. Future research would benefit from examining whether social drinking motives are associated with increased alcohol-related cognitions in the context of heightened positive mood in university students or younger adults.

Enhancement Drinking Motives and Alcohol Attentional Bias

A focus of the present chapter was to examine whether enhancement motives for drinking are positively associated with alcohol-related cognitions in
the context of heightened positive mood (in contrast to baseline and negative mood conditions). The present findings demonstrate that enhancement motives for drinking were positively associated with biases in maintenance of attention towards alcohol stimuli following positive mood induction. However, contrary to what was predicted by hypothesis three, enhancement drinking motives were also positively associated with biases in maintenance of attention in the baseline condition and following negative mood induction. On the other hand, enhancement motives for drinking were not significantly associated with biases in initial orientation towards alcohol stimuli across each of the investigated mood conditions in the present sample of social drinkers. The findings presented in this chapter are somewhat inconsistent with previous research by Birch et al. (2008) and Grant et al. (2007), who revealed that individuals who report higher levels of enhancement motives for drinking displayed greater attentional bias towards alcohol cues following musically induced positive mood, relative to negative mood (Birch et al., 2008; Grant et al., 2007). These previous findings (Birch et al., 2008; Grant et al., 2007) reflect a positive reinforcement model of alcohol use whereby enhancement motivated drinkers are more inclined to engage in alcohol seeking behaviours in the context of heightened positive mood, with the likely intention of augmenting already experienced positive emotions. However, previous studies by Birch et al. (2008) and Grant et al. (2007) included samples of university students who reported heavier and more problematic alcohol use than social drinkers included in the present dissertation. Therefore, enhancement motives for alcohol use may be associated with increased alcohol attentional bias in the context of heightened positive mood, in social drinkers with relatively heavy and/or problematic drinking behaviour. Interestingly, contrary to these
previous studies (Birch et al., 2008; Grant et al., 2007), the present findings indicate that enhancement motives for drinking are also positively associated with attentional bias towards alcohol stimuli in the context of heightened negative mood. This observation suggests that rather than engaging in alcohol seeking behavior to augment existing positive affect, enhancement motivated drinkers may be more inclined to engage in alcohol seeking behavior to increase positive affect when experiencing negative emotions. To this end, enhancement motives for drinking may also reflect negative reinforcement properties, whereby drinking to enhance positive affect is prominent in situations where one may actually desire to reduce or avoid negative mood. However, the present findings present only preliminary indications of these associations and thus, further investigation is required.

Enhancement Drinking Motives and Craving for Alcohol

An additional emphasis of the present chapter was to report on findings that examine whether enhancement motives for drinking are positively associated with craving for alcohol in the context of heightened positive mood (in contrast to negative mood and baseline conditions). The findings did not support hypotheses three, as enhancement motives for drinking were not significantly associated with craving for alcohol following positive mood induction, negative mood induction or at baseline measures. This finding is inconsistent with recent research by Lingdren and colleagues (2015) who demonstrated that enhancement motives for drinking are associated with increased craving for alcohol in university students. One potential explanation for the discrepancy in findings is that enhancement motives for drinking may incite greater craving for alcohol in younger alcohol
users (such as university students) relative to older adult drinkers. As such, an interesting endeavour for future research would be to examine whether enhancement motives are associated with increased alcohol-related cognitions in the context of heightened positive mood, in younger cohorts of alcohol users, such as university students. Taken together, the present findings indicate that enhancement motives for alcohol use are positively associated with attentional bias towards alcohol stimuli, but not craving for alcohol in social drinkers. Moreover, enhancement motives do not account for variability in alcohol-related cognitions in response to heightened positive affect in the present sample of social drinkers.

*Reward Sensitivity and Alcohol-Related Cognitions*

A further objective of this chapter was to present findings regarding the association between trait reward sensitivity and alcohol-related cognitions in the context of heightened positive mood (relative to baseline and negative mood conditions). The findings partially supported hypothesis four, in that trait reward sensitivity was positively associated with biases in maintenance of attention (but not initial orientation) towards alcohol stimuli in the present sample of social drinkers. However, in contrast to the predictions made by hypothesis four, the association between reward sensitivity and alcohol attentional bias was not exclusive to the positive mood condition. That is, trait reward sensitivity was positively associated with biases in maintenance of attention across each of three investigated mood conditions (i.e. positive mood, negative mood induction and baseline conditions). Additionally, heightened trait reward sensitivity was positively associated with craving for alcohol following positive mood induction.
in the present sample of social drinkers. However, in contrast to the predictions made by hypothesis four, the association between reward sensitivity and craving for alcohol was not exclusive to the positive mood condition. That is, reward sensitivity was also positively associated with craving for alcohol at baseline measures (but not following negative mood induction). Taken together, the present findings indicate that whilst individuals with heightened trait reward sensitivity are likely to experience enhanced alcohol attentional bias towards alcohol stimuli and craving for alcohol, trait reward sensitivity does not account for variability in responsivity to increases in positive affect in the present sample of social drinkers.

Theoretical accounts propose that attentional bias towards alcohol stimuli develops through repeated experiences with the rewarding effects of alcohol (Franken, 2003; Robinson & Berridge, 1993; 2001). To this end, previous research indicates that alcohol attentional bias is generally more pronounced in heavier drinkers with more extensive alcohol use histories, relative to lighter drinkers (Bruce & Jones, 2004; Field et al., 2004; Field et al., 2007; Murphy & Garavan, 2011; Sharma et al., 2001; Tibboel et al., 2010; Townshend & Duka, 2001). However, the present findings indicate that attentional bias towards alcohol stimuli is not only influenced by the extent of one’s alcohol use, but is also predicted by heightened sensitivity to rewarding stimuli (i.e. alcohol cues) in social drinkers. To this end, the experimental findings presented in this chapter provide the first known empirical evidence that heightened trait reward sensitivity is associated with enhanced attentional bias towards alcohol stimuli in social drinkers. Furthermore, the current findings suggest that social drinkers with
heightened trait reward sensitivity also experience increased craving for alcohol. Given that social drinking is likely to precede problematic levels alcohol use, the present experimental findings provide important information regarding potential pathways to dependence. That is, the present findings indicate that individuals with heightened reward sensitivity may be more vulnerable to engaging in clinically relevant alcohol-related cognitions that are consistently associated with problematic alcohol drinking behaviour.

A wealth of existing literature illustrates that heightened reward sensitivity is positively associated with alcohol use (Booth & Hasking, 2009; Gullo, et al., 2010; Gullo et al., 2010; Ivory & Kambouropoulos, 2012; Kabbani & Kambouropoulos, 2013; Loxton & Dawe, 2001; Morgan et al., 2014; Lyvers et al., 2009; O’Connor & Colder, 2005; Tapper et al., 2015), and that both attentional bias towards alcohol stimuli and subjective craving increase subsequent alcohol consumption (Field & Eastwood, 2005; O’Malley, 2002). Thus, in conjunction with these previous findings, the present outcomes suggest that attentional bias towards alcohol stimuli and craving for alcohol may be the mechanisms through which heightened reward sensitivity influences drinking behaviour. That is, individuals with heightened trait reward sensitivity may engage in alcohol use as a result of increased craving for alcohol and enhanced attention directed towards alcohol-related cues. However, longitudinal studies are required to determine whether enhanced alcohol attentional bias and craving for alcohol subsequently lead to alcohol use in individuals with heightened reward sensitivity. Furthermore, the association between heightened reward sensitivity and alcohol-related cognitions holds important clinical implications for alcohol
use intervention. To this end, therapeutic techniques that aim to modify attentional processes and manage alcohol cravings may interrupt well-established pathways between reward sensitivity and alcohol use. Preliminary evidence suggests that attentional bias modification training demonstrates clinical utility for the treatment of problematic alcohol use (Fadardi & Cox, 2009; Field & Eastwood, 2005; Schoenmakers & Weirs, 2010). Similarly, interventions that aim to reduce craving for alcohol have also demonstrated clinical efficacy (Hallgren, Owens, Brovko, Ladd, McCrady & Epstein, 2015; Naqvi et al., 2015). Therefore, the present findings indicate that alcohol users with heightened trait reward sensitivity may be particularly likely to benefit from clinical interventions that involve attentional bias modification training and craving management.

Initial Orientation vs Maintenance of Attention towards Alcohol Stimuli

The present dissertation aimed to address limitations of previous attentional bias research by examining differences in biases in initial orientation and maintenance of attention towards alcohol stimuli. Contrary to predictions, the findings indicate that positive mood induction did not significantly enhance biases in initial orientation or maintenance of attention towards alcohol stimuli in the present sample of social drinkers. Moreover, unlike biases in maintenance of attention, positively reinforced drinking motives (i.e. social and enhancement drinking motives) and heightened trait reward sensitivity were not significantly associated with biases in initial orientation towards alcohol-related stimuli at baseline, or following either positive or negative mood inductions. Thus, the present findings suggest that the positively reinforced drinking motives (i.e. social and enhancement motives) and individual variation in trait reward sensitivity are
not likely to impact the relatively rapid automatic processing of alcohol related
cues. These outcomes are comparable to previous research by Field and
colleagues (2004) who found that heavy social drinkers demonstrated greater
biases in maintenance of attention, but not initial orientation towards alcohol
related cues. Only one existing study has found that changes in mood state
influences biases in initial orientation towards alcohol stimuli in social drinkers
(Field & Quigley, 2009). However, this previous study examined the influence of
stress induction on biases in initial orientation (Field & Quigley, 2009), indicating
that the relatively automatic rapid processing of alcohol stimuli may be influenced
by negative emotions (i.e. stress), rather than heightened positive affect. Although
hypotheses regarding biases in initial orientation were not supported, the current
findings provide important information regarding the specific aspects of attention
(i.e. maintenance of attention) that are likely to be influenced by individual
variation in factors such drinking motives and trait reward sensitivity.

*Positive Mood as Moderating Associations between Individual Difference Factors and Alcohol-Related Cognitions in Social Drinkers*

It was anticipated that participants’ reported level of positive mood would
moderate associations between individual difference factors and alcohol-related
cognitions following the positive mood induction. That is, it was predicted that
the association between positively reinforced drinking motives (i.e. social and
enhancement drinking motives) and alcohol-related cognitions (i.e. attentional
bias and craving) would be strongest in those who reported higher levels of
positive mood following the positive mood induction. However, contrary to
hypotheses 5(a) and 6(a), reported level of positive mood was not found to have a
moderating influence on the association between social and enhancement drinking
motives and alcohol attentional bias in the present study. Similarly, in contrast to the predictions made by hypotheses 5(b) and 6(b), reported level of positive mood was not found to have a moderating influence on the association between social and enhancement drinking motives and craving for alcohol in the present study. Moreover, it was expected that associations between trait reward sensitivity and alcohol-related cognitions would be strongest in those who report higher levels of positive mood following the positive mood induction. Contrary to hypothesis 7(a) and 7(b), the present findings indicate that reported level of positive mood did not moderate the associations between trait reward sensitivity and alcohol attentional bias or craving for alcohol following positive mood induction. Whilst analyses evaluating the efficacy of the positive mood manipulation procedure indicated that the positive mood induction was successful in increasing positive mood amongst participants (see p. 60) it may be the case that the reported level of positive mood was not substantial enough to have a moderating influence on the association between the investigated individual difference factors (i.e. social motives, enhancement motives and trait reward sensitivity) and alcohol-related cognitions in the present sample of social drinkers. Alternatively, given that social drinking motives, enhancement drinking motives and reward sensitivity were positively associated with alcohol attentional bias and craving for alcohol in the context of other mood conditions (i.e. baseline measures and following negative mood induction), it may be the case that positive mood is not an important factor in the association between these individual difference factors and alcohol-related cognitions per se. As such, no firm conclusions can be drawn, and further investigation is required to determine whether positive mood moderates the association between the investigated individual differences factors (i.e. social and
enhancement drinking motives and reward sensitivity) and alcohol-related cognitions in studies where level of positive mood is reported to be higher amongst study participants.

Study Limitations

A limitation of the findings presented in this chapter is that the present sample of social drinkers reported relatively low mean scores on measures of sensitivity to reward (see p. 56) which is likely to have impacted on findings regarding this variable. Furthermore, low reported means for alcohol craving and substantial variation in attentional bias scores (as indicated by large standard deviation scores relative to the mean) may have also impeded present findings. Additionally, it is important to note that the risk of Type 1 error is inflated as multiple significance tests were conducted in the analyses. Future studies may consider reducing the significance level to .01 in order to minimise the risk of Type 1 error. However, given the exploratory nature of the present analyses, a significance level of .05 was maintained. Other study limitations and clinical implications of present findings will be presented in the general discussion.

