THE EFFECTS OF ALCOHOL ON COGNITIVE PROCESSES RELATED TO SOCIAL ANXIETY

By

FRANCESCA GIORGIA ZANINOTTO

A thesis submitted to
Kingston University
for the degree of
DOCTOR OF PHILOSOPHY

School of Psychology
Kingston University
September 2020

Abstract

Social anxiety is generally characterised by the features of excessive fear of negative evaluation in social situations and it is often associated with alcohol use and misuse. Socially-anxious individuals may consider alcohol to be a confidence-enhancer and may use it as self-medication to alleviate anxiety symptoms arising during social situations. However, the relationship between social anxiety and alcohol use is not linear and it involves several cognitive processes. This thesis presents a series of studies investigating the relationship between social anxiety and the effects of alcohol. The aim was to explore the effects of alcohol on attentional and other cognitive processes, as well as individual characteristics, that might be important to better understand the complex relationship between social anxiety, cognition and alcohol use. First, the effects of alcohol on attention were tested in a non-clinical sample of high socially-anxious (HSA) and low socially-anxious (LSA) individuals' by examining their eye movements using a series of eye tracking tasks. The first eye tracking task examined how alcohol influenced participants' attention using a dot probe paradigm; the second and the third eye tracking tasks measured the influence of alcohol on involuntary (antisaccade task) and voluntary (prosaccade task) eye movements. The second set of tasks (4-5) investigated decision-making processes and attentional biases in a similar sample of HSA and LSA individuals under the effects of alcohol. Task 4 used a modified Iowa Gambling Task (IGT) paradigm to assess the effects of alcohol on participants' decision-making processes under ambiguity; task 4 also used the "Game of Dice" (GDT) paradigm to measure the influence of alcohol on participants' risk-taking behaviours during a non-ambiguous Task; task 5 consisted of a dot probe task to measure the effects of alcohol on participants' attentional biases using a shorter stimulus presentation time than previously adopted. The final study was a survey comprising several questionnaires looking at the relationships between social anxiety and drinking behaviours, motives, attentional styles and mindfulness traits. Results

strongly indicated that HSA participants drink alcohol as a coping strategy and to regulate their negative emotions. The eye tracking tasks showed that alcohol influenced social anxiety by increasing vigilance via longer dwell times, especially when shown emotional faces (angry or happy) compared to neutral facial expressions. Overall, alcohol impaired reaction times, accuracy and speed; error rates increased in both groups, regardless of their levels of social anxiety. There was an effect of alcohol on decision-making in situations of risk under ambiguity when emotional content was shown (IGT) but not in a situation where risks were explicit and no emotional content was shown (GDT). On the IGT, HSA participants shifted from selecting fewer advantageous choices to selecting more advantageous choices after consuming alcohol compared with LSA participants. Finally, the survey showed that high levels of social anxiety and drinking-related behaviours are associated with lower mindfulness abilities. Overall, these findings demonstrate a complex interaction between alcohol use and social anxiety that is mediated by several cognitive factors, such as attention and decision-making processes. The findings imply an important role for cognitive processes in clinical interventions designed to address problematic alcohol use in social anxiety.

Acknowledgements

As I write this acknowledgment, I remember how much of a life journey these past years have been for me over the course of this thesis.

I would like to thank my PhD supervisors, Dr Phil Terry and Dr Giulia Galli. Giulia has been not just an advisor, but also a supportive friend who has always been there for me. Phil is someone you will instantly love and never forget once you meet him. He has been my rock for all of these years, pushing me to not give up during my worst moments, reminding me that the end of my journey was close (and here it is). I will always be grateful for his guidance, his patience, motivation and immense knowledge.

I am also grateful to Dr Sabira Mannan and Dr Chris Askew their scientific advice and knowledge and many insightful discussions and suggestions.

I will be forever thankful to my colleagues Rose Turner and Zoë Mchayle for the time we spent together at university, for the laughs and for the tears, and for all the fun we have had over the past five years.

I thank my friend Anna, who has constantly been my light during my darkest hours.

I thank my Italian friends Ilaria and Giorgia for supporting me even when living in another country, and for always providing me with wonderful friendship.

I would like to thank my family. A thank you to my sister who has constantly been by my side and for her unconditional love.

To my mother, for her love, support and understanding, and for literally being my strength. She is the strongest woman I have ever known.

Finally, I would like to dedicate this thesis to my father. He sacrificed everything for his family. His hard-working attitude taught me to never give up, to be determined and committed. He had faith in me and my intellect even when I completely lost faith in myself. This journey has not been easy, and I could not have done it without his advices and his love. There are no words to convey how much I am grateful to be his daughter.

Table of contents

List of Figures

List of Tables

CHAPTER 1

General Introduction

1.1.Overview

Social anxiety, which is often characterised by fear of judgment and evaluation in social situations (American Psychology Association, 2013), is one of the most common anxiety disorders, with an estimated lifetime prevalence of 12.1 percent (Kessler, Berghund, Demler, Jin, & Walters, 2005). According to a large number of studies, the feelings of avoidance and distress related to social situations that are characteristic of socially-anxious individuals might also impact many other aspects of an individual's life (Davidson, Hughes, George, & Blazer, 1993; Sanderson, DiNardo, Rapee, & Barlow, 1990). For example, social anxiety is often associated with alcohol use and misuse (i.e., 19-28 percent; Davidson et al., 1993; Kushner, Abrams, & Borchardt, 2000; Van Ameringen, Mancini, Styan, & Donison, 1991). Kushner et al. (2000)

reported that socially-anxious individuals are twice as likely to have an alcohol use disorder compared to the general population. There is also evidence that high socially-anxious individuals experience more adverse consequences than low socially-anxious individuals from drinking alcohol (Buckner et al., 2006; Gilles et al., 2006; Stewart et al., 2006). Additionally, previous studies have shown that high socially-anxious individuals often drink alcohol in order to cope with anxiety symptoms during social situations, while individuals with low social anxiety report drinking more for the "enhancement" feelings produced by alcohol (Ham et al., 2007). Social anxiety and alcohol use have one factor in common: they can generate, or be caused by, attentional biases. Social anxiety is associated with selective attention regarding social evaluation, and there is considerable evidence emphasizing the role played by biased attentional processing toward negative social cues (e.g., Amir et al., 2009; Wells et al., 1995; Rapee et al., 1997; Schultz et al., 2008). Additionally, social anxiety is maintained by controlled strategies to regulate negative feelings, which include attentional avoidance of salient social stimuli (Wells et al., 1995; Hofmann, 2007; Rapee et al., 1997). Several studies have suggested that alcohol decreases the focus of attention (e.g., Josephs et al., 1990; Steele et al., 1990; Dougherty et al., 2000), which might change how someone with social anxiety responds to salient stimuli.

The present thesis aimed to investigate the effects of alcohol on attentional and decision-making processes in socially-anxious individuals (tasks 1-5). Additionally, it examined how individual cognitive characteristics and drinking behaviours relate to social anxiety through a series of self-report questionnaires (Study 6).

1.2.Types of Anxiety

Anxiety arises when an individual judges the demands of a situation to be greater than their ability to cope with it (Barlow et al., 1986). The American Psychiatric Association classified anxiety disorders into three categories: Phobic anxiety disorders; Panic disorder, and Generalised Anxiety Disorder (DSM-5; American Psychiatric Association, 2013). Social anxiety falls within the category of phobic anxiety; this category encompasses anxiety provoked by identifiable objects or events. On the other hand, Generalised Anxiety Disorder (GAD) is characterised by uncontrollable and excessive worry, which is not always attributable to particular circumstances (e.g., Wittchen et al., 1994). Because of their uncontrollable concern, people with GAD might be compromised in terms of social, occupational, and role functioning. GAD may also be reflected in high rates of emotional problems, divorce, unemployment, and self-reported interference with everyday activities (e.g., Henning et al., 2007; Massion et al., 1993). GAD has a high rate of comorbidity with social anxiety.

For all kinds of anxiety, "worry" is common and can be defined as a "mental preoccupation with potential negative elements that may occur in the future" (Brown et al., 1993). In terms of learning theories, worrying might be interpreted as a form of punishment or an omission of reward (Mueller et al., 2010). An important feature of worrying is that it is mostly future-oriented. In fact, worrying can be characterised by intolerance to uncertainty, especially uncertainty toward the future (Dugas, Gagnon, Ladoucer, and Freeston, 1998). It is also an important aspect of social anxiety.

1.3.Social Anxiety

Social Anxiety Disorder (SAD; Kessler et al., 2005) is one of the most common psychological disorders, with an estimated lifetime prevalence of 12.1% in the United

States. The diagnostic criteria for Social Anxiety Disorder have evolved over the various editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM). Since 2004, minor changes have been applied to the diagnostic classification systems for SAD, but the key elements of both the DSM and ICD criteria have remained relatively consistent. The important defining features of SAD, according to DSM-5 (APA, 2013), include "fear or anxiety in social situations in which the individual is exposed to possible scrutiny by others and fear of acting in a way that will be negatively evaluated by others (either resulting from the individual's own behavior or from showing anxiety symptoms such as blushing, trembling or sweating)." Individuals with SAD might experience intense anxiety or avoidance behaviours in social situations. Young people may be classified with SAD by the DSM-5 if they experience anxiety during interactions with peers, and they may express social anxiety through several behaviours (e.g., crying, tantrums, freezing, or failing to speak). Children with SAD might show anxiety or fear during social situations in which they are required to speak in front of others, meet new people, asking for help in outside places (such as shops or schools), joining parties or social events where peers are present (Beidel & Turner, 2007; Rao et al., 2007). Previous research has shown that socially-anxious individuals endorse lower levels of quality of life than do individuals without social anxiety, and are less content in terms of employment, family, relationship, and non-work activities (Eng et al., 2005; Mendlowicz & Stein, 2000; Olatunji et al., 2007; Safren, Heimberg, Brown, & Holle, 1996; Stein and Kean, 2000). Recent epidemiological studies conducted in the United States have shown that SAD is relatively common amongst children and adolescents (Burstein et al., 2011; Lawrence et al., 2017). Studies using community samples indicate a rise in prevalence with age (Beesdo et al., 2007; Burstein et al., 2011; Canino et al., 2004; Lawrence et al., 2017), but this rise was not apparent in a large UK-wide study (Ford, Goodman, & Meltzer, 2003). A noticeable difference in adult prevalence appears between countries; East Asian countries seem to report a lower prevalence of SAD compared to elsewhere (Brockveld, Perini, & Rapee, 2014). SAD tends to change across the lifespan but remains chronic and persistent for many people (Beesdo-Baum et al., 2012; Bruce et al., 2005). Previous studies suggest that if SAD is untreated during childhood and adolescence, it tends to persist (Beesdo-Baum et al., 2012; Burstein et al., 2011; Kessler et al., 2012); onset before 11 years of age increases the risk of persistence into adulthood (Abidin, 1992; Beesdo et al., 2007; Wittchen & Fehm, 2003). A network meta-analysis was conducted to understand the best treatments that might be used as interventions for socially-anxious individuals (Mayo-Wilson et al., 2014). Their findings suggested that both pharmacological and psychological interventions might be successful for social anxiety, in particular individual CBT. Additionally, the class of drugs, including SSRIs and SNRIs, showed greater effects on socially-anxious individuals than appropriate placebos (Mayo-Wilson et al., 2014).

Social anxiety disorder has been found to have high comorbidity with GAD, depression, specific phobia, panic disorder, and agoraphobia (Bandelow et al., 2015). In a study with a European sample, 19.5% of socially-anxious individuals had a comorbid major depressive disorder and 38.3% had other anxiety disorders, including GAD, panic disorder and post-traumatic stress disorder (Ohayon & Schatzberg, 2010).

High levels of social anxiety are also associated with substance use problems. For example, a study in the USA showed that social anxiety disorder in childhood and adolescence was predictive of alcohol and cannabis dependence at 30 years of age (Buckner et al., 2008). The study examined the relationship between SAD, alcohol use disorder, and cannabis dependence, after controlling for theoretically-relevant variables (e.g., gender, other anxiety disorders, and mood disorders) in a longitudinal cohort over

14 years. Children and adolescents with social anxiety disorder were 1.56 times more likely to develop alcohol dependence and 1.94 times more likely to develop cannabis dependence than non socially-anxious individuals (Buckner et al., 2008).

In this thesis, the term "social anxiety" will typically be used (rather than SAD, social phobia, or other terms) since the studies described do not involve people formally diagnosed with a social anxiety disorder. Most cognitive models of social anxiety (and related empirical research) adopt a similar practice since they assume that the condition is expressed along a continuum of severity.

1.4.Cognitive Models of Social Anxiety

The two most influential cognitive models of social anxiety are the Clark and Wells model (1995) and the Rapee and Heimberg model (1997). The Clark and Wells model focuses on the processes that inhibit the person with social anxiety from changing their negative beliefs about social interaction. Based on previous experience, socially-anxious individuals develop a number of expectations about themselves and the external social environment. Socially-anxious individuals' expectations can be divided into three categories (Clark and Wells, 1995): "(1) excessively high standards for social performance (e.g., "I should only speak when people pause," "I must always sound intelligent and fluent"); (2) conditional beliefs concerning the consequences of performing in a certain way (e.g., "If people get to know me, they won't like me," "If I disagree with someone, they will think I am stupid/will reject me"); (3) unconditional negative beliefs about the self (e.g. "I'm boring," "I'm stupid," "I'm different")". If individuals have these expectations, they may also judge relevant situations as dangerous, and they may predict failure when trying to achieve future performances (e.g., “I will blush” or “I’ll make a fool of myself”). Additionally, socially-anxious individuals may also interpret equivocal social signals as cues of negative evaluation by others. A person with social anxiety becomes anxious when a social situation is appraised in this way (Clark and Wells, 1995).

On the other hand, the Rapee and Heimberg model (1997) is based on the assumption that people with social anxiety generally think that other people are instinctively critical and more likely to evaluate them negatively (Leary, Kowalsky & Campbell, 1988). They argue that people with social anxiety are excessively concerned with how they might be judged by other people. In this case, there could be several processes that are generated to maintain social anxiety. During a social situation, a person develops a mental representation of his/her external appearance and behaviour as apparently seen by the audience; simultaneously, the individual will also allocate attentional resources towards the self-representation and the threat that can be present in the social environment. Socially-anxious individuals might experience behavioural, cognitive, and physical symptoms of anxiety from the moment that they perceive a negative evaluation as having been made by the audience. The symptoms will be interpreted as a confirmation for people with social anxiety that others will negatively evaluate them.

Rapee and Spence (2004) described social anxiety as lying on a continuum of social/evaluative concern in which a clinical diagnosis of a social anxiety disorder (therefore, the extreme concept of social anxiety itself) is associated with falling toward the upper end of the continuum. They proposed that the level of social anxiety experienced is largely the product of genetic factors (Cherny et al., 1994). The genetically-mediated level acts like an individual’s “set point.” By the term “set point,” researchers refer to an individual’s level of social anxiety that is relatively stable and consistent, but which can be altered and is not permanent. There are many factors that can contribute towards moving the individual (up or down) from this level of social anxiety. The movement is expressed as a different level of social anxiety, in which the final level of the setpoint reflects both environmental and genetic influences. This will appear when external influences from the environment are strong enough to change the structure of social anxiety expressions (biases, behavioural styles, beliefs, or even neurobiology; Kendler et al., 2001). There are three major factors that contribute to the power of environmental influence. First, "timing" is defined as the incidence at crucial phases of vulnerability. Second, "impact"; represents the severity of the factor or its significance to the person. Finally, "chronicity": is the period of an individual's life where the factor is dominant. For example, someone with a low genetic propensity for social anxiety might be shifted to a higher level by adverse environmental episodes (e.g. persistent and severe bullying at school); this might consequently lead to the emergence of social anxiety. However, a person born with a strong genetic tendency for social anxiety might never move to a high level of actual social anxiety because of the buffering effects of a supportive family that encourages social interaction over a number of influential years.

Generally, when environmental factors cause changes in the expression of social anxiety, these will be relatively minor and transitory. When a protective environmental influence ends, the person will return to their set point unless other buffering factors are present. Such an account would explain why shared environmental influence diminishes with age (Eley et al., 1999).

The model also suggests that the expression of social anxiety may be affected by cultural norms and mores. For example, in collectivist cultures where the concept of "the group" is very important, individuals might experience social anxiety related to the fear of causing distress to others. There might also be gender differences in social anxiety due to culture. For example, social anxiety might be more tolerated in females and less in males from middle childhood. Culture may also affect an individual's tendency to recognize a mental health problem and seek treatment. These factors (and others) will consequently impact the diagnosis rates in a particular culture.

In 2009, Moscovitch criticised the cognitive-behavioural models of social anxiety (e.g., Clark et al., 1995; Rapee et al., 1997), arguing that they did not provide a clear enough definition of fear in social anxiety (confounding feared outcomes when stimuli are present with feared stimuli). Moscovitch developed a new model that focused on the biased self-perception that might characterise a socially-anxious individual. A person with social anxiety may perceive flawed self-attributes in themselves and may fear being exposed to others. A socially-anxious individual may then use safety behaviours as protective strategies to reduce the likelihood of exposure. In the model, there are four primary areas of perceived self-deficiencies: "(1) social skills and behaviours (e.g., I will do something stupid), (2) showing signs of anxiety (e.g., I will sweat), (3) physical appearance (e.g., I am ugly) and (4) character (e.g., I am boring)". In conclusion, while the focus of previous cognitive models was directed towards the external expression of social anxiety, Moscovitch's cognitive-behavioural model focused on internal elements that may characterise socially-anxious individuals.

A key cognitive function that is strongly related to social anxiety and which is implicit in all of the models of social anxiety described above is attention (Hartman, 1983; Clark et al., 1995). The Clark and Wells model and the Rapee and Heimberg model identify attention towards external appraisal as a critical process in generating social anxiety. Other theories have focused more specifically on the central role played by attentional processes in different kinds of anxiety, including social anxiety. One such influential theory of how attention and anxiety interact is the Attentional Control Theory (ACT;

Eysenck et al., 2007), which aimed to build on the strengths of Processing Efficiency Theory (Eysenck et al., 1992) whilst attempting to address its limitations. The Processing Efficiency Theory argued that anxiety disrupts the central executive to negatively affect processing efficiency, and the detrimental effects on processing efficiency are greater than on performance effectiveness. However, studies testing Processing Efficiency Theory focused entirely on cognitive tasks using non-emotional or neutral stimuli, whereas previous research has shown that socially-anxious individuals' performance is preferentially disrupted by threat-related stimuli in particular (e.g., Egloff & Hock, 2001; Eysenck & Byrne, 1992; Keogh & French, 2001; Mogg et al., 2000).

Because of such limitations, Eysenck developed the ACT ten years later (2007). The relationship between the two main elements of the previous theory (performance effectiveness and efficiency) is essential to the Attentional Control Theory. The main assumption of the ACT is that anxiety has a specific effect on cognitive performance and on the functioning of the central executive (Eysenck et al., 2007). Where ACT has particular relevance in the context of social anxiety is in its assumption that anxiety is increased when attention is allocated to threat-related stimuli; therefore, the attentional focus on any concurrent task is reduced unless it involves the threatening stimulus. Individuals with anxiety choose to allocate attentional resources to threat-related stimuli (Eyesenck, 2007), and for socially-anxious people, the threat-related stimuli will include the kinds of stimuli described by Clark and Wells and by Rapee and Heimberg: social stimuli that indicate negative evaluation. ACT also assumes that there are two attentional control systems (Corbetta and Shulman, 2002). The first attentional system is goal-directed and is influenced by expectations, knowledge, and current goals. The second attentional system is stimulus-driven and responds preferentially to relevant stimuli. While the goal-directed attentional system is involved in the top-down control of attention (presumably mediated by the prefrontal cortex), the stimulus-driven attentional system concerns the bottom-up control of attention (probably mediated by the temporoparietal and ventral frontal cortices; Corbetta and Shulman, 2002; Posner and Petersen, 1990). The ACT hypothesises that the balance between the two attentional systems is disrupted by anxiety, especially during stressful situations. In relation to social anxiety, threats that signal social evaluation are likely to disrupt the balance between the two systems because of preferential allocation of attention (stimulus-driven) to the threatening stimuli.

In summary: taken together, the various cognitive models of social anxiety have suggested that socially-anxious individuals demonstrate biases in their self-perception and commonly underestimate their performance during social situations; they show an increase in self-negative thoughts compared to people who are not socially-anxious (Clark et al., 1995; Moscovitch et al., 2009; Heimberg et al., 2010). Moreover, these cognitive processes are not independent of cultural influence: the importance of cultural norms and mores in the development and expression of social anxiety is evident from cross-cultural comparisons (Rapee et al., 2004). A theory that integrates features of other cognitive models and will be particularly relevant for this thesis because of its focus on how specific threat-related stimuli affect attention and performance is the Attentional Control Theory (ACT, Eysenck, et al., 2007). The ACT predicts that people with high anxiety levels might show impaired performance on particular cognitive tasks in response to certain stimuli because of interference with a top-down attentional control system (Eysenck & Derakshen, 2011; Eysenck, Derakshan, Santos, & Calvo, 2007). Studies in this thesis will assess how biased attentional processes might relate to social anxiety and how (or if) such processes might be altered by the consumption of alcohol since social anxiety has been linked with alcohol misuse, as noted in Section 1.3, and discussed further below.

1.5.Social Anxiety, alcohol use, and cognition

As the main goal of this thesis is to explore the relationship between alcohol use and social anxiety, this section will examine why alcohol may be consumed in different ways by socially-anxious people compared with people who are not socially-anxious. It will also describe how cognitive models of social anxiety may explain how the consumption of alcohol can influence social anxiety through its effects on attentional processes.

Alcohol has long been recognised as having anxiolytic properties that arise from its pharmacological effects at the receptor level. These effects may be important in driving alcohol use among people who experience anxiety, including those who suffer from social anxiety. Oscar-Berman et al. (1997) suggested that alcohol reduces anxiety by facilitation of the GABAergic inhibitory system. Kushner et al. (1996) demonstrated a GABAergic antianxiety effect after a low dose of alcohol. Other anxiolytic drugs, such as benzodiazepines and opiates that have been used to treat anxiety can also facilitate the transmission of GABA (for review: Ticku, 1990). A study that used proton magnetic resonance spectroscopy to explore the whole brain and regional GABA levels in socially-anxious individuals found that brain levels of GABA were lower in socially-anxious participants compared with people who were not socially-anxious, suggesting that alcohol might help relieve social anxiety by facilitating GABA transmission (Pollack et al., 2008). Amygdala hyperactivity is associated with impairments in GABAergic functions (Aroniadou-Anderjaska et al., 2007), and this might explain the increased amygdala activity observed in response to threatening stimuli - angry faces - in socially-anxious individuals (Stein et al., 2020) and may also hint at why alcohol might have some efficacy in reducing social anxiety, since it may enhance GABA function in the amygdala.

More generally, there is a common belief among the wider population that alcohol boosts confidence and can serve as a “social lubricant” (Monahan et al., 2000), albeit that such beliefs do not provide an explanation of how these effects are produced. Nevertheless, if alcohol produces these outcomes, then socially-anxious people may be expected to benefit from using alcohol in social situations in order to reduce social anxiety. Consistently, according to epidemiological studies, there is a high rate of comorbidity between social anxiety and alcohol use disorders. Research conducted on individuals with social anxiety has suggested that the 12-month prevalence of alcohol use disorders ranges between 13% and 17% among socially-anxious people, compared with a base rate of 4% to 9% in the general population (Burns & Teesson, 2002; Grant et al., 2005; Hasin, Stinson, Ogburn, & Grant, 2007; Teesson et al., 2010). People diagnosed with Alcohol Use Disorder (AUD) are twice as likely as the general population to be diagnosed with social anxiety (Hasin et al., 2007; Teesson et al., 2010). Previous studies have found that when social anxiety and AUD co-occur, they tend to be more severe and to impact more on quality of life than is the case for either of the disorders alone (Randall, Thomas & Thevos, 2001; Schneier, Martin, Liebowitz, Gorman, & Fyer, 1989). Early comorbidity models supported the assumption that alcohol is negatively reinforcing for anxious individuals because it relieves tension (Conger, 1951; Sher & Levenson, 1982). More recent research has examined alcohol use as a kind of “safety behaviour”. A safety behaviour in the context of cognitive-behavioural therapy for social anxiety is described as a behaviour adopted to decrease social anxiety in the short term. However, safety behaviours are generally considered to be negative behaviours, because they can prevent the acquisition of information that could change underlying maladaptive beliefs, consequently reinforcing and maintaining social anxiety in the long term (Hope, Heimberg, & Turk, 2010a, 2010b). When alcohol is used as a safety behaviour during stressful situations, the aim of a socially-anxious person is to prevent feared negative outcomes (Baillie & Sannibale, 2007; Tran & Haaga, 2002). Social drinking has been identified as one of two typical safety behaviours exhibited by socially-anxious individuals to alleviate social anxiety symptoms (the other behaviour is social avoidance; Brook et al., 2016).

Various theories are consistent with the view that alcohol consumption can be a safety behaviour for socially-anxious people. For example, the Tension Reduction Theory (TRT; Conger, 1951) proposed that alcohol consumption is often reinforced because of its tension-reducing properties. The theory has been tested (for example) using animals in stress-inducing tasks, showing that animals approach feared stimuli faster after consuming alcohol (Pohorecky & Brick, 1987; Conger, 1951). According to Kushner (1990), the TRT may predict that socially-anxious individuals, after learning to use alcohol to reduce tension during social situations, could develop a reliance on alcohol to relieve these unpleasant symptoms in the future (Kushner et al., 1990). Other researchers that have measured alcohol's effect on social anxiety supported Conger's theory whilst offering a more cognitive interpretation, suggesting that individuals with social anxiety would develop greater expectations of alcohol's tension-reducing properties during tense social situations, in comparison with people who were less anxious in such situations (e.g., Goldman, Del Boca, & Darkes, 1999). However, Conger's theory has been subject to a great deal of criticism, and the limitations of TRT are increasingly apparent. The theory gives a weak definition of 'tension' (which includes not only anxiety but other negative affective states), a poor consideration of the specific situations that cause tension, and it fails to consider important individual differences (e.g., that some people might be more sensitive to alcohol's pharmacological effects than others; Sher & Levenson, 1982). As an alternative, Sher and Levenson (1982) developed the Stress Response Dampening model (SRD), which suggests that socially-anxious individuals might not drink alcohol to moderate their reactions during stressful situations, but instead alcohol consumption happens when they anticipate or experience anxiety during stressful situations. Therefore, according to SRD, alcohol may work as an anxiolytic if it is consumed during or before a stress-inducing event or situation (Sher & Levenson, 1982). The SRD is considered to offer a better explanation compared with TRT because of its explicit acknowledgment of the role of individual difference variables (Greeley & Oei, 1999). According to this theory, socially-anxious individuals should be more sensitive to alcohol's SRD effects during social situations compared to non-anxious individuals. Thus, socially-anxious individuals may be more likely to develop alcohol problems (Finn & Pihil, 1988).

In terms of alcohol's effects during or before stress-inducing events, a few studies have examined the effects of alcohol on social anxiety during public speaking tasks, but they have found mixed results regarding the anxiolytic effect of alcohol. Some studies have indicated that alcohol reduces anxiety during social performance (Abrams, Kushner, Medina, & Voight, 2001; Himle et al., 1999; Kidorf & Lang, 1999), while other studies have disputed that (Himle et al., 1999; Keane & Lisman, 1980; Naftolowitz, Vaughn, Ranc, & Tancer, 1994) or have specifically highlighted the important influences of alcohol expectations and placebo effects (Abrams & Kushner, 2004). Supporting this, Stevens (2017) investigated the acute effects of alcohol during a speech task on social performance for individuals with social anxiety. Participants' social anxiety was assessed through physiological (ECG) and self-report measures on three separate occasions, after receiving either alcohol, an alcohol-free placebo drink, or orange juice. Alcohol reduced self-reported anxiety during the speech task in socially-anxious participants, compared to the control group. Additionally, participants with high social anxiety reported less anxiety during the placebo condition, suggesting that alcohol expectancy can indeed reduce social anxiety to some extent (Stevens et al., 2017).

Related to this, Burke and Stephens (1999) proposed that alcohol expectancies of social facilitation and social anxiety reduction are made when individuals feel social anxiety during social situations that involve drinking. Therefore, alcohol outcome expectancies regarding social facilitation can moderate the relationship between social anxiety and alcohol use. Consequently, socially-anxious individuals with strong social facilitation expectancies might drink more alcohol compared to socially-anxious individuals with weak social facilitation expectancies (Burke & Stephens, 1999). This was supported by an experimental study that suggested that outcome expectancies about tension reduction and the pharmacological effects of alcohol work together, reducing social anxiety in socially-anxious individuals (Kushner, Medina and Voight, 2001). Although these studies have supported the assumption that alcohol outcome expectancies might moderate the relationship between alcohol use and social anxiety, other studies have argued about the importance of this moderation role (Eggleston, Woolaway-Bickel, & Schmidt, 2004).

However, it has become clear that the link between social anxiety, the specific social situation, and the person’s motivation to drink alcohol is less straightforward than indicated by these studies. Thomas, Randall & Carrigan (2003) investigated the relationship between alcohol and two different features of social anxiety: concerns of performance in social situations and fear of social interactions (Thomas et al., 2003). Their findings suggested that socially-anxious people who show higher fear scores in social interactions were more likely to drink in order to cope with social anxiety, compared with socially-anxious individuals who had greater anxiety scores when performing in social situations.

The SRD (and also the earlier TRT) has much in common with Khantzian's (1985) Self-Medication Hypothesis, an overarching theory that tries to explain psychotropic drug use more generally as a way of reducing the distress caused by particular feelings. Different drugs may be used to alleviate different kinds of unpleasant affective states. In the context of social anxiety and alcohol use or misuse, the SMH would argue (like TRT) that social anxiety precedes alcohol misuse, it provides some respite from social anxiety symptoms, and that the relief from distress motivates continued (potentially problematic) alcohol use (Chutuape and De Wit, 1995). Therefore, SMH predicts that individuals with social anxiety might feel less anxious after alcohol consumption, and this perception of anxiety reduction may promote excessive drinking during social situations (Chutuape & de Wit, 1995; Carrigan & Randall, 2003). A study using a self-report questionnaire on a sample of 454 adults assessing social anxiety, alcohol consumption, reward sensitivity, and alcohol expectancies showed that the expectations of increased confidence and tension reduction were significant predictors of drinking, supporting an association between alcohol expectancies and drinking behaviours (Booth et al., 2009). Additionally, the study also showed that the association between social anxiety and drinking is moderated by both reward sensitivity and expectancies and supported a three-way interaction between social anxiety, reward responsiveness, and increased confidence expectancies. In line with the SMH, their findings suggested that socially-anxious individuals might drink during social situations with the expectation that alcohol would reduce anxiety.

These three theories (TRT/SRD/SMH) have much in common, in that they all argue that alcohol consumption is motivated by the desire to reduce distress, but they have all been criticised on the grounds that the nature of the relationship between social anxiety and alcohol needs more extensive explanation (Books et al., 2002). In particular, the models are over-generalised: they do not adequately consider individual factors that are known to have important influences on the relationship (e.g. social context, gender, individual differences; Books et al., 2002). Morris, Stewart, and Ham (2005) published a review of the models in which they highlighted the importance of considering social contextual variables, such as the type of situation (e.g. performance vs social interaction), the accessibility of alcohol use, the kind of fear and the distress associated with the particular situation, along with person-specific factors (e.g., gender), in order to better investigate the relationship between alcohol and social anxiety. It is also the case that the theories are weak in explaining the complex nature of the comorbidity of AUD with SAD, and how each disorder can influence the other. However, the general thrust of the three theories is widely accepted: alcohol is often used as a means to reduce distress and so is likely to serve a tension-reducing role for people with social anxiety (Books et al., 2002).

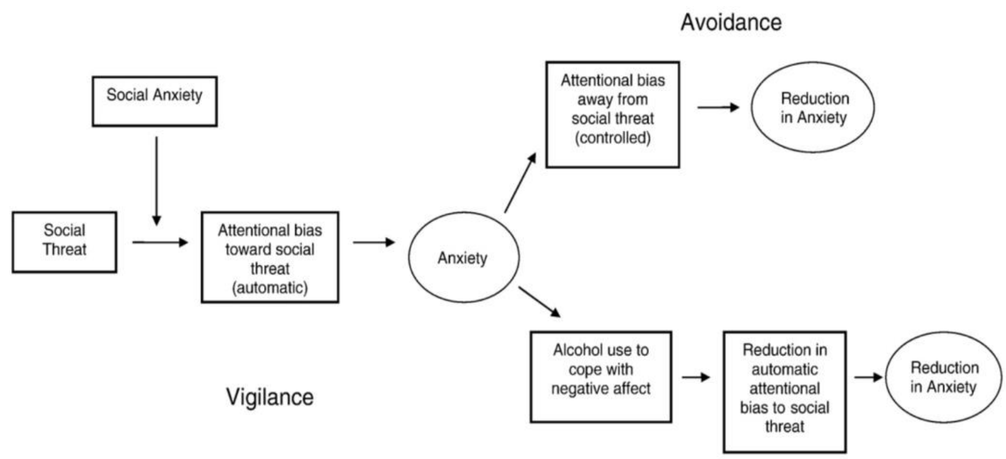
None of the three related theories outlined above (TRT/SRD/SMH) has attempted to identify particular cognitive processes that might be altered by alcohol and which might explain the drug's tension-reducing effects, although some of the cited empirical studies refer to important cognitive processes as mediators (e.g., expectancies). One of the first attempts to explain how particular cognitive processes affected by alcohol might influence social anxiety was by Joseph and Steel (1990), who conducted two studies following the Attentional Allocation Model (AAM). In their study, Joseph and Steel (1990) manipulated the attentional demands of activity while waiting before giving a speech, based on the assumption that anxiety decreases when more attentional resources are required as an activity becomes more complex. Participants were tested twice, either with a placebo drink or with alcohol. The researchers varied the attentional demands of the activity by comparing a low-demand condition with a more demanding slide-rating condition. Results showed that anxiety decreased when the situation became more attentionally-demanding, supporting the Attention Allocation Model. Furthermore, as attention was focused on an ongoing activity, alcohol reduced attentional capacity, and consequently, individuals allocated attention to the salient activity without having the capacity to have stressful thoughts during the demanding situation (Steel et al., 1990). Other studies have based their research on the AAM theory (e.g., Curtin et al., 2001; Fleming et al., 2013; Giancola et al., 2010; MacDonald et al., 2000; Monahan et al., 2000; Sevincer et al., 2012). For example, an EEG study measuring P3 event-related potentials showed that alcohol reduced anticipatory fear and response inhibition in participants by affecting cognitive processing capacities (Curtin et al., 2001). A further study using attentional tasks and assessing physiological variables (skin conduction and heart rate) prior to delivering a self-disclosing speech suggested that alcohol reduced self-reported anxiety and decreased skin conductance levels in response to the stressor (Sher et al., 2007). Sustained attention was disrupted after alcohol consumption, consistent with the predictions of the AAM (Joseph et al., 1990), and showing that alcohol can create attentional 'myopia' by disrupting cognitive functioning in socially-anxious individuals during a situation where a salient threatening distractor is present. However, it may not be necessary for such a distraction to be present: another study has shown that anxious and intoxicated individuals demonstrated tension-reduction even when a distractor is not present (Sayette, 1992). Sayette et al. (1992) instead suggested that social anxiety is only indirectly influenced by alcohol through its effects on information processing (the "Appraisal Disruption Model"). During a stimulus presentation, alcohol can disrupt the initial appraisal of anxiety by inhibiting the activation of a previously established threat memory network. The consequences of these effects should be seen immediately (Sayette, 1993). Accordingly, studies that use facial expressions of negative emotion (threatening stimuli for socially-anxious people) and which prompt fast initial reactions to the stimuli might be particularly useful for understanding alcohol's effects. This model also suggests that alcohol might have different effects based on the depth of processing required by the stimuli presented. If a stimulus is salient and easy to process, anxiety will not be reduced by alcohol. On the other hand, when the stimulus presented is difficult to process and less salient, alcohol's effects on anxiety should be greater. This assumption was positively and successfully tested on a non-clinical sample of anxious participants (Sayette, Martin, Perrott, Wertz, & Hufford, 2001). Participants were asked to present a self-disclosing speech about their physical appearance (a stress-induction situation) either before or after drinking alcohol. Alcohol was more likely to reduce stress when initial stress appraisal occurs during intoxication compared with the situation when the initial appraisal occurred before drinking. However, the ADM model produced different findings when tested with clinical samples of socially-anxious people. In fact, individuals with social anxiety efficiently processed socially-threatening stimuli due to their enhanced salience. A study evaluating the effect of alcohol on social anxiety using an emotional Stroop task containing socially-threatening and neutral words showed that, overall, socially-anxious and control participants performed slower in the placebo condition with socially-threatening words than with other words, but alcohol reduced this effect only in participants who were not socially-anxious. However, participants with social anxiety showed a memory bias for socially-threatening words only in the placebo condition and not in the alcohol condition (Gerlach et al., 2006). These findings indicated that socially-anxious participants experienced similar levels of anxiety in both the alcohol and placebo conditions, but they remember anxiety less precisely after alcohol, suggesting a possible reinforcing effect that might support alcohol use as a self-medication strategy (Gerlach et al., 2006).