Conclusions

To conclude, the findings presented in this chapter provide the first known experimental evidence that heightened positive mood (via mood induction) significantly enhances craving for alcohol in social drinkers. In contrast, positive mood induction did not significantly enhance attentional bias towards alcohol stimuli (maintenance of attention and initial orientation), relative to baseline measures in social drinkers. Moreover, the findings indicate that positively
reinforced drinking motives and trait reward sensitivity do not account for variation in alcohol-related cognitions in response to increases in positive affect. Additionally, positive mood does not moderate associations between positively reinforced drinking motives (i.e. social and enhancement motives) or trait reward sensitivity and alcohol-related cognitions following positive mood induction. The present findings may have been impeded by a lack of variance in relation to measures of enhancement drinking motives and reward sensitivity, as well as low reported means for alcohol craving and substantial variation in attentional bias scores. Although many of the hypotheses regarding individual difference factors were unsupported, a number of important findings were obtained that enhance understanding of drinking patterns and behaviour in social drinkers. To this end, the present findings suggest that individuals who drink to enhance positive affect and to socialise with others, are more inclined to attend to alcohol-related stimuli in the environment. Moreover, the findings presented in this chapter demonstrated that social motives for drinking are associated with increased craving for alcohol at under baseline and positive mood conditions (but not in the negative mood condition). On the other hand, enhancement motives for drinking were not associated with increased craving for alcohol across any of the mood conditions. Furthermore, the present findings provide the first known empirical evidence that heightened trait reward sensitivity is positively associated with attentional bias towards alcohol-related cues in social drinkers. Additionally, the findings demonstrate that heightened reward sensitivity is positively associated with craving for alcohol in social drinkers. An additional observation is that social and enhancement drinking motives and trait reward sensitivity were significantly associated with biases in the maintenance of attention specifically, and not biases
in the initial orientation towards alcohol-related cues. This has important clinical implications as biases in the maintenance of attention may be more amenable to therapeutic intervention compared to the relatively rapid and automatic processing of alcohol stimuli that is characteristic of initial orientation towards alcohol cues. Taken together, the findings presented in this chapter provide important information regarding cognitive correlates of alcohol use in social drinkers, which may be used to guide clinical interventions for alcohol use.
Chapter 5

ALCOHOL-RELATED COGNITIONS IN SOCIAL DRINKERS: THE ROLE OF NEGATIVE MOOD AND INFLUENTIAL FACTORS ASSOCIATED WITH NEGATIVE REINFORCEMENT

This chapter reports on one of the primary research questions related to the role of negative mood in alcohol-related cognitions in social drinkers, and whether theoretically derived individual factors play a role in this relationship. This chapter reports on findings that examine whether negative mood induction significantly enhances attentional bias towards alcohol stimuli and craving for alcohol in social drinkers, in comparison to baseline measures of mood state. Secondly, this chapter reports on findings that assess whether negatively reinforced drinking motives (i.e. coping and conformity motives) are positively associated with attentional bias towards alcohol stimuli and craving for alcohol in the context of heightened negative mood. Furthermore, this chapter examines whether tolerance of negative affect is negatively associated with alcohol attentional bias and craving for alcohol in the context of heightened negative mood. An additional objective of this chapter is to report on findings that investigate whether associations between negatively reinforced drinking motives (i.e. coping and conformity motives) and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) is strongest in those who report higher levels of negative mood following the negative mood induction. Of further interest to this chapter is reporting on findings that examine whether the association between tolerance of negative affect and alcohol-related cognitions is strongest in those who report higher levels of negative mood following the negative mood induction.
Negative Reinforcement of Alcohol-Related Cognitions

Theoretical accounts propose that some individuals are motivated to consume alcohol in order to reduce or avoid negative emotional experiences (Baker et al., 2004). Specifically, it is postulated that individuals learn that alcohol can temporarily alleviate negative affect, thereby reinforcing this behaviour and increasing the likelihood of using alcohol to avoid or reduce negative emotions in the future. Consequently, negative mood has been identified as one of the key predictors of alcohol use disorders (Witkiewitz, Bowen & Donovan, 2011) and is consistently associated with problematic alcohol use (Colder & Chassin, 1993; Dvorak et al., 2014; Kuvaas et al., 2014; Wills et al., 2006; Witkiewitz et al., 2011; Wray et al., 2012) and relapse following treatment (Lowman, et al., 1996; Witkiewitz, 2011; Witkiewitz & Villarroel, 2009; Zywiak et al., 2006). Extending on negative reinforcement theory of alcohol use, it is proposed that increases in negative affect may influence important cognitive correlates of alcohol use, including attentional bias towards alcohol stimuli and craving for alcohol. Chapter three findings lend support to this contention by demonstrating that alcohol attentional bias and craving for alcohol are significantly associated in the context of heightened negative mood (via mood induction) in social drinkers. Examining circumstances that influence alcohol-related cognitions in social drinkers provides clinically relevant information that may enhance understanding of pathways to problematic alcohol use. Thus, a focus of this chapter is to examine the influence of heightened negative affect on attentional bias towards alcohol stimuli and craving for alcohol in social drinkers.
A wealth of literature has established that experimental manipulation of negative mood enhances craving for alcohol in dependent drinkers (Coffey et al., 2002; 2006; 2010; Cooney, et al., 1997; Litt et al., 1990; Rubonis et al., 1994; Saladin et al., 2003; Stasiewicz et al., 1997). Moreover, previous research indicates that reducing craving through targeted intervention, subsequently decreases the association between negative affect and heavy alcohol use (Witkiewitz et al., 2011). However, previous research examining the influence of negative affect on craving for alcohol in social drinkers is limited and inconsistent. Only two previous experimental studies have examined the influence of negative affect on craving for alcohol in social drinkers, with inconsistent findings (Bailey & Baillie, 2013, Field & Powell, 2007). To this end, Field and Powell (2007) established that heightened negative affect (i.e. via stress induction) increased craving for alcohol in social drinkers (Field & Powell, 2007). On the other hand, Bailey and Baillie (2013) found that heightened negative mood (via mood induction) did not significantly enhance craving for alcohol in social drinkers. These previous (Bailey & Baillie, 2013; Field & Powell, 2007) examined the influence of negative affect on craving for alcohol in undergraduate university students, thus it is not clear whether findings would generalize to older adult social drinkers. In light of the limited and inconsistent findings of previous research, further examination of the influence of heightened negative affect on craving for alcohol in social drinkers is warranted.
The Role Negative Mood in Alcohol Attentional Bias in Social Drinkers

Existing experimental studies examining the influence of heightened negative affect on attentional bias towards alcohol stimuli in social drinkers is also relatively limited. Three experimental studies have established that negative mood induction enhances attentional bias towards alcohol stimuli in social drinkers who report drinking alcohol to cope with negative emotions (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007). A study conducted by Grant and colleagues (2007) demonstrated that musically induced anxious mood was associated with increased attentional bias for alcohol-related cues in college students who endorse coping motives for drinking. Similarly, exposure to a laboratory stress task was found to increase biases in attention towards alcohol stimuli in individuals who drink to cope (Field & Powell, 2007; Field & Quigley, 2009). On the other hand however, two other studies have found that experimental manipulation of negative mood did not increase biases in attention towards alcohol in coping-motivated drinkers (Birch et al., 2008; Emery & Simons, 2015). Additionally, previous research has examined the influence of heightened negative affect on alcohol attentional bias in university students exclusively (Birch et al., 2008; Emery & Simons, 2015; Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007). Thus, it is not clear whether findings would generalize to older adult social drinkers. Therefore, there is inconsistency within the available literature regarding the influence of heightened negative affect on attentional bias towards alcohol stimuli in social drinkers, which requires further investigation.
The existing literature examining the influence of heightened negative affect on alcohol attentional bias and craving for alcohol in social drinkers is both limited and inconsistent. Collectively, previous studies indicate that there is variability in responsivity to heightened negative affect amongst social drinkers. That is, not all social drinkers respond equally to increases in negative mood with enhanced alcohol attentional bias and craving for alcohol. Given the implications for understanding drinking behaviour, it is important to establish why some social drinkers are more likely to experience alcohol attentional bias and craving for alcohol in the context of heightened negative mood. Surprisingly, very few studies have examined factors associated with the individual that may account for variability in responsivity to heightened negative affect in social drinkers. To this end, it is suggested that the strength of the negative reinforcement system in any given individual becomes an important source of variability that influences the propensity to engage in alcohol seeking behaviours in the context of heightened negative mood (Ralston et al., 2013). As such, the literature indicates that negatively reinforced motives for alcohol use, such as coping and conformity drinking motives (Cooper, 1994), may provide insight as to why some individuals experience enhanced alcohol attentional bias and craving for alcohol following increases in negative mood. Moreover, the literature indicates that individual differences in capacity to tolerate negative emotions (Simons & Gaher, 2005) may also influence vulnerability to experiencing greater alcohol-related cognitions in the context of heightened negative affect.
Cooper (1994) identified two differential motivations for consuming alcohol that reflect negative reinforcement contingencies: *coping motives* and *conformity motives* for alcohol use. According to Cooper (1994), coping motives are internally derived motivations for alcohol use that involve consuming alcohol to reduce or avoid negative affect and are directly associated with emotion regulation. On the other hand, *conformity motives* are externally derived motivations for alcohol use that involve drinking to fit in with a group, and are indirectly related to affect regulation through other incentives. Given that both *coping* and *conformity* motives for alcohol use are associated with regulation of negative emotional experiences, it follows that individuals who identify with these drinking motives may be more inclined to engage in alcohol-related cognitions in the context of heightened negative mood. Existing studies examining the associations between drinking motives and alcohol-related cognitions in the context of heightened negative mood have been confined to internal drinking motives exclusively (i.e. coping motives). Therefore, previous research has not yet considered how external drinking motives (i.e. conformity motives) may influence alcohol-related cognitive processes, such as attentional bias and craving for alcohol, in the context of heightened negative mood in social drinkers.

Previous research indicates that coping-motivated drinkers display greater attentional bias towards alcohol stimuli following experience of anxious mood, relative to positive mood (Grant et al., 2007) and in response to exposure to increases in stress (Field & Powell, 2007; Field & Quigley, 2009). Taken together, these studies indicate that individuals who drink alcohol to cope with
negative affect are more likely to attend to alcohol-related stimuli in the context of negative emotional experiences. Other studies however, have found that coping motives do not influence attentional bias towards alcohol stimuli in the context of heightened negative affect (Birch et al., 2008; Emery & Simons, 2015). For example, Birch and colleagues found that experimental manipulation of negative mood did not increase biases in attention towards alcohol in coping-motivated drinkers (Birch et al., 2008). Similarly, Emery & Simons (2015) recently found that coping motives failed to moderate the association between negative mood and attentional bias towards alcohol stimuli. However, this finding was due to insignificant associations between heightened negative affect and attentional bias towards alcohol stimuli. Thus, inconsistency exists within the available literature regarding the influence of coping motives on attentional bias towards alcohol cues, particularly in the context of heightened negative mood. Moreover, there are currently no known studies examining the influence of conformity drinking motives on alcohol attentional bias in the context of heightened negative mood in social drinkers.

Existing research regarding the influence of negatively reinforced drinking motives (i.e. coping and conformity motives) is limited. Only two known experimental studies have examined the association between coping drinking motives and craving for alcohol, in the context of heightened negative mood (Bailey & Baillie, 2013; Field & Powell, 2007). Contrary to their hypotheses, Bailey and Baillie (2013) found that individuals who endorse coping motives for drinking did not experience increased craving for alcohol following negative mood induction. However, the authors concede that the median split used to select
participants with high endorsement of coping motives may have limited these results. Furthermore, a placebo alcoholic beverage administered prior to the mood induction did not effectively assist in reducing negative affect, thus participants may not have desired another drink to cope with heightened negative mood in this instance. Furthermore, Field and Powell (2007) found that a laboratory stress task enhanced craving for alcohol, irrespective of whether participants reported high or low levels of coping motives. Taken together, these findings suggest that higher levels of coping drinking motives are not positively associated with craving for alcohol in the context of heightened negative mood. However, these previous studies (Bailey & Baillie, 2013; Field & Powell, 2007) have included samples of university students exclusively, and thus it is not clear whether the findings generalise to older adult social drinkers. Furthermore, there are currently no known studies examining the influence of conformity drinking motives on craving for alcohol in the context of heightened negative mood in social drinkers. Therefore, further research is required to elucidate the influence of coping and conformity motives and alcohol-related cognitions in the context of heightened negative mood in social drinkers.

_Tolerance of Negative Affect_

Theoretical accounts inherently propose that individuals vary in their capacity to endure negative emotional experiences (Baker et al., 2004). Consequently, low tolerance of negative affect is often accompanied by action tendencies to avoid or alleviate negative emotional experiences, such as engaging in alcohol use for rapid attenuation of negative mood (Simons & Gaher, 2005). Previous research has often used the meta-emotion construct of distress tolerance
(Simons & Gaher, 2005) to measure an individual’s capacity to tolerate negative emotions. To this end, existing studies have demonstrated significant associations between low distress tolerance and alcohol-related problems (Buckner et al., 2007; Denhardt & Murphy, 2011; Simons & Gaher, 2005). Furthermore, Howell and colleagues (2010) found that individuals with low distress tolerance reported motivation to consume alcohol in order to cope with negative emotional states. Additionally, distress tolerance has been found to both mediate (Buckner et al., 2007) and moderate (Gorka, Ali & Daughters, 2011) the relationship between depression and problematic alcohol use. Taken together, these studies indicate that individuals with low tolerance of negative affect are particularly vulnerable to alcohol use when in the context of heightened negative mood. Moreover, the inability to tolerate negative affect, more so than the presence of negative affect per se, may increase risk for alcohol use problems. Therefore, it is reasonable to assume that individual variation in capacity to tolerate negative emotions may account for why some social drinkers experience increased alcohol-related cognitions in the context of heightened negative mood. However, there are currently no known experimental studies that have investigated associations between tolerance of negative affect and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) following negative mood induction in social drinkers. Given the implications for treatment, the present study will examine whether individual variation in capacity to tolerate negative affect is associated with greater alcohol attentional bias and craving for alcohol following increases in negative mood (via mood induction) in social drinkers.
Summary

In line with negative reinforcement perspectives of alcohol use (Baker et al., 2004) it is proposed that increases in negative affect may enhance alcohol attentional bias and craving for alcohol in social drinkers. However, the influence of heightened negative affect on alcohol-related cognitions in social drinkers is currently unclear, as previous studies have produced inconsistent findings and have been confined to the examination of university students exclusively (Bailey & Baillie, 2013; Birch et al., 2008; Emery & Simons, 2015; Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007). Moreover, the collection of available studies indicates that there is variability in responsivity to heightened negative affect in social drinkers. Yet, very few studies have examined factors associated with the individual that may account for why some social drinkers are more likely to engage in alcohol-related cognitions in the context of heightened negative mood. To this end, it is proposed that negatively reinforced drinking motives (i.e. coping and conformity motives), and individual variation in capacity to tolerate negative emotions, may account for variability in responsivity to heightened negative affect in social drinkers. Previous studies have examined the influence of coping motives for drinking on alcohol-related cognitions in the context of heightened negative mood with incongruent findings (Bailey & Baillie, 2013; Birch et al., 2008; Emery & Simons, 2005; Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007). Moreover, there is currently no empirical literature regarding the associations between conformity drinking motives and alcohol-related cognitions following negative mood induction in social drinkers. Additionally, whilst it has been established that low tolerance of negative affect is associated with problematic alcohol use (Buckner et al., 2007; Denhardt &
Murphy, 2011; Gorka et al., 2011; Simons & Gaher, 2005), existing studies are yet to examine whether individual variability in capacity to tolerate negative affect is associated with greater alcohol-related cognitions in the context of heightened negative mood. Therefore, a focus of this chapter is to present findings that examine the influence of negative mood induction on alcohol-related cognitions in social drinkers. Moreover, this chapter will present findings that investigate whether individual variation in negatively reinforced drinking motives (i.e. coping and conformity motives) and tolerance of negative affect account for variability in responsivity to heightened negative affect in social drinkers.

Aims and Hypotheses

This chapter aims to present findings that investigate whether heightened negative mood enhances alcohol attentional bias and craving for alcohol in social drinkers. Moreover, this chapter aims to present findings that will examine whether coping and conformity motives for alcohol use and low tolerance of negative emotions are associated with greater alcohol attentional bias and craving for alcohol in the context of heightened negative mood. This will be investigated along two key lines: The first will involve exploring whether coping and conformity motives and lower tolerance of negative affect are associated with increased alcohol attentional bias and craving for alcohol following negative mood induction, relative to baseline measures and positive mood induction. The second will involve examining whether associations between individual difference factors (i.e. coping motives, conformity motives and tolerance of negative affect) and alcohol-related cognitions are strongest in those who report higher levels of negative mood following negative mood induction. Eye-tracking
equipment will be used to measure different subcomponents of attention, including biases in initial orientation and maintenance of attention towards alcohol-related cues. Moreover, empirically supported mood manipulation procedures will be employed to stimulate both positive and negative affect in the present sample of social drinkers.

In light of previous research the following hypotheses are made:

1. Attentional bias towards alcohol stimuli (initial orientation and maintenance of attention) and craving for alcohol will be significantly enhanced following negative mood induction, relative to baseline measures in social drinkers.

2. Coping motives for drinking will be positively associated with (a) biases in maintenance of attention towards alcohol stimuli, (b) biases in initial orientation towards alcohol stimuli, and (c) subjective craving for alcohol, following negative mood induction, but not at baseline measures or following positive mood induction.

3. Conformity motives for drinking will be positively associated with (a) biases in maintenance of attention towards alcohol stimuli, (b) biases in initial orientation towards alcohol stimuli, and (c) subjective craving for alcohol, following negative mood induction, but not at baseline measures or following positive mood induction.
4. Tolerance of negative affect will be negatively associated with (a) biases in maintenance of attention towards alcohol stimuli, (b) biases in initial orientation towards alcohol stimuli, and (c) subjective craving for alcohol, following negative mood induction, but not at baseline or following positive mood induction.

5. The associations between coping drinking motives and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of negative mood following negative mood induction.

6. The associations between conformity drinking motives and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of negative mood following negative mood induction.

7. The associations between tolerance of negative affect and alcohol-related cognitions (i.e. (a) alcohol attentional bias and (b) craving for alcohol) will be strongest in those who report higher levels of negative mood following negative mood induction.
METHOD

Data from a sample of 99 social drinkers were included in the analyses. Information pertaining to participants, materials and methodology of the present dissertation is presented in chapter two (see p. 48)

DATA ANALYSES

See p. 56 for a description of data screening and testing of assumptions. To test the hypotheses, a series of t-test analyses were first conducted to examine whether negative mood induction enhanced alcohol attentional bias and craving for alcohol, relative to baseline measures. Next, bivariate (Pearson) correlation analyses and hierarchical regression analyses were conducted to examine associations between individual difference factors (i.e. coping and conformity drinking motives and tolerance of negative emotions) and alcohol-related cognitions (i.e. biases in initial orientation, biases in maintenance of attention and subjective craving for alcohol) under negative mood, positive mood and baseline conditions. Additionally, hierarchical regression analyses were conducted to examine associations between individual difference factors and alcohol-related cognitions, where participants’ reported level of alcohol use was found to influence the dependent variables. Moderation regression analysis was conducted to examine whether the association between conformity drinking motives and attentional bias is strongest in those who report higher levels of negative mood following the negative mood induction. In light of the findings of Pearson’s correlation and hierarchical regression analyses (i.e. no significant associations), no further analyses were conducted to determine whether reported level of
negative mood moderates the association between the other individual difference factors examined (i.e. coping motives and tolerance of negative affect) and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) following negative mood induction.

RESULTS

The Influence of Negative Mood Induction on Alcohol-Related Cognitions

Hypothesis 1

A series of paired samples -test analyses were conducted to test the hypothesis that negative mood induction would enhance alcohol-related cognitions (biases in maintenance of attention, biases in initial orientation and craving for alcohol), relative to baseline measures in social drinkers (see Table 4.1). The analyses revealed that negative mood induction did not significantly enhance attentional bias towards alcohol stimuli (maintenance of attention and initial orientation) and craving for alcohol in social drinkers.

Table 4.1.

Results for Paired-Samples t-tests for Comparison of Alcohol-Related Cognitions Measured at Baseline and Following Negative Mood Induction

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline</th>
<th>Negative Mood</th>
<th>95% CI for mean</th>
<th>t</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>AB Main</td>
<td>-207.26</td>
<td>323.61</td>
<td>-164.44</td>
<td>415.17</td>
<td>-14.74-100.39</td>
</tr>
<tr>
<td>AB I.O</td>
<td>24.15</td>
<td>124.36</td>
<td>3.72</td>
<td>175.37</td>
<td>-57.66-16.79</td>
</tr>
<tr>
<td>Craving</td>
<td>11.61</td>
<td>16.51</td>
<td>10.74</td>
<td>14.30</td>
<td>-3.49-1.75</td>
</tr>
</tbody>
</table>

Note. AB Main= biases in maintenance of attention, AB I.O = biases in initial orientation, Craving = craving for alcohol
Hypothesis 2(a)

Pearson’s correlation analysis was conducted to test the hypothesis that coping motives for alcohol use would be positively associated with biases in maintenance of attention following negative mood induction, but not at baseline measures or following positive mood induction. Pearson’s correlation analysis revealed that coping motives for drinking were not significantly associated with biases in maintenance of attention following negative mood induction $r = .15, n = 99, p = .14$, positive mood induction $r = .13, n = 99, p = .19$, or at baseline $r = .17, n = 99, p = .09$. Thus, the findings suggest that coping motives for drinking are not positively associated with biases in maintenance of attention across each of the investigated mood conditions (negative mood, positive mood and baseline conditions).

Hypothesis 2(b)

Pearson’s correlation analysis was conducted to test the hypothesis that coping motives for alcohol use would be positively associated with biases in initial orientation towards alcohol stimuli following negative mood induction, but not at baseline measures or following positive mood induction. Pearson’s correlation analysis revealed there were no significant correlations observed between coping motives for alcohol use and biases in initial orientation towards alcohol at baseline, $r = -.03, n = 99, p = .73$, following negative mood induction, $r = .06, n = 99, p = .56$, or following positive mood induction, $r = .03, n = 99, p = .79$. Therefore, the findings suggest that coping motives for drinking are not positively associated with biases in initial orientation towards alcohol stimuli in
the context of heightened negative mood, or other investigated mood conditions (i.e. positive mood and baseline conditions).

**Hypothesis 2(c)**

Pearson’s correlation analysis was conducted to test the hypotheses that coping drinking motives would be positively associated with craving for alcohol following negative mood induction, but not at baseline measures or following positive mood induction. The analysis revealed small, albeit significant positive correlations between coping drinking motives and craving for alcohol following negative mood induction $r = .22, n = 99, p < .05$, positive mood induction $r = .26, n = 99, p < .05$, and at baseline $r = .29, n = 99, p < .01$. Pearson’s correlation analysis also indicated that reported level of alcohol use (as measured by the AUDIT) was significantly associated with craving for alcohol across each of the mood conditions (baseline $r = .45, n = 99, p < .001$, positive mood $r = .32, n = 99, p < .01$, negative mood $r = .39, n = 99, p < .001$). As such, an additional hierarchical regression analysis was conducted to further examine the association between coping drinking motives and craving for alcohol, whilst controlling for level of alcohol use (see Table 4.2). The hierarchical regression analysis indicates that when controlling for reported level of alcohol use, coping motives for alcohol use did not significantly contribute to variance in craving for alcohol under negative mood, positive mood or baseline conditions.
Table 4.2. Hierarchical Regression Analyses Evaluating Alcohol Use and Coping Drinking Motives as Predictors of Craving in Baseline, Positive Mood and Negative Mood Conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
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<th>$sr^2$</th>
<th>$R^2$</th>
<th>$AR^2$</th>
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<tbody>
<tr>
<td><strong>Baseline</strong></td>
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<td></td>
</tr>
<tr>
<td>Step 1 Alcohol use</td>
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<td>5.02</td>
<td>.20</td>
<td></td>
<td><strong>.21</strong></td>
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<tr>
<td>Step 2 Alcohol Use</td>
<td><strong>.41</strong></td>
<td>3.96</td>
<td>.13</td>
<td></td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>Coping Motives</td>
<td>.08</td>
<td>.80</td>
<td></td>
<td>.00</td>
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<tr>
<td><strong>Positive mood</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1 Alcohol use</td>
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<td>3.36</td>
<td>.10</td>
<td></td>
<td><strong>.10</strong></td>
</tr>
<tr>
<td>Step 2 Alcohol use</td>
<td><strong>.26</strong></td>
<td>2.35</td>
<td>.05</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Coping Motives</td>
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<td>1.16</td>
<td></td>
<td>.01</td>
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<tr>
<td><strong>Negative mood</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Step 1 Alcohol use</td>
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<td>4.17</td>
<td>.15</td>
<td></td>
<td><strong>.15</strong></td>
</tr>
<tr>
<td>Step 2 Alcohol use</td>
<td><strong>.37</strong></td>
<td>3.42</td>
<td>.10</td>
<td></td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>Coping Motives</td>
<td>.04</td>
<td>.38</td>
<td></td>
<td>.00</td>
</tr>
</tbody>
</table>

Note. * Indicates significance value of $p < .05$, ** indicates significance value of $p < .01$

**Hypothesis 3(a)**

Pearson’s correlation analysis was conducted to test the hypothesis that conformity motives for alcohol use would be positively associated with biases in maintenance of attention following negative mood induction, but not at baseline measures or following positive mood induction. Pearson’s correlation analysis revealed small, albeit significant correlations between conformity drinking motives and biases in maintenance of attention at baseline $r = .20$, $n = 99$, $p < .05$ and following negative mood induction $r = .22$, $n = 99$, $p < .05$. In contrast, conformity motives were not significantly associated with biases in maintenance of attention following the positive mood induction $r = .14$, $n = 99$, $p = .18$. 

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The analysis also revealed that participant’s reported level of alcohol use (as measured by the AUDIT), was not significantly associated with biases in maintenance of attention across each of the investigated mood conditions (baseline $r = .12, n = 99, p = .22$, positive mood $r = .10, n = 99, p = .31$, negative mood $r = .18, n = 99, p = .07$). Therefore, level of alcohol use was not entered as a covariate in the analysis. Taken together, the findings indicate that conformity motives for alcohol use are positively associated with biases in maintenance of attention under baseline and negative mood conditions, but not in the positive mood condition.