Consistent with their outcomes, a study by Stevens et al. (2009) assessing the effects of alcohol on participants with and without social anxiety, using a dot-probe paradigm that presented both socially-threatening and neutral stimuli, reported that people with social anxiety performed significantly slower when presented with a socially-threatening stimulus in the placebo condition compared with the other participants, but this effect was reduced during the alcohol condition. Their findings suggested that social anxiety is associated with an attentional bias toward threatening stimuli that may be reduced by alcohol, perhaps supporting the possibility of a reinforcing effect of alcohol emerging to reduce social anxiety (Stevens et al., 2009).

The key findings and theories described above, which have aimed to explain the complex relationship between alcohol use, attention and social anxiety, have been drawn together by Bacon et al. (2010) and synthesised within their "Avoidance Coping Cognitive Model". The model integrates elements of previous work to explain how alcohol's cognitive effects might predispose alcohol problems in people with social anxiety. In line with previous theories, Bacon et al. (2010) argue that alcohol serves as a negative reinforcer through its capacity to reduce social anxiety (Conger et al., 1956; Sher et al., 1982), but additionally, they attribute a primary role to the cognitive process of attention in order to explain the relationship between social anxiety and alcohol use. They propose that socially-anxious people may allocate more attentional resources to threatening stimuli and can then either (1) avoid the social threat to reduce anxiety or (2) consume alcohol to cope with negative affect. Alcohol consumption reduces the allocation of attentional resources to the threat and is therefore followed by a reduction of social anxiety. Hence there are two types of avoidance pathways (overt avoidance of alcohol use), and they are both moderated by social anxiety levels (Figure 1.1). The temporary alleviation of social anxiety serves as a negative reinforcer that will encourage the person to apply the same avoidance mechanism in the future. Based on these assumptions, alcohol has a negative impact on both automatic and controlled attention. The model includes and combines (1) theories that attempt to explain the relationship between social anxiety and alcohol use by describing the negative reinforcement of alcohol use and its effect on cognitive processes of threat (Sayette, 1993; Steel et al., 1990) with (2) theories suggesting that attentional biases are shown in individuals with social anxiety particularly at early and automatic stages of processing (Amir et al., 2001; Bögels et al., 2004; Ledley et al., 2006).

In summary, the Avoidance-Coping cognitive model suggests that alcohol is likely to affect socially-anxious people in a different way from people who are less socially-anxious. Because socially-anxious individuals are predisposed to show attentional biases at an early stage of processing stimuli that signal social threat, they might consider alcohol to be anxiolytic in that situation and therefore use it as a form of self-medication. People who do not exhibit social anxiety should not demonstrate the same degree of attentional bias towards threatening stimuli, and therefore they are less likely to be affected by alcohol in the same way. The core principles of this model will inform the studies reported in this thesis.

Figure 1.1: The Avoidance-Coping model (Bacon and Ham, 2010) explains the alcohol-induced reduction in attention to social threat in socially-anxious individuals.



1.6.Aim of this project

Five laboratory-based cognitive tasks and one online survey were conducted. The first study included three eye tracking tasks (tasks 1-3) that examined attention in socially-anxious individuals under the influence of alcohol or after drinking a placebo; the second study included three computerised tasks (tasks 4-5) looking at socially-anxious individual's attentional biases and decision-making processes under the influence of alcohol and after drinking a placebo; and the final study was an online survey. Overall, the thesis aimed to explore the relationship between alcohol and social anxiety by testing key cognitive factors that might play a role as mediators in the association between social anxiety and drinking. In this way, the research may help to develop tools to identify people at risk for problem drinking and may have implications for the delivery of cognitive-based interventions (both in treatment and recovery) for this at-risk subgroup of drinkers. The first study, in the next chapter, tested alcohol's effect on socially-anxious participants' attention through the execution of three eye tracking tasks which presented emotional stimuli, such as angry and happy faces. The aim was to test whether alcohol ameliorated any differences in attentional processes exhibited by socially-anxious participants compared with people who are less socially-anxious.

Chapter 2

The effects of alcohol on eye movements in socially anxious individuals: an eye tracking study

2.1. Introduction

As described in the previous chapter, several cognitive theories have proposed that individuals with social anxiety show attentional and memory biases when processing information from socially threatening stimuli (e.g. Clark & McManus, 2002; Heinrichs & Hofmann, 2001). However, studies have shown different kinds of outcomes in relation to these theories. Thus while there are studies that suggest that socially-anxious individuals show attentional vigilance towards threatening stimuli (e.g. Bantin, Stevens, Gerlach, & Hermann, 2016 Staugaard, 2010), other studies have suggested a different effect: socially-anxious individuals can react slower towards threatening stimuli and can show difficulty disengaging from them (Amir, Elias, Klumpp, & Przeworski, 2003; Buckner, Maner, & Schmidt, 2010; Liang Tsai & Hsu, 2017). A recent study that has applied, for the first time, network analysis to investigate how social anxiety is related to attentional bias, suggested that socially-anxious individuals might be characterised by preferential attentional engagement with threat, supporting the hypothesis that attentional biases play a fundamental role in the maintenance of SAD (Hereen & McNelly, 2016). Over the years, much other research has been carried out in an attempt to better understand the relationship between social anxiety and attentional biases. Taylor et al. (2016) conducted a study showing that socially-anxious individuals with poor self-reported attentional control scores exhibited more difficulty disengaging from threats compared with those who reported better attentional control ability. Their findings suggested that the relationship between attentional bias and social anxiety might be moderated by attentional control (Taylor, Cross, & Amir, 2016). Other evidence that highlights an important role of attentional control comes from researchers who have suggested that impaired attentional control ability causes attentional biases for threatening stimuli (Hereen, De Raedt, Koster, & Philippot, 2013; Cisler & Koster, 2010).

As described in the previous chapter, the ACT is based on two major assumptions: "(1) anxious individuals show impairments in the two most critical central executive functions (inhibitions and shifting); (2) anxious individuals make more efforts to achieve a goal in order to compensate for the adverse effects of anxiety" (Eysenck et al., 2007). According to these assumptions, anxious individuals might allocate more attentional resources to identify in the environment a possible threatening stimulus and they might show longer response latencies when performing tasks that involve response inhibition and shifting functions. One technique that has been extensively used to examine such attentional control processes and how they are affected by different kinds of stimulus is eye tracking. Eye tracking devices can record a number of responses that reflect attention. For example, two types of eye movements that are recorded by the latest models of eye tracking are gaze fixations and saccades. Gaze fixations happen when the eyes focus on a visual target for a period of time, and saccades are the most rapid movements that occur between two fixations: their amplitude ranges from small movements to large ones (Rayner, 1988). Eye tracking research quantifies these two types of eye movements to produce metrics like duration of each fixation, number of fixations and saccade latitude. Previous literature has shown that such metrics may reflect attentional control functions in anxious individuals (Ainsworth & Garner, 2013; Eckstein, Guerra-Carillo, Miller Singley, & Bunge, 2017). Eye tracking studies have shown that individuals fixate more on the eye region compared with other facial features (e.g.. Adolphs et al., 2006; Walker-Smith et al., 1977). Importantly, individuals with social anxiety disorder show attentional bias when looking at emotional face stimuli (i.e. Abrams et al., 2001; Gilboa-Schechtman et al., 2005; Mohlman et al., 2007; Calvo et al., 2018). Additionally, socially-anxious individuals display similar patterns of eye movements when looking at faces: they show a tendency to avoid salient facial features (eyes) and a propensity for hyperscanning less-salient facial features (e.g. mouth; Horley et al., 2003; Horley et al., 2004). Understanding which particular facial features socially-anxious individuals look at most may explain why people with social anxiety evaluate facial emotions differently compared with non-socially-anxious individuals. For this reason, in this study, eye-movements around specific Areas of Interest (AoI) were analysed, namely the eyes and the mouth, as well as the face overall, in order to understand better the features to which socially-anxious participants allocated more attention. The studies presented in this chapter used three different eye tracking paradigms to investigate the effect of alcohol on attentional control functions in socially-anxious and non-socially-anxious individuals when shown emotional and neutral face stimuli: 1. A dot-probe eye tracking task; 2. An antisaccade task; 3. A prosaccade task.

2.1.1. Effects of alcohol on eye movements

Eye movements can be recorded at very high temporal and spatial resolution (Collewijn et al., 1975; Robinson et al., 1964). From eye position tracks, researchers can deduce consistent and reliable parameters of brain functions. These parameters are particularly helpful to identify pathological conditions such as muscular/neuromuscular fatigue (Bahil et al., 1975; Baloh et al., 1976; Barton et al., 1995) from different cortical and/or subcortical dysfunctions, for example, lack of attention (Gaymard et al., 1998; Pierrot-Deseilligny et al.,1991,1995). In a simple laboratory setting, through the use of an eye tracker, it is also possible to investigate reflexive guided saccades that can show the effects of alcohol at low-to-moderate doses of less than 0.8% (grams alcohol per kg body weight). Previous research demonstrated that moderate-to-high doses of alcohol might increase saccade latencies and reduce peak eye velocities (Jantti et al., 1983; Lehtinen et al., 1979; Nyberg et al., 2004; Stapleton et al., 1986). The investigation of the relationship between alcohol use and saccadic movements is important as it can be used in several applications linked to work safety and/or for law enforcement officials to quickly evaluate a person's condition.

Available data regarding the role of alcohol on eye movements during antisaccade and prosaccade tasks are contradictory. For example, one study testing the effects of alcohol in head-injured participants during an antisaccade task suggested that error rates are clearly increased after alcohol consumption (blood alcohol levels between 1.89 and 3.84 g/l; Crevits et al., 2000). In 2013, Marinkovic replicated this study on healthy participants with an alcohol dose of 0.6 g/kg for males and 0.55 g/kg for females. Their findings suggested a general increase of error rates after alcohol consumption (Marinkovic et al., 2013). However, these studies have been subject to a great deal of criticism, since replications with healthy participants have not always found effects of alcohol (Blekher et al., 2002; breath alcohol concentration 80 mg/dl; Vorstius et al., 2008; breath alcohol concentration 65 mg/dl). Other contradictory results came from two studies (Khan et al., 2003; blood alcohol concentration 0.8%; Vassallo et al., 2002; blood alcohol concentration 0.44%) which tested the effects of alcohol on antisaccade error rates with healthy participants. Their findings suggested a decrease in error rates, probably because of alcohol's effect of "attenuating the reflexive response rather than the inhibitory control process" (Fillmore and Weafer, 2013).

A recent study (Schmidt et al., 2013) investigated the effects of low-dose alcohol consumption (alcohol levels below 0.8%) on reflexive saccades. Their findings indicated that low levels of blood alcohol do not influence reflexive saccades. Another eye movement task that is widely applied to investigate the inhibitory effect of alcohol on saccades is the stop signal task (also called "saccade countermanding"). Studies have suggested that a low dose of alcohol (e.g., 0.45 g/kg) slows manual stop signal reaction times (SSRT) (Caswell et al., 2013; de Wit et al., 2000; Dougherty et al., 2008; Fillmore and Vogel Sprott, 1999; Gan et al., 2014; Loeber and Duka, 2009; McCarthy et al., 2012; Nikolaou et al., 2013; Ramaekers and Kuypers, 2006; Reynolds et al., 2006).

2.1.2. Dot probe eye tracking task

The cognitive models of anxiety cited in Chapter 1 (Section 1.2.) imply that socially-anxious individuals show an attentional bias to threatening facial expressions in other people. The dot probe paradigm is one of the most common tasks used to investigate attentional biases towards threat stimuli (e.g. threat words, angry faces; Bar-Haim et al., 2007). This particular attentional task requires participants to look at two stimuli for a certain time. When the stimuli disappear from the screen, a stimulus (e.g. two dots, arranged either horizontally or vertically) replaces one of the stimuli. Participants are instructed to press a key as quickly and as accurately as possible if the two dots are horizontal and another specific key if they are vertical. The stimuli are presented together and differ for emotional content (happy/angry vs. neutral). It is assumed that participants will automatically focus their attention on particular kinds of targets and their reaction times will reflect their attentional biases. As described in Chapter 1, previous research has suggested that the human attention system may be divided into two subsystems: orienting toward stimuli and disengaging from stimuli (Posner et al., 1990). Those subsystems are the processes that underlie the scores in the dot probe paradigm which measure attentional biases. An attentional bias 'index' is obtained by subtracting the mean reaction time (RT) to dots replacing threat stimuli from the mean RT to dots replacing neutral stimuli in a threat-neutral stimulus pair (Bradley, Mogg, Falla, & Hamilton, 1998; MacLeod et al., 1986; Mogg, Bradley, & Hallowell, 1994).

Previous studies have often used dot-probe tasks to assess biassed attentional processing in social anxiety; early studies (e.g. MacLeod, 1986) mostly used word stimuli, whereas later studies mostly used images (in particular, faces) (i.e. Klumpp et al., 2009; Stevens et al., 2009). Studies that used word stimuli typically did not find an effect of social anxiety on attention (e.g., Horenstein & Segui, 1997; Pishyar, Harris, & Menzies, 2004). However, facial expressions are generally preferred as stimuli because the information in faces may indicate negative evaluation by others, and this is particularly relevant to socially-anxious individuals (Rapee & Heimberg, 1997); Staugaard (2010) noted, for example, that "an angry face is a potent sign of sociality". Enhanced vigilance towards threat stimuli in high- compared to low- trait anxious individuals has been supported by previous reviews that analysed a large number of dot probe studies (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijendoorn, 2007; Frewen, Dozois, Joanisse, & Neufeld, 2008). For example, in the study by Fox et al. (2001), high-state anxious individuals showed more difficulty disengaging their attention from threatening stimuli (represented by angry faces) compared to low-state anxious individuals. A similar finding was reported by Yiend and Mathews (2001): high-trait anxious students displayed more difficulties to disengage their attention from threatening stimuli compared to low-trait anxious participants. These studies were not specifically directed towards social anxiety; similar outcomes might be predicted, given the association between social anxiety and fear of negative evaluation. The current thesis includes such tests for people with high social anxiety (here and Chapter 3).

It is also noteworthy that previous dot-probe studies have used widely different methodologies, and consequently some heterogeneous results have been reported (i.e. Helfinstein et al., 2008; Klumpp and Amir, 2009; Mansell et al., 1999; Pishyar et al., 2008; Pishyar et al., 2004, Pineles and Mineka, 2005; Stevens et al., 2009). In the dot probe paradigm, the potential moderators of attention might be defined as the stimulus type, the stimulus duration, the situational anxiety and the severity of social anxiety (if social anxiety specifically is tested). First, the type of stimulus may determine attentional bias. Most studies have used neutral faces as reference stimuli, others have used neutral household objects (Chen, Ehlers, Clark & Mansell, 2002; Mansell et al., 1999; Sposari & Rapee, 2007). Second, studies have shown that when anxiety is induced, an attentional bias may be more likely to be detected. For example, during a test session where participants have been asked to anticipate giving a speech when a visual dot-probe task was performed (e.g. Mansell et al., 1999; Pineles & Mineka, 2005). Third, the duration of the stimulus presentation varies significantly across the studies. The vigilance-avoidance hypothesis suggests that the likelihood of measuring an anxiety-related attentional bias will depend on stimulus duration (Mogg, Bradley, DeBono, & Painter, 1997). High socially-anxious individuals displayed a moderate and consistent vigilance effect for shorter (100 ms) stimulus durations (e.g., Mogg &

Bradley, 2002; Pishyar et al., 2008; Stevens et al., 2009). Instead, no vigilance effect has been observed in studies using longer (500ms) stimulus durations for socially-anxious individuals (e.g. Gotlib et al., 2004; Mogg, Philippot, & Bradley, 2004). In reviewing the evidence, Stevens, Rist & Gerlach (2011) concluded that the effects of early attention might be observable if dot probe tasks use short face stimuli presentations (e.g. < 200 ms) but not when dot probe eye tracking tasks use longer presentation times to measure eye movements (Stevens, Rist, & Gerlach, 2011). Fourth, attentional bias may depend on the magnitude of social anxiety. Stevens et al. (2016) suggested that the effect is more obvious in patients than in non-patient socially-anxious people (Stevens et al., 2016).

The dot-probe methodology has mostly been used to examine how attention is allocated towards or away from threatening facial stimuli (Helfinstein et al., 2008; Klumpp et al., 2009; Stevens et al., 2009). However, in the task reported in this thesis, the dot probe task was not intended as a way of measuring attentional bias, instead, it was used to maintain attention on the relevant stimulus for eye-tracking measurements. Two measures were assessed: dwell times on face stimuli were the key measures, but dot-probe reaction times were also recorded. These were therefore the dependent variables. The independent variables were the type of face (angry, happy or neutral), whether or not alcohol was consumed beforehand (placebo or alcohol) and the participant's level of social anxiety, defined as high social anxiety (HSA) or low social anxiety (LSA) by median split. A stimulus presentation time of 1500 ms was used, based on previous research. Schofield et al. (2012) conducted an eye tracking study using a dot-probe task to investigate the relationship between attention over time and symptoms of social anxiety and depression. In their study, trials consisted of emotional faces presented for either 1500 ms or 500 ms. They found that high socially-anxious participants showed longer dwell times on angry expressions during the first 500 ms, suggesting a difficulty in disengagement from threat cues during the early stage of face viewing. Reaction times to the dot-probe stimuli were also recorded, but they were not considered primary data. It was hypothesised that an interaction would arise between social anxiety group and alcohol/placebo consumption, such that 1) HSA participants would show increased attention (indexed by longer dwell times) toward angry faces (but not happy faces) during the placebo condition, compared to LSA participants; 2) alcohol would reduce this effect relative to placebo in HSA participants. It was also predicted that (3) alcohol would produce a main effect indexed by longer reaction times and longer dwell times for both groups.

2.1.3. Antisaccade task

Saccadic eye movements can be voluntary or involuntary. For example, when we read, search, or explore, the saccades are generated voluntarily. If there is a particularly salient visual object or an unexpected movement, involuntary saccades are more likely to happen. In this case, the eyes are drawn by a specific feature or event in the environment. Saccadic eye movements adjust the high-resolution fovea to points of interest (e.g., Walls, 1962). Different tasks, which manipulate particular sets of experimental conditions, have been used to investigate whether and when a saccade is generated involuntarily. The most common and important task is the antisaccade task (Hallett, 1978). During the antisaccade task, the instructions for the participants are to generate an eye movement in the opposite direction (away) from the target. During a single trial, the involuntary programming of a saccade towards a stimulus is originated by the onset: the participant is asked to look in the opposite direction at that time. In this way, each trial becomes a competition between the voluntary and involuntary orienting response. Previous literature has shown that several cognitive functions are activated during an antisaccade task, e.g., working memory, goal or intention activation, and attentional focus (Mitchell, Macrae, & Gilchrist, 2002; Nieuwenhuis, Broerse, Nielen, & de Jong, 2004; Reuter & Kathmann, 2004). Mitchell et al. (2002) suggested that the error rates increase when a task involving working memory resources was presented to healthy participants. Unsworth et al. (2004) showed that there is a difference in antisaccade performance between individuals with high and low working memory span. In their study, participants were assigned to two different groups (high span vs low span) based on their OSPAN (Operation-Span task; Turner & Engle, 1989) scores. Successively, participants were asked to perform an antisaccade and a prosaccade task. Participants made more errors during the antisaccade task compared with the prosaccade task, and overall, individuals from the low-span group made more errors than individuals assigned to the high-span group (Unsworth, Schrock, & Engle, 2004). Other research has also suggested a correlation between working memory functions and antisaccade performance in different patient groups (Gooding & Tallent, 2001). In their study, Gooding & Tallent compared the performance of schizophrenia and bipolar patients with non-patient controls on three different tasks: antisaccade; working memory; sensorimotor tasks. The schizophrenia patients displayed deficits on both antisaccade and working memory tasks; bipolar patients showed more errors on the antisaccade task compared with controls (Gooding & Tallent, 2001).

Four different measures are produced from an antisaccade task that are particularly important to understand the cognitive and neural mechanisms involved in the volitional control of behaviour: error rates, errors followed by correct saccades, latencies and dwell times. The first measure is the average of the error rates. Generally, participants can control their saccades and generate a voluntary saccade in the correct direction on most trials (e.g. Hallett, 1978). However, errors may happen on a proportion of trials when a saccade is directed towards the target. A difference in the error rates can be noticed when people with certain types of brain dysfunction are compared with a control group of healthy participants. For example, individuals with frontal lobe lesions and individuals with schizophrenia show a significantly increased error rate average compared with healthy individuals (Guitton, Buchtel, & Douglas, 1985; Fukushima et al., 1988). Reuter and Kathmann (2004) investigated the average of antisaccade error rates in healthy participants, reporting an error rate between 5% and 25%. A number of studies have identified a typical antisaccade error rate of 20% (Ettinger et al., 2003a, 2005b; Smyrnis et al., 2002; Tatler & Hutton, 2006; Everling & Fischer, 1998). Another characteristic of the error rate suggested from previous research is that it is not constant, but typically changes across the lifespan. Error rates are higher during childhood, lower during early adulthood and then rates increase slowly with advancing age until around 60 years. After this age, antisaccade error rates increase quickly (Fisher, Biscaldi, & Gezeck, 1997; Klein & Foerster, 2001; Olincy, Ross, Youngd, & Freedman, 1997). When an error is happening, the response might be considered involuntary since it goes against what was intended (Everling and Fisher, 1998; Munoz and Everling, 2004). The model that has been used to explain these particular errors is called the "race model" (Massen, 2004; Munoz and Everling, 2004). According to the race model, the voluntary antisaccade program and the stimulus-driven prosaccade program compete for saccade origination. When a correct antisaccade is referred to as correct it means that the antisaccade program reaches a critical threshold faster than the prosaccade program, suggesting that the prosaccade response was correctly inhibited. An antisaccade error is made when a prosaccade program "wins" this competition and reaches the critical threshold faster than the antisaccade program. Several antisaccade studies have tried to define the properties that modulate an error during performance (Munoz and Everling, 2004). For instance, if the duration of the central fixation point is too short and it disappears before the arrival of the target, the error rates increase (Fischer and Weber, 1997). Moreover, an increase in error rates has been observed on one side of the visual field when the target is more likely to appear on that side than the other side (Koval et al., 2004). Several studies that used an antisaccade paradigm with anxious and non-anxious individuals (but not necessarily testing social anxiety) have shown that anxious participants have a tendency to find it difficult to efficiently inhibit responses when viewing emotional stimuli such as facial expressions (Derakshan, Smyth, & Eysenck, 2009; Garner et al., 2006, Reinholdt-Dunne et al., 2012; Wieser, Pauli, & Mühlberger, 2009).

The third measure that is important to analyse is the latencies of correct antisaccades and incorrect prosaccades. Eye-tracking studies indicate that correct prosaccade latencies are typically shorter than correct antisaccade latencies; this latency difference between prosaccade and antisaccade tasks suggests that the processes involved in the antisaccade and prosaccade movements are different (Godijn et al., 2007). Latencies can vary dramatically from one trial to the next (Antoniades & Carpenter, 2013). Correct antisaccades typically are generated 100-150 ms later than prosaccades and therefore the average latency for antisaccade errors is shorter compared with prosaccades (Munoz and Everling, 2004). A recent study that used antisaccade and prosaccade tasks with individuals of high and low social anxiety revealed that correct antisaccade latencies were longer than correct prosaccade latencies (Sluis et al., 2017).

The fourth measure is the total time in milliseconds spent on the current area of interest (dwell time). Previous studies have demonstrated that there is a difference in dwell times on particular stimuli between people with social anxiety and control groups (Buckner et. al, 2010; Schofield et al., 2012; Wieser et al., 2009). These antisaccade studies investigated gaze patterns of socially-anxious and non-socially-anxious individuals. Participants were shown threatening and non-threatening stimuli (in set sizes from 1 to 4 facial expressions) for a long time. The socially-anxious participants' dwell times were increased for the threatening stimuli. Recently, a study that offered a larger set of stimuli (8 threatening faces and 8 non-threatening faces) to two different groups of participants (clinical sample of socially-anxious and non-socially-anxious individuals) on a free viewing task, reported similar findings: longer dwell times for threatening faces for the clinical and socially-anxious groups (Lazarov et al., 2016). These outcomes suggest that clinically-diagnosed SAD and socially-anxious participants demonstrate a visual attentional bias toward threatening stimuli over time.

One further characteristic of the antisaccade task is that the participants' results can be improved when the task is performed a second time (Dyckman & McDowell, 2005). Finally, regarding the effects of alcohol on antisaccades, Khan et al. (2003) tested alcohol's effects on antisaccade performance. Their findings suggested a decrease in reflexive saccades in the antisaccade task and an increase in antisaccade latencies under the effect of alcohol.

Based on the previous research outlined above, the current study explored antisaccades in HSA and LSA participants when shown threatening (angry faces) and non-threatening (neutral faces and inverted neutral faces) stimuli, either after drinking alcohol or after drinking a placebo. As with the dot-probe eye tracking task, an interaction of social anxiety level with alcohol/placebo was expected, leading to four hypotheses: 1) in line with the vigilance hypothesis (e.g. Eysenck et al., 1992; Matthews et al., 1990), HSA participants would show increased error rates when angry faces appeared on the screen compared to the LSA group during the placebo condition, suggesting a difficulty in disengaging attention from threatening targets; 2) the error rates of HSA participants to threat stimuli would be more similar to those of LSA participants after consuming alcohol; 3) overall error rates would increase under the effect of alcohol in HSA and LSA participants (i.e. there will be a main effect of alcohol); and 4) HSA and LSA participants would show different dwell times on different areas of interest during the performance of an incorrect antisaccade after placebo - more specifically, HSA participants would spend more time looking around the eyes area compared to the LSA participants. The independent variables were alcohol condition (placebo vs. alcohol), social anxiety group (HSA vs. LSA), face position (right vs. left), and face type (angry, neutral, inverted), The dependent variables were: error rates, mean dwell times and mean response latencies.

2.1.4. Prosaccade task

The prosaccade task requires individuals to fixate on the cue location, in contrast with the antisaccade task in which participants are asked to inhibit an involuntary eye movement to the target location. The prosaccade task is commonly used as a control measure in an antisaccade paradigm and can be presented in the same block or in separate blocks (Ainsworth & Garner, 2013). The present study used separate blocks of antisaccade and prosaccade tasks (Everling 1996, 1997).

Henderson et al. (2005) showed that when participants were allowed to move their eyes over face stimuli (free viewing condition), accuracy increased by 28%, compared with the condition in which participants were asked to hold their fixations steady. Their research was the first direct evidence that eye movements play a functional role in face learning (Henderson, Williams and Falk, 2005). Recent studies suggest that different eye fixation strategies to extract visual information when processing faces are adopted by people from different cultures (Blais, Jack, Scheepers, Fiset, and Caldara, 2008). For example, while Asians' eye fixations concentrated on the face centre (nose), Caucasians in face recognition displayed a dispersed eye fixation pattern (primarily on the eyes and mouth; Caldara et al., 2008).

Horley et al. (2003) measured the visual scanpath to investigate how socially-anxious participants process interpersonal stimuli (facial expression: sad faces vs happy faces). Their findings suggested that participants avoided fixating on salient facial features (eyes, nose, mouth) and, in particular, participants avoided looking at the eye region when the stimuli were represented by sad facial expressions. Their outcomes are in accordance with previous research indicating that the most important signal for social threat in facial expressions may involve the eye region (Darwin, 1872/1955; Öhman, 1986). When a feared situation is avoided, the threat is reduced for socially-anxious individuals, and this is the reason why avoidance is a common coping strategy. Avoidance of salient features, particularly the eyes, suggests that scanning problems in socially-anxious people may have a basis in fear of potential threat contained in faces. The prosaccade task is therefore likely to be helpful by revealing HSA and LSA participants' dwell times on different areas of interest (eyes, mouth, face) and how dwell times change under the influence of alcohol. In this study, the following predictions were made: 1) In line with previous studies (e.g. Horley et al., 2003, Horley et al., 2004; Moukheiber et al., 2010), HSA participants would show reduced dwell times around the eye AoI (the effect should be most apparent with angry faces) compared to LSA participants during the placebo condition; 2) Alcohol should reduce the size of this effect for HSA participants relative to LSA participants, i.e. HSA participants would show longer dwell times under the influence of alcohol than after placebo; 3) Since alcohol has non-specific disruptive effects on eye movements, a main effect of alcohol will occur, indexed by longer dwell times overall and increased error rates for both HSA and LSA groups. As with the antisaccade task, the independent variables were alcohol condition (placebo vs. alcohol), social anxiety group (HSA v.s LSA), face position (right vs. left), and face type (angry, neutral, inverted). As for the antisaccade task, the dependent variables were error rates, mean dwell times, and mean latencies.

2.2 Methods

2.2.1. Participants

One hundred and forty-five students from Kingston University first participated in an online screening study. The online screening study included the Brief Fear of Negative Evaluation scale (BFNE; Leary, 1983a), the Social Interaction Anxiety Scale (SIAS; Clarke et al., 1998), the Liebowitz anxiety scale (Liebowitz, 1987), and the Michigan Alcohol Screening Test (Selzer et al., 1971); the measures are described further below. To minimize the proportion of the sample with mid-range levels of social anxiety, we invited those with BFNE scores below 35 (LSA) or above 38 (HSA) to participate in the study. In line with previous literature, a cut off-score of 38 was employed to assign participants to the HSA group (Carleton et al., 2011). Only social drinkers (minimum of 8/10 units consumed weekly by women/men, respectively; 1 UK unit is equivalent to 8g of alcohol) were accepted into the study. The other exclusionary criteria were that participants (a) were currently in good health and not taking any medication, (b) had not experienced any unusual reactions to alcohol, and (c) were not pregnant. Students signed up through an online research participation scheme in exchange for either course credits or payment of £20. No participant had a history of alcohol-related problems, as indicated by the Michigan Alcohol Screening Test (Selzer et al., 1971). After screening, 40 students (Mean age = 22.1 years; SD = 5.2 years; men: n = 13) were recruited. Several eyetracking studies investigating attentional biases in HSA and LSA individuals have used similar sample sizes to our study (N=29, Weiser et al., 2009; N=39, Shofield et al., 2013; N=40, Lazarov et al., 2016). However, critical reflection on the issue of sample size, power and effect size are given in the Discussion section, along with some post hoc evaluation of sample size in the context of power analysis (Section 2.6). The research protocol was approved by the Kingston University Faculty of Arts and Social Sciences Research Ethics Committee, and the study was conducted according to the ethical standards of the British Psychological Society and the Declaration of Helsinki 1964.

2.2.2 Anxiety Measures

2.2.2.1. Brief of Fear of Negative Evaluation (BFNE)

Watson and Friend (1969) developed the FNE contemporarily with the Social Avoidance and Distress Scale (SADS) to evaluate and assess if individuals experience distress when interacting with other people. While SADS was developed to assess the experience of distress and resultant avoidance of social situations, the FNE measures anxiety about negative evaluation (Ammerman, 1988). The fear of negative evaluation was defined as “fear about others’ evaluations, distress over their negative evaluations, avoidance of evaluative situations, and the expectation that others would evaluate oneself negatively” (Watson and Friend, 1969, p.449). The construct of fear of negative evaluation includes general social-evaluative anxiety (e.g. meeting people, public speaking) and the FNE scale measures individual differences on this variable. This scale is one of the most-used questionnaires to assess social anxiety (McNeil, Reis, & Turk, 1995). Originally, the FNE was developed and standardised with a college population, it contains 30-items and it uses a true-false response format. The FNE measures individuals’ expectation of receiving a negative evaluation from others (e.g., ‘‘If someone is evaluating me I tend to expect the worst’’), looking foolish and making a bad impression on others. In 1983, Leary developed a brief version (BFNE) to facilitate the questionnaire administration. The new scale comprised 12 statements and it correlates highly with the original scale (r = 0.96; Leary, 1983a; Westra & Stewart, 2001). Its reliability has also been established in non-clinical samples. The BFNE (alpha = 0.90) has a high level of internal consistency and a test–retest reliability coefficient of 0.75 (tested over a 4-week interval; Leary, 1983a).

2.2.2.2. Social Interaction Anxiety Scale (SIAS)

The Social Interaction Anxiety Scale (SIAS) is a self-report questionnaire (Mattick and Clarke, 1998) for measuring social interaction anxiety (anxiety related to the initiation and maintenance of social interactions). The items of this scale came from a starting pool of statements comprising items modified from existing fear surveys and social anxiety inventories (e.g. Bryant and Trower, 1974; Leary, 1983; Richardson and Tasto, 1976; Thurstone and Thurstone, 1930; Watson and Friend, 1969; Wolpe and Lang, 1964) and from new items developed from the results of clinical interviews with socially-anxious patients. It has a high internal consistency (alpha = 0.93) and a 1-month test–retest correlation coefficient above 0.90.

2.2.2.3. Liebowitz Social Anxiety Scale

The Liebowitz Social Anxiety Scale (LSAS) was originally designed for the clinical assessment of fear and avoidance in socially-anxious patients (Liebowitz, 1987). Initially, the scale was mostly used in studies of pharmacotherapy for social phobia (e.g. Liebowitz et al., 1992; Lott et al., 1997; Munjack et al., 1991; Noyes et al., 1997; Reich & Yates, 1988; Versiani et al., 1992). It has also been used in research investigating cognitive-behavioural (Brown, Heimberg, & Juster, 1995) and comparative (Heimberg et al., 1998) treatments for social phobia. The scale includes 24 items that define different social situations. The clinician or person administering the test is asked to rate the patient's level of fear and avoidance on a four-point Likert scale for each statement. Both the fear and the avoidance scales include scores that range from 0 (no fear) to 3 (severe fear). For calculating the final score, the LSAS is divided into two subscales: social interaction (11 items) and performance situations (13 items). Therefore, an overall score is obtained along with six additional scores based on fear and avoidance: total fear, fear of social interaction, fear of performance situations, total avoidance, avoidance of social interaction, and avoidance of performance situations. This measure was originally developed to provide separate scores for avoidance and fear factors. However, studies have demonstrated a high correlation between the subscales and therefore, a redundancy between subscales (Heimberg et al., 1999, Oakman et al., 2003). Excellent internal consistency has been found for total scores and for all subscales (total fear, fear of performance, fear of social interaction, total avoidance and avoidance of social interaction; Heimberg et al., 1999).