**Hypothesis 3(b)**

Pearson’s correlation analysis was conducted to test the hypothesis that conformity motives for alcohol use would be positively associated with biases in initial orientation towards alcohol stimuli following negative mood induction, but not at baseline measures or following positive mood induction. The analysis indicated that there were no significant correlations between conformity motives for alcohol use and biases in initial orientation towards alcohol at baseline, $r = .00, n = 99, p = .97$, following negative mood induction, $r = -.04, n = 99, p = .70$, or following positive mood induction, $r = .01, n = 99, p = .91$. Therefore, the findings indicate that conformity motives for alcohol use are not positively associated with biases in initial orientation towards alcohol-related stimuli across each of the investigated mood conditions.
Hypothesis 3(c)

Pearson’s correlation analysis was conducted to test the hypothesis that conformity motives for alcohol use would be positively associated with craving for alcohol following negative mood induction, but not at baseline measures or following positive mood induction. Pearson’s correlation analysis indicates small, albeit significant positive correlations between conformity drinking motives and craving for alcohol following negative mood induction $r = .27, n = 99, p < .01$ and positive mood induction $r = .25, n = 99, p < .05$. In contrast, conformity drinking motives were not significantly associated with craving for alcohol at baseline $r = .19, n = 99, p = .05$. Pearson’s correlation analysis indicated that reported level of alcohol use (as measured by the AUDIT) was significantly associated with craving for alcohol in the positive mood ($r = .32, n = 99, p < .01$) and negative mood ($r = .39, n = 99, p < .001$) conditions. As such, an additional hierarchical regression analysis was conducted to further examine the association between conformity drinking motives and craving for alcohol in the context of heightened negative mood and positive mood, whilst controlling for level of alcohol use (see Table 4.2). The hierarchical regression analysis indicates that conformity motives for alcohol use did not significantly contribute to variance in craving for alcohol under negative or positive mood conditions, when controlling for reported level of alcohol use.
Table 4.3. Hierarchical Regression Analyses Evaluating Alcohol Use and Conformity Drinking Motives as Predictors of Craving in Positive Mood and Negative Mood Conditions

<table>
<thead>
<tr>
<th>Variable</th>
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<th>R²</th>
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<tbody>
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<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>.32**</td>
<td>3.35</td>
<td>.10</td>
<td>.32</td>
<td>.10</td>
<td>.10**</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
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<td>2.53</td>
<td>.06</td>
<td>.34</td>
<td>.12</td>
<td>.02</td>
</tr>
<tr>
<td>Conformity Motives</td>
<td>.14</td>
<td>1.29</td>
<td>.12</td>
<td></td>
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</tr>
</tbody>
</table>

Note. * Indicates significance value of p <.05, ** indicates significance value of p<.01

The Influence of Tolerance of Negative Affect on Alcohol-Related Cognitions

Hypothesis 4(a)

Pearson’s correlation analysis was conducted to test the hypothesis that tolerance of negative affect (as measured by the distress tolerance scale) would be negatively associated with biases in maintenance of attention towards alcohol stimuli following negative mood induction, but not at baseline measures or following positive mood induction. The analysis revealed that tolerance of negative affect was not significantly associated with biases in maintenance of attention towards alcohol stimuli following negative mood induction $r = -.09, n = 99, p = .35$, positive mood induction $r = -.10, n = 99, p = .34$, or at baseline $r = .00, n = 99, p = .97$. Thus, the findings suggest that tolerance of negative affect is not significantly associated with biases in maintenance of attention towards alcohol.
stimuli across each of the investigated mood conditions (i.e. negative mood, positive mood and baseline conditions).

Hypothesis 4(b)

Pearson’s correlation analysis was conducted to test the hypothesis that tolerance of negative affect would be negatively associated with biases in initial orientation towards alcohol stimuli following negative mood induction, but not at baseline measures or following positive mood induction. The analysis revealed that tolerance of negative affect was not significantly associated biases in initial orientation towards alcohol at baseline, \( r = -.17 \), \( n = 99 \), \( p = .10 \), following negative mood induction, \( r = .11 \), \( n = 99 \), \( p = .27 \) or following positive mood induction, \( r = .03 \), \( n = 99 \), \( p = .78 \). Therefore, the findings suggest that tolerance of negative affect is not significantly associated with biases in initial orientation towards alcohol stimuli under negative mood, positive mood and baseline conditions.

Hypothesis 4(c)

Pearson’s correlation analysis was conducted to test the hypothesis that tolerance of negative affect would be negatively associated with craving for alcohol following negative mood induction, but not at baseline or following positive mood induction. The analysis revealed that tolerance of negative affect was not significantly associated with craving for alcohol following the negative mood induction \( r = .04 \), \( n = 99 \), \( p = .72 \), positive mood induction \( r = .00 \), \( n = 99 \), \( p = .96 \), or at baseline measures \( r = -.01 \), \( n = 99 \), \( p = .89 \). Thus, the findings indicate that tolerance of negative affect is not significantly associated with craving for alcohol.
alcohol in the context of heightened negative mood, or other investigated mood conditions (i.e. positive mood and baseline conditions).

Negative Mood as Moderating Associations between Coping Drinking Motives and Alcohol-Related Cognitions Following Negative Mood Induction

Hypothesis 5(a) and 5(b)

In light of the null findings regarding the association between coping motives for alcohol use and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) following negative mood induction, further analyses were not conducted to determine whether reported level of negative mood moderates the association between coping drinking motives and alcohol attentional bias or craving for alcohol, following negative mood induction.

Negative Mood as Moderating Associations between Conformity Drinking Motives and Alcohol-Related Cognitions Following Negative Mood Induction

Hypothesis 6(a)

A moderation regression analysis was conducted to test the hypotheses that reported level of negative mood would moderate the association between conformity drinking motives and attentional bias towards alcohol stimuli following negative mood induction. Given that conformity drinking motives were not found to be significantly associated with biases in initial orientation, only biases in maintenance of attention were explored in this instance. To control for the effect of habitual level of alcohol use, participants’ AUDIT scores were entered at step one and accounted for 3.4% of the variance in biases in maintenance of attention following negative mood induction. When conformity drinking motives and reported level of negative mood were entered at step two,
the model explained 10.4% of the variance in attentional bias following negative mood induction $F(3,95) = 3.67, p < .05$. As such, the inclusion of conformity drinking motives and negative mood accounted for an additional 7% of the variance in attentional bias, $R^2_{\text{change}} = .07, F(2, 95) = 3.72, p < .05$. The interaction effect of conformity drinking motives and negative mood was entered at step three. Following the inclusion of this effect, the overall model accounted for 11.3% of the variance in attentional bias following negative mood induction $F(4, 94) = 2.98, p < .05$. Thus, including the interaction between conformity drinking motives and negative mood only accounted for an additional 0.9% of the variance in attentional bias towards alcohol following negative mood induction $R^2_{\text{change}} = .01, F(1, 94) = .92, p = .34$. Inspection of the beta values revealed that the interaction between conformity motives and negative mood did not significantly contribute to biases in maintenance of attention following negative mood induction (beta = -0.09, $p = .34$). These findings indicate that reported level of negative mood does not moderate the association between conformity drinking motives and biases in maintenance of attention following negative mood induction. That is, the association between conformity drinking motives and alcohol attentional bias is not strongest in social drinkers who report higher levels of negative mood following negative mood induction.

**Hypothesis 6(b)**

In light of the null findings regarding the association between conformity drinking motives and craving for alcohol following negative mood induction, further analyses were not conducted to determine whether reported level of
negative mood moderates the association between conformity motives and craving for alcohol, following negative mood induction.

*Negative Mood as Moderating Associations between Tolerance of Negative Affect and Alcohol-Related Cognitions Following Negative Mood Induction*

**Hypothesis 7(a) and 5(b)**

In light of the null findings regarding the association between tolerance of negative affect and alcohol-related cognitions (alcohol attentional bias and craving for alcohol) following negative mood induction, further analyses were not conducted to determine whether reported level of negative mood moderates the association between tolerance of negative affect and alcohol attentional bias or craving for alcohol, following negative mood induction.

**DISCUSSION**

A primary objective of this chapter was to report on findings that investigate whether heightened negative mood influences alcohol-related cognitions in social drinkers. Contrary to predictions made by hypothesis one, negative mood induction was not found to significantly enhance alcohol attentional bias or craving for alcohol in the present sample of social drinkers. An additional objective of this chapter was to present findings that test the prediction that negatively reinforced drinking motives (i.e. coping and conformity motives) and lower tolerance of negative affect would be associated with greater alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) in the context of heightened negative mood. The predictions made by hypotheses two and four were not supported as coping motives and tolerance of negative affect
were not significantly associated with attentional bias towards alcohol stimuli (initial orientation and maintenance of attention) or craving for alcohol across each of the investigated mood conditions (i.e. negative mood, positive mood, or baseline conditions). In contrast, the findings partially support hypothesis three in that conformity motives for alcohol use were significantly associated with biases in maintenance of attention towards alcohol stimuli at baseline measures and following the negative mood induction (but not following positive mood induction). However, moderation analysis indicates that the association between conformity drinking motives and alcohol attentional bias was not strongest in those who reported higher levels of negative mood following the negative mood induction (hypothesis 6a). Furthermore, the findings did not support the other predictions made by hypothesis two, as craving for alcohol was not significantly associated with biases in initial orientation towards alcohol stimuli or craving for alcohol across each of the investigated mood conditions (i.e. negative mood, positive mood, or baseline conditions). Given the non-significant findings regarding coping motives, the moderating influence of reported level of negative mood on the associations between coping motives and alcohol-related cognitions following negative mood induction were not investigated (hypotheses 5a & 5b). Similarly, the moderating influence of reported level of negative mood on the associations between tolerance of negative affect and alcohol-related cognitions following negative mood induction were not investigated, given the previous non-significant findings (hypotheses 7a and 7b). Finally, in light of prior non-significant findings, the moderating influence of reported level of negative mood on the association between conformity motives and craving for alcohol following negative mood induction was not investigated (hypothesis 6b).
The findings presented in this chapter demonstrate that heightened negative mood (via mood induction) did not significantly enhance biases in maintenance of attention towards alcohol stimuli in social drinkers. This finding is consistent with two previous studies by Birch et al. (2008) and Emery and Simons (2015), who also found that negative mood induction did not significantly enhance attentional bias towards alcohol stimuli in social drinkers. On the other hand, the findings presented in this chapter are inconsistent with three existing studies demonstrating that experimentally induced negative affect is associated with biases in maintenance of attention towards alcohol-related cues in social drinkers (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007). The variability in outcomes may be due to qualitatively different negative mood inductions used across available studies. To this end, the negative mood induction procedures used in the present dissertation and in previous studies where heightened negative affect did not enhance alcohol attentional bias (Birch et al., 2008; Emery & Simons, 2015), were designed to elicit melancholic aspects of negative affect. On the other hand, in previous studies where heightened negative affect was found to increase attentional bias towards alcohol stimuli (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007), mood induction procedures experimentally induced arousal aspects of negative emotion, such as stress and anxiety. Taken together, the existing literature indicates that social drinkers may be more inclined to attend to alcohol stimuli in the context of heightened stress and anxiety, rather than when experiencing melancholic or dysphoric emotions. This observation has important clinical implications as it suggests that therapeutic interventions that aim to assist alcohol users in
controlling attention directed towards alcohol cues (Fadardi & Cox, 2009) are likely to benefit individuals who experience enhanced attentional bias in the context of heightened stress and anxiety.

*The Influence of Negative Mood on Biases in Initial Orientation*

The findings presented in this chapter indicate that heightened negative mood did not enhance biases in initial orientation towards alcohol stimuli in the present sample of social drinkers. This finding is incongruent with previous research conducted by Field and Quigley (2009), which found that a laboratory stress task subsequently increased biases in both initial orientation and maintenance of attention towards alcohol-related cues. However, the present findings are consistent with that of Field and colleagues (2004), who demonstrated that non-dependent drinkers did not display biases in initial orientation towards alcohol cues. As discussed previously, the mood manipulation procedure in the present study was designed to induce aspects of negative emotion that are more consistent with sadness or dysphoria, rather than anxiety or stress. Taken together, the available findings demonstrate that whilst stress may influence biases in initial orientation towards alcohol stimuli in social drinkers (Field & Quigley, 2009), this does not appear to generalise to low arousal negative emotion, such as depressed or melancholic mood. Moreover, previous research has identified that abstinent alcoholics tend to display biases initial orientation towards alcohol cues (Noel et al., 2006), which is likely to be a consequence of repeated and extensive alcohol use. Therefore, alcohol users who have had recurrent experiences with using alcohol to cope with negative emotions may be quicker to orient to alcohol related cues in the context of heightened
negative emotions. As such, future research may benefit from examining whether other cohorts of alcohol users with more extensive alcohol use histories, such as abstinent or dependent alcohol users, are quicker to orientate to alcohol-related cues in the context of heightened negative affect.

The null findings obtained in relation to biases in initial orientation, may be due in part to the selection of alcohol-related stimuli used in the eye-tracking task. To this end, there is evidence to suggest that the type of alcohol-related cue presented may differentially influence biases in initial orientation and maintenance of attention towards alcohol stimuli. For example, Forestell and colleagues (2012) found that individuals who drink to escape demonstrate biases in maintenance of attention towards inactive alcohol cues (e.g. pictures of alcoholic beverages), and biases in initial orientation towards active alcohol cues (e.g. a picture of a human drinking a beer). Thus, according to Forstell et al. (2012) presenting only inactive alcohol-related cues in the attentional bias task, may have impeded present findings related to the influence of heightened negative affect on biases in initial orientation towards alcohol stimuli in social drinkers. As such, future research may benefit from investigating whether heightened negative mood influences biases in initial orientation towards alcohol stimuli, using measures of attentional bias that include both active an inactive alcohol-related cues.

*The Influence of Negative Mood on Craving for Alcohol*

Contrary to expectations, heightened negative affect was not found enhance craving for alcohol in the present sample of social drinkers. This finding
is consistent with previous research by Bailey and Baillie (2013) who also found that negative mood induction did not significantly enhance craving for alcohol in social drinkers. On the other hand, the present finding is inconsistent with previous research by Field & Powell (2007) who found that stress induction subsequently enhanced craving for alcohol in social drinkers. Once again, the variation in findings may be due in part to the qualitatively different stimuli used across available studies. Similar to the present dissertation, Bailey and Baillie (2013) used a mood induction procedure that was designed to stimulate dysphoric negative emotion amongst study participants. Therefore, social drinkers may be more inclined to experience increased craving for alcohol in the context of heightened stress, rather than low arousal of negative emotion such as melancholy or dysphoria. This finding has important implications for understanding potential pathways to problematic alcohol use, and suggests that interventions involving craving management strategies may be most advantageous for individuals who experience craving for alcohol in the context of heightened stress.

The findings presented in this chapter are somewhat inconsistent with previous research indicating that heightened negative mood increases craving for alcohol in dependent drinkers (Coffey et al., 2002; 2006; 2010; Cooney, et al., 1997; Litt et al., 1990; Rubonis et al., 1994; Saladin et al., 2003; Stasiewicz et al., 1997). In light of these findings, it is reasonable to suggest that the propensity for negative affect (other than stress) to enhance craving for alcohol may be more prevalent in heavy and dependent alcohol users, rather than social drinkers. This may due to heavier alcohol users having a greater number of experiences with alcohol as a coping mechanism for heightened negative mood. Moreover, it may
be the case that the stimulation of negative mood in the present dissertation was not substantial enough, or not ecologically valid, to influence craving for alcohol. To this end, four existing studies have used personalised examples of negative emotional experiences to induce negative affect in participants, which subsequently enhanced craving for alcohol (Coffey et al., 2002; 2006; 2010; Saladin et al., 2003). Thus, negative mood induction may evoke craving for alcohol when the experience of negative affect is of personal relevance to the individual. Thus, further research is required to establish whether personalised examples of negative emotional experiences subsequently increase craving for alcohol in social drinkers.

Collectively, the available studies indicate that social drinkers are more likely to experience enhanced alcohol-related cognitions (e.g. biases in initial orientation towards alcohol stimuli, biases in maintenance of attention towards alcohol stimuli, and craving for alcohol) in the context of heightened stress, rather than melancholic or dysphoric negative emotions. This observation has important implications for clinical intervention and for understanding potential pathways to dependence. To this end, it has been proposed that individual variability in responsivity to stress may influence the development and maintenance of alcohol-use disorders (King, Munisamy, de Wit, & Lin, 2006). In line with this assertion, previous research indicates that heavy drinkers (King et al., 2006) and individuals at risk of alcohol dependence (Schuckit, Gold, & Risch, 1987) experience a greater reduction in biological markers of stress following the ingestion of alcohol. Therefore, certain individuals may be more likely to engage in alcohol use to alleviate stress, and thus may also be more likely to attend to alcohol
stimuli or experience craving for alcohol in the context of heightened stress. As such, further research would benefit from examining whether heavy or dependent alcohol users demonstrate enhanced attentional bias towards alcohol stimuli and craving for alcohol in the context of increased stress. To this end, positive associations between heightened stress and alcohol-related cognitions in heavy or dependent drinkers may indicate a possible pathway to dependence.

Coping Drinking Motives and Alcohol-Related Cognitions

The findings presented in this chapter are consistent with previous research by Birch and colleagues (2008), which found that individuals who drink to cope with negative affect do not demonstrate increased biases in maintenance of attention towards alcohol stimuli in the context of heightened negative mood. On the other hand, the present findings are incongruent with three other previous studies which have found that higher levels of coping motives for alcohol use are associated with greater attentional bias towards alcohol stimuli following negative mood induction (Grant et al., 2007; Field & Powell, 2007; Field & Quigley, 2009). It is important to note that present findings may have been impeded by the fact that the present sample of social drinkers reported lower levels of coping motives for alcohol use relative to other previous studies where coping motives have been found to influence attentional bias in the context of heightened negative mood (Grant et al., 2007; Field & Powell, 2007; Field & Quigley, 2009). For example, significant findings were obtained in studies by Field and Powell (2007) and Field and Quigley (2009), where coping motives were equal to or greater than the median score (median = 2.4). The median score for coping motives in the present sample of social drinkers was comparatively lower (median= 1.6) than in
previous studies (e.g. Field & Powell, 2007; Field & Quigley, 2009), and was not used to split the sample into those with high and low coping motives. Additionally, the mean score for coping motives in the present sample (mean = 1.7) was relatively lower than that obtained in the study conducted by Grant and colleagues (2007; mean= 2.4). Taken together, the available studies indicate that coping motives for alcohol use may influence alcohol attentional bias in the context of heightened negative mood, in social drinkers who strongly identify with drinking to cope with negative affect.

An additional finding presented in this chapter is that coping motives for drinking were not significantly associated with craving for alcohol in the context of heightened negative mood. This is consistent with previous research (e.g. Bailey & Baillie, 2013; Field & Powell, 2007), which has found that higher levels of coping motives for alcohol use are not associated with increased craving for alcohol following increases in stress and negative mood. In their study, Bailey and Baillie (2013) conceded that their results might have been explained by the fact that the reported level of craving was very low. This also appears to be true of the present study, as the mean craving score reported by the present sample of social drinkers was relatively low at baseline measures and following both positive and negative mood inductions. Therefore, the sample of social drinkers in the present dissertation did not report high levels of craving across each of the investigated mood conditions, which is likely to have impacted on study findings. Additionally, according to negative reinforcement models, alcohol misuse often ensues as a means of regulating negative affect (Baker et al., 2004). However, due to the lack of problematic alcohol use in the present sample of social drinkers,
participants may have employed more effective coping strategies in response to increases in negative mood. Taken together, the available findings indicate that stress, as opposed to dysphoric negative affect, may enhance craving for alcohol in social drinkers. However, present findings may have been impeded by low variability in craving scores and greater capacity for effective emotion regulation amongst the present sample of social drinkers.

Conformity Drinking Motives and Alcohol-Related Cognitions

The present chapter reports on findings that provide the first known experimental examination of whether conformity motives for alcohol use are positively associated with alcohol-related cognitions in the context of heightened negative mood in social drinkers. Importantly, the findings suggest that conformity motives for alcohol use are positively associated with attentional bias towards alcohol stimuli (maintenance of attention), following increases in negative affect (i.e. via mood induction) in social drinkers. However, the association between conformity drinking motives and alcohol attentional bias is not exclusive to heightened negative mood, as conformity motives were also positively associated with attentional bias towards alcohol stimuli (maintenance of attention) in the baseline condition. In contrast, conformity motives for alcohol use were not significantly associated with craving for alcohol across any of the investigated mood conditions in social drinkers. Taken together, the present findings suggests that whilst conformity drinking motives are positively associated with biases in maintenance of attention in social drinkers, they do not account for variability in alcohol-related cognitions in response to heightened negative mood. To this end, external drinking motives, such as conformity
motives, are only indirectly associated with emotion regulation, and thus heightened negative mood may not be a significant precursor to enhanced alcohol-related cognitions for individuals who report higher levels of conformity motives. Moreover, it is important to note that the present sample of social drinkers did not report high levels of conformity motives for alcohol use. Thus, low variability in conformity motives scores may have impeded on present findings.

**Tolerance of Negative Affect and Alcohol-Related Cognitions**

It is proposed that the capacity to tolerate negative emotions, rather than the experience of negative mood itself, may increase vulnerability to alcohol use in some individuals. To this end, it was expected that lower tolerance negative affect would be associated with enhanced alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) in the context of heightened negative mood. However, low tolerance of negative affect was not significantly associated with attentional bias towards alcohol stimuli (including biases in initial orientation and maintenance of attention) or craving for alcohol following negative mood induction in the present sample of social drinkers. These findings may be due to the fact that one’s capacity to tolerate negative affect may exert influence at higher levels of negative mood, such as that experienced by depressed individuals. Thus, whilst the negative mood induction was found to be successful in the present dissertation, the level of negative mood experienced by participants may not have been substantial enough for variation in tolerance of negative affect to influence alcohol-related cognitions. Moreover, a number of studies have indicated that low tolerance of negative affect (as measured by distress tolerance) is associated with problematic alcohol use (Buckner et al., 2007; Denhardt &
Murphy, 2011; Gorka et al., 2011; Simons & Gahe r, 2005), indicating that tolerance of negative affect may have a greater influence on alcohol-related cognitions in heavier drinkers. Additionally, the capacity to tolerate negative affect was reported to be relatively high in the present sample of social drinkers, which is likely to have impacted on study findings.

Study limitations

The findings presented in this chapter may have been impeded by the fact that the present sample of social drinkers did not strongly identify with drinking to avoid negative emotional experiences (coping motives) or to fit in with others (conformity motives). Additionally, the present sample of social drinkers reported relatively high capacity to tolerate negative affect, which may have also limited present findings. To this end, it may be the case that the assessment tool used to measure tolerance of negative affect (i.e. the distress tolerance scale) may not have been appropriate for the present sample of social drinkers. The Distress Tolerance Scale (DTS; Simons & Gahe r, 2005) is designed to measure participants’ evaluations and expectations in relation to experiencing negative emotional states. However, the items of the DTS that refer to feeling “distressed or upset,” may not be commensurate with participants’ conceptualizations of negative affect. As such, assessing capacity to tolerate negative affect via examining emotional distress tolerance may be more suitable in clinical samples of alcohol users with greater psychopathology, rather than social drinkers. Additionally, low mean reported level of craving and substantial variation in attentional bias scores (as indicated by large standard deviation score relative to the mean) across each of the mood conditions, may have also impacted on study
findings. Moreover, the risk of Type 1 error is inflated as multiple significance tests were conducted in the analyses. Given the exploratory nature of the present analyses, a significance level of .05 was maintained in the analyses. Future studies may consider reducing the significance level to .01 in order to minimise the risk of Type 1 error. Further study limitations will be presented in the general discussion.

Conclusions

To conclude, this chapter reports on findings indicating that heightened negative mood did not enhance attentional bias towards alcohol stimuli or craving for alcohol in the present sample of social drinkers. Moreover, the findings indicate that drinking to cope with negative affect (coping motives) is not significantly associated with increased alcohol attentional bias or craving for alcohol in the context of heightened negative mood in social drinkers. Additionally, tolerance of negative affect was not significantly associated with alcohol-related cognitions following negative mood induction in social drinkers. Importantly, drinking to fit in with others (conformity motives) was positively associated with alcohol attentional bias (maintenance of attention) in social drinkers, however, this relationship was not exclusive to heightened negative mood. Furthermore, conformity drinking motives were not significantly associated with craving for alcohol in the context of heightened negative mood in social drinkers. Taken together, the findings reported in this chapter suggest that negatively reinforced drinking motives (coping and conformity motives) and tolerance of negative affect do not account for variability in alcohol-related cognitions in response to heightened negative affect in social drinkers. However,
the present findings are likely to be limited by the fact that social drinkers did not strongly identify with coping and conformity motives for alcohol use, and also reported relatively high capacity to tolerate negative affect. To this end, the present sample of social drinkers may have developed more adaptive methods of emotion regulation than those with higher levels of pathological alcohol use. Given the implications for understanding drinking behaviour, further research is required to identify other individual difference factors that may increase vulnerability to alcohol-related cognitions in the context of heightened negative mood in social drinkers.
Overview

The overall aim of the present dissertation was to enhance understanding of drinking behaviour by investigating the role of positive and negative mood in alcohol-related cognitions in social drinkers. Drawing from prominent theoretical models of alcohol use (Baker et al., 2004; Cooper, 1995), it was proposed that increases in positive or negative affect may enhance alcohol attentional bias and craving for alcohol in social drinkers. To this end, the primary research objectives involved experimental examination of the influence of heightened positive and negative mood on attentional bias towards alcohol stimuli and craving for alcohol in social drinkers. Of further interest was whether certain theoretically derived factors associated with the individual influence the relationship between mood state (positive or negative) and alcohol-related cognitions in social drinkers. As such, individual variation in trait characteristics (i.e. reward sensitivity and tolerance of negative affect), and differential motivations to consume alcohol (social motives, enhancement motives, coping motives, conformity motives) were examined in relation to alcohol attentional bias and craving for alcohol following positive and negative mood inductions. A final line of investigation involved examining whether an interaction between these individual difference factors (reward sensitivity, tolerance of negative affect and drinking motives) and mood state (positive or negative) influences alcohol attentional bias and craving for alcohol in social drinkers.
The Role of Positive Mood in Alcohol-Related Cognitions in Social Drinkers

A prominent theory within the alcohol use literature is that some individuals consume alcohol in order to augment positive emotional experiences (Cooper, 1995). This contention is supported by a number of studies indicating that positive mood is associated with subsequent alcohol consumption (Crooke et al., 2013; Dvorak et al., 2014; Simons et al., 2005; Simons et al., 2010). Given that alcohol attentional bias and craving for alcohol are considered to be important factors in alcohol use, it follows that these alcohol-related cognitions may also be influenced by positive affect. However, previous experimental research investigating the influence of positive mood on attentional bias towards alcohol stimuli and craving for alcohol in social drinkers is limited and inconsistent (Birch et al., 2008; Emery & Simons, 2015; Grant et al., 2007). Thus, one aspect of the present dissertation focussed on examining the influence of heightened positive affect (via mood induction) on alcohol attentional bias and craving for alcohol in social drinkers.

**Attentional Bias and Craving: Mutually Exacerbated Cognitive Process in the Context of Heightened Positive Mood in Social Drinkers**

Chapter three of the present dissertation demonstrated that alcohol attentional bias and craving for alcohol are significantly associated in the context of heightened positive mood in social drinkers. This finding provides support for the EI theory of desire (Kavanagh et al., 2005), which contends that internal cues (i.e. increases in positive mood) may facilitate intrusive thoughts (i.e. craving) and subsequent pursuit (i.e. attention towards alcohol stimuli), of the desired stimuli (i.e. alcohol). Interestingly, alcohol attentional bias and craving for alcohol were
not found to be significantly associated prior to the mood manipulation procedure (i.e. baseline conditions). A meta-analytic review of previous studies has indicated that in the absence of internally generated cues (i.e. changes in mood state), the association between alcohol attentional bias and craving for alcohol is relatively weak in social drinkers (Field et al., 2009). Therefore, the findings of the present dissertation are consistent with theoretical perspectives and previous research (Field & Powell, 2007) indicating that social drinkers may be more likely to experience alcohol attentional bias and craving for alcohol in the context of internally generated cues, such as increases in positive affect. Therefore, the present findings highlight the important influence of positive affect on alcohol attentional bias and craving for alcohol in social drinkers. The implications of this finding are that some social drinkers may be more vulnerable to alcohol misuse in the context of positive emotional experiences. Further research involving longitudinal studies is required to determine whether the association between alcohol attentional bias and craving for alcohol subsequently corresponds with increased alcohol consumption in the context of positive mood.