2.2.3. Other Questionnaires

2.2.3.1. Drinking Motives Questionnaire Revised (DMQR)

Investigating the reasons underlying drinking for high- and low-socially-anxious participants is necessary for this study, as it might contribute to a better understanding of the comorbidity between social anxiety and alcohol use disorders. A large body of research has shown that people drink alcohol for different social and psychological reasons (e.g., Cooper, Kuntsche, Levitt, Barber, & Wolfe, 2016; Ham & Hope, 2003).

The Drinking Motives Questionnaire Revised (DMQ-R) was developed based on the Cox and Klinger's (1988, 1990) Motivational Model (Cooper et al., 1994). The self-report measure comprises of four main motives for alcohol consumption that might serve either as positive or negative reinforcements and which are internally or externally generated: 1) drinking to enhance positive mood or well-being (positive reinforcement motive and internally generated; 2) drinking to achieve positive social rewards (positive reinforcement motive and externally generated); 3) drinking to cope with negative feelings (negative reinforcement motive and internally generated); and 4) drinking to conform and to avoid social rejection (negative reinforcement motive and externally generated). The questionnaire is a 20-item measure of motives for alcohol consumption (Cooper, 1994), and the structure suggests the four motives for alcohol use mentioned above: 1) enhancement (e.g., "to have fun"), 2) social (e.g., "because it helps you enjoy a party"), (3) coping (e.g., "drinking to forget your problems"), (4) conformity (e.g., "so you won't feel left out").

The DMQ-R has been widely tested and validated among adolescents (e.g. Cooper, 1994; Hauck-Filho, Teixeirs, & Cooper, 2012; Kuntsche, Knibbe, Gmel, & Engels, 2006; Kuntsche, Stewart, & Cooper, 2008), university students (e.g. Marrtens, Rocha, Martin & Serrao, 2008; Simons, Correia, & Carey, 2000) and adults (e.g. Cooper, Frone, Russel, & Mudar, 1995; Mezquita et al., 2011). The four-factor model has consistently shown the best fit to the data, and the DMQ-R has been validated in the USA (Kuntsche, Knibbe, Gmel, & Engels, 2005), in Brazil (Hauck-Filho et al., 2012), Switzerland (Kuntsche et al., 2006; Kuntsche et al., 2008), and in six different European countries (Denmark, England, Germany, Italy, Portugal, and Switzerland; Fernandes-Jesus et al., 2016).

2.2.3.2. Alcohol and mood questionnaire

Participants rated the “strength” and the “pleasantness” of the drink on a 100 mm visual analogue scale (VAS) which anchor points “Low” and “High” (Birak et al., 2010). Current mood was assessed using a 100 mm VAS scale anchored at “Not at all” and “Very” for the following adjectives: “Relaxed”, “Irritable”, “Alert”, “Contented”, “Lightheaded”, “Stimulated”, “Drowsy” (Field and Duka, 2002).

2.2.4. Behavioral and Physiological Materials and Measures

2.2.4.1. Breath Alcohol Concentration (BAC)

In order to ensure the effectiveness of the alcohol manipulation, all participants were tested for breath alcohol concentration directly before the testing session and immediately afterward with a breathalyzer (Drager Alcoltest 7410, Drager Sicherheitstechnik GmbH, Lubeck, Germany). Breath alcohol concentration was tested in both drug conditions (alcohol and placebo). Participants’ breath alcohol concentrations in the placebo condition were always negligible, ranging between 0.00% and 0.05%.

2.2.4.2. Eye tracker

The eye tracking measures were recorded using an EyeLink 1000 device (SR Research Ontario, Canada). All participants were seated with their head on an adjustable height chin rest that was placed centrally 57 cm in front of a screen. The stimuli were presented on a 19-inch Dell 1908FP LCD PC screen, with a resolution of 1024 × 768 and a refresh rate of 60 Hz. The eye-tracking headset was attached and adjusted. The participants' eye position relative to the monitor was calibrated with both EyeLink's built-in 9-point calibration system and an in-house horizontal 7-point calibration for offline confirmation of eye position amplitude. The eye tracking tasks were programmed using the software DataViewer and data was extracted and processed using MATLAB (The MathWorks, Inc.).

2.2.5. Stimulus materials

Stimuli were images from the NimStim Set of Facial Expressions (Tottenham et al., 2009; see Figure 1), which included naturally-posed photographs (e.g., with hair, make-up) of 43 professional actors (18 female, 25 males; 21 years old to 30 years old) in New York City. Actors were African (N=10), Asian- (N=6), European- (N=25), and Latino-American (N=2). The stimuli chosen for the dot probe task were emotional faces (angry and happy expressions). The stimuli used in the antisaccade and prosaccade tasks were neutral, angry and inverted faces. Based on previous literature, by using faces and inverted faces it may be possible to control for the low-level properties that characterise the stimuli while also manipulating the high-level properties (Gilchrist et al., 2006). To obtain the inverted faces, original photographs were turned upside-down. The locations and duration of fixations were calculated from Areas of Interest (AOIs; Holmqvist et al., 2011) drawn around the eyes, mouth and the whole face region.

Figure 2.1: Example of Neutral, Angry and Happy facial expressions that have been used for this study.

2.2.6. Alcohol administration

Drink formulations were derived from Birak et al. (2010). The dose of alcohol was 0.65 g/kg body weight for men and 0.57 g/kg for women. On average, this was equivalent to around 5.7 and 4.5 UK units of alcohol for average weight men and women, respectively. The alcohol drinks were made of Waitrose vodka (37% alcohol-by-volume) plus diet Schweppes Indian tonic water to a total beverage volume of 240 ml, plus 4 ml Angostura Bitters. The placebo drink replaced vodka with equivalent tonic water, and 3-4 drops of vodka were floated on the drink surface and around the rim of the glass to mask olfactory cues.

2.2.7. Drinking and Laboratory procedures

A repeated measures design was adopted in which the participants were each tested twice: once with a placebo drink and once with the alcoholic drink. Drink order was counterbalanced across the 41 participants. Participants were tested over 14 separate days, with at least 5 days between test sessions. They were asked to abstain from alcohol and other drugs from at least the night before each session, and to avoid all food within the 3 hours preceding a scheduled test session.

Once they arrived at the laboratory, they were tested with a breathalyser to confirm recent abstinence from alcohol (all participants tested at zero). They were then weighed and asked to wait in a room adjoining the laboratory while the drink for that session was prepared. Participants were instructed to consume gradually the drink over 15 minutes. After consumption, participants were asked to wait 15 min before taking part in the three tests. The eye-tracking tasks then began immediately after the 15-min absorption period. The order of the tasks was not counterbalanced as we wanted participants to complete the dot-probe task consistently 15 minutes after drinking their placebo/alcohol beverage and also to be at a relatively consistent level of intoxication for each of the tasks. The order of the tasks was the following: (1) dot-probe task, (2) antisaccade task; and (3) prosaccade task. Each task was 20 minutes long for a total duration of 60 minutes.

2.3. Tasks

2.3.1. Task 1: Dot-probe eye tracking task

Task 1 consisted of a dot probe task measuring participants' eye movements to indicate attentional biases. Each trial of the task started with the presentation of a solid dot at the centre of the screen, and the participants were asked to accurately fixate on the dot until eye drifts were recorded and analysed by a drift-correcting function. The dot was then replaced by a central fixation cross for 500ms. Then, the faces were presented side-by-side after the disappearance of the fixation cross for 1500 ms. Immediately after the offset of the picture pair, a probe (either two vertical dots [:] or two horizontal dots [..]) was presented in the position of one of the preceding pictures until the participant made a response, or for a maximum duration of 2 s. Participants were instructed to identify the orientation of the dots (horizontal vs. vertical) by pressing as quickly as possible one key (m) when the dots were horizontal and another key (z) when the dots were vertical. The stimuli consisted of 32 different picture pairs, each presented three times (96 trials). There were two types of picture pairs in which an emotional face (either “angry” or “happy”) was paired with a neutral face of the same model, producing 16 angry-neutral faces pairs and 16 happy-neutral faces pairs. For each pair type, half of the faces were male, and half of them were female.

2.3.2. Task 2: antisaccade task

Task 2 was an antisaccade task. The stimuli consisted of 48 pictures presented in three blocks (144 trials). 16 pictures were angry faces, 16 were neutral faces and 16 were upside-down neutral faces. Each trial started with the presentation of a fixation point. The presentation of the stimulus was initiated as soon as the participants’ eye movements were stabilised on the fixation point. The stimuli were presented either to the right or the left side of the screen for 1500 ms. The fixation point was then replaced by a fixation cross that stayed on the screen for 500 ms. Participants were instructed to look in the opposite direction (away) from the face as quickly as possible.

2.3.3. Task 3: prosaccade task

The third Task, like the antisaccade task, comprised three blocks of 48 trials each. An angry, neutral or inverted face was shown on the left or on the right side of the screen. The instruction for the participants was to look at the stimuli when they appeared. First, participants were asked to accurately fixate on the dot for drift correction. After this, a fixation cross replaced the dot and it stayed on the screen for 500 ms or until the participant accurately fixated it. Faces were presented on the screen for 1500 ms. Each trial started with a solid dot at the centre of the screen.

2.4. Data recording and analysis

In each task, three Areas of Interest (AOIs) were defined for each picture, selecting manually the area around the eyes, the mouth and the entire face. In the antisaccade and prosaccade tasks a new AOI was added by selecting the area in the opposite direction from the target stimuli. Gaze variables were produced from the accumulation of fixations that fell within each of these AOIs. Therefore, we obtained dwell times, error rates and latencies for each AOI of a given face. Latencies between the beginning of item examination and the first alternation between interest areas reflect how quickly participants abandon their initial examination of the stimulus and look at the response choices. Longer latencies are indicative of a constructive matching strategy and shorter latencies are indicative of a response elimination strategy.

2.5. Results

2.5.1. Participant characteristics

Study variable summaries (means and standard deviations for the social anxiety and drinking motive scores) for the whole sample and by social anxiety group are presented in Table 2.1. The total sample had a mean BFNE score of 36.15 (SD= 11.55). The HSA group had a mean score of 46.25, while the LSA group had a mean score of 26.19 (Table 2.1). An independent t-test showed that the difference was significant ($t(39) = 11.93$, $p < .001$). There was not a significant difference in mean alcohol units consumed per week between HSA and LSA participants ($t(38)=-.65$, $p=.52$). There was no difference between males and females in terms of social anxiety scores ($t(38)= -.51$, $p=.61$), and Breath Alcohol Concentration did not differ between LSA and HSA groups ($t(36)= -1.71$, $p=.09$). An independent t test was run to compare HSA and LSA participants scores on the SIAS, showing that there was a significant difference between

HSA and LSA participants, t(38)= 3.79, p= .001. Additionally, independent t-tests comparing HSA and LSA participants' scores on the Leibowitz subscales showed significant differences on the Performance subscale (t(38)= 2.72, p=.01) as well as on the Social Skills subscale (t(38)= 3.15, p =.003).

Table 2.1: Mean scores and standard deviations for age, drinking variables and anxiety measures for the high socially-anxious participants (HSA group) compared with the low socially-anxious participants (LSA group); social anxiety group division is based on BFNE scores.

	LSA Group	**HSA Group**
Age	Mean = 22.28; SD = 6.41	Mean = 21.65; SD = 3.62
Alcohol Units	Mean = 20.48; SD = 16.89	Mean = 18.2; SD = 9.82
Breath Alcohol Pre-Test	Mean = .29; SD = .1	Mean = .24; SD = .72
Breath Alcohol Post-Test	Mean = .29; SD = .08	Mean = .32; SD = .08
BFNE Score	Mean = 26.19; SD = 5.32	Mean = 46.25; SD = 15.12
SIAS	Mean = 19.66; SD = 11.89	Mean = 36.05; SD= 15.12
LSAS Performance	Mean = 42.66; SD = 11.35	Mean = 51.45; SD = 9.04
LSAS Social Skills	Mean = 36; SD = 10.31	Mean = 45.85; SD = 9.04

Next, we assigned participants to high and low anxiety groups based on their SIAS scores. The total sample had a mean SIAS score of 27.82 (SD=15.91). Study variables are presented in Table 2. An independent t test was run to compare HSA and LSA participants scores on the Leibowitz subscales, suggesting that HSA individuals had higher scores for Performance factors (t (39) = 2.73, p = .009) and for Social skills factors (t (39) = 3.11, p = .003) compared with the control group. An independent t-test was run to investigate if there was a difference in HSA and LSA participants on weekly alcohol units consumed. The difference was not significant (t(38) = -.65, p= .52) suggesting that anxiety did not affect weekly alcohol units consumed. For this thesis, the BFNE was used as the main scale to measure social anxiety as there were no obvious differences between BFNE and SIAS and the former is more relevant in the context of previous research. Therefore, the sample was divided into two groups (HSA and LSA) based on their results on the BFNE (Leary et al., 1983; Weeks et al., 2005; Carleton et al., 2007).

Table 2.2: Mean scores and standard deviations for the high socially-anxious participants (HSA group) compared with the low socially-anxious participants (LSA group); social anxiety group division is based on SIAS scores.

	LSA Group	**HSA Group**
Age	Mean = 23.26; SD = 6.64	Mean = 21; SD = 3.27
Alcohol Units	Mean = 19.05; SD = 15.33	Mean = 20.14; SD = 12.72
Breath Alcohol Pre-Test	Mean = .28; SD = .09	Mean = .25; SD = .09
Breath Alcohol Post-Test	Mean = .29; SD = .08	Mean = .32; SD = .08

BFNE Score	Mean = 28.84; SD = 8.92	Mean = 42.76; SD = 9.57
SIAS	Mean = 14.42; SD = 7.13	Mean = 39.95; SD= 11.09
LSAS Performance	Mean = 41,37; SD = 10.88	Mean = 52.05; SD = 9.07
LSAS Social	Mean = 14.42; SD = 7.13	Mean = 39.95; SD = 11.09

Next, we analyzed participants' scores on the questionnaires assessing drinking characteristics and subjective responses before and after testing. Independent t-tests were conducted to test whether drinking motive endorsement (social, enhancement, coping, conformity) and the feeling of relaxation (before and after the drink) were related to social anxiety group (HSA vs LSA). The independent t-tests found significant differences between groups for coping drinking motives, ($t(38) = 2.28$, $p = .02$) and for conformity drinking motives ($t(38) = 1.99$, $p=.05$), suggesting that HSA participants reported significantly greater coping and conformity motives for drinking compared to LSA participants. Positive drinking motives (social, enhancement) were not significantly different between social anxiety groups.

Table 2.3.: Mean scores and standard deviations of drinking motives and alcohol and mood subscales, social anxiety group division is based on BFNE scores. High socially anxious participants scored higher to low socially anxious individuals on the coping and conforming drinking motives.

	LSA Group	**HSA Group**

DMQR-Social	M=18.1; SD=3.86	M=19.5; SD=5.15
DMQR-Coping	M=9.05; SD=3.06	M=11.6; SD=3.95
DMQR- Enhancement	M=14.75; SD=4.11	M=15.75; SD=5.29
DMQR- Conformity	M=7.15; SD=2.79	M=9; SD=3.06
Relax Before Placebo	M=7.64; SD=1.51	M=7.18; SD=2.03
Relax After Placebo	M=8.13; SD=1.12	M=6.92; SD=2.16
Alert Before Placebo	M=6.51; SD=2.41	M=6.61; SD=2.23
Alert After Placebo	M=4.1; SD=2.37	M=4.26; SD=2.54
Lightheaded Before Placebo	M=1.1; SD=1.8	M=2.15; SD=2.88
Lightheaded After Placebo	M=1.91; SD=2.29	M=1.54; SD= 1.54
Relax Before Alcohol	M= 7.72; SD= 1.21	M=6.81; SD= 1.62
Relax After Alcohol	M= 8.13; SD= 1.12	M= 6.51; SD= 2.1
Alert Before Alcohol	M= 6.58; SD= 2.49	M= 6.64; SD= 2.04
Alert After Alcohol	M= 4.1; SD= 2.37	M= 4.26; SD= 2.54
Lightheaded Before Alcohol	M= .82; SD= 1.72	M= 1.12; SD= 1.52
Lightheaded After Alcohol	M= 4.32; SD=3.12	M= 5.28; SD= 2.24

A 2 x 2 x 2 mixed-measures ANOVA was run with Drug (Placebo vs Alcohol) and Time (Before vs After drinking) as within-subject factors and Social Anxiety group (HSA vs LSA) as a between-subjects factor to test whether participants scored differently on items from the Alcohol and Mood scale (Relaxed, Alert and Lightheaded) after consuming either the alcoholic or the placebo drink. For the item Relaxed, there was no main effect of Drug (F(1,38)= .47, p = .49, partial η^2 =.01) but no main effect of Time (F(1,38)= .09, p =.76, partial η^2 =.002). However, the main effect of Social

Anxiety group was significant, $F(1,38)= 9.77$, $p= .003$, partial $\eta^2 =.21$, suggesting that HSA participants reported feeling less relaxed (M=6.85, SD=.24) than LSA participants throughout (M=7.9; SD=.24). The interaction between Drug and Social Anxiety was not significant, $F(1,38)=.93=.34$, partial $\eta^2 =.02$), (Figure 2.2).

For the item Alert, there was a main effect of alcohol ($F(1,38)= 9.95$, $p= .003$, partial $\eta^2 =.21$) suggesting that participants felt significantly less alert after drinking alcohol (M=5.4; SD= .29) than after drinking placebo (M=6.31; SD= .36). Time was also significant ($F(1,38)= 34.98$, $p<.001$, partial $\eta^2 =.48$), suggesting that participants reported feeling more alert before drinking (M=6.59; SD=.33) than after consuming the drink (M=5.13, SD=.31). However, Social Anxiety was not significant ($F(1,38)=.06$; $p=.79$, partial $\eta^2 =.002$), suggesting that participants were affected in the same way by alcohol, regardless of their social anxiety levels. The interaction between Drug and Social Anxiety was not significant, $F(1,38)=.02$, $p=.89$, partial $\eta^2 =.001$. In contrast, the interaction between Drug and Time was significant ($F(1,38)=14091$, $p=.001$, partial $\eta^2 =.27$), showing that participants reported feeling less alert after alcohol than after placebo (Figure 2.3).

Similarly to the Alert item, for the item Lightheaded there was a main effect of alcohol ($F(1,38)=16.17$, $p<.001$, partial $\eta^2 =.29$) showing that participants reported feeling more lightheaded in the alcohol condition (M=2.9; SD=.28) than the placebo condition (M=1.68; SD=.31). There was a main effect of Time ($F(1,38)=50.12$, $p<.001$, partial $\eta^2 =.57$), suggesting that participants felt more lightheaded after consuming either drink (M=3.26; SD=.3) compared with before having the drink (M=1.32; SD=.28). Social anxiety was not significant, $F(1,38)=.95$, $p=.33$, partial $\eta^2 =.02$. The interaction between Drug and Social Anxiety was not significant, $F(1,38)=24$, $p=.63$, partial $\eta^2 =.006$. There was a significant interaction between Drug and Time ($F(1,38)=48.41$, $p<.001$, partial η^2

=.56) suggesting that participants felt more lightheaded especially after drinking alcohol (Figure 2.4).

Figure 2.2: Mean scores for high Socially-Anxious (HSA) and low socially-anxious (LSA) participants (N=41) on the subjective mood item “Relaxed” (measured on a Visual Analog Scale; scores ranging from 0-10 cm) 15 minutes after drinking either a placebo or alcohol drink.

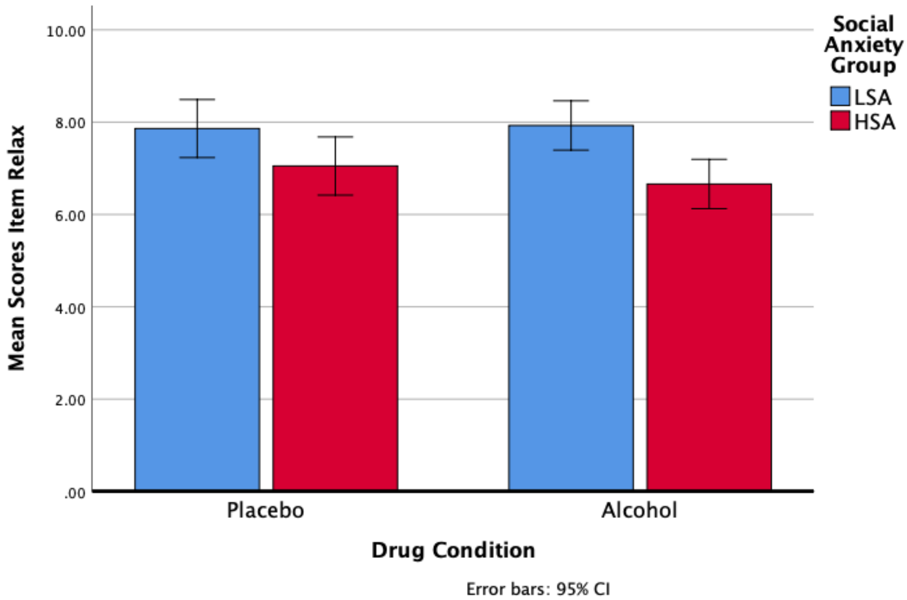


Figure 2.3: Mean scores for high Socially-Anxious (HSA) and low socially-anxious (LSA) participants (N=41) on the subjective mood item “Alert” (measured on a Visual Analog Scale; scores ranging from 0-10 cm) 15 minutes after drinking either a placebo or alcohol drink.

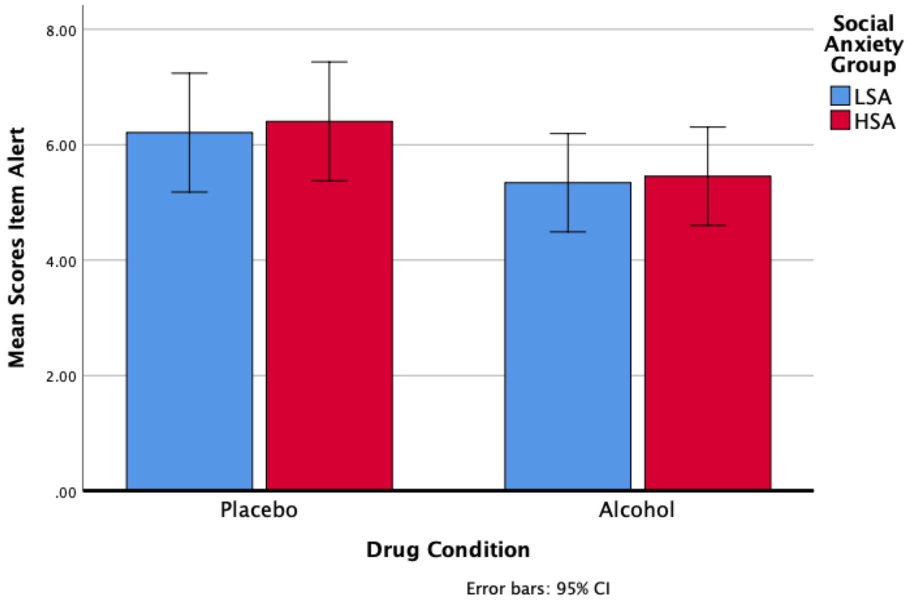
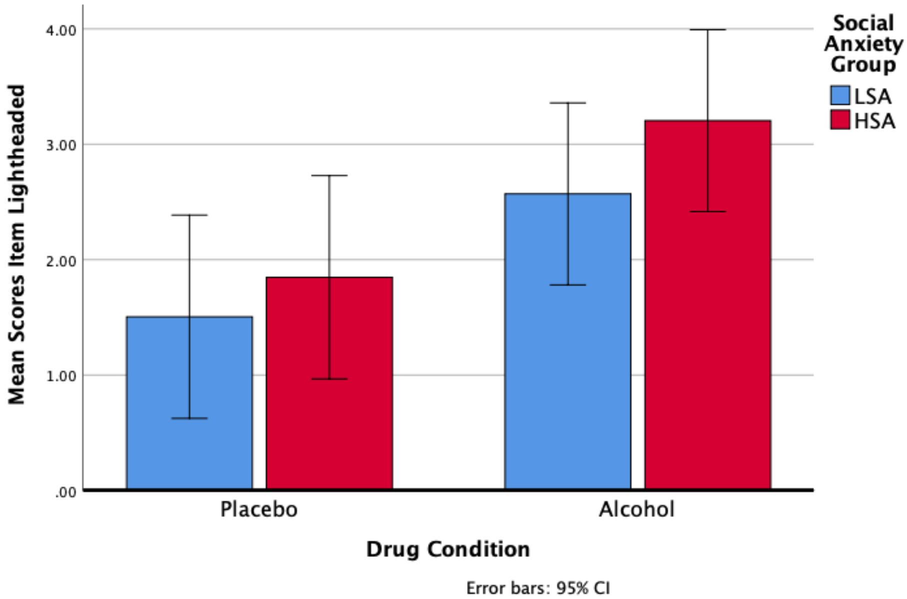


Figure 2.4: Mean scores for high Socially-Anxious (HSA) and low socially-anxious (LSA) participants (N=41) on the subjective mood item “Lightheaded” (measured on

a Visual Analog Scale; scores ranging from 0-10 cm) 15 minutes after drinking either a placebo or alcohol drink.



2.5.2. Dot probe task results

2.5.2.1. Eye Movements

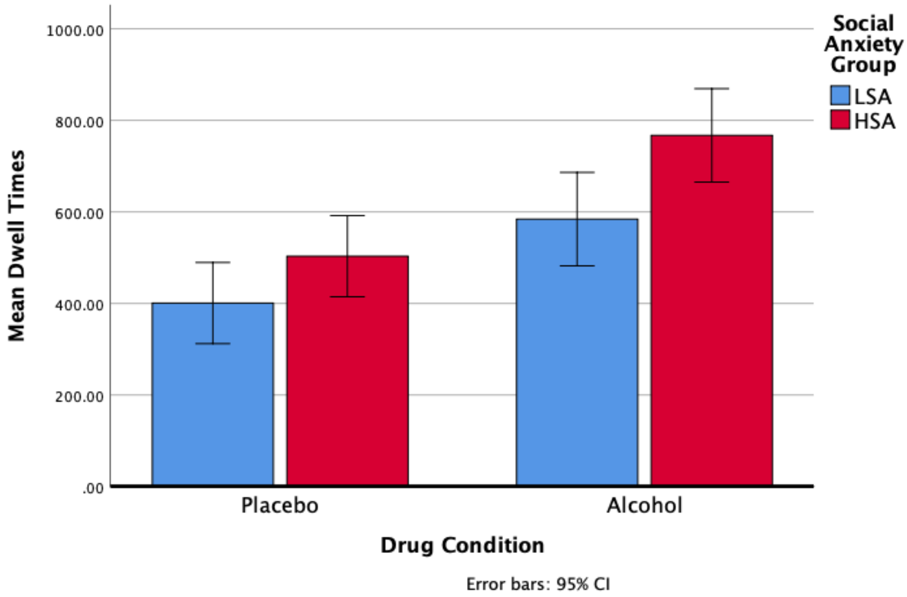
The average durations spent looking in different areas of interest (dwell times around the whole face area, the eyes area and the mouth area) were analysed using 2 x 2 x 2 mixed-measures ANOVAs, in which the social anxiety group (HSA vs LSA) was the between-subject factors, and the within-subject factors were the drink type (Alcohol vs Placebo) and the type of stimulus (Emotional vs Neutral). The emotional stimulus was either an "Angry" or "Happy" expression (analysed separately). The dwell times considered were: 1. Time spent looking at angry faces compared with neutral faces, and 2. Time spent looking at happy faces compared with neutral faces. Thus, for this task, the IVs were Social Anxiety group, Drug (Placebo/Alcohol), and face type; the DVs were visual dwell times for each of the 3 AoIs.

2.5.2.2. Angry vs Neutral Faces: Dwell Times on Whole Face

For dwell times on Angry vs Neutral faces, there was a main effect of Drug, $F(1,38) = 25.51$, $p<.001$, partial $\eta^2 = .39$, and a main effect of Social Anxiety, $F(1,38) = 8.4$, $p = .006$, partial $\eta^2 = .18$. However, the interaction between Drug and Social Anxiety was not significant ($F(1,38)= .79$, $p=.37$, partial $\eta^2 = .02$). Therefore participants in each group spent more time looking at the stimuli under the influence of alcohol compared with placebo, but HSA participants looked longer at faces than did the LSA participants, an effect that was not altered by alcohol. (Figure 2.5; Means and SD.s are in Appendix A, pp. 281).

The main effect of Face type was not significant, $F(1,38)= 3.11$, $p=.09$, partial $\eta^2 = .08$, suggesting that participants' performance was not affected by the two different types of facial expression.

Figure 2.5: Average time spent looking at faces (mean dwell time) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).

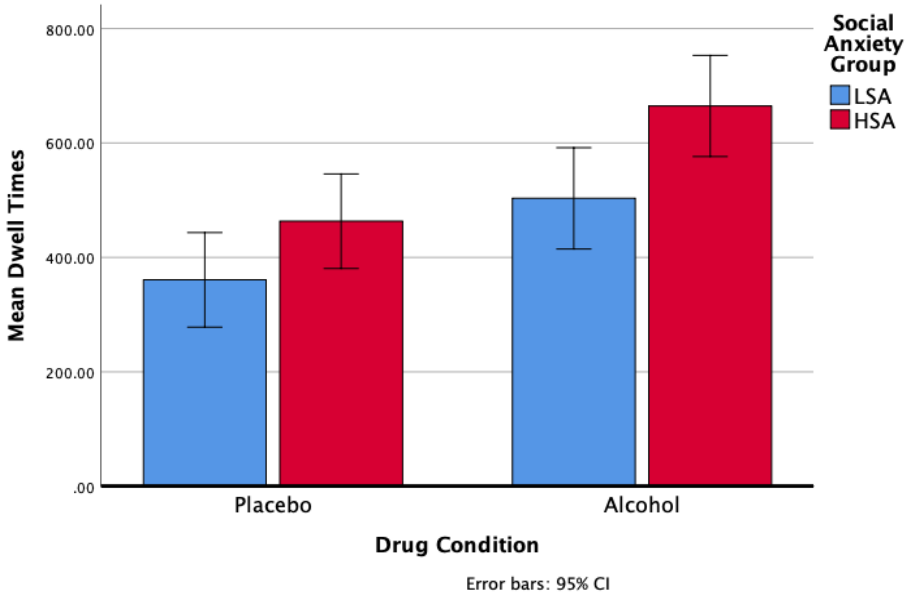


2.5.2.3. Angry VS Neutral Faces: Dwell Times on the Eyes Region

Average dwell times around the eyes area for angry and neutral faces were analysed using a 2 x 2 x 2 ANOVA as in the previous section.

There was a main effect of Drug, $F(1,38)=24.66$, $p<.001$, partial $\eta^2 = .39$, and a main effect of Social Anxiety ($F(1,38)=7.3$, $p=.01$, partial $\eta^2 = .16$), but the interaction between Drug and Social Anxiety was not significant ($F(1,38) = .73$, $p = .39$, partial $\eta^2 = .02$). These outcomes suggest that HSA participants spent more time looking around the eye area compared with the LSA participants, and that alcohol increased overall dwell times, but not differentially for the two groups (Figure 2.6). Thus, the pattern was similar to that shown for responses to the whole face. The main effect of Face Type was not significant, $F(1,38)=.21$, $p=.64$, partial $\eta^2 = .01$.

Figure 2.6: Average time spent looking at eyes (mean dwell time) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



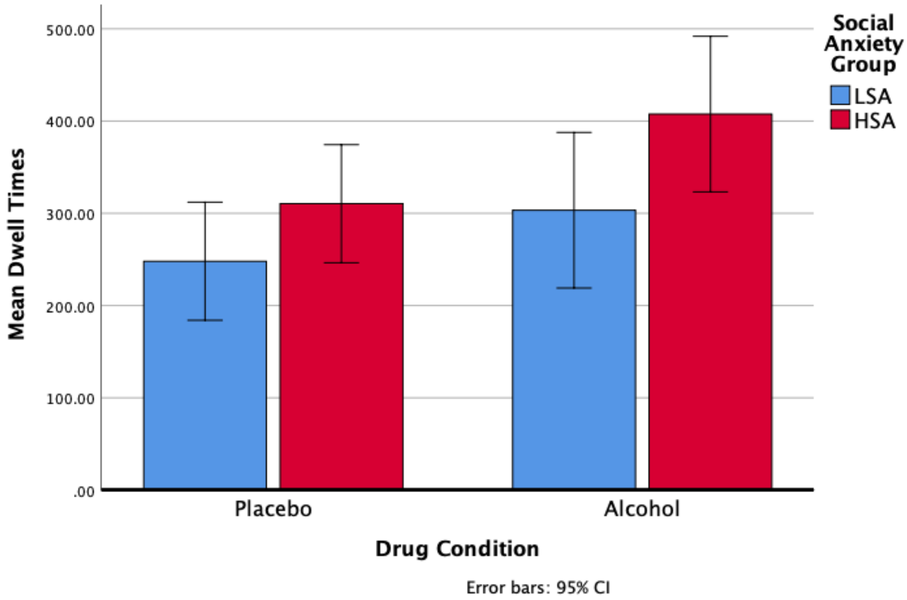
2.5.2.4. Angry vs Neutral Faces: Dwell Times on the Mouth Region

The main effect of Drug was significant, F(1,38)=5.49, p=.024, partial η^2 =.13, and the main effect of Social Anxiety group was also significant, F(1,38)= 4.14, p=.05, partial η^2 = .86. However, the interaction between Drug and Social Anxiety was not significant, F(1,38)= .41, p= .52, partial η^2 = .01. Alcohol produced an increase in dwell times on the mouth area for all participants, and HSA participants spent longer than LSA participants looking at the mouth area (Figure 2.7). Again, the pattern of results is similar to that shown for the whole face and the eyes region.

The main effect of Face type was significant, F(1,38)= 25.58,p= <.001, partial η^2 =.4. Overall, participants spent more time looking at the mouth region of neutral faces (M=

450.43, SD= 40.7) compared to the mouth region of angry faces (M= 187.16, SD= 20.69).

Figure 2.7: Average time spent looking at mouths (mean dwell time) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).