The Role of Positive Mood in Craving for Alcohol in Social Drinkers

Extending on chapter three findings, chapter four examined the influence of heightened positive mood (via mood induction) on alcohol attentional bias and craving for alcohol in social drinkers. The present findings provide the first known experimental evidence that positive mood induction significantly enhances craving for alcohol in adult social drinkers. This current finding extends on previous research by Kabbani and colleagues (2014) who found that self-reported measures of positive affect positively correlated with increased craving for
alcohol both prior to and following alcohol consumption in social drinkers. Previous experimental research has also demonstrated that positive mood induction significantly increases craving for alcohol in dependent drinkers (Mason et al., 2008). Taken together, the available evidence suggests that responding to increases in positive mood with enhanced craving for alcohol may be implicated in a pathway to problematic alcohol use. As such, individuals who are at risk of alcohol misuse would benefit from education regarding the potential to experience craving for alcohol in the context of heightened positive mood. Furthermore, the present findings suggest that treatment efforts would benefit from implementing effective craving management strategies for individuals who are vulnerable to experiencing greater craving for alcohol in the context of heightened positive mood.

The Role of Positive Mood in Alcohol Attentional Bias in Social Drinkers

Contrary to expectations, positive mood induction did not significantly enhance attentional bias towards alcohol stimuli, relative to baseline measures in adult social drinkers. These findings are consistent with a previous study conducted by Emery and Simons (2015), who also found that positive mood induction did not significantly enhance attentional bias towards alcohol stimuli in college students. The null findings reported in chapter four may be explained in part by social drinkers having greater emotion regulation capacities and less influenced by the rewarding effects of alcohol, relative to heavy or dependent drinkers. Additionally, the mood induction procedure utilised to stimulate positive mood in the present dissertation (i.e. via presentation of pictures and mood-congruent music), may not have been ecologically valid enough to influence
attentional bias towards alcohol stimuli. That is, heightened positive affect may exert greater influence on attentional bias in environments where previous positive drinking experiences have occurred (i.e. at a bar or social events). Alternatively, social drinkers may be more inclined to attend to alcohol stimuli in the context of mood induction procedures that include personalised scripts of prior experiences where alcohol use has co-occurred with heightened positive affect. Thus, further research to this effect is required to examine the influence of heightened positive affect on attentional bias towards alcohol stimuli in social drinkers.

The Role of Individual Factors in the Relationship between Positive Mood and Alcohol-Related Cognitions in Social Drinkers

Chapter three and chapter four findings suggest that social drinkers vary considerably in their experience of alcohol-related cognitions in response to heightened positive mood. This suggests that certain factors associated with the individual may influence whether social drinkers respond to increases in positive mood with enhanced alcohol attentional bias and/or craving for alcohol. Yet, very little previous research has examined individual factors that may account for variability in alcohol-related cognitions in the context of heightened positive mood. Therefore, chapter four also investigated whether theoretically derived individual difference factors such as variation in trait reward sensitivity and positively reinforced drinking motives (i.e. social and enhancement motives), influence alcohol attentional bias and craving for alcohol in the context of heightened positive mood.
Trait Reward Sensitivity and Alcohol-Related Cognitions

At the crux of Gray’s reinforcement sensitivity theory (RST; 1970) is the supposition that individuals with heightened reward sensitivity are more likely to engage in appetitive motivational behaviours that stimulate dopaminergic pathways, such as alcohol use. To this end, recent research indicates that heightened reward sensitivity is positively associated with a number of problematic health related behaviours, including gambling (Gaher, Hahn, Shishido, Simons & Gaster 2015, Wardell, Quilty, Hendershot & Bagby, 2015), smoking (Tapper et al., 2015), and dysfunctional eating (Stapleton & Whitehead, 2014). Consistent with these studies, the findings presented in chapter four of the present dissertation provide the first empirical evidence that heightened trait reward sensitivity is positively associated with greater propensity to attend to alcohol-related cues in the environment (i.e. alcohol attentional bias) in social drinkers. Surprisingly, the findings indicate that the association between reward sensitivity and attentional bias is not exclusive to heightened positive mood. That is, reward sensitivity was positively associated with alcohol attentional bias under positive mood, negative mood and baseline conditions. Moreover, the association between reward sensitivity and attentional bias towards alcohol stimuli was not necessarily stronger in social drinkers who reported higher levels of positive following the positive mood induction. Therefore, the present outcomes suggest that individual differences in trait reward sensitivity do not account for why some social drinkers exhibit greater attentional bias for alcohol-related cues in response to heightened positive mood. Similarly, the findings presented in chapter four demonstrate that trait reward sensitivity is positively associated with craving for alcohol under baseline and positive mood conditions in social drinkers. Thus,
individuals with heightened trait reward sensitivity are no more vulnerable to experiencing craving for alcohol in the context of heightened positive mood, relative to baseline measures. Additionally, the association between reward sensitivity and craving for alcohol was not necessarily stronger in social drinkers who reported higher levels of positive mood following the positive mood induction. Thus, the present findings indicate that whilst heightened reward sensitivity appears to have an important influence on craving for alcohol, it does not account for variation in craving in response to heightened positive mood in social drinkers.

An Integrated Approach to Understanding Reward Sensitivity and Alcohol-Related Cognitions in Social Drinkers

Hasking and colleagues (2015) recently proposed an integrated approach to alcohol use, which may have implications for further understanding positive associations observed in the present study between trait reward sensitivity and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol). Drawing from Gray’s RST (1970) and Bandura’s Social Cognitive Theory (1986; 1997), Hasking and colleagues’ (2015) integrated approach proposes that individuals with heightened reward sensitivity are likely to have outcome expectancies regarding alcohol use that have been formed over numerous experiences with alcohol, as well as lowered self-efficacy for refusing the temptations of reinforcing behaviours (Hasking et al., 2015). Consistent with this assertion, Hasking and colleagues (2015) found that reward sensitivity was associated with greater alcohol consumption and alcohol-related problems, via expectations of increased confidence and lower drinking refusal self-efficacy in
social situations. Drawing on Hasking et al.’s (2015) integrated approach, the positive associations between heightened trait reward sensitivity and alcohol-related cognitions observed in the present sample of social drinkers may be explained in part by social-cognitive constructs, such as alcohol expectancies and drinking refusal self-efficacy. That is, individuals with heightened trait reward sensitivity may be more inclined to attend to alcohol-related stimuli or experience craving for alcohol when they also hold positive outcome expectancies regarding alcohol use and lowered drinking refusal self-efficacy. In consideration of this proposition, an interesting endeavour for future research would be to investigate whether social cognitive constructs, such as alcohol expectancies and drinking refusal self-efficacy, mediate the association between reward sensitivity and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) in social drinkers. Moreover, in keeping with the objective of understanding the role of positive mood in alcohol-related cognitions in social drinkers, future studies would benefit from examining associations between these factors in the context of heightened positive mood. To this end, existing research suggests that alcohol expectancies vary according to mood state, with the findings of one study indicating that some alcohol users report increased reward expectancy following positive mood induction (Birch, Stewart, Wall, McKee, Eisnor, & Theakston, 2004). Furthermore, drinking refusal self-efficacy has been shown to decrease in the context of negative mood (Ralston & Palfai, 2010). However, the relationship between drinking refusal self-efficacy and positive mood remains to be established. Investigations of the interaction between social-cognitive factors (i.e. alcohol expectancy and drinking refusal self-efficacy), trait characteristics (e.g. reward sensitivity), and motivational factors (i.e. mood state), will assist in
developing a more complex understanding of alcohol attentional bias and craving for alcohol in social drinkers, and ultimately enhance current knowledge regarding drinking behaviour.

Social and Enhancement Motives and Alcohol-Related Cognitions

Another important line of investigation contributing to current understanding of alcohol use is establishing whether differential drinking motives influence alcohol attentional bias and craving for alcohol in the context of positive mood. Of particular interest is the role of positively reinforced internal and external motives for alcohol use, such as enhancement motives and social motives, as they relate to alcohol attentional bias and craving for alcohol. Drawing from Cooper’s (1994) motivational model of alcohol use, chapter four of the present dissertation explored whether enhancement and social motives for drinking would be associated with greater alcohol attentional bias and craving for alcohol in the context of heightened positive mood. The findings indicate that both social and enhancement motives for alcohol use are positively associated with attentional bias towards alcohol stimuli under positive mood, negative mood and baseline conditions. Thus, whilst social and enhancement drinking motives influence attentional bias towards alcohol stimuli in social drinkers, the association between these drinking motives and alcohol attentional bias is not contingent upon heightened positive mood.

The outcomes of the present study indicate that social motives for alcohol use are positively associated with craving for alcohol under positive mood and baseline conditions. These findings indicate that alcohol users who more strongly
identify with social motives for alcohol use may be more likely to experience craving for alcohol in general, and in the context of heightened positive mood. In contrast the findings suggest that individuals who endorse social motives for alcohol use are less likely to experience craving for alcohol in the context of heightened negative mood. Moreover, enhancement motives for alcohol use were not significantly associated with craving for alcohol across each of the investigated mood conditions. Taken together, the present findings indicate that whilst social drinking motives are likely to influence craving for alcohol in social drinkers, they do not account for variation in responsivity to heightened positive affect. On the other hand, enhancement drinking motives are not associated with craving for alcohol in social drinkers.

Contrary to the findings of the present dissertation, two previous studies have demonstrated that individual who strongly endorse enhancement motives for alcohol use display greater attentional bias towards alcohol stimuli in the context of heightened positive mood, relative to heightened anxious mood (Birch et al., 2008; Grant et al., 2007). Previous studies by Grant et al., (2007) and Birch et al., (2008) conducted mass screenings of participants to identify enhancement motivated drinkers, and included only those with enhancement motive scores that were one standard deviation above the overall sample mean. In contrast, participants included in the present dissertation did not strongly identify with social or enhancement motives for alcohol, which is likely to have impacted upon observed relationships. Therefore, further investigation is warranted to examine the association between differential drinking motives, positive mood and alcohol related cognitions (i.e. alcohol attentional bias and craving for alcohol), using a
sample of alcohol users who more strongly identify with drinking to enhance positive affect, or drinking to socialise with others. Moreover, other previous studies examining social and enhancement motives for alcohol use have largely focused on samples of undergraduate students, and have indicated that these drinking motives are particularly pertinent to younger alcohol users. To this end, the existing literature indicates that undergraduate students frequently endorse social and enhancement motives for alcohol use (Van Damme et al., 2013; Kuntsche, Knibbe, Gmel & Engels, 2005; Mohr, Armeli, Tennen, Temple, Todd, Clark, & Carney, 2005), and that these motives are often associated with heavier alcohol consumption (Kuntsche et al., 2005; LaBrie, Hummer & Pedersen, 2007; Lewis, Phillippi, & Neighbors, 2007). As such, future research would benefit from examining whether social and enhancement motives for alcohol use influence alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol) in the context of positive mood, in a sample of younger alcohol users.

The Role of Negative Mood in Alcohol-Related Cognitions in Social Drinkers

Attentional Bias and Craving as Mutually Exacerbated Cognitive Processes in the Context of Heightened Negative Mood in Social Drinkers

Negative reinforcement models of alcohol use suggest that some individuals are motivated to consume alcohol in order to reduce or avoid negative emotional experiences (Baker et al., 2004). As alcohol attentional bias and craving for alcohol are considered to be cognitive correlates of alcohol use, it was proposed that negative mood may also influence these alcohol-related cognitions. To this end, chapter three findings demonstrate that alcohol attentional bias and craving for alcohol are significantly associated in the context of heightened
negative mood in social drinkers. As discussed previously, attentional bias and craving for alcohol were not significantly associated prior to mood induction (i.e. at baseline). This finding is consistent with previous research indicating that stress induction enhances the association between alcohol attentional bias and craving for alcohol in social drinkers (Field & Powell, 2007), and suggests that negative mood has an important influence on alcohol-related cognitions in social drinkers. Taken together, the available evidence indicates that both high arousal (i.e. stress) and low arousal (i.e. dysphoria) negative emotions may precipitate a reciprocal relationship between alcohol attentional bias and craving for alcohol in social drinkers.

The Influence of Negative Mood Induction on Alcohol-Related Cognitions in Social Drinkers

Extending on chapter three findings, chapter five investigated the influence of heightened negative mood (i.e. via mood induction) on attentional bias towards alcohol stimuli and craving for alcohol, relative to baseline measures. Contrary to expectations, the findings indicate that heightened negative mood did not significantly increase attentional bias towards alcohol stimuli, relative to baseline measures in social drinkers. This is consistent with previous experimental studies by Birch and colleagues (2008) and Emery and Simons (2015), which found that negative mood induction did not significantly enhance alcohol attentional bias in university students. On the other hand, previous experimental studies by Field and Powell (2007) and Grant et al. (2007), found that increases in negative affect (via mood induction) significantly enhanced alcohol attentional bias in university students. As discussed previously, the variability in findings may be explained by qualitatively different mood induction
procedures used across studies (see p 148). Thus taken together, the findings indicate that social drinkers may be more inclined to attend to alcohol stimuli in the context of heightened stress and anxiety, rather than when experiencing low mood or dysphoric emotions.

Chapter five findings also indicate that negative mood induction did not significantly enhance craving for alcohol, relative to baseline measures in social drinkers. This finding is consistent with previous research by Bailey & Baillie (2013) who also found that negative mood induction did not enhance craving for alcohol in social drinkers. On the other hand, the present finding is inconsistent with previous experimental research indicating that heightened stress (via laboratory stress task) increases craving for alcohol in social drinkers (Field & Powell, 2007). As discussed previously, the negative mood induction used in Field and Powell’s (2007) study was again qualitatively different to that used by both Bailey and Baillie (2013) and the present dissertation (see p 150). Taken together, the available evidence suggests social drinkers may experience increased craving for alcohol in the context of heightened stress, rather than when feeling sad or depressed. Moreover, previous experimental research has consistently demonstrated that heightened negative affect is associated with greater craving for alcohol in dependent drinkers (Coffey et al., 2002; Coffey et al., 2010; Coffey et al., 2006; Cooney et al., 1997; Field & Powell, 2007; Kwako et al., 2015; Litt et al., 1990; Saladin et al., 2003; Stasiewicz et al., 1997). To this end, the null findings in chapter five may be explained in part by the notion that social drinkers tend to have more adaptive emotion regulation strategies and/or fewer experiences with alcohol as a coping mechanism for negative emotions, relative to dependent
drinkers. Alternatively, the ecological validity of mood induction procedure utilised to stimulate negative mood in the present study (i.e. via presentation of pictures and mood-congruent music), may have impacted on current findings. To this end, four previous studies have utilised personalised examples of negative emotional experiences to induce negative affect in participants, subsequently triggering craving for alcohol (Coffey et al., 2002; 2006; 2010; Saladin et al., 2003). Thus, negative mood may evoke craving for alcohol when the experience of negative affect is of personal relevance to the individual. As such, further examination regarding the influence of negative mood on craving for alcohol in social drinkers is warranted utilising alternative mood elicitation procedures, such as autobiographical recall of negative emotional experiences.

The Role of Individual Difference Factors in the Association between Negative Mood and Alcohol-Related Cognitions in Social Drinkers

The findings reported in chapter five indicate an overall lack of responsivity to heightened negative mood in the present sample of social drinkers. However, chapter three findings suggest that some social drinkers experience increased alcohol attentional bias and craving for alcohol in the context of heightened negative mood (i.e. via mood induction). Taken together, chapter three and chapter five findings suggest that factors associated with the individual may account for variability in alcohol attentional bias and craving for alcohol in response to increases in negative affect. As such, the present dissertation examined whether individual variation in tolerance of negative affect and negative reinforced drinking motives (coping and conformity motives) influence alcohol
attentional bias and craving for alcohol in the context of heightened negative mood.

**Tolerance of Negative Affect and Alcohol-Related Cognitions**

Chapter five investigated whether individual variation in tolerance of negative affect was associated with enhanced alcohol attentional bias and craving for alcohol in the context of heightened negative mood. Contrary to expectations, lower tolerance of negative affect was not significantly associated with greater attentional bias towards alcohol stimuli or craving for alcohol following the negative mood induction. However, due to the relatively low levels of problematic alcohol use amongst social drinkers included in the present dissertation, more adaptive methods of emotion regulation (rather than alcohol seeking behaviour) may have been utilised in response to heightened negative affect. Moreover, the assessment tool utilised to measure tolerance of negative affect (i.e. distress tolerance scale) may have not have been appropriate for the sample of social drinkers. That is, the distress tolerance scale includes items that refer to experiences of feeling “distressed or “upset” to measure appraisal and tolerance of negative emotions. As such, social drinkers may not have identified with such conceptualisations of negative affect that refer to relatively high levels of negative emotion. To this end, assessing individual variation in tolerance of negative affect via the distress tolerance scale may be more appropriate in studies involving clinical samples of alcohol users, rather than social drinkers.

Despite the null findings regarding tolerance of negative affect and alcohol-related cognitions in chapter five, theoretical models propose that clinical
interventions for alcohol use are likely to benefit from strategies that target low
tolerance of negative affect (Gratz & Roemer (2004). Moreover, contemporary
research indicates that experiential avoidance of negative affect via ruminative
thinking mediates the association between low tolerance of negative emotion and
negative affect amongst substance users (Magidson et al., 2012). That is,
substance users with low tolerance of negative affect who also tend to overly
focus on symptoms of distress (i.e. rumination), experience increased negative
affect (Magidson et al., 2012), which is likely to further facilitate avoidance of
negative emotions via substance use. To this end, future studies would benefit
from investigating whether individuals with low tolerance of negative affect who
also tend to ruminate on negative emotional experiences demonstrate greater
alcohol-related cognitions in the context of heightened negative mood. Therefore,
whilst low tolerance of negative affect was not found to influence alcohol
attentional bias or craving for alcohol in the present sample of social drinkers, it is
likely to be an important factor in understanding drinking behaviour and warrants
further examination in relation to alcohol-related cognitions.

Coping Drinking Motives and Alcohol-Related Cognitions

Chapter five reported on tests of whether individuals who endorse higher
levels of coping motives for alcohol use demonstrate greater alcohol-related
cognitions in the context of heightened negative mood. Contrary to predictions,
coping motives for alcohol use were not significantly associated with attentional
bias or craving for alcohol following negative mood induction, or in the context of
other mood states. When the present findings are considered in relation to other
similar studies, it is apparent that coping motives are not associated with alcohol-
related cognitions when negative mood induction reflects sad or dysphoric mood (e.g. Birch et al., 2008). On the other hand, individuals who drink to cope with negative affect appear to be more inclined to attend to alcohol stimuli in the context of increased anxiety and stress (Field & Powell, 2007; Field & Quigley, 2009; Grant et al., 2007).

Blackwell and Conrod (2003) devised a modified version of the drinking motives questionnaire (Modified DMQ-R), which differentiates between depression-related coping motives and anxiety-related coping motives for alcohol use. Grant and colleagues (2007) included the modified DMQ-R in their study and found that higher levels of anxiety-related coping motives were associated with enhanced attentional bias towards alcohol stimuli in the context of heightened anxious mood. This suggests that individuals may differentiate in their capacity to cope with high arousal (e.g. anxiety) and low arousal (e.g. depression) negative affective states and thus, may be more inclined to attend to alcohol-related cues in the context of these emotional experiences. However, Grant et al. (2007) did not examine whether anxiety-related coping motives were also significantly associated with increased alcohol attentional bias in the context of depressed mood. Thus, it is not known whether social who endorse anxiety-related coping motives are more inclined to engage in alcohol-seeking behaviour (i.e. attentional bias) in response to increases in negative affect in general or anxious mood exclusively. Similarly, is not known whether individuals who endorse depression-related coping motives are more inclined to attend to alcohol cues in response to generalised negative affect or depressed mood specifically. Therefore, future research would benefit from examining whether depression-related coping
motives and anxiety-related coping motives are associated with greater alcohol-related cognitions in the context of heightened depressed and anxious mood, respectively in social drinkers.

Conformity Drinking Motives and Alcohol-Related Cognitions

The findings presented in chapter five provide the first known experimental evidence that drinking to fit in with others (i.e. conformity motives) is positively associated with attentional bias towards alcohol stimuli in social drinkers. However, the association between conformity motives for alcohol use and alcohol attentional bias is not contingent upon increases in negative mood, as conformity motives were positively associated with attentional bias towards alcohol stimuli under both negative mood and baseline conditions. In contrast, conformity motives for alcohol use were not significantly associated with craving for alcohol in social drinkers. One possible explanation for the present findings is that an individual who is concerned about fitting in with others may be more vigilant to relevant environmental stimuli, in order to adjust their behaviour accordingly and avoid social scrutiny. To this end, social drinkers who are motivated to consume alcohol in order to fit in with others may be more attentive to the drinking patterns of their peers, in order to modify their own level consumption so that it is consistent with expectations of others. As such, social drinkers who endorse conformity drinking motives may be inadvertently be more inclined to attend to alcohol-related stimuli in the environment.
Interestingly, emerging evidence indicates that coping and conformity motives for alcohol use influence drinking behaviour in socially anxious individuals in particular. To this end, Terlecki and Buckner (2015) found that heavy situational drinking among undergraduates with clinically elevated social anxiety could be jointly attributed to desire to cope with negative affect (coping motives) and to avoid social scrutiny (conformity motives). Moreover, recent research indicates that coping and conformity motives differentially mediate the association between social anxiety and alcohol use in men and women (Buckner & Shah, 2015). That is, drinking to cope with anxiety mediated the relationship between social anxiety and drinking problems amongst women, whilst conformity motives mediated the social anxiety-drinking problems relationship amongst men. Thus, in consideration of treatment implications, it would be beneficial for future research to examine whether coping and conformity motives moderate associations between social anxiety and alcohol-related cognitions following anxious mood induction. Additionally, future research would benefit from examining whether observations in relation to drinking motives, social anxiety and alcohol-related cognitions are consistent across gender, or differentiated between men and women.

Initial Orientation and Maintenance of Attention towards Alcohol Stimuli

The present dissertation differentiated between biases in the initial orientation and maintenance of attention towards alcohol-related stimuli in the examination of alcohol attentional bias in social drinkers. A limitation of much of the existing research regarding alcohol attentional bias is that many studies fail to make important distinctions between these subcomponents of attention, with the
majority of previous studies focusing on biases in maintenance of attention exclusively. The present dissertation established that several of the investigated constructs including alcohol craving, reward sensitivity, and social and enhancement motives for alcohol use were significantly associated with biases in maintenance of attention towards alcohol stimuli. However, the investigated variables were not found to influence biases in initial orientation towards alcohol-related cues in social drinkers.

The present findings are largely consistent with research by Field and colleagues (2004) who discovered that heavier social drinkers displayed greater biases in the maintenance of attention, but not biases in initial orientation towards alcohol stimuli. On the other hand, Field and Quigley (2009) found that stress induction influenced both the rapid initial orientating and maintenance of attention towards alcohol stimuli in social drinkers. The incentive sensitization theory (Robinson & Berridge, 1993; 2001) suggests that alcohol attentional bias arises from learned associations, whereby alcohol-related stimuli acquire incentive motivational properties through connections with rewarding effects of alcohol. To this end, the sample of social drinkers utilised in Field and Quigley’s (2009) study may have had previous experience with drinking alcohol in response to stress, and as such alcohol-related stimuli are particularly salient when stress is induced. Therefore, the association between experiencing stress and attending to alcohol stimuli may be relatively automatic, accounting for biases in the rapid initial orientation towards alcohol stimuli following stress induction in Field and Quigley’s (2009) study.
Previous research indicates that abstinent alcohol dependent drinkers demonstrate greater biases in initial orientation towards alcohol stimuli, rather than biases in maintenance of attention (Noel et al., 2006). Given that maintenance of attention towards alcohol stimuli is likely to reflect greater cognitive control, the pattern of attention observed in alcohol-dependent users who are attempting to abstain from drinking (e.g., Noel et al., 2006) may reflect deliberate attempts to direct attention away from alcohol cues perhaps in order to reduce temptation to drink. However, in line with the incentive sensitisation theory (Robinson & Berridge, 1993; 2001), previously established connections between alcohol-related stimuli and the rewarding effects of alcohol, may influence aspects of attention to which there is less cognitive control in this cohort of alcohol users, such as the relatively automatic initial orienting towards alcohol stimuli. To this end, the propensity to rapidly attend to alcohol-related stimuli may be characteristic of alcohol users with more extensive alcohol use histories and more prominent learned associations between alcohol stimuli and the rewarding properties of alcohol. As such, individuals who engage in lower levels of alcohol use, such as the present sample of social drinkers, may be less likely to initially attend to alcohol-related stimuli in the environment. However, certain circumstances, such as experiencing increases in stress, may precipitate social drinkers to rapidly attend to alcohol-related cues (Field & Quigley, 2009).

Previous research by Noel and colleagues (2006) suggests that biases in maintenance of attention may be more reflective of motivation to consume alcohol than biases in the relatively automatic initial orientation towards alcohol cues. Extending on this, the findings of the present dissertation indicate that biases
in maintenance of attention are more susceptible to the influence of other variables such as positive and negative mood states, differential drinking motives, and individual trait characteristics, relative to biases in initial orientation. As such, biases in maintenance of attention may be more amenable to clinical intervention compared to biases in initial orientation towards alcohol stimuli, and thus should be a focus of treatment efforts for therapeutic intervention and relapse prevention.

Study Limitations

Limitations Associated with Investigated Variables

A number of limitations involving the investigated variables warrant discussion. Firstly, several individual difference factors investigated in the present dissertation were not strongly endorsed by study participants and thus, low variability within each of these factors is likely to have impacted on the present outcomes. To this end, study participants reported relatively low mean scores for coping motives, conformity motives, enhancement motives and trait reward sensitivity. Additionally, study participants reported relatively high tolerance of negative affect, which is also likely to have impeded outcomes relevant to this factor. The individual difference factors investigated in the present dissertation are largely associated with direct and indirect maladaptive regulation of emotional experiences. Given the relative lack of problematic alcohol use in the present sample of social drinkers, it may be the case that study participants generally employed more adaptive methods of affective regulation in response to emotional experiences than those that are characteristic of the individual traits and drinking
motives examined in the present dissertation. To this end, it would be beneficial for future studies to screen participants prior to study inclusion, or to utilise a clinical sample of alcohol users, in order to investigate the influence of differential drinking motives and trait characteristics on alcohol-related cognitions in a cohort of individuals with higher levels of reward sensitivity and drinking motives.