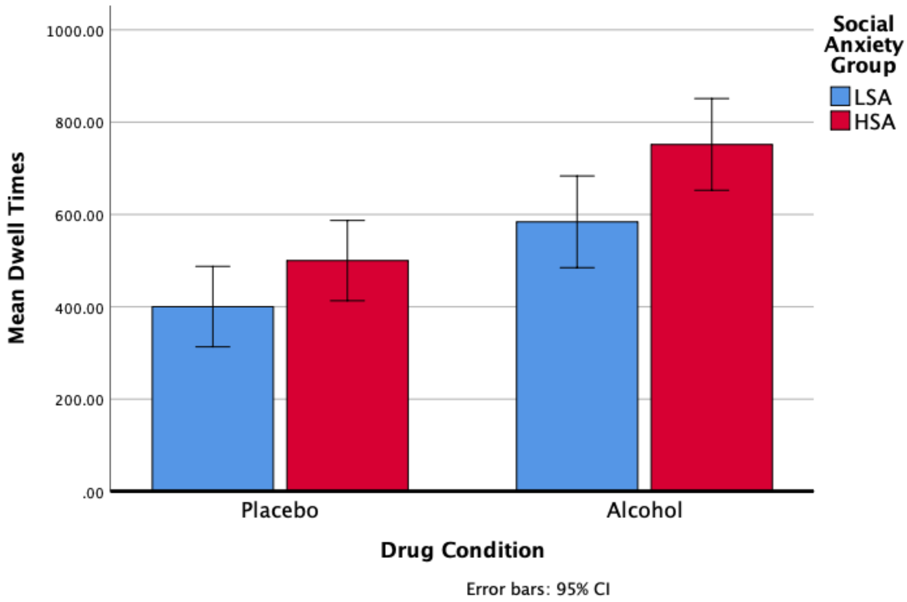


2.5.2.5. Happy VS Neutral Faces: Dwell Times on Whole Face

Dwell times on each area of interest were analysed for happy vs. neutral stimuli using a 2 x 2 x 2 mixed model ANOVA.

There was a main effect of Drug, F (1,38) = 23.59, p <.001, partial η^2 = .38, and a significant effect of Social Anxiety too, F (1,38) = 7.94, p=.008, partial η^2 =.17. The interaction between Drug and Social Anxiety was not significant, F(1,38)= .57, p= .45, partial η^2 =.01. As with the Angry face stimulus comparisons, HSA participants showed longer dwell times on both stimuli compared with LSA participants; alcohol increased dwell times for both groups (Figure 2.8; see Appendix A, pp. 281). The main effect of Face type was not significant, $F(1,38)=.52$, $p=.47$, partial η^2 =.01.

Figure 2.8: Average time spent looking at happy and neutral mouths (mean dwell time) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).

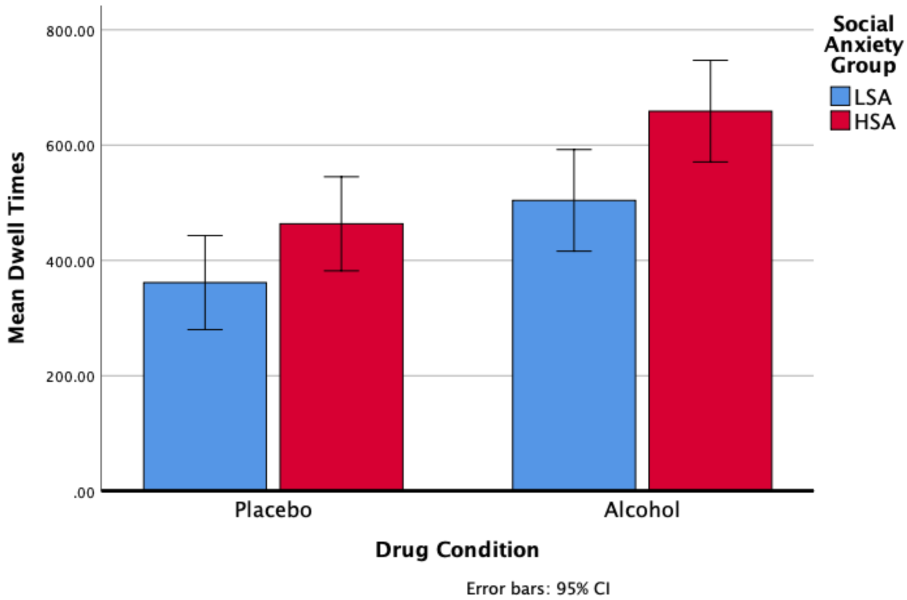


2.5.2.6. Happy VS Neutral Faces: Dwell Times on the Eyes Region

There was a main effect of Drug (F (1,38) = 23.46, p <.001, partial η^2 =.38), indicating that alcohol increased participants' dwell times. There was also a main effect of Social Anxiety (F (1,38) = 7.18, p=.011, partial η^2 =.16), reflecting that HSA participants looked more around the eye region compared to LSA participants (Figure 2.9). The interaction between Drug and Social Anxiety group was not significant, F(1,38)=.57, p=.45, partial η^2 =.01.

Face type was not significant, F (1,38) = .24, p= .63, partial η^2 =.01, suggesting that performance was not affected by the type of stimulus displayed (Happy vs. Neutral).

Figure 2.9: Average time spent looking at at the eyes regions of happy and neutral faces (mean dwell time) after placebo and after alcohol by by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).

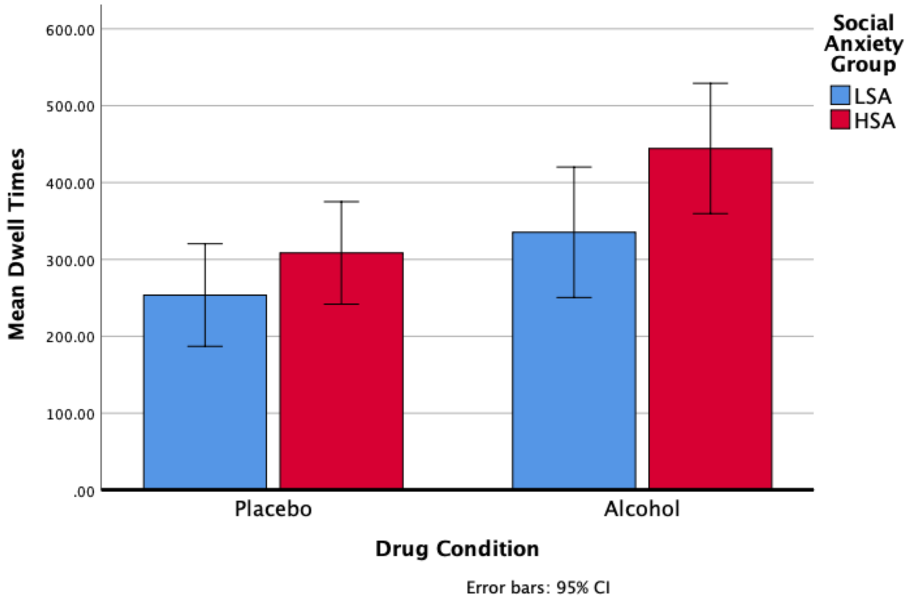


2.5.2.7. Happy vs. Neutral Faces: Dwell Time on the Mouth Region

There was a significant effect of Drug, F(1,38)=11.29, p=.002, partial η^2 = .23; alcohol increased dwell times overall. The main effect of Social Anxiety approached significance, F(1,38)= 3.7, p=.06, partial η^2 =.09. The interaction between Drug condition and Social Anxiety group was not significant, F(1,38)= .7, p= .41, partial η^2 =.02 (Figure 2.10).

The main effect of Face type was statistically significant (F(1,38)=18.39, p<.001, partial η^2 =.33) reflecting that all participants spent more time looking around the mouths of neutral faces (M=450.43; SD= 40.7) than the mouths of happy faces (M=224, 65; SD= 22.84).

Figure 2.10: Average time spent looking at the mouth region of happy and neutral mouths (mean dwell time) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.3.1. Reaction Times

Data analyses for the dot probe task were based on reaction times (RT) for correct responses. Incorrect responses were not included in the analysis. Three analyses were conducted: (1) a mixed-model ANOVA to analyse RT when the dots were placed behind the angry faces paired with neutral faces, compared with the trials when the dots were positioned behind the neutral faces paired with the angry faces; (2) ANOVA to analyse RT when the dots were placed behind the happy faces paired with neutral faces compared with the trials when the dots were positioned behind the neutral faces paired with the happy faces; (3) ANOVA to analyse RT when probes appeared in a location previously occupied by an emotional face (either happy or angry), or a neutral face, based on a previous analysis by Cooper et al. (2006). The IVs were Social Anxiety and Drug, and the DV was reaction time. Faster reaction times would be expected by HSA participants to the angry face (threat) stimuli.

2.5.3.2. Reaction Times: Angry vs Neutral Faces

Reaction times were analysed by 2 x 2 x 2 mixed model ANOVAs, with two within-subjects factors of (1) relative probe Position (probe appears in location of emotional or neutral stimulus), and (2) Drug (placebo or alcohol); the between-subjects factor was Social Anxiety (LSA vs. HSA).

Primary outcomes

A main effect of Drug was found, F(1,39)= 8.01, p =.007, partial η^2 =.17 showing that participants' reaction times were longer after alcohol (Table 2.4). The main effect of Social Anxiety was not significant, F(1,39) = .42, p= .52, partial η^2 =.01, and the interaction between Drug and Social Anxiety was also not significant, F (1,39) = .03, p = .86. partial η^2 =.001.

Secondary outcomes

The effect of Probe position was also not significant (F(1,39)= .99, p=.32, partial η^2 =.02). The interaction between Alcohol, Social Anxiety and Probe Position was significant (F(1,39)= 5.28, p = .02, partial η^2 =.12), suggesting that individuals had slower reaction times after alcohol, especially the HSA group compared with LSA participants. This effect appeared to be greater when the dots were placed behind the angry faces (Table 2.4). A different score was calculated to explore if alcohol had a greater effect in the HSA group for angry faces compared to LSA participants when dots replaced either angry or neutral faces. Alcohol had a greater effect in HSA (M=-72.37;SD=112.27) compared to LSA (M=-38.07;SD=152.42) participants when dots replaced angry stimuli, but this difference was not significant, t(1,39)=.44, p=.41. In contrast, alcohol had a greater effect in LSA (M=-67.91; SD=159.21) compared to HSA

(M=-47.93; SD=96.92) participants when dots replaced neutral stimuli, but similarly, this difference was not significant (t(1,39)=.48=p=.63). Therefore, the impression from the three way interaction (Table 2.4) was not supported by the post hoc t-tests.

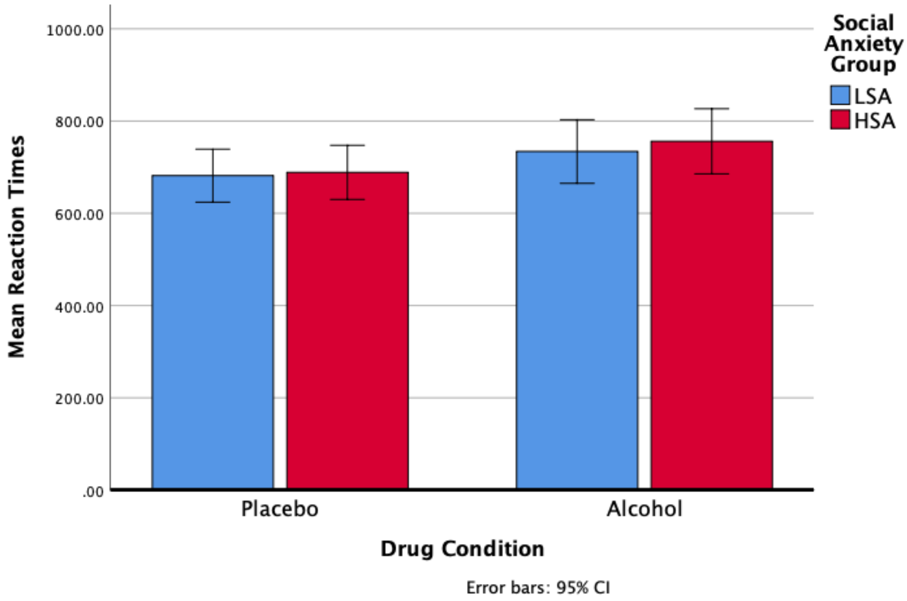
Table 2.4: Mean reaction times (msec) for HSA and LSA participants (N=41) comparing angry vs neutral stimuli after alcohol or placebo.

	Placebo Condition		**Alcohol Condition**	
	Angry vs Neutral	**Neutral vs Angry**	**Angry vs Neutral**	**Neutral vs Angry**
HSA	M= 696.11 SD= 25.8	M= 687.39 SD= 22.92	M= 768.48 SD= 37.3	M= 735.33 SD= 37.3
LSA	M= 678.51 SD= 25.44	M= 663.61 SD= 22.59	M= 722.54 SD=36.78	M=741.69 SD= 36.78

2.5.3.3. Reaction Times: Happy vs Neutral Faces

ANOVA was conducted in the same way as for the comparison of Angry and Neutral stimuli, above. The effect of Drug was significant (F(1,39) = 11.17, p= .002, partial η^2 =.22): mean RTs increased after alcohol (M = 749.92, SD= 23.72) compared with placebo (M= 684.1, SD= 20.09). There was no overall significant difference between the social anxiety groups, F(1,39) = .13, p= .72, partial η^2 =.003, and the interaction between Drug and Social Anxiety was also not significant, F(1,39) = 1.95, p= .67, partial η^2 =.004 (Figure 2.11). Finally, there was no significant interaction between Alcohol, Social Anxiety and Probe Position, F(1,39) = .03, p= .86, partial η^2 =.001.

Figure 2.11: Average reaction times when dots replaced a happy or a neutral face after either placebo or alcohol: high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.3.4. Reaction Times: Emotional faces VS Neutral faces

An additional analysis was conducted to investigate the effects of alcohol and of the emotional faces in general (merging angry and happy stimuli) on participants' reaction times. A 2 x 2 x 2 x 2 repeated measures ANOVA was run with three within-subjects factors of (1) relative probe Position (probe appears in location of emotional or neutral stimulus), (2) type of Face (angry, happy), and (3) Drug (placebo, alcohol); and a between-subjects factor of Social Anxiety group.

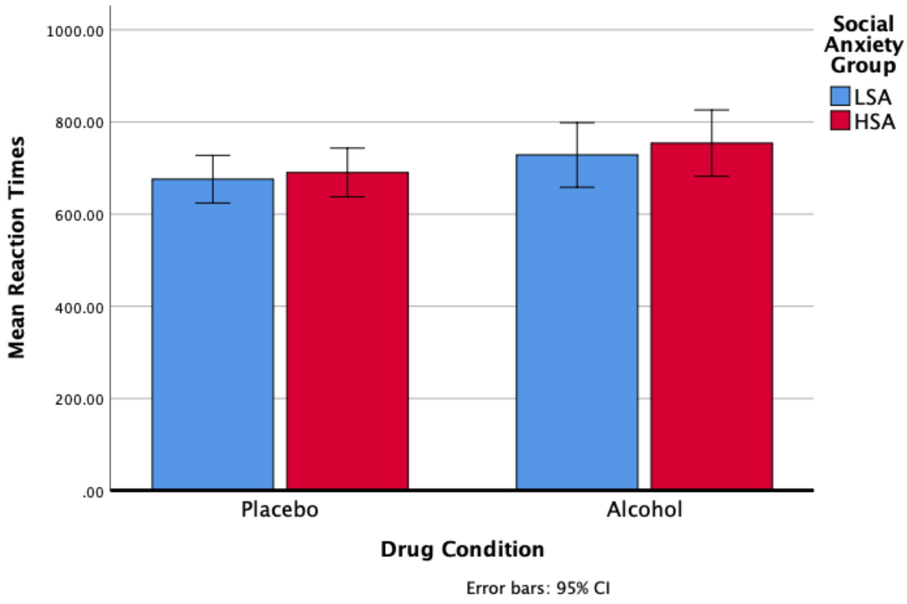
Primary outcomes

There was a main effect of Drug, F(1,39)= 10.23, p=.003, partial η^2 =.21, indicating that participants had significantly slower reaction times after alcohol. The main effect of Social Anxiety was not significant, F(1,39) =.26, p= .62, partial η^2 =.007. The interaction between Drug and Social Anxiety group was also not significant, F(1,39)= .09, p= .76, partial η^2 =.002 (Figure 2.12).

Secondary outcomes

The main effect of Probe Position was not significant, (F(1,39)= .02, P = .89, partial η^2 =.001. The main effect of Face type was also not significant, F(1,39)= .99, p=.32, partial η^2 =.02, indicating that participants had similar reaction times for angry (M=710.7, SD= 19.68) and happy (M=717.01, SD=20.58) faces.

Figure 2.12: Average reaction times (msec) when dots replaced an emotional or a neutral face after placebo or alcohol: high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.4. Antisaccade Results

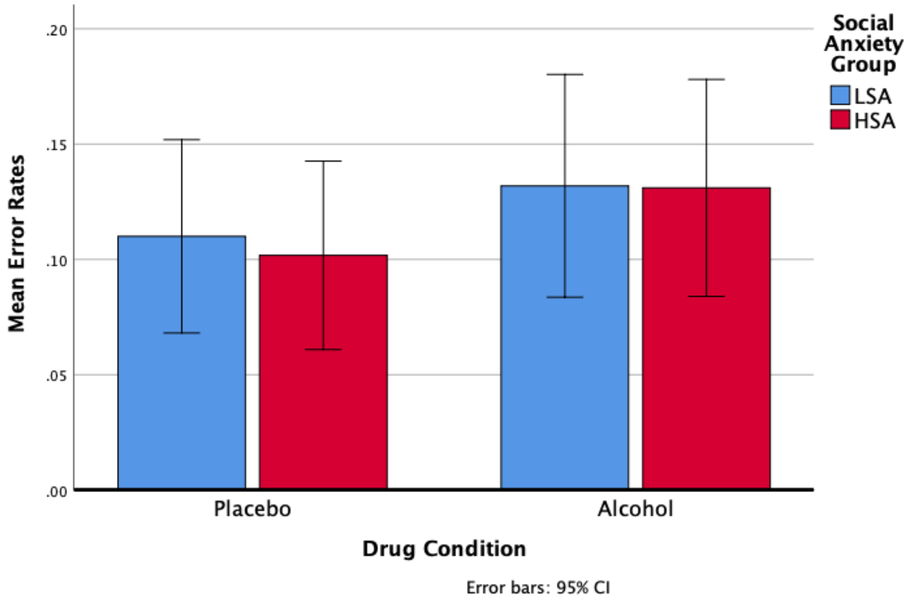
For this task, the IVs were Social Anxiety, Drug, Face Type and Face Location; the DVs were error rates (number of times that saccades fell in the wrong direction), dwell times for different AoIs (average time spent looking at a particular area) and latencies (measurement of the interval between the presentation of a target stimulus and the onset of a saccade).

2.5.4.1. Error Rates

Error rates were analysed using a 2 x 3 x 2 x 2 ANOVA with Drug, Face Type and Face Location as within-subject factors and Social Anxiety as a between-subjects factor. A Shapiro-Wilk test was performed and showed that the distribution of error rates for LSA participants (but not HSA participants) in the placebo condition departed significantly from normality (HSA: W=.91, p=.07; LSA: W=.89, p=.03), as well as HSA in the alcohol condition (W=.87, p=.02). Error rates for LSA participants in the alcohol condition were normally distributed (W=.92, p=.11). ANOVA therefore remained the preferred statistical test, since the pattern of deviation was not large enough or consistent enough to indicate that it would not produce reliable outcomes: ANOVA is not very sensitive to moderate deviations from normality, and simulation studies (using a variety of non-normal distributions) have shown that the false positive rate is not affected much by this violation of the assumption (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996).

A main effect of Drug was found ($F(1,37)=4.49$, $p=.041$, partial $\eta^2=.11$), indicating that error rates significantly increased after alcohol (M=.133, SD=.013) compared with placebo (M=.104, SD=.017). Social Anxiety was not significant, $F(1,37)= 68.27$, $p = .87$, partial $\eta^2=.65$, suggesting that the HSA group produced similar error rates (M=.116, SD=.020) to the LSA group (M=.121, SD=.020). Social Anxiety did not interact significantly with Drug ($F(1,35)=.008$, $p=.928$), (Figure 2.13). The main effect of Face Type was significant ($F(1,37)=9.13$, $p=.005$, partial $\eta^2=.19$), as was Face Location ($F(1,37)=5.77$, $p=.02$, partial $\eta^2=.13$); overall, participants made more errors when angry faces were displayed (M= .13, SD= .02) compared with neutral faces (M= .11, SD = .01) and inverted faces (M = .11, SD= .01). The interaction between Face Type and Drug was also statistically significant, $F(1,37)=5.67$, $p=.023$, partial $\eta^2=.13$, showing that participants in the placebo condition made more errors with angry faces (M=.111, SD=.016) compared with neutral faces (M=.099, SD=.014), this effect increased after alcohol consumption (average error rates on angry face: M= .158, SD= .021; average error rates on neutral face: M = .13, SD=.019).

Figure 2.13: Average error rates after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41) on the Antisaccade task.



Participants made more mistakes when an angry face was displayed, and fewer mistakes when an inverted face was shown on the screen. Alcohol seemed to increase error rates just for angry and neutral stimuli, and not for inverted stimuli. This lack of effects for inverted faces suggest that inverted stimuli are not perceived as normal faces and thus participants' attention was less captured by upside down targets (Gilchrist et al., 2006).

2.5.4.2. Dwell times: Whole Face Area

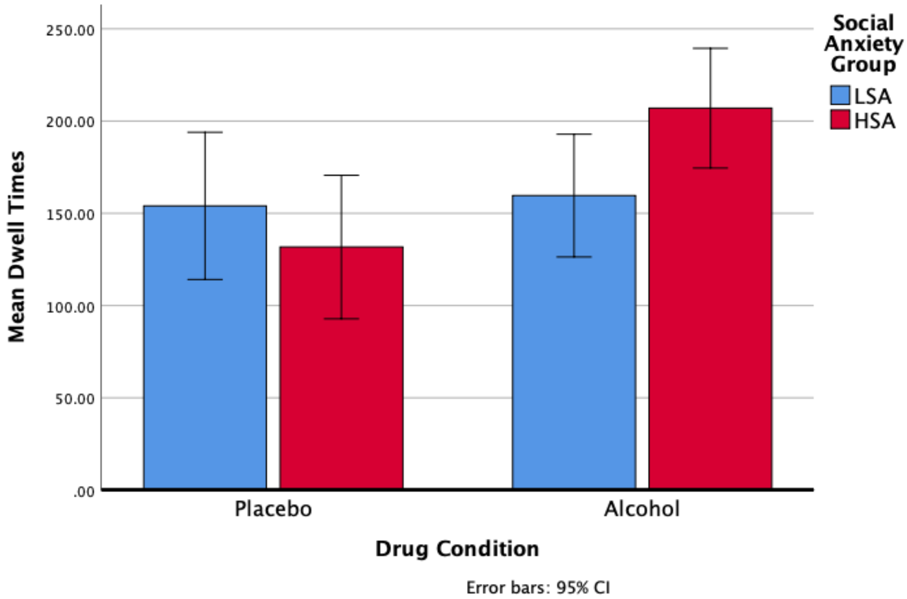
The average durations spent looking at the whole face and specific Areas of Interest (below) were analysed in the same way as for error rates.

There was a main effect of Drug, F(1,37)=6.17, p=.018, partial η^2 =.14, as dwell times increased after alcohol. The main effect of Social Anxiety was not significant, F(1,37)= .41, p= .52, partial η^2 =.01, but there was a statistically significant interaction between Drug condition and Social Anxiety (F(1,37)= 4.59, p=.03, partial η^2 =.11), (Figure 2.14). Post hoc t-tests showed that there was no significant difference between LSA (M=154.02; SD= 95.5) and HSA (M=131.73; SD=75.66) participants (t(37)= -.81, p=.42) in the placebo condition, but there was a significant difference in the alcohol condition between LSA (M=161.24; SD=62.18) and HSA (206.98; SD=78.61) participants (t(38)= 2.04, p=.04). After alcohol, HSA participants spent significantly more time looking at the face compared with LSA participants (Figure 2.14).

The main effect of Face Type was not significant, F(1,37)=1.11, p=.299, partial η^2 =.03, the participants did not respond differently depending on the Face Type.

The interaction between Social Anxiety and Face Type was not significant, F(1,37)= 2.6, p=.12, partial η^2 =.06, suggesting that there was no effect of social anxiety on time spent looking at different types of stimuli.

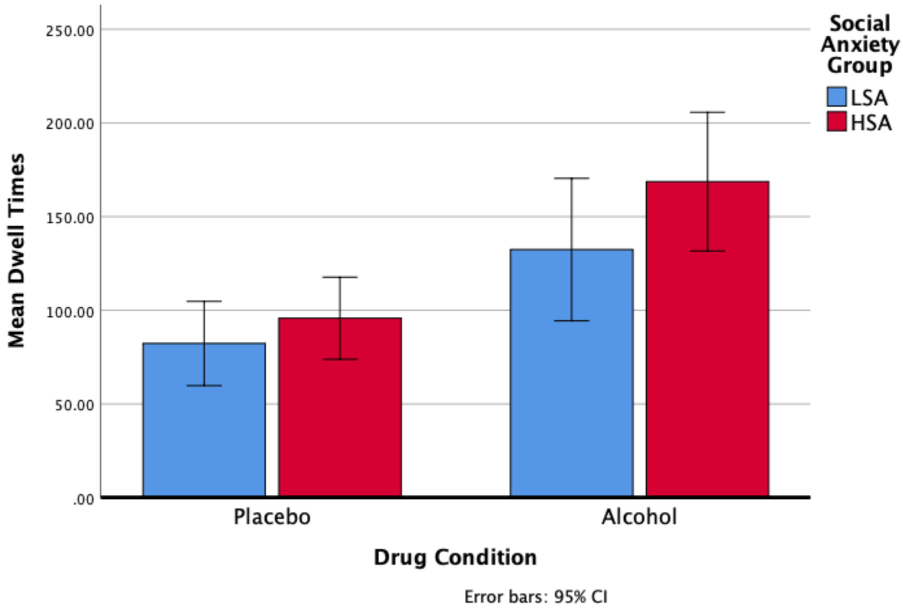
Figure 2.14: Average dwell times (msec) looking at the whole face area after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.4.3. Dwell Times: Eyes Region

There were main effects of Drug ($F(1,37) = 22.97$, $p<.001$, partial $\eta^2 = .38$) and of Face Type ($F(1,37) = 7.51$, $p=.009$, partial $\eta^2 = .17$), suggesting that alcohol increased dwell times overall, and that dwell times around angry eyes were significantly longer compared to dwell times around neutral and inverted eyes. Social Anxiety was not statistically significant, $F(1,37) = 2.07$, $p = .16$, partial $\eta^2 = .05$. The interaction between Drug and Social Anxiety was not significant, $F(1,37) = .78$, $p = .38$, partial $\eta^2 = .02$, (Figure 2.15). The interaction between Face Type and Social Anxiety was not significant, $F(1,37) = 2.02$, $p=.16$, partial $\eta^2 = .05$. In contrast, there was a significant interaction between Face Type and Drug ($F(1,37) = 3.21$, $p=.04$, partial $\eta^2 = .08$), suggesting that participants spent more time looking at stimuli under the effects of alcohol (mean and sd.s., Appendix B3, pp. 283).

Figure 2.15: Average dwell times (msec) looking at the eyes area after placebo or after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).

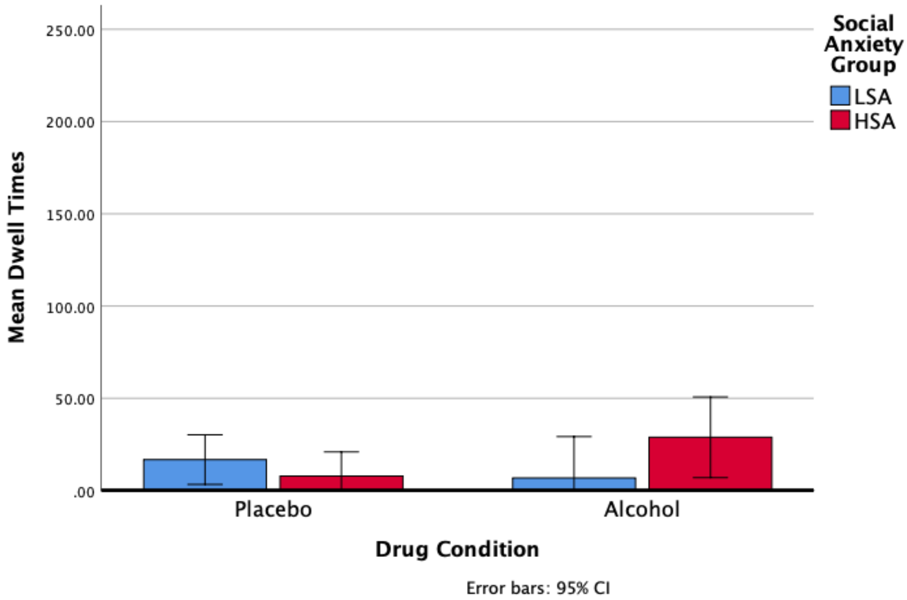


2.5.4.4. Dwell times: Mouth Region

Drug condition was not significant, $F(1,37)=1.5$, $p=.22$, partial $\eta^2=.04$, and nor was Social Anxiety, $F(1,37)=.52$, $p=.47$, partial $\eta^2=.01$. In contrast, the interaction between Social Anxiety and Drug was significant, $F(1,37)=5.49$, $p=.02$, partial $\eta^2=.13$ (Figure 2.16). However, post hoc two-sample t-tests showed a non-significant difference in the placebo condition between LSA (M=29.29; SD=35.3) and HSA (23.71; SD=33.05) participants ($t(37)=-.51$, $p=.61$). Similarly, there was no significant difference for dwell times during the alcohol condition between LSA (M=6.46; SD= 28.9) and HSA (M=28.88; SD=60.87) participants ($t(38)=1.48$, $p=.14$), hence the effect was marginal.

Face Type was significant, $F(1,37)=8.08$, $p=.007$, partial $\eta^2 =.18$, suggesting that, overall, participants spent more time looking at inverted mouths (M=30.29;SD=5.25) compared with mouths on neutral (M=23.16; SD=9.79) or angry (M=13.05; SD=5.4) faces. The interaction between Face Type and Social Anxiety was not significant ($F(1,37)=1.65$, $p=.21$).

Figure 2.16: Average dwell times (msec) looking at the mouth area after placebo or alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.4.5. Latencies

The mean latency in milliseconds to the first fixation was calculated by averaging the latency to the first fixation for each Face Type during the placebo or alcohol condition. A 3 x 2 x 2 ANOVA with Face type (Angry/Neutral/Inverted) and Drug (Placebo vs

Alcohol) as repeated measures and Social Anxiety as a between-subjects factor was conducted.

There was no significant main effect of Drug, $F(1,35)= 2.03$, $p=.16$. Social Anxiety was not significant, $F(1,37)= .244$, $p=.62$, partial $\eta^2 =.01$, and the interaction between Drug and Social Anxiety was also not significant, $F(1,37) = .05$, $p =.82$, partial $\eta^2 =.001$. Finally, Face type was not significant, $F(1,37)= .14$, $p = .71$ partial $\eta^2 =.004$.

2.5.5. Prosaccade task

Similarly with the antisaccade task, for this task the IVs were Social Anxiety, Drug, Face Type and Face Location; the DVs were error rates (number of times that saccades fell in the wrong direction), dwell times for different AoIs (average time spent looking at a specific area) and latencies (the interval between the presentation of a target stimulus and the onset of a saccade).

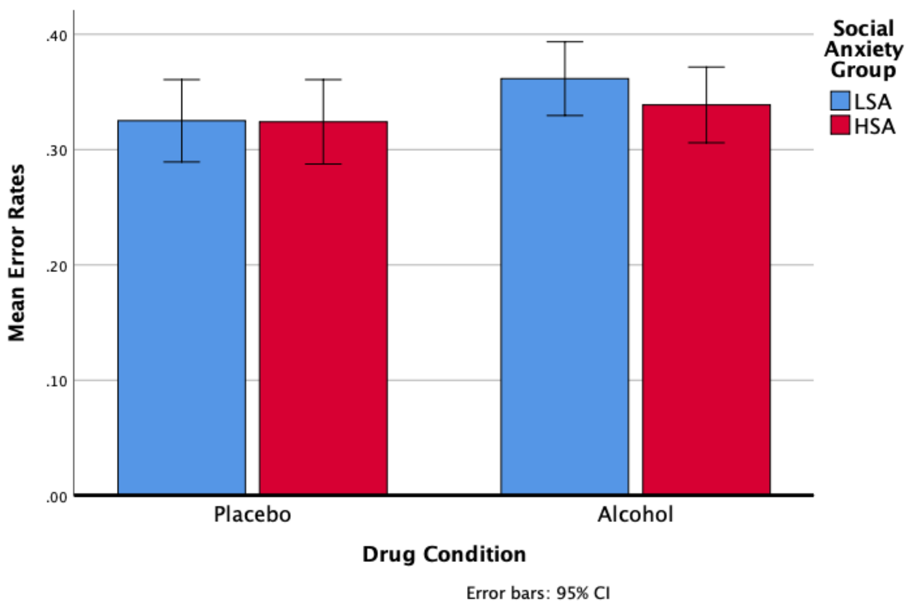
2.5.5.1. Error Rates

A 2 x 3 x 2 x 2 ANOVA was carried out with Drug, Face Type, and Face Location as within-subject factors and Social Anxiety as a between-subject factor.

A Shapiro-Wilk test showed that error rates during the placebo condition were normally distributed for HSA ($W=.94$, $p=.32$) and LSA ($W=.97$, $p=.78$) participants, as were errors for HSA participants in the alcohol condition ($W=.89$, $p=.02$). The distribution of error rates in LSA participants during the alcohol condition departed significantly from normality ($W=.89$, $p=.02$). Overall, the results of these analyses did not suggest that ANOVA would be inappropriate.

There was a main effect of Drug, $F(1,39)=4.12$, $p=.049$, partial $\eta^2 =.096$, reflecting an overall increase in errors after alcohol. Social Anxiety was not significant ($F(1,39) =.33$, p =.56, partial η^2 =.96). The interaction between Drug and Social Anxiety group was also not significant, F(1,39) = .75, p = .39, partial η^2 =.02 (Figure 2.17). Face Type was statistically significant, F(1,39) = 146.29, p <.001, partial η^2 =.39, indicating that participants made more errors when a neutral and an inverted face appeared on the screen (angry face: M=.26, SD=.01; neutral face: M=.37, SD= .01; inverted face: M=.38, SD=.01). Post-hoc paired sample t tests showed that there was a significant difference in errors between angry and neutral faces (t(40)=-9.6, p<.001), and between angry and inverted faces (t(40)=-12.07, p<.001).

Figure 2.17: Mean error rates after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41) on the Prosaccade task.

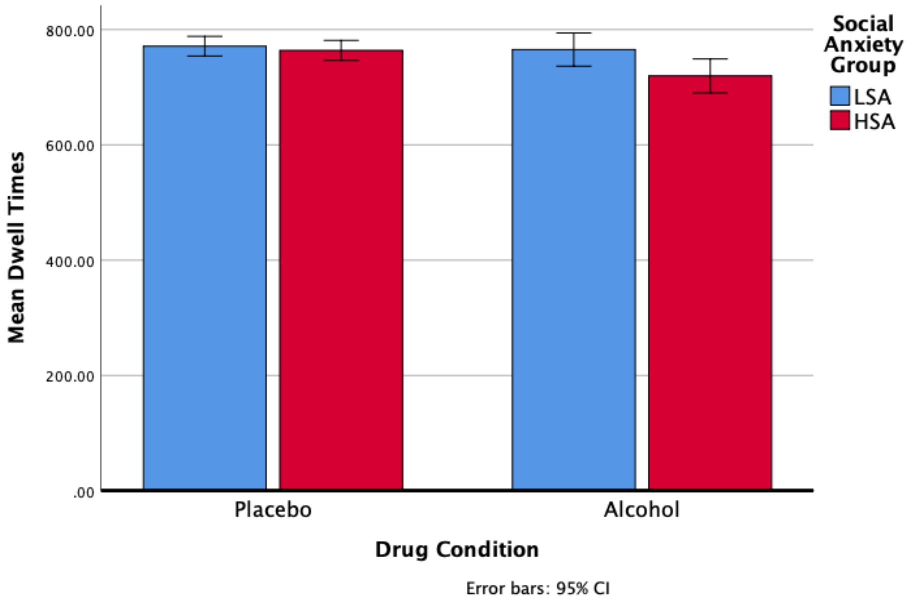


2.5.5.2. Dwell Times: Whole Face

As with the antisaccade task, a 2 x 3 x 2 x 2 ANOVA analysed the mean time spent looking at the faces (Dwell Time), in which Face type (Angry, Neutral, Inverted), Drug (Placebo vs. Alcohol) and Location were repeated measures, and Social Anxiety was a between-subject factor.

There was a main effect of Drug, F(1,39)=9.09, p=.004, partial η^2 =.19, reflecting that alcohol decreased participants' dwell times. Social Anxiety was not significant, F(1,39)= 3.35, p=.07, partial η^2 =.08. However, the interaction between Drug and Social Anxiety group was statistically significant, F(1,39)=5.38, p=.026, partial η^2 =.12 (Figure 2.18). A two-sample t-test indicated a non-significant difference in the placebo condition between LSA (M=771.14; SD=38.98) and HSA (763.77; SD=37.59) participants (t(39)= -.61, p=.54). However, there was a significant difference in dwell times during the alcohol condition between LSA (M=765.37; SD= 40.21) and HSA (M=719.62; SD=83.76) participants (t(39)=-2.21, p=.03), suggesting that the HSA group spent less time looking at the faces after alcohol than after placebo, whereas the LSA participants were similar irrespective of drug condition. The main effect of Face Type was not significant, F(1,39)=8.56, p=.006, partial η^2 =.18.

Figure 2.18: Average dwell times (msec) looking at the face area of all stimuli after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.5.3. Dwell Times: Eyes Region

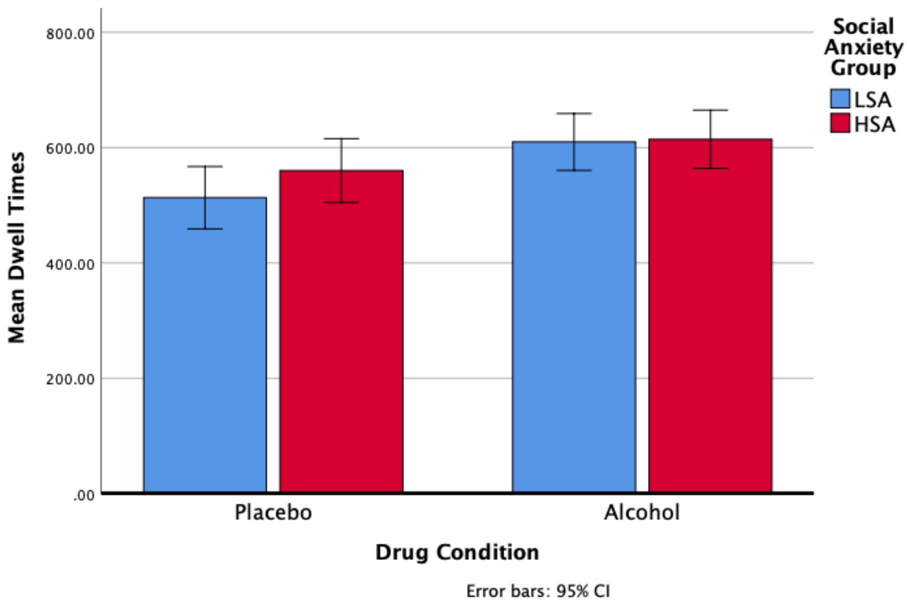
Mean dwell times around the eyes AOI region for angry, neutral and inverted faces were analysed as before.

There was a main effect of Drug, F(1,39)=19.703, p<.001, partial η^2 =.33, suggesting that participants spend more time looking at the eyes region under the influence of alcohol (M=613.76, SD= 17.68) compared with the placebo condition (M=540.98, SD=18.25). The main effect of Social Anxiety was not significant, F(1,39)= .64, p=.43 partial η^2 =.02. The interaction between Social Anxiety and Drug was not significant, F(1,39)= 1.49, p=.23, partial η^2 =.04, (Figure 2.19)

The main effect of Face Type was significant (F(1,39)= 45.33, p<.001, partial η^2 =.54) suggesting that individuals spent more time looking at the eyes of angry (M=613.27, SD=19.8) and neutral (M=623.35, SD=21.27) faces, and less time looking at the eyes of inverted faces (M=486.48, SD=14.35). Post hoc t tests showed a significant difference when looking at angry eyes compared with inverted eyes (t(40) =6.82,p<.001), but not when looking at angry eyes compared with neutral eyes (t(40)=-

1.44,p=.16). The interaction between Face Type and Drug was also significant, F(1,39)=38.68, $p<.001$ partial η^2 =.49, suggesting that participants spent more time looking at inverted eyes during the alcohol condition (M=591.52; SD=141.83) compared with the placebo condition (M=380.71; SD=89.72). Post hoc t test showed that the difference was statistically significant (t(80)=-.804, $p<.001$). Comparisons with other faces were not significant.

Figure 2.19: Average dwell times (msec) looking at the eyes area after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



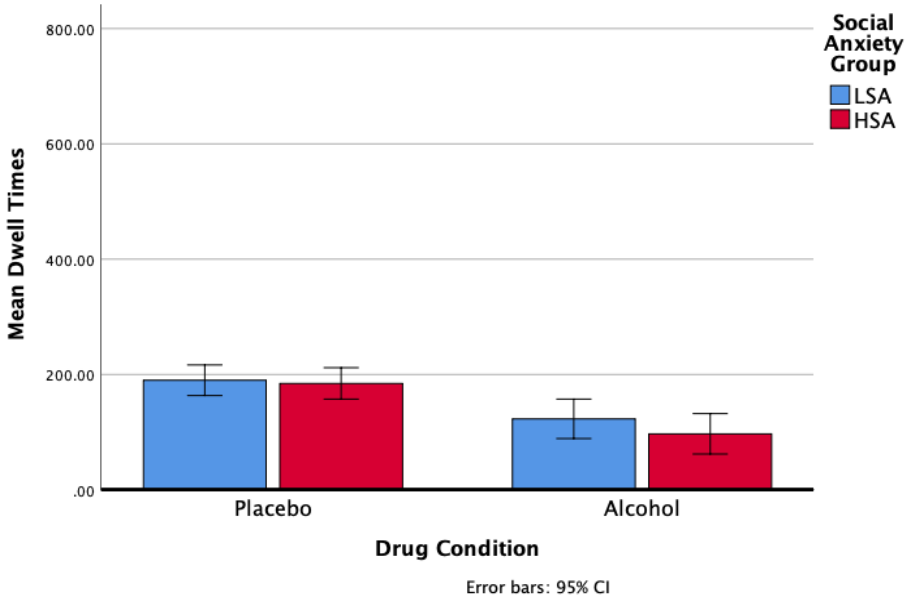
2.5.5.4. Dwell Times: Mouth Region

Dwell times around the mouth region were analysed as above.

There was a main effect of Drug, F(1,39)=39.21, $p<.001$, partial η^2 =.5, showing that participants spent less time looking at the mouth region after alcohol. Social Anxiety was not statistically significant, $F(1,39)= .38$, $p=.38$, partial $\eta^2 =.02$. The interaction between Social Anxiety and Drug was also not significant, $F(1,39)=.69$, $p=.41$, partial $\eta^2 =.01$ (Figure 2.20).

There was a main effect of Face type, $F(1,39)= 124.43$, $p < 001$, partial $\eta^2 =.76$, suggesting that participants looked longer at the mouth regions of inverted faces (M=282.4, SD=14.2) compared with angry (M=87.18, SD=11.87) and neutral (M=74.07, SD=11.22) faces. The interaction between Drug and Face type was also significant, $F(1,39)= 22.9$, $p<.001$, partial $\eta^2 =.79$, reflecting a tendency for alcohol to decrease significantly this effect on inverted faces (M=184; SD=162.21), compared with the placebo condition (M=381.34; SD=96.69). A post hoc t test showed that the difference was significant ($t(80)=6.68$, $p<.001$). Comparisons for other faces were not significant.

Figure 2.20: Average dwell times (msec) looking at the mouth area after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



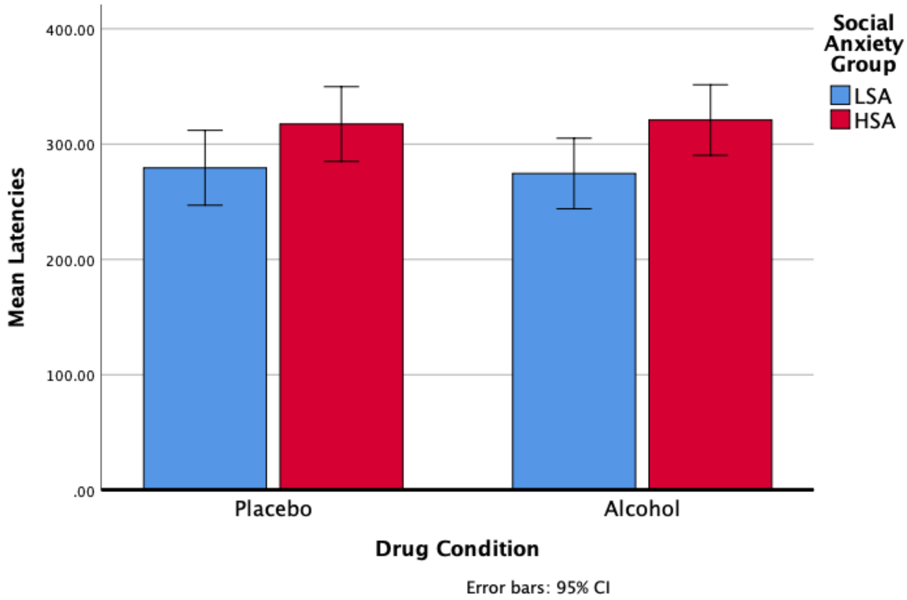
2.5.5.6. Latencies

Latencies, in milliseconds to the first fixation, were calculated by averaging the latency to the first fixation for each type of stimulus. Data were analysed using a 3 x 2 x 2 ANOVA with Face Type (Angry/Neutral/Inverted) and Drug (Placebo vs. Alcohol) as repeated measures and Social Anxiety as a between-subjects factor.

The main effect of Drug was not significant, F(1,38)=.005, p=.94, partial η^2 =.01, suggesting that participants' latencies were not affected by alcohol. In contrast, there was a main effect of Social Anxiety, F(1,38)= 4.58, p= .04, partial η^2 =.11: LSA individuals had shorter latencies compared with HSA participants. The interaction between Social Anxiety and Drug was not significant, F(1,38)= .17, p=.68, partial η^2 =.01 (Figure 2.21).

Also, Face Type was not significant, F(1,38)=.06, p=.81, partial η^2 =01. showing that the type of face did not affect participants' latencies.

Figure 2.21: Average eye movement latencies (msec) after placebo and after alcohol by high socially-anxious (HSA) and low socially-anxious (LSA) participants (N=41).



2.5.6. Latencies: Antisaccade and Prosaccade

A 2 x 3 x 2 x 2 repeated measure ANOVA was run with Drug condition (Placebo vs Alcohol), Face type (Angry/Neutral/Inverted) and type of task (Antisaccade vs Prosaccade) as repeated measures and Social Anxiety group as a between-subjects factor.

The main effect of Drug was not significant ($F(1,37)=1.3$, $p=.26$, partial $\eta^2 =.03$), nor was Social Anxiety ($F(1,37) = 1.25$, $p = .27$, partial $\eta^2 =.95$). The interaction between Social Anxiety and Drug was also not significant, $F(1,37)=.08$, $p=.78$, partial $\eta^2 =.03$. The main effect of Face type was not significant, $F(1,37) = .33$, $p= .57$, partial $\eta^2 =.01$. A significant effect of task was found ($F(1,37)= 79.97$, $p <.001$, partial $\eta^2 =.68$), suggesting that participants had longer latencies during the antisaccade task (M= 398.23; SD= 16.84) compared with the prosaccade task (M=298.92, SD= 10.05).

2.6. Discussion

The aim of this study was to investigate the effects of an acute dose of alcohol (0.65 g/kg body weight for men and 0.57 g/kg for women) on a non-clinical sample of high socially-anxious participants compared to a group of less socially-anxious individuals using three different kinds of eye-tracking tasks.

In contrast with previous studies that have suggested a small negative relationship between social anxiety and weekly drinking behaviours (e.g. Eggleston et al., 2004; Ham & Hope, 2005; Ham & Hope; 2007), the HSA and LSA participants did not differ significantly in terms of alcohol units consumed per week. Breath alcohol scores suggested also that participants absorbed alcohol in the same way regardless of their levels of social anxiety. In contrast, HSA participants differed from LSA participants in terms of self-reported motives to drink alcohol. This study showed that while positive motives (social and enhancement) are not affected by participants' levels of social anxiety, the negative motives of coping and conformity might be affected by high social anxiety. This is in line with previous studies (Terlecki et al., 2014; Lewis et al., 2008; Stewart et al., 2006) that suggest that high socially-anxious individuals self-reported greater coping and conformity motives (negative drinking motives) on the Drinking

Motivation Questionnaire, compared with low socially- anxious participants. The present outcomes suggest that HSA individuals are more likely to drink in social situations in order to cope with negative emotions and to conform with their peers. However, this group also reported feeling less relaxed before and after drinking alcohol, suggesting that alcohol fails to change their levels of relaxation. Participants reported feeling more alert before drinking in both conditions, but less alert especially after drinking alcohol. Similarly, they reported feeling more lightheaded after drinking, especially in the alcohol condition. Therefore, alcohol affected the self-reported feelings of both groups in predictable ways, suggesting that the lack of effects that might be observable elsewhere cannot be attributed to using a dose of alcohol that was too low to influence behaviour.

In the first task, gaze patterns were analysed in relation to socially-threatening stimuli in people with high and low social anxiety under the effects of alcohol. In contrast with the initial hypothesis suggesting that HSA participants would show attentional biases towards angry faces, compared to LSA participants, the results showed instead that HSA individuals spent more time looking at all stimuli in general compared with LSA participants. HSA participants also showed increased dwell times around the eyes area, compared with LSA participants.

The time spent looking at the stimuli increased after alcohol for all participants, in line with our third hypothesis, suggesting that alcohol would have an effect overall in both social anxiety groups. In contrast, previous studies that measured gaze patterns in HSA and LSA participants suggested that socially-anxious individuals have greater dwell times when threatening stimuli, in particular, are presented (i.e. Buckner et al., 2010; Lazarov et al., 2016; Shofield et al., 2011; Wieser et al., 2009; Fox et al., 2001). In this study, participants spent similar times looking at all stimuli, with the unusual exception of happy mouths compared with the neutral mouths, where participants spent more time looking around the neutral mouth area. The increase in dwell times after alcohol consumption in all participants shows a change in attentional processes that is not affected by social anxiety. Overall, participants showed a difficulty disengaging their attention from all stimuli after consuming alcohol. These results are in line with the theory that alcohol might have tension-reducing properties (Conger, 1956), however, the findings suggest that these properties might not be selective for socially-anxious individuals but apply to the whole sample.

The study also showed that two different emotional face types produce similar effects on HSA and LSA individuals, and this might partly be caused by the redundancy of the face stimuli created by the repetition of the same face stimuli over a short period of time. This would be in line with a previous neuroimaging study that showed a habituation effect in the amygdala in response to facial stimuli (Breiter et al., 1996). During that task, the amygdala response to different types of faces (fearful, happy and neutral) was shown to decline rapidly within run. In particular, evidence of habituation was suggested when the amygdala signal within and across runs with happy expressions and runs with fearful expressions (Breiter et al., 1996). In the current study, participants were presented with the same face set for each task in both alcohol and placebo sessions, and this might have caused some habituation in participants' reactions to emotional and neutral stimuli.

Another explanation for the lack of effect of the face stimulus might be the type of negative emotion chosen as target (angry face). We based our choice of emotional expressions on previous literature which tested the effect of angry and happy faces on socially-anxious participants (i.e. Horley et al., 2004). High socially-anxious individuals are generally afraid of negative evaluation and rejection from others and might find some facial expressions, such as disgusted or contemptuous faces, more threatening than angry faces. In line with this assumption, previous studies have shown that socially-anxious individuals can be particularly sensitive to disgusted and contemptuous faces (Amir et al., 2005; Stein et al., 2002), and can take less time to recognise sad (Leber et al., 2009), fearful (Leber et al., 2009) or disgusted expressions (Montagne et al., 2006).

The importance of the role of attention in social anxiety and alcohol use disorders is supported by several theories (Clark and Wells, 1995; Rapee and Heimberg, 1997; Sayette, 1993; Steele and Josephs, 1990; Bacon and Ham, 2010) that suggest that attention is involved in the development and maintenance of the disorders. In the current study, alcohol consumption seemed to change attentional biases in all participants, suggesting that alcohol does not have a selective effect on social anxiety. These results are in contrast with a previous study that investigated the effects of alcohol on the processing of emotional faces in socially-anxious individuals using a dot probe paradigm (Stevens et al., 2010). The difference in results might be due to the characteristics of the sample: in their study, Stevens et al., recruited a clinical sample of 40 socially-phobic patients compared with 40 controls, while this study (like many others) used a sample of non-clinical socially-anxious people, allowing better generalisation to the wider population.

This study involved the use of a dot probe task to measure eye movements rather than reaction times. However, this task also allows the assessment of attentional biases by analysing the differences in response times towards probes that replace emotional stimuli compared to probes that replace neutral stimuli. If the reaction times are shorter for the trials where probes replace threatening (angry) faces, it suggests that attention has been drawn towards that stimulus type (Bar-Haim et al., 2007; Mogg and Bradley, 1998). Overall, reaction times were slower under the effect of alcohol. This might be caused by the tendency of participants to perform slower in order to compensate for reductions in accuracy after drinking (Ahmadi et al., 2013; Stevens et al., 2010; Marczinski et al., 2007; Cox et al., 1999). However, HSA individuals did not respond significantly differently from the LSA group, and the type of stimulus did not affect performance. Previous studies have suggested that socially-anxious individuals produce significantly slower reaction times to threatening faces when stimuli are presented for shorter times (i.e. 100 ms; 500 ms; Cooper et al., 2006). A systematic review conducted by Bantin et al. (2016) compared outcomes from 10 studies that involved performance on a dot probe task comparing anxious and non-anxious individuals: the studies differed in their presentation times. Bantin et al. (2016) showed that in socially-anxious individuals there is a vigilance effect towards threatening faces when the duration of the stimuli on the screen is between 200 ms and 1000 ms. Weierich et al. (2008) proposed an explanation for this effect and suggested that in socially-anxious individuals, initial attention might be captured by threatening targets at the early stage of the stimulus presentation time (first 500 ms) (Weierich et al., 2008). These hypotheses have been supported by results from a neurobiological study (Davis & Whalen, 2001), which showed an association between vigilance towards social threats and amygdala activation in socially-anxious participants, but this effect decreased due to habituation during longer presentation times. In conclusion, in order to assess initial attentional processes, Bantin et al. (2016) suggested using a presentation time of 500 ms. The current study focused primarily on the assessment of gaze patterns in socially-anxious individuals under the effect of alcohol, and for this reason, a presentation time of 1500 ms was used. The results showed that attentional biases are not apparent at exposure durations of 1500 ms, suggesting that participants' attentional focus is switched at least once and they might have changed their attention from the emotional stimulus to the neutral face before the probe appearance (Weierich et al., 2008). Eye tracking studies in support of this explanation suggest that participants might shift their attention 350 ms after stimulus onset (Garner et al., 2006b). In this study, alcohol slowed reaction times in general, but there was no interaction between alcohol and social anxiety, suggesting that all participants were affected in the same way by alcohol (Grattan-Miscio et al., 2005; Schweizer et al., 2006; Gilbertson et al., 2010).

Task two involved the use of an antisaccade task to examine gaze patterns with socially-threatening stimuli among socially-anxious individuals after alcohol or placebo. In this task, participants were instructed to look away from the target location, in other words to inhibit a reflexive response and "reprogram" a new voluntary process. Participant eye movement data were recorded after consuming an alcoholic or a placebo drink; three types of stimuli were presented: angry, neutral and inverted faces. The first measure analysed was the average number of errors made by participants. Errors were increased by alcohol consumption. Both groups (HSA and LSA) showed impairments in inhibiting eye movements towards the angry face, especially after alcohol consumption, compared to neutral and inverted faces. Results indicated that emotional faces attract the participants' gaze, even when the instructions given were to look away from the stimuli. The initial hypothesis was that socially-anxious participants should have been more distracted and increased their error rates with angry faces relative to neutral faces. The results support just part of the hypothesis: the emotional face had an effect regardless of the participants' levels of social anxiety. Overall, participants found it more difficult to efficiently inhibit responses when presented with emotional stimuli such as an angry face. Accordingly, alcohol seems to affect participants' attentional control mechanisms, and the allocation of attentional resources to the threatening stimuli increases after alcohol consumption. In contrast with the vigilance hypothesis, socially-anxious individuals did not differ from low socially-anxious participants in time spent looking at the emotional face (e.g. Eysenck, 1992; Matthews, 1990). Although the study's outcomes are in line with the findings of Crevits et al. (2000), which suggested that alcohol increased error rates, it seems to contradict findings from Vorstius et al (2008), and Blekher et al. (2002), both suggesting that error rates in the antisaccade and prosaccade tasks are not affected by moderate alcohol intoxications. The current findings also contradict Vassallo and Abel (2002) and Khan et al. (2003), which reported a decrease in error rates after alcohol consumption. The difference in outcome might be attributed to the sample characteristics: in the study by Vassallo et al., they recruited seventeen males to perform the antisaccade task. Moreover, the alcohol dose was lower (0.44 mL/kg) compared to our study (0.65 mL/kg). In the study by Khan et al., only eight males were recruited for their experiments, compared with our much larger sample, which was primarily females. Furthermore, participants' error rates increased in both tasks when the stimuli were upright faces compared with the inverted face, suggesting that normal faces generate a stronger involuntary or voluntary saccadic orienting response. This is in line with previous studies that used inverted faces as a comparison stimulus and found that visual properties of the target can influence individuals' error rates (Valentine 1988; Gilchrist et al., 2006). The recognition of upright faces might induce an increase in the stimulus-related activity and therefore, a higher chance to commit an error. This suggests that the error could also be visual-attentional and not just motoric (Gilchrist et al., 2006).

In the present study, the lack of a social anxiety-related effect on error rates suggested that performance accuracy was not affected by anxiety. This might be caused by the design of the tasks: the antisaccade and the prosaccade tasks were performed by individuals in separate blocks (firstly, participants were shown with 144 antisaccade trials; secondly, participants were asked to perform a dot probe task; and thirdly, participants were shown with 144 prosaccade trials). Previous studies that have used a mixed-task design (antisaccade and prosaccade trials are shown during the same task block) have suggested that the task switching requires participants to allocate attentional resources differently, which might be affected more by anxiety during the performance (Ansari et al., 2008; Bishop et al., 2007). According to Ansari et al. (2007), their findings support the assumption of ACT, suggesting that anxious individuals have more difficulties exercising efficient top-down attentional control to distribute attentional resources according to task demands. The present study did not show an anxiety effect and this might be caused by the fact that tasks were performed separately and did not require a challenging task demand; participants had more time to get used to the task and adjust their performance during the task duration.

The second measure analysed was dwell time (the average time spent looking at the areas of interest) on the stimuli when participants made an error and failed to look in the opposite direction from the targets. In fact, in this antisaccade task, participants were instructed to make an involuntary saccade away from the stimuli. The outcomes indicated that in the alcohol condition, when participants did not look away, HSA individuals spent more time looking at angry faces compared with the LSA group. HSA participants have more difficulty disengaging attention from the targets after consuming an alcoholic beverage. Alcohol seems to increase all participants' dwell times for all types of faces.

The findings from the analysis of the eyes region supported in part the initial hypothesis: social anxiety did not affect participants' dwell times, and both social anxiety groups looked longer at angry eyes compared to neutral and inverted eyes. An antisaccade task requires participants to look away from stimuli and consequently to suppress an involuntary eye movement. Here, alcohol seemed to slow participants' eye movements and to increase fixation patterns around the three targets. Participants are better able to look away from the stimuli after placebo, thus following the instructions given at the beginning of the task.

The final measure analysed was participants' eye movement latencies. This measure represents the ability to process efficiently, and according to the attentional control theory, anxiety should impair this function (Eysenck et al., 2011). However, social anxiety did not affect latencies, and nor did the different facial expressions. In line with previous work, which reported that alcohol can impair oculomotor functioning, the present findings indicated that antisaccade latencies were significantly prolonged by alcohol, suggesting that alcohol might disrupt motor preparation in both HSA and LSA individuals (Vorstius et al., 2012; Roche et al., 2010; Khan et al., 2003; Bleckher et al, 2002). These outcomes suggest that social anxiety does not interact with alcohol to affect oculomotor functioning, since HSA and LSA participants are similarly affected by alcohol.

Task three involved the use of a prosaccade ttask to examine socially-anxious participants' gaze patterns in response to threatening stimuli, and how they are affected by alcohol. In this task, participants were required to make a reflexive saccade towards an appearing target. For the prosaccade task, an error happens when the participant's first fixations are directed away from rather than towards the stimulus. Participants' error rates increased on neutral and inverted faces compared with angry faces, suggesting that participants displayed a tendency to be more accurate for angry faces. This is in line with previous research which showed an enhancement in the detection of angry target faces (Fox et al., 2000). The earlier study suggested an adaptive explanation for this effect: an efficient visual system needs to "be fast at detecting potential threat and to maintain attentive processing in the location of threat once it has been detected" (Fox et al., 2000). However, analogously with the antisaccade task, social anxiety did not affect participants' error rates. Alcohol increased overall error rates for neutral and inverted targets, suggesting that participants were more likely to look away from faces when neutral and inverted targets were shown on the screen and more likely to look at the stimuli when angry faces appeared. These results are in contrast with previous research suggesting error rates are not affected by moderate alcohol intoxication (Vorstius et al., 2007; Blekher et al., 2002). The second measure recorded (dwell times) confirmed these outcomes for error rates: all participants spent significantly more time looking at angry faces, compared with neutral and inverted stimuli, suggesting that the participants' attention was generally more attracted to emotional faces. Alcohol seemed to reduce participants' dwell times when looking at faces. HSA participants spent more time looking at faces after drinking a placebo compared with LSA participants. In contrast, alcohol increased dwell times when participants looked at the eyes regions. When looking at mouths, participants spent significantly more time looking at inverted mouths compared with angry and neutral mouths. This was perhaps understandable since the mouths of inverted faces were effectively placed in the same screen position as the eyes for the neutral and angry faces, suggesting a tendency to look in the eye region of faces in general. These results contrast with the initial hypothesis that HSA individuals would differ from LSA participants in avoiding the eye region. In contrast, the findings showed that social anxiety did not affect participants' dwell times or the regions they looked at.

When analysing the antisaccade and prosaccade tasks separately, neither alcohol nor type of stimulus influenced participants' prosaccade latencies. In contrast, social anxiety did affect participants prosaccade latencies: LSA participants had shorter latencies compared with HSA participants, reflecting a tendency for low socially-anxious participants to initiate saccades more quickly towards stimuli and therefore, faster reaction times towards faces. This is in contrast with previous literature that reports a lack of anxiety effect in prosaccade latencies (Sluis et al., 2017; Weiser et al., 2009).

A limitation of this study is that a relatively small sample size was used, based on the typical sample sizes used in previous, analogous studies. A more appropriate method for deriving sample size would have been via power analysis, incorporating estimates of the effect size for the critical interaction (Drug x social Anxiety) that was tested throughout. Post-hoc power analyses were conducted using G*Power as a way of estimating an appropriate sample size for this study (Faul et al., 2007). The most closely comparable study was by Moutinho and colleagues (Moutinho et al., 2021), which investigated social anxiety and eye tracking, albeit that alcohol's effects were not tested. Moutinho et al. (2021), with an effect size of $r = .061$, $\alpha = .05$ and power = .80, the expected sample size would have been 36 participants, but they used a sample size of 28 participants. However, the interaction was not significant, so it is difficult to estimate sample sizes on the basis of this. It is difficult to find in the literature other examples of effect sized that tested similar interactions. The findings of this study showed that the interactions between social anxiety and alcohol had an effect size that ranged between .11 and .13. Despite a relatively small sample size we have significant results between high socially-anxious and low socially-anxious participants. Larger sample sizes may increase the power to detect group differences in some of the measures we tested.

2.6.1. Conclusion

An acute dose of alcohol impaired overall performance in all three tasks, by increasing the eye tracking errors made by participants, regardless of their level of social anxiety. In task one, social anxiety affected participants' eye movements by increasing the time spent looking at face stimuli overall. In task two, HSA participants spent more time looking at faces only after drinking alcohol, while in task three, HSA participants spent more time looking at faces after placebo than after alcohol. In task one there was a lack of effect of the type of face (emotional expressions); in tasks two and three there was an effect on participants' performance under the influence of alcohol when emotional faces were displayed. The findings suggested that all participants produced prolonged dwell times with angry faces.

According to the Attention Allocation Model (Steel et al., 1990), alcohol reduces attentional capacity during the performance of an activity and therefore, socially-anxious individuals would allocate more attention to the salient activity, reducing the capacity for anxious or stressful thoughts during the situation. In contrast with the theory, the findings overall do not show selective effects of alcohol on socially-anxious individuals, but instead show effects on both groups overall, suggesting a general effect of alcohol on individuals' cognition and performance. Furthermore, the AAM model differentiates between high demand activity (for example, the antisaccade task) and low demand activity (for example, the prosaccade task), suggesting that individuals with social anxiety might show more of a response to threat when performing the low demand activity compared with the high demand activity. However, the current findings are also in contrast with this assumption, as there was no effect of social anxiety in either task.

Overall, the effects of social anxiety and alcohol on eye tracking measures (reflecting attention) were limited. It was therefore decided to look at other cognitive processes, not involving eye tracking, but that have been shown to be altered in social anxiety and that might be affected by alcohol. In this context, a focus of recent interest has been on decision-making processes in people with social anxiety, and how these processes are affected by alcohol. The next chapter explores decision-making in this way using tasks other than eye tracking. Additionally, a new dot-probe task was included as follow-up to task 1, in order to test whether attentional bias related to social anxiety can be shown (and modified by alcohol) using a more conventional dot-probe paradigm with shorter stimulus presentation (Chan et al., 2002; Egloff et al., 2003; Mogg et al., 1999; Macleod et al., 1986).

Chapter 3

(Tasks 4 – 6)

Effects of an acute dose of alcohol on decision-making and attention in people with social anxiety disorder

3.1. Introduction

Tasks 1-3 were conducted in order to investigate how eye movements in socially-anxious and non-socially-anxious people are affected by alcohol when they are presented with stimuli that might be considered highly-salient to socially-anxious people. While the tasks in the previous study measured attention via eye movements, the current study investigated the effects of a similar amount of alcohol on decision-making processes in HSA and LSA participants. Additionally, this study also tested attentional bias for threatening stimuli in SA/LSA participants using a more conventional dot-probe reaction-time task than the one used in the earlier eye tracking study (task 1). As in the previous chapter, for this series of tasks it was expected that

HSA and LSA participants would exhibit different decision-making behaviours in a non-drug (placebo) condition, since HSA participants will allocate attentional resources differently compared to LSA participants, especially when threat-related stimuli are presented. However, alcohol is expected to reduce this disruptive effect in HSA participants, so the performance difference between the two groups should be attenuated after the consumption of alcohol.

The studies reported in this chapter examined the effects of alcohol on three cognitive tasks, two of which tested decision-making (modified IOWA task, game of dice task) and one of which tested attentional bias via a conventional dot-probe procedure. The dot-probe task was conducted to test whether shortening the stimulus presentation time (relative to the previous study) allowed an attentional bias to be detected (it might then be altered by alcohol in HSA participants). The modified IOWA task was used to measure decisions under conditions of ambiguity, whereas the game of dice task was to measure decision-making in a situation with explicit rules.

3.1.1. General anxiety, Social anxiety and decision-making

Previous research has shown how individuals with GAD tend to allocate working memory capacities and attentional resources in order to seek cues of possible future losses (Mathews & MacLeod, 1985; Mogg & Bradley, 1998; Borkovec, 2002; Borkovec, Alcaine, & Behar, 2004; Borkovec & Sharpless, 2004; Hayes, Hirsch, & Mathews, 2008). Mueller et al. (2010) investigated individuals' sensitivity to future loss and reward in participants with GAD and in controls by using a decision-making paradigm. Their outcomes suggested that individuals with GAD learned significantly faster than participants without GAD to avoid selections on a task associated with long-term loss, indicating that generally-anxious individuals adopt different learning strategies that are more future-oriented (Mueller et al., 2010).

These studies were conducted on individuals with GAD; however, the effects might be different for individuals with SAD or high levels of social anxiety. According to the American Psychiatric Association, social anxiety may influence individuals' perceptions of the risks and benefits of particular situations involving social interactions. This effect on risk/benefit perception might influence a socially-anxious individual's propensity toward risky decision-making and risk-taking (APA, 2000). A large number of studies have investigated socially-anxious individuals' behaviours that involved decision-making processes. Beidel et al. (1998) reported that socially-anxious people are typically characterised by shyness, inhibition and risk aversion (Beidel & Turner, 1998). Consequently, people with social anxiety might avoid exposure to risky situations, like attending certain social events (Myers et al., 2003) or joining substance-using peer groups (Fergusson et al., 1999). When socially-anxious people choose to avoid a certain situation, they are often aware of the missed opportunities and lost benefits (Kashdan et al., 2008). For example, a person with social anxiety might avoid a job interview even if s/he is aware of the potential lost benefit for his/her career. Socially-anxious individuals then face a conflict of opposite choices: the avoidance of the situation to reduce anxiety versus approaching it to gain the benefits from the same situation. Stein and Paulus (2009) define pathological avoidance as a dysfunctional shift toward avoidant decisions. A loss of benefits is the result of this shift.

According to other studies, however, socially-anxious individuals might also show the opposite characteristics to the ones described above, such as disinhibition or risk-prone behaviours (Buckner et al., 2006; Erwin et al., 2003; Hanby et al., 2012; Kashdan et al., 2008; Kashdan et al., 2010; Kashdan et al., 2009; Rounds et al., 2007; Schneier et al., 2010). Kashdan et al. (2008) investigated the relationship between social anxiety and different appraisals for particular situations of social interactions and risk-taking behaviours by asking socially-anxious and non-anxious participants to rate 51 social events which also involved risk-taking behaviours. Their findings showed that HSA individuals evaluated risk-taking activities as to be avoided but also as having the potential to satisfy curiosity and advance their social status, suggesting that unwanted anxious reactions might co-exist with the recognition of reward incentives (Kashdan et al., 2008). Feelings of anxiety and curiosity might be evoked through exposure to challenging and new situations (e.g. meeting new people, risk-taking sports); these potential incentives are suggested to evoke intense curiosity in socially-anxious people who show exploratory responses (Kashdan, 2004; Silvia, 2006; Spielberg & Starr, 1994). For a socially-anxious person, the engagement in risky behaviours is associated with a feeling of reward, and consequently it might become a strategy to appear more socially attractive to other people (Baumeister & Tice, 1990; Gilbert, 2001). Stein and Paulus (2009) called this effect of approach and avoidance, the ‘Yin and Yang’ of anxiety disorders. There is a neurobiological explanation for this coexistence: norepinephrine and dopamine are respectively involved as important modulatory neurotransmitters in reward- and fear-related processes (Stevens et al., 2014). Dysfunction of these neurotransmitters systems may cause specific symptoms, such as emotional numbing or hyperarousal and sensitization (Stein and Paulus, 2009).