The present findings are also likely to be impeded by the fact that study participants reported low mean levels of craving for alcohol and substantial variation in alcohol attentional bias scores across each of the investigated mood conditions (i.e. baseline, positive mood and negative mood conditions). Low reported mean levels of craving for alcohol may be due in part to the relatively low levels of problematic alcohol use in the present sample of social drinkers. Moreover, self-reported measures were used to assess craving for alcohol, which may not be commensurate with actual day to day experience. Furthermore, the large variation in alcohol attentional bias scores may be due in part to variability in head movement amongst study participants whilst completing the attention task. Additionally, naturally occurring differences in eye characteristics (e.g. eye colour, pupil dilation, pupil drift, eyelid occlusion of the pupil) may also account for substantial variation in attentional bias scores.

Limitations Associated with Alcohol Stimuli

Attentional bias outcomes may have been restricted by the selection of alcohol-related stimuli utilised during the eye tracking tasks. For example, the present dissertation utilized a variety of general alcohol-related cues in the
attentional bias tasks, rather than alcohol stimuli that reflect the preferred tastes of the participant. Theoretical models suggest that attentional bias develops through repeated pairings of alcohol cues with rewarding effects of alcohol, which subsequently increase the incentive salience of alcohol related stimuli (Franken, 2003; Robinson & Berridge, 1993; 2001). This implies that individuals may be more inclined to attend to alcohol stimuli that reflect personal experiences with alcohol, and to which conditioned associations have been developed (Staiger & White, 1991). For example, an alcohol user who regularly consumes beer may be more inclined to attend to beer-related stimuli than stimuli associated with other types of other alcoholic beverages, such as wine-related stimuli. Similarly, an individual who prefers to consume wine may be less inclined to attend to beer-related stimuli. Moreover, the attentional bias findings may also have been limited by the use of inactive alcohol-related stimuli exclusively. According to psychophysiological work, the brain processes active (e.g. picture of a person consuming an alcoholic beverage) and inactive (e.g. picture of an alcoholic beverage) stimuli differently, with scenes that contain people yielding greater processing than those that contain objects alone (e.g. Allison, Ginter, McCarthy, Nobre, Puce, Luby & Spencer, 1994; Bentin & Allison, 1996; Bobes, Valdés-Sosa, & Olivares, 1994; VanRullen & Thorpe, 2001). To this end, Forestell and colleagues (2012) demonstrated differential outcomes for active and inactive alcohol cues presented at various stimulus duration times. Consequently, expanding the range of alcohol stimuli to include both active and inactive alcohol stimuli, may provide important information about attentional bias processes, particularly in relation to the distinction between biases in initial orientation and maintenance towards alcohol. Therefore, an interesting endeavour for future
research would be to investigate attentional bias in the context of alcohol-related cues that match the personal preference of participants and that include both active an inactive stimuli.

Limitations Associated with Sample Selection

The present dissertation examined associations between individual difference factors, mood state and alcohol-related cognitions in social drinkers with varying levels of alcohol use. Consequently, the current findings are confined to social drinkers exclusively, and may not generalize to other cohorts of alcohol users, such as heavy or alcohol dependent drinkers. Previous studies indicate that the magnitude of attentional bias corresponds with level of habitual alcohol use (Cox et al., 2006; Field & Cox, 2008; Jones et al., 2006), and that craving for alcohol is characteristic of heavy alcohol consumption (APA, 2013). Therefore, it follows that heavier alcohol users may demonstrate greater attentional bias and craving for alcohol than the sample of social drinkers in the present dissertation. As such, future research would benefit from replicating the investigations of the present dissertation, using a clinical sample of alcohol dependent individuals or alcohol users who engage in heavier alcohol consumption.

Limitations Associated with Study Design

The overall methodology of the study involved exposing participants to both positive and negative mood inductions prior to assessing attentional bias and craving for alcohol. Half of the present sample was randomly allocated to receive the positive mood induction first, whilst the other half received the negative mood
induction first, and vice versa. Whilst the order of mood induction was counterbalanced amongst participants to minimise contamination, a limitation of this methodology is that it is unclear what implications there may be for experiencing either the positive or negative mood induction first. This is an issue for consideration in future research involving a similar methodological approach.

A broad conceptual limitation of the present study is that drinking motives were considered to be relatively consistent within an individual, and were assessed accordingly via self-report questionnaire. However, recent research suggests that drinking motives may actually fluctuate within the individual, and may be influenced by one’s current mood state (Bailey & Baillie, 2013; Dvorak, Pearson, & Day, 2014). Thus, a limitation of the present study is that it is not known whether drinking motives may have varied as a function of heightened positive and negative mood, and what impact this may have had on alcohol-related cognitions. As such, including a dynamic assessment of drinking motives following positive and negative mood inductions would be of benefit to future research.

Clinical Implications

Emotion Regulation Strategies for Alcohol Use

Developing insight into the cognitive processes that are associated with alcohol use in social drinkers can enhance understanding of pathways to dependence, and provide important information to guide treatment interventions aimed at reducing or abstaining from alcohol consumption. To this end, the present findings hold important clinical implications with respect to understanding
the role of positive and negative affect in alcohol attentional bias and craving for alcohol, and the individual differences factors that may influence these relationships. Collectively, the findings of the present dissertation are broadly consistent with positive and negative reinforcement models of alcohol use (Baker et al., 2004; Cooper, 1995), in that alcohol attentional bias and craving for alcohol are significantly associated in the context of heightened positive and negative mood. Moreover, positive mood induction was found to significantly enhance craving for alcohol in social drinkers. The implication of these findings is that some alcohol users may be more inclined to attend to alcohol stimuli and experience craving for alcohol in the context of heightened positive and negative affect. As alcohol attentional bias and craving for alcohol are considered to have an important influence on drinking behaviour, it is likely that some individuals may be more vulnerable to subsequent alcohol use under these circumstances. Although the present dissertation investigated alcohol attentional bias and craving for alcohol in social drinkers, treatment-seeking individuals may benefit from understanding the association between mood state and alcohol-related cognitions (i.e. alcohol attentional bias and craving for alcohol), and potential vulnerability to alcohol use in the context of heightened positive and negative mood. Moreover, clinical interventions that aim to enhance emotional awareness and develop effective emotion regulation skills would be beneficial to alcohol users who are inclined to attend to alcohol-related stimuli in the environment or who experience craving for alcohol. Thus, identification of individual characteristics and drinking patterns that influence attentional bias and craving in the context of heightened positive and negative mood, would assist clinicians to identify individuals who would likely benefit from such interventions.
Clinical Interventions for Craving Management

The present findings indicate that individuals with heightened trait reward sensitivity and those who drink to socialise with others, experience increased craving for alcohol irrespective of mood state. This important information suggests that clinical interventions for alcohol use may benefit from including assessment of reward sensitivity and drinking motives, as well as craving management strategies for treatment seeking individuals who identify with heightened trait reward sensitivity and social drinking motives. Strategies for craving management have long been a feature of clinical intervention for alcohol use, with a number of cognitive and behavioural approaches demonstrating positive treatment outcomes (Florshiem et al., 2008; Matto, Strolin-Goltzman, Mogro-Wilson 2010; Naqvi et al., (2015; Stalcup et al., 2006). The findings of the present dissertation suggest that alcohol users with heightened reward sensitivity and who drink to socialise with others are amongst those most likely to benefit from craving management strategies in the treatment of alcohol use.

Attentional Retraining Interventions

Collectively, the findings of the present dissertation suggest that individuals with heightened reward sensitivity and those who are motivated to drink alcohol in order to enhance positive affect, to socialise with others, or to fit in with others, are more likely to attend to alcohol-related stimuli in the environment. Furthermore, these characteristics are associated with biases in maintenance of attention specifically, which appear to reflect greater cognitive
control, and are therefore are likely to be more amenable to therapeutic intervention than biases in initial orientation towards alcohol cues. As such, clinical assessment of alcohol users would benefit from including measures that assist in identifying heightened reward sensitivity, as well as differential drinking motives, in order to ascertain vulnerable individuals and to implement targeted treatment strategies. To this end, there has been clinical interest in the efficacy of therapeutic strategies that aim to modify attention directed towards alcohol stimuli, with variable outcomes.

Field and Eastwood (2005) demonstrated that attentional retraining to avoid alcohol related cues in heavy social drinkers subsequently reduced alcohol attentional bias and resulted in less alcohol consumption than individuals who were trained to attend to alcohol related cues. In a replication and extension of this earlier study, Field and colleagues (2007) examined the efficacy of attentional retraining, including novel alcohol pictures that had not been included during the attentional retraining procedure. As predicted, attentional retraining to avoid alcohol-related cues resulted in decreased alcohol attentional bias for the alcohol-related stimuli that was utilised during the attentional retraining. However, participants unexpectedly demonstrated increased attentional bias for novel alcohol pictures following the attentional retraining, indicating that the effects of attentional retraining did not generalize to other alcohol-related cues. Moreover, a study published in the same year by Schoenmakers and colleagues (2007) reported comparable findings, with reduced attentional bias following attentional retraining, which did not generalize to other novel stimuli that was not included in the training procedure. It could be said that the attentional retraining in these
studies did not really produce a change in alcohol attentional bias, as effects were only found on the task on which participants were trained, and they did not generalize to novel stimuli. However, it may be the case that some alcohol users demonstrate greater attentional bias for alcohol stimuli that reflects their preferred alcoholic beverage (e.g. red wine). Therefore, the single session attentional retraining described in the above studies may have some utility in reducing attentional bias when individuals are more inclined to attend to specific alcohol-related stimuli involving their drink of choice. Moreover, single-session attentional retraining studies do not necessarily reflect the potential clinical applications of attentional bias modification, as it takes time to learn and practice skills that are needed for long-term behaviour change. This is certainly true of other therapeutic interventions for alcohol use (i.e. Cognitive Behavioural Therapy; CBT). As such, attentional retraining may assist individuals in learning how to respond effectively to specific stimuli, however, multiple sessions of attentional retraining may be required to produce long-lasting and generalizable reductions in alcohol attentional bias.

Schoenmakers et al. (2010) found that five sessions of attentional retraining to avoid alcohol-related stimuli over a three-week period, led to a reduction in alcohol attentional bias that generalized to novel stimuli. This important finding indicates that multiple sessions of attentional retraining may be required to reduce generalized alcohol attentional bias. Moreover, Fadardi and Cox (2009) evaluated the efficacy of an alcohol attentional control training program (AACTP) which included two training sessions for hazardous drinkers and four training sessions for harmful drinkers. Results indicated that the AACTP was effective in reducing alcohol attentional bias in both harmful and hazardous
drinkers. Furthermore, harmful drinkers reported a reduction in alcohol consumption immediately following training, with reduced levels of alcohol use maintained at a three-month follow-up. This finding indicates that multiple sessions of attentional retraining are effective in reducing both alcohol attentional bias and alcohol use. However, it is important to note that Farardi and Cox’s (2009) study did not include a control group, therefore participants are likely to have been aware that the aim of the AACTP was to reduce alcohol consumption, which is subsequently what occurred in this study. Thus, participants’ expectations that the AACTP may assist in the reduction of alcohol use may have influenced subsequent drinking behaviour. More recently, Weirs and colleagues (2015) investigated the effectiveness of an online AACTP involving multiple sessions, relative to active control conditions and other forms of cognitive bias modification. The findings indicated that all participants reported a reduction in alcohol consumption following training and there were no differences between AACTP and other interventions utilised in the study. As such, non-specific treatment effects, such as participating in an intervention or monitoring of alcohol use, may explain these findings. Taken together, the available studies indicate that alcohol attentional bias is amenable to therapeutic intervention, and that attentional retraining may be an effective intervention for reducing alcohol attentional bias. Present findings indicate that individuals with heightened trait reward sensitivity and those who drink alcohol to enhance positive emotions, socialise with others or to fit in with others, are amongst those most likely to benefit from attentional retraining interventions.
Conclusions

To conclude, the present dissertation enhances understanding of important cognitive processes associated with alcohol use in social drinkers. The findings indicate that some social drinkers experience enhanced alcohol attentional bias and craving for alcohol following increases in positive and negative affect. This is inferred from findings demonstrating that alcohol attentional bias and craving for alcohol are mutually exacerbated in the context of heightened positive and negative mood. Moreover, positive mood induction was found to significantly enhance craving for alcohol in social drinkers. As such, there is variability in alcohol-related cognitions in response to increases in positive and negative affect in the present sample of social drinkers. Extending on this, individual variation in trait reward sensitivity, tolerance of negative affect and differential drinking motives (social motives, enhancement motives, coping motives and conformity motives) did not account for the variability in response to heightened positive and negative mood. However, trait reward sensitivity, social drinking motives, enhancement drinking motives and conformity drinking motives were each positively associated with attentional bias towards alcohol stimuli in social drinkers. Moreover, trait reward sensitivity and social drinking motives were positively associated with craving for alcohol in social drinkers. Taken together, the present findings suggest that these individual difference factors have an important influence on alcohol-related cognitions in social drinkers. On the other hand, coping motives for alcohol use and tolerance of negative affect were not found to influence alcohol-related cognitions in the present sample of social drinkers. These insignificant findings may be due in part to the present sample of
social drinkers not identifying strongly with coping motives for alcohol use and reporting relatively high tolerance of negative affect. Thus, social drinkers may have potentially utilised more adaptive emotion regulation strategies than those with problematic levels of alcohol use. As such, it will be important for future studies to extend investigations of alcohol-related cognitions to heavy or dependent alcohol users, and those who strongly identify with the differential drinking motives and trait characteristics examined in the present dissertation. Moreover, the findings of the present dissertation provide evidence for assessment of reward sensitivity and drinking motives amongst treatment seeking alcohol users, and for the implementation of therapeutic interventions that involve emotion regulation, attentional retraining and craving management strategies. Taken together, the findings reported in the present dissertation enhance current understanding of factors that increase vulnerability to alcohol-related cognitions in social drinkers and provide valuable information that can be used to guide clinical interventions for alcohol use.
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