Previous research has shown that individuals who abuse alcohol show difficulties in decision-making and make more risky decisions compared with non-alcohol abusers (Bechara & Damasio, 2002). Laboratory studies have produced similar findings in social drinkers after an acute dose of alcohol. For example, Lane, Cherek, Pietras & Tcheremissine (2004) conducted a study in which participants were required to perform a risk-taking task and choose between two responses (defined as risky and non-risky) after consuming either placebo, 0.2, 0.4, or 0.8/kg alcohol. Their findings showed that participants were likely to repeat risky responses after consuming an acute dose of alcohol (Lane et al., 2004). A possible explanation is provided by the evidence that alcohol influences executive functions (such as working memory, response inhibition and attentional set shifting; Abroms, Fillmore & Marczinski, 2003).

Behavioural economists have demonstrated that there is a tendency among people to have an aversion towards ambiguity. This assumption has been supported by several neuroimaging studies that explored the brain areas activated during decision-making processes in situations involving risk and ambiguity (Volz et al., 2005; Krain et al., 2006; Yoshida and Ishii, 2006). These studies suggested that the regions activated in situations in which the individual is encoding the level of uncertainty are the amygdala, the striatum and the orbitofrontal cortex (OFC). In contrast, the brain area involved when individuals are inhibiting the impulsive aversion to ambiguity and when they are analysing the context to determine the uncertainty is the lateral prefrontal cortex. Furthermore, the regions activated during the estimation of possible future risky outcomes are the posterior parietal cortex and the dorsal striatum (Hsu et al., 2005; Huettel et al., 2006). Neuroimaging studies have also investigated the relationship between addictions and decision-making. After a period of abstinence, people with addictions might show behavioural pathologies (Kalivas and Volkow, 2005). Chronic dependence patients frequently show neurological disorders, such as ataxia, visuospatial disorganisation and executive dysfunction (Scheurich, 2005; Sullivan and Pfefferbaum, 2005). A considerable number of studies found evidence of impaired decision-making in patients with alcohol dependence.

Over the last 20 years, the IOWA Gambling task (IGT; Bechara et al., 1994) has been used widely in the field of decision-making and as a tool for clinical assessment (Dunn et al., 2006; Bechara, 2007). During the IGT task, participants are typically instructed to maximise winning while choosing repeatedly - 100 times - a card from 4 decks. Each card indicates a net gain or a loss of money. The key manipulation lies on the four decks: two of them are programmed to be advantageous and ‘good’ in the long term (small winnings but with an overall net gain of money), and two of them are designed to be disadvantageous and 'bad' in the long term (bigger winnings but even bigger losses, with an overall loss of money). The challenge of the game lies in tracking the overall yield from each of the four decks. Previous research that examined the neural substrates underlying decision-making and reward processes showed that delay-discounting tasks measuring impulse control and intertemporal choice in decision-making situations are associated with immediate reward (Wittman et al., 2008). Several studies have shown that alcohol-dependent patients select more choices related to future loss compared to controls (Mazas et al., 2000; Kim et al., 2003; Fein et al., 2004; Dom et al., 2006b; Loeber et al., 2009; Miranda et al., 2009; Salgado et al., 2009). Early-onset alcohol dependent patients show a preference to select cards from decks associated with immediate reward but also associated with greater loss in the long term (Dom et al., 2006a; Bickel et al., 2007). The underlying psychological mechanism for the extensive decision-making deficits has been investigated in alcohol dependence (Robinson and Berridge, 2003). Individuals with alcohol dependence showed an impairment in the executive functions and an excessive attribution of motivational salience to reward that might cause anomalous decision-making processes (Fein and Chang, 2008). Kim et al. (2011) investigated the behaviours of alcoholic patients while they were performing the IGT and the Game of Dice task (GDT; Brand et al., 2005). The GDT is a gambling task that provides within the instructions explicit rules about the risks associated with each choice that participants are required to make (Brand et al., 2005). Their findings suggested an overall capacity on the IGT to learn from the previous selections to guess the probability distributions of each deck. However, individuals with alcohol-dependence showed poor performance on the later IGT trials and on the GDT, compared to controls, suggesting that individuals with alcohol dependence might have a different sensitivity to reward and punishment (Gul and

Pesendorfer, 2005). Based on these findings, the authors suggested that there is biassed attribution of motivational salience in people with alcohol dependence during low IGT performance. In line with these assumptions, previous literature suggested that alcohol-dependent patients may be more sensitive to reward and towards the stimuli predicting it. This may be one of the factors that leads to compulsive and persistent drug-taking (Kalivas and Volkow, 2005; Leland and Paulus, 2005; Hyman et al., 2006; Bjork et al., 2008; Fein and Chang, 2008). Additionally, neuroimaging studies also showed that executive functions (e.g., working memory, response inhibition and cognitive flexibility) might be compromised in alcohol dependent individuals, causing anomalous decision-making compared to healthy individuals (Noel et al., 2007; Verdejo-Garcia et al., 2007b). In summary, previous research has extensively explored the mechanisms underlying IGT performance in alcohol dependent individuals; however, much less is known about the effects of alcohol on healthy individuals while performing the IGT. One such study was by Balodis et al. (2006), who investigated whether acute alcohol intoxication produced impaired decision-making by participants while performing the IGT and a task measuring impulsivity, the Newman Perseveration task (NT). The first 46 participants were not informed about the real aim of the study, instead, they were told that the project was examining the effects of alcohol on memory and that the two tasks were used as 'distractors' tasks. This group received a simplified version of the instructions. In contrast, the last 86 participants were informed that the study was measuring the effects of alcohol on decision-making processes and received full instructions about the two tasks. Participants who were instructed about the real purpose of the study performed significantly better than participants who believed that the card games were 'distractor' tasks. However, both groups had increased scores regardless of either knowledge level or intoxication level. Their outcomes implied that the performance of intoxicated and sober participants did not differ, suggesting that there are other individual characteristics (such as personality traits) that might play a more important role in decision-making processes (Balodis et al., 2006).

Gilman et al. (2012) investigated the effects of intravenous alcohol on risky decision-making, suggesting that participants who experience less sedative and more stimulatory effects of alcohol show an increase in risky choices. In the same study, significantly greater activation in the striatum was visible under the effect of alcohol, while participants were making risky choices compared with the safe choices condition. These outcomes suggested that, during a decision-making process, alcohol might influence risk-taking behaviours by activating the brain regions involved in reward and might impair the response to positive and negative feedbacks (Gilman et al., 2012). Additionally, studies have suggested that heavy drinkers are more likely to take risks after drinking and to report stimulant rather than sedative effects under the influence of alcohol (King et al., 2002; Goudriaan, Grekin & Sher 2007; Yan & Li 2009; Huang, Jacobs & Derevensky 2010).

In summary, there are overlaps between the brain structures involved in social anxiety, decision-making and alcohol's effects . The cerebellum, the neocortex (especially the frontal lobes) and the limbic system are the brain areas widely considered to be most vulnerable to alcohol's effects during the performance of tasks involving decision-making processes (Moselhy et al., 2001; Oscar-Berman et al., 1993; Sullivan, 2003). Those regions are the same as the ones activated during related cognitive tasks (e.g. the dot probe task and the IGT) which involve attention and decision-making processes (Xiangrui Li et al., 2010; Mueller et al., 2010). Neuroimaging studies have also shown that socially-anxious individuals present neural activation to threat-provoking stimuli over the temporal and frontal cortices as well as limbic structures (Frick et al., 2014).

3.1.2. Emotions and decision-making

Several studies have explored the role of emotions when making decisions (e.g. Bechara et al., 1997; Loewenstein et al., 2001), suggesting that socially-anxious individuals might show biases in their decision-making processes and avoidance behaviours compared to non-socially-anxious individuals. For example, the somatic marker theory (Damasio et al., 1991) suggests that decisions are influenced by the emotional responses (defined also as "gut feelings"or as "embodied markers") activated in the decision-making process. These emotional responses can also be associated with specific choices. Different studies explored these mechanisms using the IGT or related paradigms and have often measured skin conduction responses (SCRs) as predictors (or correlates) of decisions (Bechara et al., 1997; Suzuki et al., 2003; Lawrence et al., 2006; Starcke et al., 2009; Pittig et al., 2014). Additionally, physiological responses have often been shown to be related to the processing of facial expressions, and in particular of angry faces (Johnse et al., 1995; Stein et al., 2002; Springer et al., 2007; Anokhin and Golosheykin, 2010; Alpers et al., 2011).

Pittig et al. (2014) combined the features of benefit and loss conflict to investigate behavioural avoidance as a decision-making process. The authors created a new experimental paradigm based on the IOWA gambling task (Bechara et al., 1994, 2000). The new experimental paradigm involved a modified gambling task, which included 4 decks of cards showing angry and happy faces instead of numbers. The choice of threatening facial expressions was based on the assumption that facial expressions can cause greater emotional responses in socially-anxious individuals compared with non-socially-anxious people (see Chapter 1, pp. 54). Previous research showed how emotional facial expressions are processed preferentially and result in specific behavioural responses (e.g., Alpers and Gerdes, 2007; Bublatzky et al., 2014b; Eisenbarth et al., 2011; Gerdes et al., 2012; Neumann et al., 2014). A confrontation with angry faces compared to happy faces may trigger avoidant decisions in socially-anxious individuals (Horstmann, 2003; Marsh et al., 2005; Seidel et al., 2010). Moreover, previous studies have also looked at the effects of alcohol on face processing, showing that alcohol may have an emotion-specific effect only on angry faces (Khouja et al., 2019).

Evidence of how angry facial expressions may influence decision-making processes in healthy individuals is provided by studies that associated rewards and losses with facial expressions (Averbeck and Duchaine, 2009; Furl et al., 2012). In these studies, participants were asked to select which emotional expression – between angry and happy faces - yielded more frequent rewards. Their findings showed that participants selected more happy faces even when the angry faces gained more wins (Averbeck and Duchaine, 2009). Pittig et al., (2014) conducted a study using the IGT paradigm in which the cards were represented by either angry faces (linked with advantageous choices) or happy faces (linked to disadvantageous choices) to assess whether socially-anxious participants showed particular biases in decision-making processes caused by emotional expressions, compared to non-socially-anxious individuals. In their study, levels of social anxiety and social avoidance were assessed using the Liebowitz Social Anxiety Scale. Initially, both groups made fewer advantageous choices (linked with angry faces), suggesting that all participants avoided the desks with angry facial expressions at the beginning of the task. Participants that scored higher on the social avoidance scale showed more avoidant decisions than the other group during the early stages. However, this effect was limited to the beginning of the task, when the contingencies were still unknown. Towards the end of the task, there was no effect of social avoidance, suggesting that all participants learned to play the game effectively, by selecting the advantageous cards regardless of the facial expressions linked with them. Their findings suggested that angry facial expressions may have a different effect on rational decisions in socially-anxious individuals compared to non-socially-anxious individuals and that those avoidance behaviours were not triggered by threatening faces in socially-anxious individuals, confirming the assumption that social anxiety is a "multidimensional construct with multiple stimuli and cognitive processes as potential triggers for anxious responses" (Hofmann et al., 2004; Bögels et al., 2010).

In addition to the IGT, the Game of Dice Task (GDT; Brand et al., 2005) has frequently been used in a laboratory setting to measure risky decision-making. During this task, similar to the IGT, participants are instructed to maximize their winnings, but in this case by guessing the number total that results from the throwing of two dice. In contrast with the IGT, in the GDT participants are presented explicitly with the amount to be won or lost that is associated with each choice.

These two tasks are frequently used together because while in the IGT participants are required to choose under ambiguity, in the GDT participants are informed from the start of the task about the risks and benefits associated with each selection. Therefore, the combination of the two tasks might help us to understand if a poor performance on decision-making tasks is caused by a generic decision-making impairment or an information sampling impairment. However, there is not much evidence about the effect of social anxiety (or anxiety more broadly) on the GDT, and the few clinical studies to date have reported contradictory results regarding the GDT and risky decision-making. According to Drechsler et al. (2008), individuals with attention-deficit hyperactivity disorder (ADHD) made more risky choices than controls when performing the task. In contrast, in another study, participants with obsessive-compulsive disorder (OCD) – often associated with anxiety - did not perform the GDT differently from healthy participants (Starcke et al., 2010). Zhang et al. (2015) reported that anxiety affected ambiguous decision-making (IGT), but not risky decision-making (GDT). However, according to a more recent study conducted by the same author, participants with anxiety tended to be less risk-seeking than low anxious participants when performing the GDT (Zhang et al., 2017). The GDT is an important tool as it is used to simulate decisions under risk and participants are supposed to conduct a cost-benefit analysis and calculate the expected utility across the task in order to optimise their performance (Brand et al., 2007). Recently, the IGT and the GDT have been tested together on participants exhibiting problem drinking and at-risk gambling involvement after either consuming placebo or alcohol (Vera et al., 2018). Alcohol affected participants' performance on the IGT but not on the GDT, suggesting an intoxication effect only on the task in which participants are not instructed about the gains and the losses during their performance. However, the researchers associated the lack of an alcohol effect on the GDT with the timing of the alcohol administration; participants performed the GDT 40 minute after drinking alcohol, when alcohol concentration levels were declining (Vera et al., 2018). As noted, the IGT has been modified with an emotional component in some previous studies to measure decision making in particular groups of participants, when emotional stimuli are present. The task has been presented with the original GDT, not modified to include an emotional element, to measure risky behaviours more broadly in the same group of participants (Turner et al., 2018; Pittig et al., 2014). For example, Turner et al. (2018), measured impulsive decision making in sexual offenders used a modified IGT showing emotional pictures (child images) combined with the standard GDT. His findings showed an effect on the IGT but not on the GDT, suggesting an effect on decision making triggered by the presence of sexually relevant cues, but not a generic decision-making deficit (Turner et al., 2018). In this study, decision-making and the acute effects of alcohol were analysed in HSA and LSA participants using a modified version of the IGT and the standard GDT. The aim was to test if social anxiety and alcohol affect decision-making processes under conditions of risk and ambiguity. The IGT included an emotional component -

four cards displaying different emotional expressions - to test whether socially-anxious individuals would show different decision-making strategies for different facial expressions compared to low socially-anxious participants. The GDT was used as a comparison task, as is commonly the case, to test for generic deficits in decision-making behaviours in situations where the costs/benefits are made explicit (e.g. as in Turner et al., 2018; Zhang et al., 2017; Liebherr et al., 2017; Pittig et al., 2014; Zhang et al., 2011). The task necessarily cannot easily be modified to include a social or emotional stimulus component, although the presence of the experimenter inevitably introduces an expectation of social evaluation.

Additionally, for task 5, a dot probe paradigm was used to measure attentional biases under the influence of alcohol in socially-anxious and non-anxious individuals. Task 1 (Chapter 2) integrated a dot probe paradigm with eye tracking technology primarily as a way of generating eye movements as indicators of how attention is allocated. Because the critical interest was in analysing eye movements rather than reaction times, the study adopted a standard stimulus presentation time of 1500 ms for participants to look at the faces and their features. Alcohol impaired reaction time, but no effect of anxiety group or face type on attentional bias was found from the dot-probe reaction time scores. This is in line with studies that used similar stimulus presentation times and did not find attentional biases in socially-anxious individuals (Weierich et al., 2008). In contrast, a number of other studies have observed a consistent vigilance effect at shorter stimulus durations, suggesting that social anxiety might enhance early perceptual facial processing (i.e. Chen et al., 2002; Egloff & Hock, 2003; Macleod, Mathews, & Tata, 1986; Mogg & Bradley, 1999).

As mentioned in the previous chapter, research that has investigated attentional biases in anxious participants using face stimuli presented for either at 500 ms or 1.250 ms, has shown that high trait-anxious individuals performed differently compared with controls when stimuli were shown at 500 ms, suggesting that attentional vigilance for threat in anxious participants was apparent at the short stimulus duration but it was less apparent at longer time intervals (Bradley et al., 2010). In this study, consistent with research which has used shorter stimulus presentation times (Bradley et al., 2010), facial expressions were presented for 500 ms in order to investigate HSA and LSA participants' attentional biases under the influence of alcohol. A number of previous studies have measured skin conduction responses (SCRs) to predict emotional arousal during social challenges (Schultz et al., 2008) and to predict and correlate decisions, as disadvantageous decision making has been found to be be accompanied with reduced skin conductance responses (Bechara et al., 1997; Suzuki et al., 2003; Lawrence et al., 2006; Starcke et al., 2009; Pittig et al., 2014). Socially-anxious participants would be expected to show a selective cardiac acceleration in response to fear-relevant stimuli (Wieser et al., 2009; Elsesser et al., 2006; Ruiz-Padial et al., 2005; Sartory et al., 1990). For this reason, we included SCR measures to examine physiological responses during decision-making processes and as possible indicators of emotional arousal during the presentation of threatening stimuli (angry faces). SCR allowed an evaluation of the extent to which the cognitive effects that occur are mirrored by similar changes in physiological reactivity.

3.1.3. Aim of this study

The current tasks explored decision-making processes and attentional biases in HSA and LSA individuals under the influence of either alcohol or placebo. The modified IGT (Pittig et al., 2014) was used in order to examine socially-anxious participants' risky behaviours during a situation with high levels of ambiguity using social stimuli; the GDT was included as a control task to investigate risky behaviours during a situation with low levels of ambiguity and no social content (Task 4). Previous work has suggested that ambiguity is relevant to risky decision-making among socially-anxious individuals (Kim et al., 2011; Zhang et al., 2015). Task 5 was a dot probe paradigm to test participants' attentional biases when presenting emotional facial expressions for durations that have previously revealed effects of social anxiety, a follow-up to task 1. The shorter stimulus presentation time (500 ms vs 1500 ms in task 3) should allow for better measurement of the initial allocation of attention in HSA and LSA participants (Stevens et al., 2010).

For the IGT task the predictions were: 1) HSA individuals should avoid disadvantageous choices more than the LSA participants during the placebo condition; 2) alcohol should affect HSA participants' decision-making processes by making them less cautious compared with their performance during the placebo condition, making their performance more similar to that of the LSA participants. For the GDT task, 3) a weaker effect of social anxiety was predicted, as the task does not include any emotional or social element, therefore, both groups are likely to show a similar level of performance in the placebo condition; however, 4) alcohol should increase risk behaviours in both groups. For the dot probe task, we expected that: 5) threat-related stimuli would be processed preferentially by HSA participants in the placebo condition, producing an attentional bias, but this effect would be reduced after drinking alcohol; 6) Relative to HSA participants, the LSA participants would show less of a performance difference (if any) between alcohol and placebo conditions.

3.2. Methods

3.2.1. Participants

Students from Kingston University were recruited after completing an online survey via the software Qualtrics. The survey included general demographic questions and four questionnaires: the SIAS (Mattick et al, 1989), the Liebowitz scale (Liebowitz, 1987), the BFNE (Leary, 1983) and the Michigan Alcohol Screening Test (Selzer et al., 1971). Some minor changes to the exclusion criteria were made after the previous three tasks; the Kingston University Research Ethics Committee required the recruitment of individuals who had more drinking experience and were less likely to show an adverse reaction to alcohol than was the case in the previous study, therefore participants who drank more than 12 units per week (in contrast to the first study in which 8 units were enough to participate) were invited to participate in the study.

Other exclusion criteria remained the same as in Chapter 2: participants were currently in good health and not taking any medications; they had not experienced any unusual reactions to alcohol, and they were not pregnant. The Michigan Alcohol Screening Test (Selzer et al., 1971) included in the online survey confirmed that participants did not have any history of alcohol-related problems. Kingston University's Faculty of Arts and Social Sciences Research Ethics Committee approved the research protocol which also followed the ethical standards of the British Psychological Society and the Declaration of Helsinki 1964.

After the initial screening, 68 people participated in the tasks. Based on the considerations of effect size discussed in Chapter 2, the sample size for the current study was likely to be adequate (allowing for the absence of similar previous studies to provide strong estimates of power). The sample was also larger than is often used in related studies, and substantially larger than for the tasks in the previous chapter (see Chapter 2, pp. 115-116).

Similar to Chapter 2, participants were divided into two groups (HSA and LSA) based on their scores from the BFNE (Leary, 1984). Those who scored below 35 were assigned to the Low Social Anxiety (LSA) group, and those who scored above 38 were assigned to the High Social Anxiety (HSA) group. Participants could choose between monetary compensation (£20) or 150 course credits. Participants provided informed consent before participation.

3.2.3. Questionnaires

The questionnaires were the same as used for the tasks in Chapter 2. Participants were asked to complete two questionnaires during both test sessions while they were waiting for drink absorption: the alcohol and mood questionnaire and the DMQR (Chapter 1, paragraph, pp).

3.2.4. Physiological measures

3.2.4.1. Breath Alcohol Concentration (BAC)

In order to ensure the effectiveness of the alcohol manipulation, participants' breath alcohol levels were measured before the test session and just after with a breathalyzer (Drager Alcoltest 7410, Drager Sicherheitstechnik GmbH, Lubeck, Germany). Breath alcohol concentration was tested in both conditions (alcohol and placebo); breath alcohol concentrations in the placebo condition were always negligible and ranged between 0.00% and 0.05%).

3.2.4.2. Electrodermal Activity (EDA)

Electrodermal activity (EDA) was continuously recorded as a measure of emotional responses during the decision-making tasks using BIOPAC skin conductance instrumentation (MP150 Data Acquisition System for Windows: BIOPAC Systems, Inc), with a constant voltage of 0.5 V (sampling rate = 62.50 Hz). Two disposable Ag/AgCl electrodes with electrodermal conducting gel were attached to the palmar surface of the middle phalanges of the second and third fingers (or alternatively on the palm) of the non-dominant hand. Participants were instructed to avoid larger movements to not disrupt the physiological responses. Data monitoring, acquisition, and analysis were conducted with AcqKnowledge software (AcqKnowledge 4.1; BIOPAC Systems, Inc).

3.2.5. Administration of alcohol

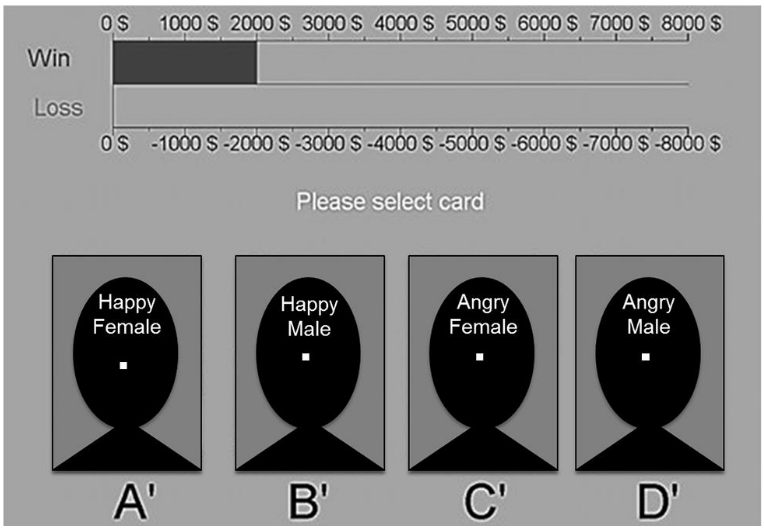
The drinking procedure was the same as for tasks 1-3 (see Chapter 2). The dose of alcohol was 0.65 g/kg body weight for men and 0.57 g/kg for women. This was equivalent to around 5.7 and 4.5 UK units of alcohol for average weight men and women, respectively.

3.3. Tasks

3.3.1. IGT and GDT

The IGT used for this study was the version created by Pittig in 2014. This version, modelled after the Iowa Gambling Task (Bechara et al., 1994, 2000), measures the effect of presenting facial expressions on decision-making. The pictures used for the IGT were taken from the Karolinska Directed Emotional Faces (KDEF, all pictures approximately 9.15’ x 5.73’ visual angle; Lundqvist et al., 1998), a well-validated picture set with moderately-expressive facial expressions (Adolph and Alpers, 2010). The task includes four decks of cards (A, B, C and D). Facial expressions of happy and angry faces were rotated for every condition. For example, if during the first session, a participant was shown pictures of happy facial expressions on card backs of decks A and B and two angry facial expressions on decks C and D, then during the second session the participant was shown two angry facial expressions on the card backs of decks A and B and two happy facial expressions on card backs of decks C and D. Participants were asked to select one card at a time from one of the decks for a total of 100 trials. The mouse-sensitive area for selecting a deck was reduced to a small square. Placeholders are used in Figure 3.1 because of the copyright terms of the KDEF.

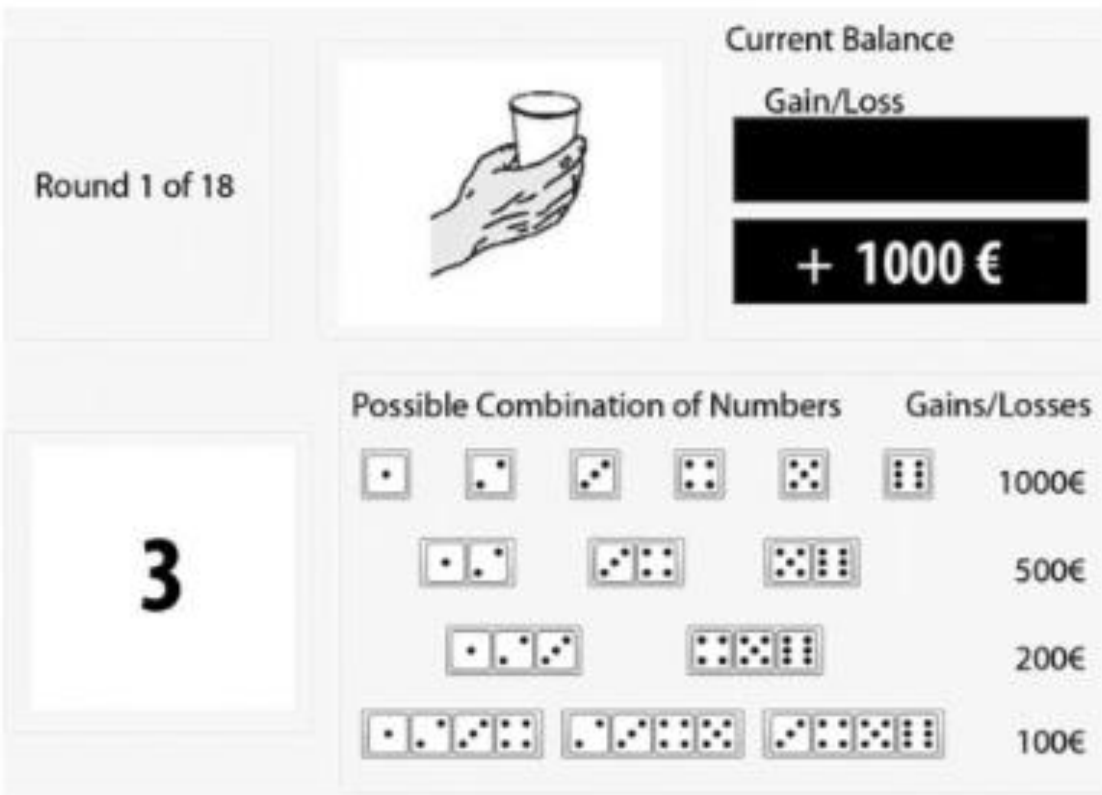
Figure 3.1: Screenshot of the social anxiety gambling Task with placeholders. White squares in the middle of each deck represent the mouse-sensitive area where participants had to click to make a selection.



In the example shown in Figure 3.1, the disadvantageous decks (A′, B′) are depicting happy facial expressions, whereas the advantageous decks (C′, D′) depict angry facial expressions. The mouse pointer moved back automatically to the centre of the screen after each trial; participants had to move it to make the next selection. This process made the facial expressions visible at every trial. Decks A and B represented disadvantageous choices: if selected, participants were shown either an immediate large gain on the screen, or occasionally larger losses (long-term loss: -$250 per 10 selections). Decks C and D represented advantageous choices: if selected participants received small immediate gains or small occasional losses (long-term gain: +$250 per 10 selections).

The game of dice Task (GDT; Brand et al., 2005) is a computerised Task used to measure general differences in risky decision-making. During this Task, a virtual dice is thrown and participants are asked on each trial (for a total of 18 trials) to guess either one or two, three and four numbers together at a time. When the guess matches the thrown number, participants win a specific amount of virtual money; if the guess is not correct, participants lose the same amount of money. The goal for the participants is to maximise the increase of a fictitious starting capital ($1000) by guessing the correct numbers thrown over 18 trials. If participants choose small numbers, these are associated with non-risky choices with a winning probability of 50% or higher (lower gains; i.e., a combination of three numbers with a 50% probability to win $200 and a combination of four numbers with a 66.67% probability to win $100). If participants choose larger numbers, these are associated with risky choices and have a lower winning probability, but are linked to higher gains (i.e., a single number with 16.67% probability to win $1000 or a combination of two numbers with a 33.33% probability to win $500). For example, if a participant bets on the combination of ‘five’ and ‘six’ and the ‘five’ or ‘six’ is thrown, the participant wins $500. In contrast, if the number ‘five’ or ‘six’ does not appear, the participant loses $500 (Figure 3.2). For analysis, a net score was calculated by subtracting the number of risky choices from the number of safe choices. A higher net score indicated more non-risky choices.

Figure 3.2: The GDT: the hand with the shaker symbolizes the shaking of the dice. It is moving during the time that participants can make a decision and put down after the decision is made. Next, the shaker is lifted and the dice become visible.



3.3.2. Dot probe Task

Angry, happy, and neutral face images were selected from the NimStim Set of Facial Expressions (Tottenham et al., 2009). Each trial started with a fixation cross for a duration of 500 ms. After the offset, an emotional face (either angry or happy) paired with a neutral face of the same person appeared on a PC-screen for 500 ms, separated by a distance of 7.5 cm. Next, a dot-probe was presented at the location of the previous emotional face (congruent location) or the neutral target (incongruent location). Participants were instructed to indicate the nature of the probe by pressing, as quickly and as accurately as possible, 'M' if the dots were horizontal or 'Z' if the dots were vertical. The probes remained on the screen until the participant made a response; participant reaction times and responses were recorded for each trial. The emotional target primes and dot-probes were counterbalanced between the left and the right position. In line with previous literature, we used 160 trials: 64 angry-neutral, 64 happy-neutral and 32 neutral-neutral filler pairs (Mogg et al., 2004). The task lasted approximately 20 min in total and it was presented using the experimental software SuperLab (Cedrus Corporation; San Pedro, CA).

3.4. Results

3.4.1. Participants characteristics

The characteristics of the 68 participants are shown in Table 3.1. The sample had an overall BFNE score of 36.81 (SD= 9.49). The mean score of the high social anxiety group was 44.19 (SD= 5.41); while the low social anxiety group had a mean score of 28.5 (SD= 5.2). There was a significant difference in mean alcohol units consumed per week between the HSA and LSA participants ($t(66) = 2.07$, $p = .04$) suggesting that HSA individuals drink significantly more per week (M=23.92, SD= 12.83) compared with LSA individuals (M= 18.72, SD= 7.39). There was also a significant difference in mean levels of breath alcohol concentration between groups (t(66)= 2.56, p =.01) showing that HSA participants have higher blood alcohol levels for the same dose (M = .28, SD= .12) compared with the LSA group (M = .21, SD= .10). Electrodermal activity results could not be extracted due to machine malfunction and so was not analysed.

	LSA Group	HSA Group
Age (years)	M=26.56; SD= 8.26	M= 25.41; SD= 8.61
Alcohol (UK Units)	M= 12.83; SD= 2.14	M=23.91; SD= 18.71
Breath Alcohol Pre Test	M= .21; SD= .1	M= .28; SD= .11
Breath Alcohol Post Test	M= .23; SD= .08	M=.27; SD= .1
BFNE	M= 28.5; SD= 5.19	M= 44.19; SD= 5.41

Table 3.1: Mean scores and standard deviations for the high socially anxious participants (HSA group) compared with the low socially anxious participants (LSA group); social anxiety group division is based on BFNE scores (N=68)

3.4.2. Drinking motivations and subjective responses to alcohol

An independent t-test was run to investigate if social anxiety group (LSA vs. HSA) affected any of the drinking motivation factors (social, enhancement, coping, conformity) and the feeling of relaxation before and after consuming either the alcoholic or the placebo beverage. The t-test indicated a significant effect for coping factors, t(66)= 2.37, p = .02: HSA participants reported higher coping motives compared to LSA participants. However, mean scores on the other factors (conformity, social and enhancement) were not significantly different between groups.

A 2 x 2 x 2 x 2 repeated measures ANOVA with 1) Time (Before and After the drink); and 2) Drug (Alcohol vs. Placebo) within-factors; and 3) Social Anxiety Group (HSA vs. LSA) between factors was used to analyse separately the items “Relaxed”, “Alert” and “Lightheaded”, from the Alcohol and Mood Questionnaire. For the first item (Relaxed), the main effect of Alcohol was not significant, $F(1,64)= .15$, $p =.69$. Factor Time was significant ($F(1,64)=9.18$, $p =.004$), indicating that participants were feeling less relaxed before consuming the drink (M=6.72, SD=.19) and more relaxed after drink consumption (M=7.36, SD=.22). There was no main effect of Social Anxiety ($F(1,64)= .35$, $p=.56$). In contrast, for the item Alert, Alcohol produced a main effect ($F(1,64)= 8.52$, $p = .005$), suggesting that participants were feeling less alert in the alcohol condition (M=5.52, SD= .24) compared with the placebo condition (M= 6.15, SD =.25). The main effect of Time was also significant ($F(1,64)= 16.83$, $p <.001$), showing that participants felt more alert before consuming the drink (M=6.25, SD=25) than after drink consumption (M=5.43, SD=.24). Social Anxiety was not significant ($F(1,64)= 2.09$, $p=.15$). For the item Lightheaded, Alcohol was significant ($F(1,64)= 35.61$, $p<.001$), suggesting that participants felt more lightheaded in the alcohol condition (M=3.4, SD=.23) compared with the placebo condition (M=2.09, SD=.29). Time was also significant ($F(1,64)= 71.53$, $p <.001$), showing that participants reported feeling less lightheaded before drinking (M=1.74; SD=.22) and more lightheaded after drinking (M=3.76, SD=.26). Social Anxiety was not significant, $F(1,64)=.18$, $p=.67$. There was a significant interaction between Alcohol and Time ($F(1,64)= 21.04$, $p<.001$), suggesting that participants felt more lightheaded after drinking, especially in the alcohol condition.

Table 3.2: Mean scores and standard deviations of drinking motives and alcohol and mood subscales of Low Socially-Anxious and High Socially-Anxious participants (N=68).

	LSA Group	HSA Group
DMQR-Social	M=16.5; SD=4.93	M=18.08; SD=4.69
DMQR-Coping	M=9.97; SD=4.03	M=12.39; SD=4.33
DMQR- Enhancement	M=14.97; SD=4.61	M=14.89; SD=3.97
DMQR- Conformity	M=8.28; SD=4.12	M=8.77; SD=3.69
Relax Before Placebo	M=6.85; SD=2.19	M=6.53; SD=1.899
Alert Before Placebo	M=6.84; SD=2.04	M=5.97; SD=2.45
Lightheaded Before Placebo	M=1.77; SD=2	M=1.29; SD=1.6
Relax After Placebo	M=7.2; SD=1.94	M=7.39; SD=1.9
Alert After Placebo	M=6.2; SD=2.15	M=5.53; SD=2.57
Lightheaded After Placebo	M=2.8; SD=2.72	M=2.51; SD= 2.53
Relax Before Alcohol	M=7.03; SD=1.61	M=6.47; SD=1.88
Alert Before Alcohol	M=6.21; SD=2.36	M=5.99; SD=2.57
Lightheaded Before Alcohol	M=2.1; SD=2.28	M=1.79; SD=2.3
Relax After Alcohol	M=7.5; SD=2.31	M=7.34; SD=2.46
Alert After Alcohol	M=5.31; SD=2.21	M=4.59; SD=2.16
Lightheaded After Alcohol	M=4.68; SD=2.67	M=5.03; SD= 2.41

3.4.2. Task 4 results

Bechara et al. (1994) suggested two ways to summarise the IGT data: mean number of selections from each deck over 100 trials, and mean net score (number of choices from good decks C and D minus the number of choices from bad decks A and B) over 100 trials. In 2000, the same author suggested calculating the mean net score as a function of each 20 trials block (Bechara, 2000). The average number of advantageous choices was our dependent variable. A 2 x 2 x 5 mixed model ANOVA with Drug (Placebo vs. Alcohol), Trial Block (5 blocks of 20 trials each) as within-subject, Social Anxiety group (LSA VS HSA) as between-subject factors, and Alcohol Units as covariate due to the difference in baseline intake levels.

There were no main effects of Alcohol (F(1,63)= .67, p =.79, partial η^2 =.001), or Social Anxiety (F(1,63) = .95, p = .33, partial η^2 =.01), or Alcohol Units (F(1,63) = .13, p = .72, partial η^2 =.002). However, the interaction between Alcohol and Social Anxiety was statistically significant, F (1,63)= 8.49, p =.005, partial η^2 =.12), suggesting that LSA participants selected more disadvantageous choices after alcohol compared with the placebo condition, whereas HSA participants selected fewer advantageous choices in the placebo condition compared with the alcohol condition (Figure 3.4). Trial was also significant, (F(1,63) = 6.4, p = .01, partial η^2 =.09), showing that participants improved their performance across the five decks (Figure 3.3). Post hoc t-tests showed a significant difference between HSA and LSA groups on Trial block 2 (t(66)=-2.3,p=.02), Trial block 3 (t(66)=-2.5, p=.01), and Trial block 4 (t(66)=-2.6, p=.01) of the Placebo condition, but none of the trial comparisons were significant for the Alcohol condition, suggesting that performance after alcohol was more similar between the 2 groups .

Figure 3.3: Mean numbers of advantageous choices over 100 trials (N=68). Higher scores indicate more frequent choices from the advantageous decks.

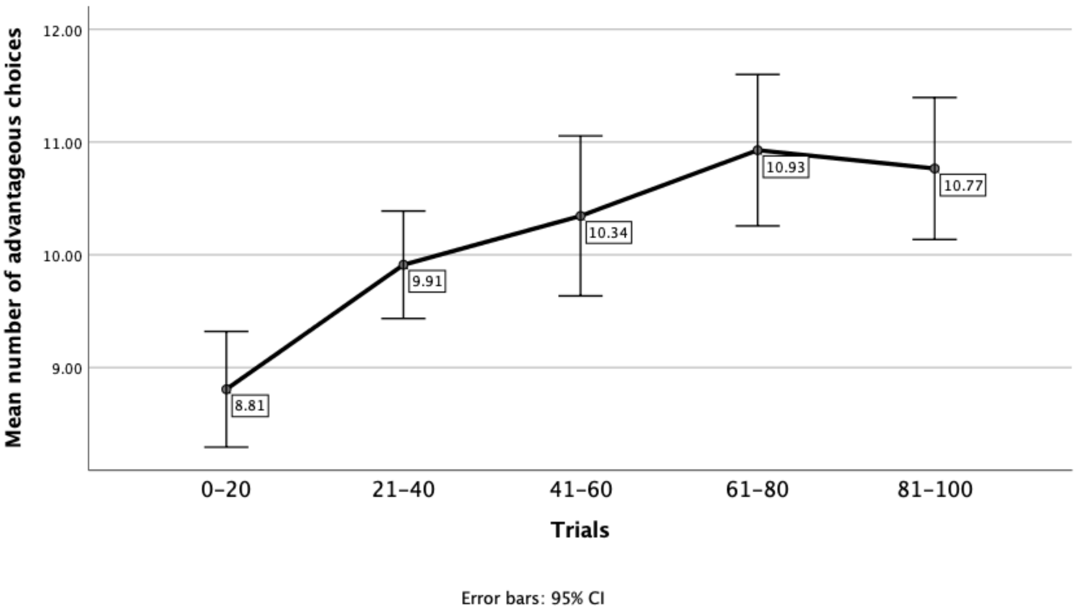
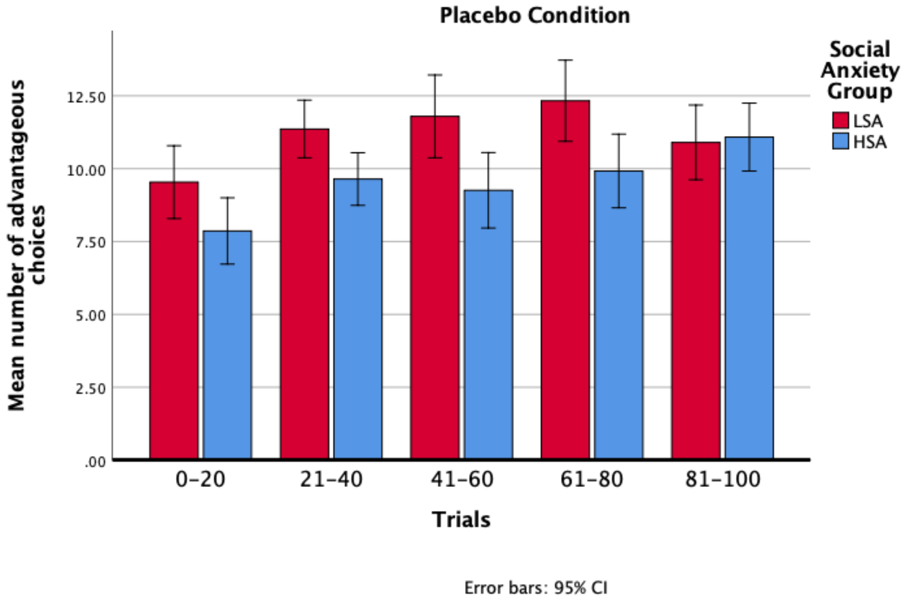
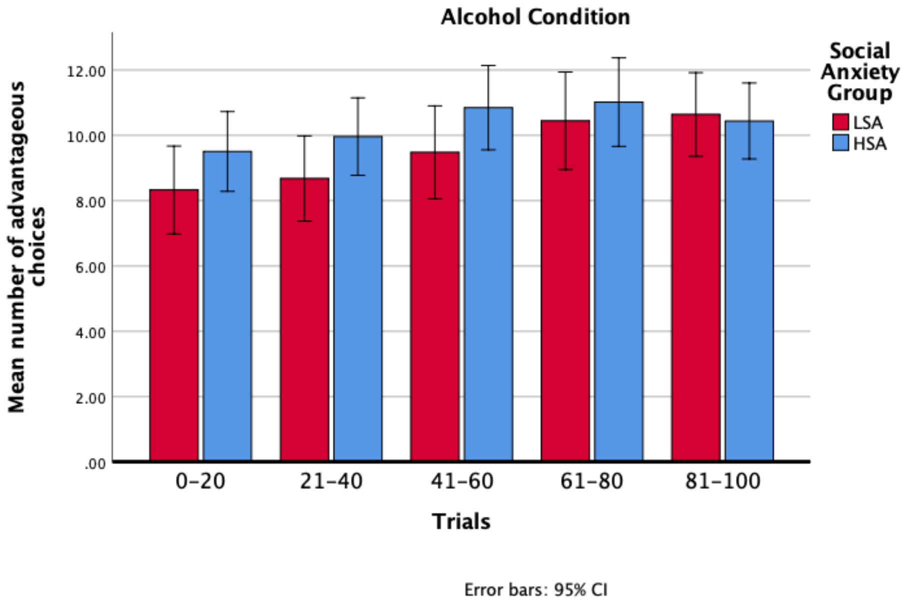


Figure 3.4: Mean number of advantageous choices made by High Socially-Anxious and Low Socially-Anxious participants after either drinking placebo or alcohol (N=68).





For the GDT, A 2 x 2 x 2 mixed model ANOVA was conducted with Drug condition (Placebo vs. Alcohol) as within-subjects factors, Social Anxiety (LSA vs. HSA) as between-subjects factors and Alcohol units as covariate. The main effect of Alcohol was not significant, $F(1,63) = 2.77$, $p = .11$, partial $\eta^2 = .04$, suggesting that participants did not differ on risky choices between the placebo (M= 8.17, SD= .93) and the alcohol (M=7.62, SD= 1.01) conditions. The main effect of Social Anxiety was also not significant, F(1,63) =.92, p = .34, partial η^2 =.01, as well as Alcohol Units, F(1,63) =2.5, p = .12, partial η^2 =.03 . The interaction between Social Anxiety and Drug was also not significant, F(1,63) =1.41, p = .24, partial η^2 =.02, (Table 3.3).

Table 3.3: Mean Game of Dice Task net scores in Low Socially-Anxious Participants and High Socially-Anxious after drinking placebo or alcohol (N=68).

	LSA	HSA
Placebo Condition	M=8.69; SD= 1.36	M=7.67; SD= 1.29
Alcohol Condition	M=7.31; SD= 1.47	M=7.94; SD= 1.39

3.4.4. Task 5 Results

Trials with inaccurate responses were removed for all reaction time (RT) analyses. First, trials were analysed when the dots appeared behind an angry face, compared with trials where dots replaced neutral faces. Then, analyses of trials where dots replaced happy faces, compared with trials where dots appeared after a neutral face. Thirdly, in line with Cooper et al. (2006), analyses of trials when dots appeared either after an emotional stimulus (angry or happy), compared with trials when dots replaced neutral stimuli. Finally, bias scores were analysed following the procedures adopted in some previous studies (e.g. MacLeod and Mathews, 1988; Cooper et al., 2006). Similarly to Task 3 in the previous chapter, we conducted repeated measures ANOVAs to analyse reaction times for each type of stimuli.

3.4.4.1. Reaction times: angry vs neutral

A 2 x 2 x 2 repeated measure ANOVA was run with two within-subject factors of (1) relative Probe Position (probe appears in location of an angry or neutral stimulus), and (2) Drug (placebo, alcohol); a between-subjects factor of Social Anxiety (HSA vs LSA) and Alcohol units as covariate. The main effect of Alcohol approached significance, F(1,62) = 3.17, p=.08, partial η^2 =.04. The main effect of Social Anxiety was not significant, F(1, 62)= .25, p=.62, partial η^2 =.004, and Probe Position was also not significant, F(1, 62)= .11, p=.75, partial η^2 =.002. The interaction between Alcohol and Social Anxiety was also not significant, F(1,62) = . 1.65, p= .21, partial η^2 =.02. Social anxiety scores and face type did not affect participants' reaction times. In conclusion, the findings showed no evidence of an attentional bias according to face type or anxiety status.

3.4.4.2. Reaction times: happy vs neutral

A 2 x 2 x 2 repeated measure ANOVA was run with (1) Probe Position (happy vs neutral) and (2) Drug condition (placebo vs alcohol) as within-subject factors, and with Social Anxiety group (HSA vs LSA) as a between-subject factor. Alcohol units consumed was a covariate. There was a main effect of Alcohol, F(1,62) = 4.69, p=.03, partial η^2 =.07, indicating that participants were faster after placebo (M=630.89 ms; SD= 16.45 ms) than after alcohol (M=672.52 ms, SD=16.13 ms). Social Anxiety group was not significant, F(1,62) = .06, p= .79, partial η^2 =.001, neither was Probe Position (F(1,62)= 1.29, p =.26, partial η^2 =.02). The interaction between Alcohol and Social Anxiety was also not significant (F(1,62)= 1.81, p =.18, partial η^2 =.02).

3.4.4.3. Reaction times: Emotional Faces VS Neutral Faces

A 2 x 2 x 2 x 2 repeated measure ANOVA was run with three within-subjects factors of (1) relative Probe Position (probe appears in location of the emotional or neutral stimulus), (2) type of Face (angry, happy), and (3) Drug (placebo, alcohol), Social Anxiety group as between subjects factors, and Alcohol units as covariate. There was a main effect of Alcohol (F(1,62)= 4.13, p=.04, partial η^2 =.06), showing that participants performed slower under the effects of alcohol (M=670.31 ms, SD= 633.08 ms) compared with placebo (M=633.08 ms; SD=16.32 ms). Social Anxiety group was not significant, F(1,62)= = .14, p=.71, partial η^2 =.002. Probe Position was not significant, (F(1,62) =.92, p= .34, partial η^2 =.01). Face type was not significant, F(1,62) =.14, p= .71, partial η^2 =.002. The interaction between Alcohol and Social Anxiety group was not significant, F(1,62) = 1.85, p =.18, partial η^2 =.03. There was a significant interaction between Social Anxiety group and Probe Position (F(1,62) = 4.15, p= .04, partial η^2 =.06). Post hoc t test suggested that there was a significant difference in reaction times between emotional (M=651.24; SD=114.61) and neutral (M=660.48; SD=121.16) faces in HSA participants ((t(32)=-2.04, p=.05), but not in LSA participants (t(31)=.72, p=.47), showing that the interaction reflected a general sensitivity to emotional faces only by the HSA group, irrespective of drink.

3.5. Discussion

The present set of tasks investigated the effects of alcohol on decision-making and cognitive processes in socially-anxious individuals. Looking at the two samples recruited in the two sets of tasks, there were some similarities and some noticeable differences between them. In the previous study (Chapter 2), the HSA and LSA groups in the sample did not differ in terms of alcohol units consumed weekly or in breath alcohol concentrations measured during the tasks. In contrast, for the sample recruited here, the HSA participants reported drinking more alcohol units per week compared with LSA participants. HSA participants also showed higher breath alcohol levels for the same dose compared with LSA participants. These findings are in line with some previous studies that have suggested a positive correlation between social anxiety and alcohol units consumed per week (Eggleston et al., 2004; Ham & Hope, 2005; Ham & Hope; 2007). This difference might be due to the recruitment requisite that changed for this second study: we adopted a higher selection criterion (participants who consumed more than 12 units per week) compared with the first set of tasks (participants who consumed a minimum of 8 units per week). However, these outcomes are not consistent with the difference in breath alcohol scores that was found (higher in HSA participants), as it would be expected that participants who consume more alcohol would also show a greater tolerance and therefore, lower breath alcohol levels (Wright et al., 1998). As this was a controlled study where participants were required to drink a specific amount of alcohol during a certain period of time, and they were also not allowed to consume other beverage and food prior the laboratory task, participants' rate of absorption of alcohol might have been affected differently and caused higher breath alcohol levels compared with a normal drinking occasion occurring in a more natural environment outside the experimental laboratory.

The significant difference in the level of consumption between the two groups could affect the interpretation of the results, hence Alcohol units consumed was used as a covariate in subsequent analyses.

In line with the findings from Chapter 2 and from previous studies, our HSA sample reported higher scores on the coping motives factor compared with the LSA group.

There was no effect of social anxiety on the conformity, social and enhancement drinking motives.

The present study had three main goals. First, to investigate how alcohol affects decision-making processes under ambiguity in socially-anxious individuals compared to controls. Participants were asked to perform the IGT after consuming either an alcoholic or a placebo beverage. In contrast with our first two hypotheses, HSA participants performed less well than the LSA participants after placebo, but the groups differed less after alcohol, suggesting that participants' performance might have been normalised somewhat under the effects of alcohol. Additionally, there was an effect of social anxiety on participants' performance on the IGT in which participants were exposed to an emotional content. In contrast, social anxiety did not affect participants' performance in the GDT task, which did not include any social or emotional stimulus, showing that there was no general effect of social anxiety on risk taking.

These findings are in contrast with previous studies that have found a relationship between performance in the standard IGT and anxiety (Schmitt et al., 1999; Warner et al, 2009; Mueller et al., 2010). For example, previous literature suggests that participants with GAD learned to avoid risky choices (Mueller et al., 2010). In this study, the net score calculated across the 5 trials showed that during the placebo condition, HSA participants make fewer advantageous choices compared with LSA individuals, although post hoc tests showed that this difference was only statistically significant during trials blocks (2-3-4). In line with previous studies that did not report any effects on alcohol on IGT performance in undergraduate students, the results show that alcohol does not seem to affect LSA participants (Balodis et al., 2016), but it did seem to eliminate the disruption of performance in the HSA group. To date, this is the first study investigating the relationship between alcohol, social anxiety and decision-making processes.

Previous literature showed that acute alcohol administration (0.8 g/kg dose) might produce a change in human risk-taking (Lane et al., 2004). In their study, Lane et al. showed that when participants had to choose between risky and non-risky choices, alcohol increased the selection of risky responses, suggesting insensitivity to past rewards. In contrast, in our study, post hoc analysis suggested HSA participants seem to have performed worse under placebo compared to LSA participants. The performance is then improved under the effects of alcohol showing no difference between the two groups.

The second goal of this study was to investigate the effects of alcohol on risky behaviours in socially-anxious and non-socially-anxious participants. The game of dice task has the advantage of simulating decisions under risk with specific rules for gains and losses allowing participants to ponder cost-benefits analysis in order to optimise their performance during the game (Brand et al., 2004). Neither alcohol nor social anxiety affected participants' performance on the Game of Dice task. Previous studies using the game of dice task on a sample of alcoholic and non-alcoholic patients reported that a strong impairment in decision-making executive functions is apparent in individuals with alcohol use problems (Brand et al., 2005). Kim et al. (2011), also suggested impaired performance by alcoholic patients on the GDT related to the possible association with reward and punishment. In contrast, Vera et al. (2018), showed that participants' performance was affected by an acute dose of alcohol on the IGT but not on the GDT, suggesting that alcohol might have an effect on decision-making processes under ambiguity but not on a task in which the rules are explicit since the beginning. The current study is partly in line with the findings of Vera et al.: HSA participants differed from LSA participants on IGT performance: they were worse after placebo, but alcohol eliminated the effect (possibly reversing it). Similarly, there was no main effect of alcohol on GDT performance. However, the sample here involved social drinkers, healthy individuals who consumed a minimum of 12 units of alcohol per week but did not have an alcohol use disorder. Participant performance was not affected by a high dose of alcohol. Social anxiety also did not produce an overall effect on the GDT, suggesting that high and low socially-anxious participants show similar risky decision-making processes while performing the task. These results are in line with Zhang et al. (2015), who suggested that anxiety might affect ambiguous decision-making (IGT), but in contrast, it might not have any effect on risk decision-making (GDT). Furthermore, the GDT did not include stimuli that were threat-related (e.g. threatening face stimuli), unlike the previous tasks (1-4). This might also reduce the likelihood of detecting an effect of social anxiety group on participants' performance.

The third goal of this study was to investigate the effect of alcohol on attention towards social cues in people with different levels of social anxiety by using a dot-probe task, with a different stimulus presentation time from task 1 (see Chapter 2). An acute dose of alcohol slowed reaction times, only when emotional faces were analysed together compared with neutral faces. Individuals might have responded more slowly after alcohol to compensate for the reduction in accuracy after drinking (Stevens et al., 2010). Previous studies which used a stimulus presentation time of 500/600 ms found an attentional bias in socially-anxious individuals when presented with threatening faces (Mogg et al., 2004; Pineles et al., 2005; Helfinstein et al., 2008; Klumpp & Amir, 2009; Stevens et al., 2009). This is in contrast with our findings: using a similar, shorter presentation time of 500 ms, we did not find an effect of angry faces specifically. However, pooling both angry and happy faces, socially-anxious participants responded faster when dots replaced emotional faces, suggesting increased vigilance for emotional facial expression in general compared with neutral targets, although much of this reflects slower reaction times to the neutral faces (i.e. they responded to the emotional faces at a similar speed to the LSA participants for both face types). These outcomes are in line with Garnet et al., (2006) who reported that high socially-anxious participants were faster compared to controls in detecting emotional faces (happy and angry) relative to neutral faces. The authors suggested that a threat-specific bias might be more apparent in clinically-diagnosed social phobic patients, consistent with previous research findings based on clinical patients with SAD (Amir et al., 2009; Schmidt et al., 2009). The sample here was a non-clinical sample, which may explain the absence of threat-specific bias and the more general bias towards emotional faces. Additionally, as discussed in Chapter 2, participants that are presented with the same set of face stimuli for multiple trials in both drinking conditions (placebo/alcohol) might exhibit some habituation for threatening faces (Breiter et al., 1996). Furthermore, the type of threatening facial expression (angry face) might not have caused an attentional bias on socially-anxious participants due to the type of emotion chosen for the design of this study: some studies have reported that socially-anxious participants might be more sensitive to a different type of facial expressions, such as disgusted or contemptuous faces, compared to angry faces (Amir et al., 2005; Stein et al., 2002).

The outcomes reported here suggest that socially-anxious individuals performed differently from low socially-anxious individuals only on the IGT and not in the GDT. In contrast with the initial prediction, HSA participants selected fewer advantageous choices than LSA participants after placebo, but they selected more after consuming alcohol, suggesting an effect of alcohol on decision making in people with social anxiety. Alcohol might have worked to reduce anxiety for socially-anxious participants, reducing the disruptive effects of the emotional pictures shown on the decks of cards, increasing attentional focus and consequently leading to better performance.

Chapter 4

Study Six

The relationship between social anxiety, drinking behaviours, mindfulness traits and attention

4.1. Introduction

The results of task 4 suggested that social anxiety affects decision-making processes under ambiguity (IGT) but not decision-making processes in situations when risks are explicit from the beginning of the task (or in the absence of emotional stimuli; GDT). Task 5, a follow-up of task 1, showed an effect of alcohol on participants' reaction times; HSA participants showed increased vigilance for emotional facial expressions compared to neutral faces, suggesting an effect of social anxiety on attention when emotional faces (either angry or happy) were shown. However, this bias was not reduced by alcohol.

While in the previous chapter the main goal was to explore the effects of alcohol on decision-making processes in people with different levels of social anxiety, the aim of the next study was to investigate how social anxiety levels are related to actual drinking behaviours, and how self-reported attentional processes (including mindfulness traits) in people with different levels of social anxiety may be associated with their patterns of alcohol use.

4.1.1. Social anxiety and attention

The thesis has argued that individuals with social anxiety are characterised by particular attentional biases when processing social information (Clark, 2001; Clark and Wells, 1995). According to previous studies investigating the relationship between attention and anxiety, attention arises from two distinct networks, an “automatic” network supports, for example, an attentional bias to threatening or emotional stimuli in socially-anxious people (Mathews, 1990; Wells & Matthews, 1994; Williams, Mathews & MacLeod, 1996); in contrast, a “voluntary” network can be used as an attentional coping mechanism to regulate anxiety (Derryberry & Reed, 1996). Examples were reported in Chapter 2, which tested the antisaccade and the prosaccade paradigms with socially-anxious participants: the two tasks required participants to either inhibit their involuntary response to external stimuli (antisaccade) or to voluntarily allocate their attention to the facial expressions presented during the task (prosaccade). Findings suggested that in task 1, HSA participants allocated more attention looking at all types of faces, and in task 2 that alcohol increased participants' dwell times towards all types of faces compared to LSA participants. The studies so far have used experimental procedures to examine the relationship between social anxiety, attention, and the effects of alcohol on attentional processes related to social anxiety. The final study in the thesis used a survey approach to look at how people with different levels of social anxiety use alcohol and how it relates to their self-reported attentional styles.

Darryberry & Reed (2002) developed a self-report questionnaire, called the Attentional Control Scale (ACS; Derryberry & Reed) to investigate individual differences in volitional attention control. Their research aimed to understand the role of anxiety and its connection with separate attentional systems involved in relatively automatic orienting and voluntary control processes. As indicated in Chapter 1, attentional control (AC) is a multidimensional construct that is characterised by two underlying distinct factors: shifting and focusing (Judah et al, 2014; Olafsson et al., 2011). While the shifting dimension measures individuals' ability to adapt and distribute attentional processes across multiple tasks during competing cognitive processing resources (e.g. "It is easy for me to read or write while I'm also talking on the phone"), the focusing dimension assesses individuals' capacity to maintain attentional resources on task-relevant requests (e.g. "My concentration is good even if there is music in the room around me"). The investigation of the subcomponent of AC through the ACS questionnaire, integrated with other questionnaires measuring social anxiety levels, drinking behaviours and mindfulness traits (since mindfulness also reflects attentional focus), might contribute to a better understanding of the attentional characteristics that are typical of socially-anxious individuals and that are linked to drinking behaviours. Having discussed behavioural aspects of socially-anxious individuals under the influence of alcohol in the previous chapters, it is now necessary to explore the relationship between individual characteristic factors that might affect social anxiety (e.g. mindfulness traits associated with attentional control features). ACS was integrated within a battery of questionnaires in order to better understand the factors that might modulate the processing of emotional information and its relationship with drinking behaviours and mindfulness traits.

4.1.2. Mindfulness traits

The practice of mindfulness meditation involves the acceptance and the letting go of distracting thoughts and emotions while at the same time focusing on orienting attention to an external or internal object (Bishop et al., 2004; Singer and Dobson, 2007). Mindfulness has been defined as a multifaceted construct composed of at least five facets: 1) acting with awareness (being attentive in present moment activities and situations); 2) observing (awareness and attention to feelings, thoughts and stimuli); 3) describing (construction of experiences, thoughts, and emotions into words); 4) non-reactivity (awareness of thoughts and feelings without reaction), and 5) non-judging (perceiving thoughts and feelings without judgment; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). All of these facets involve elements of attentional control.

For this study, which intended to explore the relationship between attentional traits, social anxiety and drinking behaviours, a questionnaire measuring the five mindfulness facets described above was adopted, since these are related to different aspects of attentional control that are not obviously addressed by the ACS. Furthermore, mindfulness has been empirically and theoretically associated with social anxiety symptoms (Clerkin et al., 2017), and might be a suitable target for intervention where problematic drinking is associated with social anxiety. Herbert and Cardaciotto (2005) argued that when a socially-anxious individual experiences a social event, it starts a long process of negative thoughts that might be described as the following: first, the socially-anxious person will pay attention to internal experience, and the focus on external cues will consequently decrease. Next, due to the lack of ability to accept thoughts without judgments, the person will experience higher social anxiety and this will increase the chance of engaging in maladaptive coping mechanisms (such as drinking or substance abuse). In contrast, individuals that are able to accept thoughts and internal experiences without engagement, are expected to engage less in maladaptive activities to cope with social anxiety (Herbart and Cardaciotto, 2005). Previous studies have supported this theory suggesting that there is a negative correlation between social anxiety symptoms and mindfulness traits (Rasmussen and Pidgeon, 2011; Schmertz et al., 2012). Moreover, clinical studies have also supported an association between social anxiety and mindfulness traits: mindfulness training (Mindfulness Based Stress Reduction) has been shown to reduce social anxiety symptoms in individuals with social anxiety disorder (Goldin et al., 2009; Jazaieri et al., 2012; Kabat-Zinn, 1990; Kocovski et al., 2009). Previous studies that have investigated the association between the five facets of mindfulness and social anxiety symptoms have shown a negative correlation between the non-judgmental and non-reactivity toward internal experiences, acting with awareness and ability of description, with the trait and state aspects of social anxiety symptoms (Baer et al., 2006; Desrosierset al., 2013).

In the past twenty years, the relationship between mindfulness and alcohol use disorders has been widely investigated (for a systematic review see Zgierska et al., 2009). There is, in fact, a negative relationship between mindfulness and substance misuse, perhaps because mindfulness involves the capacity to be present and attentive in the actual moment without judgment (Kabat-Zinn, 1994), while addiction often involves the lack of ability to accept the present moment and the avoidance of negative thoughts through the achievement of relief and pleasure by indulging in substance use (Baer, 2003; Kavanagh et al., 2005; Marlatt, 1994).

Mindfulness-based therapies have recently been successfully used to treat people suffering from substance use disorders and it is positively associated with reduced alcohol consumption (Chiesa et al., 2014, Li et al., 2017). For example, alcohol attentional bias significantly decreased after 10 sessions of mindfulness training adapted from Mindfulness-Based Cognitive Therapy (Garland et al., 2010). In another study, patients that received a mindfulness-based relapse prevention intervention were at a lower risk of alcohol relapse compared with people who received a cognitive behavioural relapse prevention intervention (Bowen et al., 2014). Similarly, Kamboj et al. (2017) reported that individuals reduced significantly their alcohol consumption after receiving a mindfulness based intervention, compared with patients in a relaxation control condition.

Karyadi and Cyders (2015) investigated the relationship between mindfulness facets and correlates of alcohol use in undergraduate social drinkers. They correlated factors from the FFMQ with scores on three alcohol-use questionnaires: the Alcohol Use Disorder Identification Test (AUDIT; Sanders et al., 1993), the Drug Abuse Screening Test (DAST; Skinner, 1982) and the National Institute on Drug Abuse – Alcohol, Smoking and Substance Involvement Screening Test (NIDA-ASSIST; NIDA, 2009). Their findings suggested that the mindfulness factors “Non Reactivity” and “Observation” were not associated with drinking factors. In contrast, the factors “Accepting without Judgment” and “Acting with Awareness” were associated with less problematic alcohol use, and the factor “Describe” was associated with lower cued alcohol cravings (Karyadi et al., 2015). Their findings were in line with previous studies investigating the relationship between drinking behaviours and mindfulness traits (Fernandez et al., 2010; Bowen and Enkema, 2014). Fernandez et al. (2010) suggested a significant association between three factors from the FFMQ (“Accepting without Judgment”, “Acting with Awareness” and “Describing”) and drinking correlates, while the mindfulness factors “Observation” and “Non Reactivity” were not associated with any of the drinking variables (Fernandez et al., 2010). In line with these findings, another study investigating the association between mindfulness traits and drinking motives suggested that individuals who reported higher scores on the factor “Describe” also reported lower coping motivation to drink (Reynolds et al., 2015). Similarly, a study of adults who reported traumatic life events and alcohol use in the past month showed that individuals with lower scores on “Non Judgmental acceptance” reported higher scores on coping motives (Vujanovic e al., 2011). Roos et al. (2015) showed that participants who reported coping reasons for drinking, had lower scores on “Accepting without Judgment”, “Acting with Awareness”, and “Describing”. Moreover, Bowen et al. (2014) reported findings from a clinical sample that had just completed a substance use outpatient program, which suggested a significantly negative relationship between the severity of dependence and “Accepting without Judgment”, “Acting with Awareness” and “Describing” (Bowen et al., 2014). In summary, several studies have suggested that the drinking motivation ”coping” is negatively associated with the mindfulness facets of “Accepting without Judgment”, “Acting with Awareness”, and “Describing”.

4.1.3. Preloading

Preloading (also known as “prepartying”, “pregaming”, “prefunking” and “front-loading”) refers to the consumption of alcohol at a domestic residence prior to attending licensed premises (Foster and Ferguson, 2014; Pedersen and LaBrie, 2007). This form of drinking is particularly common in young people for multiple reasons (e.g. to save money, to achieve drunkenness quickly, to socialise with friends) and – particularly relevant for this study - to reduce social anxiety (Walls et al., 2009). Social anxiety has been associated with preloading (Schry et al., 2013; Stewart et al., 2006), so this study measured preloading behaviours as coping strategies that might be related to social anxiety and the attentional traits exhibited by people with higher levels of social anxiety.

Social motives seem to have a general effect on preloading behaviours (Pedersen & LaBrie, 2007). Previous literature reported a positive correlation between preloading and alcohol units consumed per week, suggesting that "pre-loader" individuals drink significantly more alcohol than non-pre-loader peers, and consequently, suffered more negative consequences (Paschall and Saltz, 2007; Hughes et al., 2008). Barry et al. (2013) conducted a study to determine whether preloading status predicted BrAC levels; their findings suggested that those who were used to preloading also showed significantly higher BrAC levels compared with non-preloaders peers. In contrast, Keough et al., (2016), showed that social anxiety was negatively correlated with levels of alcohol use, but instead, it was correlated with solitary pre-drinking, suggesting that socially-anxious individuals might prefer to predrink less frequently around others, and more on their own, avoiding those social situations that might include other people who engage in predrinking. In line with these results, it has also been suggested as well that those who prefer solitary predrinking also show high levels of coping motives (Cooper, 1994; Gonzales et al., 2009). Additionally, previous literature has shown that coping-related drinking might be associated with alcohol related problems, regardless of the level of alcohol use (Kuntsche et al., 2005).

For this study, a preloading questionnaire was used in order to explore preloading behaviours which have already been linked with social anxiety in previous reports (e.g. Wells et al., 2009; Keough et al., 2016).

4.1.4. The current study

The present study investigated individual characteristics related to drinking behaviours, attention and social anxiety, including drinking motives, alcohol units consumed per week, preloading behaviours, BFNE scores, and levels of attentional control and mindfulness traits. It was predicted that associations would be found between social anxiety and 1) attentional control; 2) mindfulness traits; 3) alcohol consumption; 4) preloading behaviours. More specifically, it was expected that participants who score higher in social anxiety would report engaging more in pregaming behaviours, would perceive themselves to have lower abilities to focus and shift attention, and would show lower scores on the measures of mindfulness facets (specific details below). A relationship was also expected between alcohol use and mindfulness traits, and between drinking motives and mindfulness traits; however, these were defined as subsidiary predictions, since they are less directly relevant to the main scope of the thesis. As mentioned in Section 4.1.2., previous studies that have examined the relationships between mindfulness traits and alcohol use have shown that three subscales of the FFMQ ("Acting with Awareness", "Non-Judging" and "Non Reactivity") tend to negatively predict alcohol use (Bodenlos et al., 2013; Karyadi et al., 2015; Murphy et al., 2012). To follow up these findings, the study explored as well the relationship between alcohol use and some of the mindfulness traits and some of the drinking motives measured using the DMQR questionnaire.

Regarding the FFMQ subscales, the following predictions were made: 1) a negative association between three FFMQ subscales ("Acting with Awareness", "Non-Judging" and "Non Reactivity") and alcohol use; 2) a negative association between the subscales "Observing" and "Non-Judging" and social anxiety; 3) a negative association between the subscales of the ACS and the FFMQ subscales "Describing" and "Non-Judging";

4) a negative relationship between Coping and FFMQ subscales "Accepting without Judgment", "Acting with Awareness", and "Describing".

4.2. Methods

4.2.1. Participants

Psychology Students from Kingston University were recruited over two sequential semesters (Autumn and Spring) through the Psychology Department participant pool (via the "Sona Systems" online recruitment tool). Students signed up through the online portal in exchange for 40 course credits, they were then directed to the online survey which was set up on the Qualtrics platform. Participants provided informed consent prior to participation.

4.2.2. Design and Procedure

All measures and procedures were approved by the Kingston University Research Ethics Committee. The survey was anonymous, and participants were allowed to complete the online survey at any time within the semester in which it was received. Participants received 40 course credits after completing the questionnaire. Prior to beginning the survey, participants read and electronically signed a consent form assuring confidentiality. The first part of the questionnaire included demographic questions assessing age, sex, and ethnicity, and questions assessing weekly alcohol intake (how many days per week they typically consumed alcohol - beers, wine, spirits - and how many drinks they typically consumed per drinking occasion - average number of drinks). The second part of the questionnaire included validated scales to assess participants' social anxiety, drinking motives, pregaming behaviours, mindfulness facets and attentional control.

4.2.3. Questionnaires

4.2.3.1. Fear of Negative Evaluation

As with the previous studies, the Brief Fear of Negative Evaluation (BFNE; Leary, 1983) was used to assess participants' social anxiety. BFNE is a 12-item self-report questionnaire measuring individuals' expectations of receiving a negative evaluation from others. The questionnaire has a good internal consistency ($\alpha = .90$) and a test-retest reliability coefficient of 0.75.

4.2.3.2. Drinking Motives

The Drinking Motive Questionnaire Revised (DMQR; Cooper et al., 2003) is a 20-item questionnaire that measures motives for alcohol consumption. Items were summed to form the four DMQR subscales. The questionnaire's structure proposes four motives for alcohol consumption: (1) conformity (e.g., "so you won't feel left out"), (2) coping (e.g., "drinking to forget your problems"), (3) enhancement (e.g., "to have fun"), (4) social (i.e., "because it helps you enjoy a party"). In tasks 1-3 it was shown that high socially-anxious participants scored significantly higher for the coping and conformity factors, compared to low socially-anxious participants. In tasks 4-5, high socially-anxious participants scored significantly higher than the control group for the 'coping' factor only. From the previous findings, an association was expected between social anxiety and drinking motives (across subscales), with particularly strong relationships between social anxiety and negative motives (coping and conformity).

4.2.3.3. Pregaming motives measures (PGMM)

Participants completed the 15-item PGMM questionnaire (Bachrach et al., 2012). The questionnaire includes 15 contexts where prepartying could occur and uses a five-point scale from, ‘1-Almost Never/Never’ to ‘5-Almost always/Always’. The 15 contexts were derived from the revision of the original 20-item PGMM (Bachrach et al., 2012). The revised questionnaire has good internal consistency (α = .83).

4.2.3.4. Attentional Control

The Attentional Control Scale (ACS; Derryberry & Reed, 2002) is a 20-item self-report measure that combines 9 items assessing attentional focusing and 11 items assessing attentional shifting (Derryberry & Rothbart, 1988). The questions are rated on a 4 point Likert scale (1= almost never, to 4 = always). The final score is calculated by summing the item scores; higher scores are associated with better attentional control. In the current study, two scores were computed by summing items 1-8 and 12 for the focusing subscale (ACS-focusing) and items 10, 11 and 13-20 for the shifting subscale (ACS-shifting). The internal consistency is reported as α = .82 for focusing factors and α = .68 for the shifting factor (Olafsson et al., 2011). The test-retest reliability of the ACS items varies from 0.45 to 0.73 and it is 0.61 for the total score.

4.2.3.4. Mindfulness Traits

The Five Facet Mindfulness Questionnaire (FFMQ, Baer et al., 2006) is a self-report 39 item questionnaire rated on a 5-point Likert scare (from 1 = never or very rarely true, to 5 = very often or always true). There are five subscales within the FFMQ: “Observing” (attending to sensory stimuli that mainly derive from external sources and the body as well as related cognitions and emotions), “Describing” (labelling internal experiences with words), “Acting with awareness” (ongoing attention to, and awareness of present activity and experience), “Non-judging” (having a non-evaluative attitude towards one’s thought and emotional processes while focusing on inner experiences, rather than taking on a critical stance), and “Non-reactivity” (assuming a stance that implies being able to perceive thoughts and feelings, especially when they are distressing, but without feeling compelled to react or being overwhelmed). The questionnaire has a good internal consistency (respectively for each scale: (1) $\alpha = .83$; (2) $\alpha = .91$; (3) $\alpha = .87$; (4) $\alpha = .87$ and (5) $\alpha = .75$).

4.3. Results

4.3.1. Participant characteristics

Three hundred and twenty-three participants (Male= 42, Female= 278, Prefer not to say = 3) completed the online survey. The mean age was 24.3 years (SD=7.8 years). Participants had a mean Social Anxiety score on the BFNE of 21.37 (SD=10.71) and consumed an average of 6.8 units of alcohol per week (SD=12.54 units). 71.2 % (N=195) of participants reported having preloaded.

Table 4.1: Mean scores and standard deviations of participants' self-report scores (N=323) for Alcohol Units typically consumed per week, Brief Fear of Negative Evaluation (BFNE), Pregaming Motives Measures Questionnaire (PPGQ), Drinking Motivation Questionnaire Revised (DMQR), Attentional Control Scale (ACS), and Five Facet Mindfulness Questionnaire (FFMQ).

	Mean and Standard Deviations
Alcohol Units	M= 6.8; SD = 12.54
BFNE	M= 21.37; SD= 10.71
PPGQ	M= 31.27; SD= 12.7
DMQR Social	M= 14.89; SD= 5.67
DMQR Coping	M= 11.28; SD= 5.78
DMQR Conformity	M= 7.01; SD= 3.07
DMQR Enhancement	M= 13.43; SD= 5.42
ACS Focus	M= 23.39; SD= 6.1

ACS Shifting	M= 24.81; SD= 5.89
ACS Total	M= 48.19; SD= 11.15
FFMQ Observing	M= 24.54; SD= 7.4
FFMQ Describing	M= 26.26; SD= 7.02
FFMQ Acting with awareness	M= 25.1; SD= 6.73
FFMQ "Non-Judging"	M= 24.57; SD= 8.11
FFMQ Non Reactivity	M= 19.13; SD= 5.47
FFMQ Total	M= 119.33; SD= 24.29

4.3.2. Primary Results

Multiple regression analyses were carried out to investigate whether the different variables analysed (drinking units, PPGM, DMQ factors, ACS factors and FFMQ factors) predicted BFNE score. Firstly, (1) to examine whether drinking pattern (quantity and circumstance) was linked to social anxiety, the analysis tested if the Alcohol Units consumed per week and Pregaming Drinking scores predicted social anxiety. The results of the regression indicated that the model explained 6.2% of the variance and that the model was a significant predictor of Social Anxiety, $F(2,321)= 10.52$, $p<.001$. While Pregaming Drinking behaviours contributed significantly to the model ($B=.21$, $p<.001$), Alcohol Units consumed per week did not ($B=.01$; $p=.83$). Secondly, we measured if (2) Drinking motives could predict Social Anxiety. The outcomes from the regression showed that 14.9% of the variance in the data can be explained by predictor variables, and that the model was a significant predictor of Social Anxiety, $F(4,321)=13.88$, $p<.001$. The DMQ factors that contributed significantly to the model were the Coping motives ($B=.37$, $p = .006$) and the Conformity factor ($B=.79$, $p <.001$). In contrast, the DMQ factors that did not contribute to the model were the Social ($B=.28$, $p=.11$) and the Enhancement motives ($B=.18$, $p=.11$). Next, we tested if (3) Attentional Control predicted Social Anxiety. Results indicated that the model explained 0.11% of the variance and that the model was not a significant predictor of Social Anxiety, F(2,321)= 1.75, p = .18. None of the ACS factors contributed to the model (Shifting: B= -.03, p= .89; Focus: B= -.08, p=.56). Finally, we tested (5) if mindfulness was related to social anxiety by analysing whether the FFMQ factors predicted Social Anxiety. The model was a significant predictor of Social Anxiety (F(5;321)= 15.48, p<.001) and it explained 19.7% of the variance. The factors Observing (B= .33, p<.001), Non-Judging (B= -.35, p<.001) and Non-Reactivity (B=-.45, p<.001) contributed most to the model. In contrast, the factors Acting with Awareness (B=-.17, p=.09) and Describing (B=.02, p=. 82) did not contribute significantly to the model.

4.3.3. Secondary Results

Additionally, we carried out multiple regressions to assess if the DMQR, ACS, FFMQ and BFNE (separately) predicted Alcohol Consumption. When analysing if DMQR motives predicted alcohol consumption by participants, the outcomes showed that the 9.2% of the variance in the data was explained by the predictor variables, and that the model was a significant predictor of Alcohol Consumption, F(4,278)= 6.83, p<.001. The drinking motive that contributed significantly to the model was the Coping factor (B=.43, p= .002). The other motives did not contribute significantly to the model (Conformity (B=-.09, p=.65); Social (B=-.06, p=.18); Enhancement (B=.2, p=.26)).

The mindfulness facet that contributed significantly to the model was the factor Describing (B=.25, p=.01). The other facets were not significant predictors: Acting with Awareness (B=-.2, p =.06); Non-Reactivity (B=-.09, p=.48); “Non-Judging” (B= .01, p= .84) and Observing (B=.01, p=.91)).

Finally, multiple regressions were carried out to investigate if any of the individual drinking motives (Coping, Conformity, Social, Enhancement) were predicted by the

Mindfulness Traits. The first drinking motive analysed was the Coping factor. The results of the regression indicated that the model explained the 33.3% of the variance and that the model was a significant predictor of Mindfulness Traits, F(5,321)= 7.89, p <.001. Two mindfulness traits contributed significantly to the model: the factor "Acting with Awareness" (B= -.17, p=.004) and the factor '"Non-Judging"' (B=-.13, p=.005). The second drinking motive analysed was the Conformity factor. The model was not a significant predictor of Mindfulness Traits, F(5,321)= 3.29, p=.007. The third drinking motive analysed was the Social factor. The results of the regression indicated that the model explained the 23.4% of the variance and that the model was a significant predictor of the Mindfulness Traits, F(5,321)= 3.64, p=.003. The only trait that contributed significantly to the model was the 'Describing' factor (B=.12, p=.03). The final drinking motive investigated was the Enhancement factor. The results indicated that the model explained the 25% of the variance and that the model was a significant predictor of Mindfulness Traits, F(5,321)= 4.2, p=.001. The only factor that contributed significantly to the model was the 'Non-Judging' mindfulness trait (B=-.11, p=.01).

4.4. Discussion

This study investigated the relationship between social anxiety, attentional control and drinking behaviours in a non-clinical sample. In contrast with the previous studies in this thesis, in which participants were required to be social drinkers (drinking minimum 12 alcohol units per week) in order to attend the tasks, participants in this study did not have to meet any drinking criteria in order to participate in the survey. Because of this, the mean score for the number of alcohol units consumed per week was lower compared to the previous studies (Mean= 6.8 units per week, SD= 9.47 units). The mean BFNE score for social anxiety was 21.8 (SD= 10.71), significantly lower than in the previous tasks (tasks 1-3: M=36.15, SD=11.55; tasks 4-5 = 36.8, SD= 9.49). Social anxiety scores were correlated with preloading behaviours, indicating that participants who report higher levels of social anxiety also engaged more in preloading behaviours. This is in line with recent studies showing that greater consumption in pre-drinking social situations is correlated with higher social anxiety (Buckner et al., 2020; Keough et al., 2016). Furthermore, the outcomes of the multiple regression analyses were in line with the results from the previous studies in the thesis: the drinking motives of coping and conformity predicted social anxiety scores. As noted, previous research has also shown an association between coping and conformity motives and social anxiety (Lewis et al., 2008; Stewart et al., 2006). These results strongly suggested that drinking by people with high levels of social anxiety is used as a coping strategy to manage anxiety and facilitate social inclusion.

This study also investigated the relationship between mindfulness facets and social anxiety. Research has suggested that social anxiety symptoms are negatively correlated with mindfulness traits (Rasmussen and Pidgeon, 2011; Schmertz et al., 2012). According to Rasmussen and Pidgeon (2011), higher levels of mindfulness might predict lower levels of social anxiety. The present findings are partially in line with their results. In this study, social anxiety was negatively correlated with the mindfulness facets of “Acting with Awareness” and “Acting without Judgment”. However, in contrast with previous studies, significant associations were also found between social anxiety and the mindfulness facets of “Observing” and “Non Reactivity”. Previous research reported that socially-anxious people can show self-focused attention and safety behaviours during social situations in order to cope with social anxiety (Salkovskis, 1991; Clark et al., 1995; Wells et al., 1995). Self-focused attention is defined as ‘an awareness of self-referent, internally generated information’ (Ingram,

1990) and it plays an important role in social anxiety (Clark et al., 1995). According to the Clark and Wells model (1995), when socially-anxious individuals deal with social situations, they shift attentional processes to the self, which might cause detailed observation and monitoring of the self and of the social situation itself. This change in their attentional processes might help them to cope with self-presentation during feared situations. Consequently, socially-anxious individuals might also use safety behaviours in order to cope with social anxiety. The avoidance of social situations and the non-reactivity might also be considered as safety behaviours for a socially-anxious person.

This study investigated as well the relationship between mindfulness and drinking behaviours. Some previous studies had supported a negative relationship between mindfulness and addictions (Baer, 2003; Kavanagh et al., 2005; Marlatt, 1994), and in particular with alcohol use (Zgierska et al., 2009). Individuals with addictions tend to show more difficulties in accepting the present moment and avoiding negative thoughts (Kabat-Zinn, 1994). In line with this assumption, previous research has reported a negative relationship between the drinking motive of Coping and the mindfulness facets of Accepting without judgments, Acting with awareness, and Describing (Bowen et al., 2014; Roos et al., 2015; Vujanovic et al., 2011). Mindful awareness has also been found to play an important role in reducing uncontrolled drinking (Levin et al., 2014). The regression results are partially in line with previous research, showing a negative relationship between Coping and the mindfulness facets of Accepting without judgment and Acting with awareness. Those two mindfulness facets were also negatively-related to the scores from the PPGQ, suggesting that those who reported pre-drinking behaviours also had lower scores on the mindfulness facets of "Accepting without Judgment" and "Acting with Awareness". Additionally, the study discovered a relationship between the Enhancement drinking motive and the factor "Non-Judging", as well as an association between the Social and Enhancement drinking motives and the mindfulness facet "Describing". In line with previous research, these findings suggest that individuals who tend to drink to cope with negative feelings and engage in pre-drinking behaviours, also report more difficulties in generating a general awareness of behaviours in the present moment and an awareness of drinking behaviours in particular (Schellhas et al., 2019).

In contrast with the initial hypotheses, the study suggested that factors from the attentional control scale were not associated with social anxiety. This outcome is not in line with a previous study by Olafsson et al. (2011) that investigated the correlation between ACS and anxiety and depression traits using the Hospital Anxiety and Depression Scale (HADS, Zigmond & Snaith, 1983). The authors reported a negative, moderate correlation between Focusing and Shifting factors of the ACS and the symptoms of anxiety, suggesting that anxiety and depression are related to impaired performance on a series of neuropsychological tests that measure executive control functions (i.e., Elliott, 1998; Eysenck et al., 2007; Veiel, 1997). However, the authors were measuring anxiety and not social anxiety specifically as we did in our study. Previous studies have used the ACS combined with experiments investigating the interplay between automatic processes and effortful control (e.g., dot-probe task) in individuals with trait anxiety (Derryberry et al., 2002) or in tasks measuring speech-giving anxiety (Jones et al., 2013). In their studies investigating fear of public speaking, Jones et al. (2013), found that individuals who scored lower on the ACS also reported an increased impact of fear of public speaking during their performance. This scale has generally been combined with laboratory tasks, but in the present study it has been used as a stand-alone self-report questionnaire to assess participants' self-perception of attention and how it relates to self-reported drinking behaviours and social anxiety traits. The lack of correlations between the ACS scores and the other factors might be due to the absence of an activity requiring a certain amount of attention.

This study has some limitations. Firstly, we used a student sample with a restricted age range. Therefore, our results cannot readily be generalised to older adults or to the clinical condition of social anxiety disorder. Secondly, the majority of our sample was composed of female students, showing a gender imbalance that may have affected the results. Females are likely to have been over-represented as psychology students at Kingston University, as in most departments of Psychology. A review by the Higher Education Statistic Agency (HESA, 2020) reported a sector-wide unbalanced gender ratio in Psychology courses, leading to undergraduate research pools being overrepresented by women (Dickinson et al., 2012; McCray et al., 2005). The literature shows that there can be gender differences in the presentation and management of social anxiety disorder influenced by both psychological and biological factors, with an overall lifetime prevalance rate of 15.5% in women compared with 11.1% in men (Weinstock, 1999). The influence of gender differences on the findings will be discussed further in the general discussion section of this thesis.

Additionally, elevated social anxiety symptoms are most reliably displayed in participants under conditions of social stress or high working memory load, when attentional control resources are required (Judah et al., 2013). However, those limitations did not prevent the study from replicating some key results of previous studies (Buckner et al., 2020; Schellhas et al., 2019; Keough et al., 2016) and finding new associations between the mindfulness traits of ‘Observing’ and ‘Non reactivity’ and social anxiety, and between the mindfulness traits of ‘Accepting without judgment’, ‘Acting with awareness’ and drinking behaviours (specifically, the drinking motivation of “Coping” and preloading behaviours). Overall, this study shows that there are associations between mindfulness traits and alcohol use and social anxiety, suggesting that attentional processes reflected in mindfulness traits might play a role in drinking to avoid negative consequences (i.e. social anxiety) or in negative reinforcement drinking (i.e. coping). Mindfulness interventions may therefore be appropriate for improving control of drinking behaviours and social anxiety thoughts.

Chapter 5
General Discussion

The thesis examined the effects of alcohol on attention and decision-making processes in socially-anxious and non-socially-anxious individuals. The aim was to understand better how alcohol might alter cognition to reduce social anxiety, an effect that might support increased drinking behaviour in people with high levels of social anxiety. To explore these issues, the thesis reports on five laboratory-based tasks (Chapters 2 and 3) and an on-line survey (Chapter 4).

5.1. Overview Chapter 2

5.1.1. Participant Characteristics

For the first part of this thesis, three tasks were designed to characterise the effects of alcohol on eye movements, as an indicator of attention, in HSA and LSA individuals. The first task was set up to explore the effects of alcohol on participants' eye movements during and attentional bias (dot-probe) task; the second task examined how alcohol influences involuntary saccades (antisaccade task), and finally, the third task investigated alcohol's effects on voluntary saccades. The stimuli were facial expressions, contrasting emotional and neutral expressions. A non-clinical sample of 40 students participated, divided into two groups based on their levels of social anxiety, which were similar to those of previous studies that used non-clinical samples of socially-anxious individuals. Ham et al., 2002 reported similar, slightly higher BFNE scores for HSA participants (M=48.21, SD=7.86) compared to the HSA participants tested here (M= 42.76, SD = 9.57), and slightly lower BFNE scores for their LSA participants (M=23.96, SD=5.26) compared to the LSA participants here (M = 28.84, SD = 8.92). The findings suggested that social anxiety was not related to the amount of alcohol consumed per week or participants' breath alcohol levels after consuming a moderately high dose of alcohol, indicating that HSA and LSA participants consumed similar quantities of alcohol and were similarly affected by alcohol. In contrast, HSA participants scored higher on the negative reinforcement drinking motives compared with the LSA participants, suggesting that HSA people may drink to reduce or regulate negative affect (coping motives) and to avoid social censure (conformity motives). This finding is consistent with previous research which showed that socially-anxious individuals endorsed greater negative drinking motives (coping, conformity) compared with non socially-anxious individuals (Terlecki et al., 2015; Lewis et al., 2008; Stewart et al., 2006). Since alcohol can produce relaxation effects (e.g. Baker et al., 2004; Conger, 1956; Khantzian, 1997), it has been proposed that individuals with social anxiety may use alcohol as a form of self-medication to deal with social anxiety symptoms that arise during stressful and/or social situations (Allan et al., 1995; Kushner et al., 2000). Here, the HSA participants were less relaxed than LSA participants regardless of drink, suggesting that they were more anxious in general (which might be expected since the task involves social interaction with a stranger), but alcohol did not change their level of relaxation. Overall, all of the participants reported feeling more alert before drinking in both conditions, but less alert especially after drinking alcohol. Similarly, they reported feeling more lightheaded after drinking, especially in the alcohol condition. These results obtained through self-report measures, 15 minutes after consuming alcohol, showed that the alcohol dose used in this study was clearly effective at influencing the participants' feelings and responses.

5.1.2. Dot-probe eye tracking Task

Task 1 consisted of a dot-probe task to investigate eye movements and attentional biases to emotional facial expressions in high and low socially-anxious individuals after consuming either placebo or alcohol. Stimuli used for this task were emotional faces (angry/happy) paired with neutral faces. The measures were dwell times (primary data) and reaction times (secondary data). Because participants' gaze patterns were the main metric, a long stimulus presentation time (1500 ms) was adopted. There was an overall impairment in reaction times due to alcohol intoxication, reflecting a tendency for the participants to perform slower under the influence of alcohol. Reaction times were not affected by social anxiety or by type of stimulus. Previous research has indicated that socially-anxious individuals can show attentional biases towards angry faces when such stimuli are presented on the screen either for 100 ms or 500 ms (Cooper et al., 2006). Therefore, the reason why participants did not show attentional biases in our study might be due to the longer stimulus presentation time (1500 ms). Analyses of participants' gaze patterns showed that HSA participants spent more time looking at the stimuli overall compared with the LSA participants, suggesting a generalised attentional bias towards faces in HSA people. Alcohol increased this effect, such that the socially-anxious participants produced longer dwell times, compared to low socially-anxious individuals, for all types of stimuli under the influence of alcohol. However, the different types of facial expressions did not affect participants' eye movements. The lack of a face effect might relate to the longer stimulus presentation time compared with other studies but may also reflect the nature of the facial expressions chosen for this project. Previous research has shown that high socially-anxious participants might be particularly sensitive to disgusted and contemptuous faces, which were not used here (Amir et al., 2005; Stein et al., 2002).

5.1.3. Antisaccade Task

The aim of task 2 was to examine how alcohol modifies involuntary gaze patterns in relation to socially threatening stimuli among socially-anxious individuals. This eye-tracking task required participants to look away from the stimuli, and therefore to inhibit a reflexive response and create a competing voluntary action. Participants made significantly more errors after drinking alcohol, especially when an angry face was shown on the screen, suggesting a difficulty to inhibit an involuntary response when presented with threatening stimuli. In line with previous studies, error rates increased with inverted stimuli suggesting that these targets are processed differently (Perrett et al., 1988; Valentine, 1988; Butler & Harvey, 2005; Gilchrist et al., 2006). Overall error rates were not affected by social anxiety. However, social anxiety did affect participants' dwell times: HSA individuals spent more time looking at angry faces compared to LSA participants. The results indicated that HSA participants allocated attentional resources to threatening stimuli, in line with the theoretical frameworks that support the selective attention theory (Beck et al., 1997; Williams et al., 1997). Alcohol seemed to increase participants' dwell times for all types of faces, suggesting a stronger attribution of attentional resources towards faces under the effects of alcohol. Moreover, all participants seemed to look longer at the "eyes" region of the angry faces, compared to the same region of the neutral and inverted faces, suggesting a tendency to allocate attentional resources to threatening stimuli regardless of social anxiety levels. Finally, alcohol also increased eye movement latencies, but again no effect of social anxiety was found. The effect on latencies suggests that alcohol attenuates motor preparation of the saccadic response in both HSA and LSA individuals.

5.1.4 Prosaccade Task

Task 3 was a prosaccade task to examine HSA and LSA participants' gaze patterns in response to different types of face (angry, neutral or inverted) after drinking alcohol or placebo. In contrast with task 2, participants were required to look directly at the target when it appeared. Participants made more errors when viewing neutral or inverted faces, tending to be more accurate when angry faces appeared on the screen, suggesting that participants were more vigilant towards threatening faces compared with neutral and inverted faces. This effect was stronger under the influence of alcohol. Social anxiety did not affect participants' error rates. In contrast with the antisaccade task, HSA participants spent more time looking at faces during the placebo condition compared with the LSA group. Overall, participants spent more time looking at angry faces compared with neutral or inverted stimuli. Alcohol seemed to reduce dwell times on faces, but it increased the time spent looking around the eyes. When looking at mouths, participants spent significantly more time looking at inverted mouths compared with angry or neutral mouths. This most likely occurred because the mouths of the inverted faces were effectively placed in the same positions on the screen as the eyes of neutral and angry faces, suggesting a habit of looking around the conventional eyes area on the screen. Prosaccade latencies were not influenced by alcohol, social anxiety, or type of stimuli. In line with previous studies, prosaccade latencies were significantly shorter than antisaccade latencies (Sluis et al., 2017, Wieser et al., 2009) probably because there might be an additional cost in programming an antisaccade related to the time required to inhibit a reflexive saccade to the onset stimulus (Pratt and Trottier, 2005; Olk and Kingston, 2003).

5.2. Overview Chapter 3

5.2.1. Participants Characteristics

This set of tasks was designed to explore how decision-making processes change under the influence of alcohol in HSA and LSA participants. A non-clinical sample of 68 students participated in three laboratory tasks. As with the previous tasks, participants were divided into two groups based on their levels of social anxiety. However, in contrast with the earlier sample in Chapter 2, in this study social anxiety was positively related to the quantity of alcohol consumed per week: HSA participants reported drinking more alcohol units per week compared with the LSA participants. There was also a significant effect of social anxiety on breath alcohol concentration, suggesting that HSA participants may metabolise alcohol differently compared with the LSA group. In line with Chapter 2, high socially-anxious participants scored higher on coping motives, although conformity motives were not significantly higher in the social anxiety participants. Positive motives (social and enhancement) were also unrelated to social anxiety. Overall, participants reported feeling more relaxed after consuming either drink (placebo or alcohol), reflecting a general relaxation over the timecourse of the session. Participants also reported feeling less alert and more lightheaded after consuming alcohol. The differences between the two samples from Chapters 2 and 3 are likely due to the difference in the initial selection criteria: while in the first study participants were invited to attend the tasks if they drank more than 8 units per week, in the second study participants were invited to join the tasks if they drank more than 12 units per week.

5.2.2. Iowa Gambling Task (IGT)

Task 4 tested the effects of alcohol on decision-making processes under ambiguity in socially-anxious participants using a modified Iowa Gambling Task paradigm (IGT). The IGT that was used (Pittig et al., 2014) included two decks of either advantageous or disadvantageous cards showing angry or neutral facial expressions instead of numbers (as shown in the original IOWA task). In contrast with previous research that did not find any effect of alcohol on IGT performance (Balodis et al., 2006), the findings suggested that alcohol influenced HSA participants differently from LSA participants and might have reduced the disruption in the card selection process that was identified in HSA participants after placebo, and consequently led to better performance.

5.2.2. Game of Dice Task (GDT)

Task 4 also investigated the effects of alcohol on risky behaviors in socially-anxious and non-socially-anxious participants using the GDT, a task in which the rules are explicit from the beginning, unlike for the IGT (Brand et al., 2005). There was no effect of alcohol or social anxiety on participants' performance, suggesting that participants' decision-making processes under risk were not influenced by alcohol or by level of social anxiety. This is in line with previous research, which has suggested that anxiety (broadly defined) can influence IGT performance without affecting participants' GDT performance (Zhang et al., 2015). Another study also failed to show an effect of acute alcohol on performance on the GDT (Vera et al., 2018). In conclusion, there was no difference in participants' GDT performance after either drinking a placebo or an alcoholic drink, suggesting that alcohol might have an effect on decision-making processes under ambiguity when emotional content was shown (IGT) but not on a task in which the rules are explicit since the beginning, and in which no emotional content was used (GDT).

5.2.4. Dot probe Task (Short presentation time: 500 msec)

Task 5 was a dot probe task to examine attentional bias in socially-anxious individuals after drinking alcohol or placebo. In contrast with the previous dot-probe task, eye movements were not recorded and the stimulus presentation time was reduced from 1500 ms to 500 ms to be consistent with studies of attentional bias using RT measures. Contrary to expectations, HSA participants did not show an attentional bias towards angry faces; however, social anxiety influenced participants' reaction times for emotional stimuli more generally (angry and happy faces) compared with neutral stimuli. In line with previous research, HSA individuals responded faster than LSA participants when dots replaced the emotional targets, suggesting that they showed increased vigilance for emotional facial expression compared with neutral targets (Garnet et al., 2006). Alcohol did not affect this enhanced vigilance, and reaction times for both LSA and HSA participants were impaired non-selectively under the influence of alcohol.

5.3. Overview Chapter 4

The last study explored the relationships between social anxiety, drinking motives, drinking behaviours, attentional control, and mindfulness traits (which reflect attentional processes) using a number of standardised questionnaires distributed to a sample of 323 participants. The results showed a positive relationship between social anxiety and preloading behaviours, suggesting that participants with higher levels of social anxiety engage more in drinking behaviours before going out. Moreover, a positive relationship was identified between social anxiety and each drinking motive (social, enhancement, coping and conformity). In contrast with tasks 1-5, in which HSA participants reported drinking more for motives of coping (and conformity, tasks 1-3 only), in this study participants with higher levels of social anxiety reported drinking not just to cope and to conform but also to socialise and to feel the enhancement effects caused by alcohol. In terms of attentional processes, social anxiety was negatively correlated with the mindfulness facets of “Acting with Awareness” and “Acting without Judgment”. However, social anxiety was also positively associated with the mindfulness traits of “Observing” and “Non-Reactivity”, suggesting some important features that might characterize socially-anxious individuals, such as increased self-focused attention and self-related judgments. These findings are in line with studies that have reported how socially-anxious people may exhibit more self-focused attention and safety behaviours during social situations in order to cope with social anxiety (Salkovskis, 1991; Clark et al., 1995; Wells et al., 1995).

Finally, the last study also looked at relationships between drinking behaviours and mindfulness traits (irrespective of social anxiety). The outcomes included negative relationships between the drinking motives of coping and conformity with the mindfulness facets of “Accepting without Judgment” and “Acting with Awareness”, suggesting that participants who reported drinking in order to cope with negative feelings and to conform in social situations were also more judgmental when perceiving thoughts and feelings and were less attentive toward present moment activities and situation. Higher scores on the pre-gaming questionnaire were also negatively associated with “Accepting with Judgment” and “Acting with Awareness”, suggesting that participants who reported being more judgmental and less attentive in present situations tended to drink more alcohol before going out. Furthermore, associations were found between the social and enhancement drinking motives and the mindfulness facets of “Describing” and “Observing”, suggesting that individuals who reported drinking because of the “positive reinforcement motives” (Cox et al., 1990), such as drinking to have fun and to get drunk (enhancement) and to better enjoy social gatherings (social), also reported being better at constructions of experiences, thoughts and emotions into words, and being more aware and attentive to feelings and thoughts. The enhancement drinking motive was also related to the mindfulness facet of “Non-Reactivity”, showing that participants who drink because they like the feeling of it are also better at perceiving thoughts and feelings without judgments. These findings have important implications: understanding individual characteristics related to drinking behaviours and mindfulness traits might be important to inform clinical interventions based on the incorporation of cognitive behavioural skills and mindfulness skills (Marlatt and Gordon, 1980; Marlatt et al., 2005).

5.4. Synthesis

5.4.1. Effects of alcohol on social anxiety

From the tasks conducted in this thesis, it is clear that socially-anxious participants are more likely to drink alcohol in order to cope, in other words, to reduce or regulate their negative emotions (coping motives). This is consistent with previous research which has found that positive alcohol expectancies and negative reinforcement drinking motives might explain in part the relationship between social anxiety and alcohol use (Ham et al., 2016; O'Hara et al., 2015).

Self-focused attention is defined as 'an awareness of self-referent, internally-generated information' (Ingram, 1990) and it plays an important role in social anxiety (Clark et al., 1995). According to the Clark and Wells model (1995), when socially-anxious individuals are dealing with social situations they shift attentional processes towards the self in such a way as to provoke detailed observation and monitoring of the self and of the social situation itself. This change in their attentional processes might help them to cope with the challenge of self-presentation during feared situations. Consequently, socially-anxious individuals might also use safety behaviours in order to cope with social anxiety. The avoidance of social situations and non-reactivity might also be considered as safety behaviours for a socially-anxious person. In this thesis, HSA participants exhibited a number of modest attentional biases that might be related to excessive self-focused attention (e.g. longer dwell times in tasks 1-3; increased vigilance for emotional faces in Chapter 3). Also consistent with this proposal, the results showed that higher levels of social anxiety are related to lower scores on the mindfulness facets of "Observing" and "Non-Reactivity", suggesting that HSA individuals might have more difficulties being aware of and attentive to personal feelings and thoughts, and they might also be more judgmental about their thoughts and feelings. In conclusion, HSA individuals showed some differences in attention towards external targets but also in self-focused attention compared to LSA individuals.

Alcohol affected the eye movements of socially-anxious individuals while they were performing a dot-probe task with a long stimulus presentation time (task 1 – 1500 ms) showing that HSA participants produced longer dwell times for all types of stimuli - compared to LSA participants - under the influence of alcohol. However, alcohol did not affect HSA individuals differently from LSA participants in the shorter dot-probe task which measured only reaction times and not eye movements (task 5 – 500 ms). These findings suggested that eye tracking might be more sensitive for capturing effects of social anxiety when a dot-probe task is involved. The nature of the task is clearly important for identifying differences between groups since alcohol did not affect HSA and LSA participants differently during the antisaccade and prosaccade tasks. An important difference between the tasks is the inclusion of a further activity (pressing specific keys on a keyboard in reaction to particular targets) during the dot probe task. As the activity increased the cognitive demand, and alcohol reduced attentional capacity during the activity, socially-anxious participants might have been able to allocate more attention to the stimuli, and consequently they might have experienced less anxiety during the task, in line with a main assumption of the Attention Allocation Model (Steel et al., 1990).

Regarding the effects of alcohol on decision-making processes in socially-anxious individuals, in the IGT the HSA participants selected fewer advantageous choices in the placebo condition compared with the LSA participants, but selected more advantageous choices in the alcohol condition, suggesting that alcohol might have changed and improved HSA participants' performance by reducing sensitivity to the threat stimuli in HSA participants. These findings were in contrast with our predictions, which anticipated more cautious (better) performance by the HSA participants after placebo. In contrast, neither alcohol nor social anxiety influenced performance on the GDT, a non-ambiguous task in which the rules were explicit from the beginning and without emotional content present. The difference in decision making performance between the groups on the two tasks might be due to the presence of emotional content ("threat stimuli") in the first task (placebo condition), which might have affected the HSA group performance negatively.

5.4.2. Effects of alcohol on reaction times, speed and accuracy

Overall, alcohol impaired response speed when using the dot probe paradigm (tasks 1 and 3), suggesting a deleterious effect on information processing capacity over time (Rohrbaugh et al., 1988; Krull et al., 1994). Additionally, alcohol increased participants' error rates in tasks 2 and 3. This is in line with previous studies that tested the effects of alcohol on reaction times, speed and accuracy in the early stage of information processing, showing that alcohol can produce wide-ranging impairments in performance as a consequence (Gustafson, 1986; Lemon et al., 1993; Maylor et al., 1990; Jaaskelainen et al., 1995). However, there was no effect of alcohol on social anxiety, and HSA and LSA participants did not perform differently in the alcohol condition compared with the placebo condition.

5.4.3. Effects of alcohol on decision-making

As mentioned above, HSA individuals generally performed worse than LSA participants during the IOWA task in the placebo condition, but they increased their number of safe choices after drinking alcohol and thereby improved performance, suggesting that alcohol may have a positive effect on decision-making processes in socially-anxious individuals when emotional content is presented. Therefore, alcohol consumption might be reinforced as a self-medication strategy to reduce the impact of emotive stimuli and to reduce disruption of performance. The altered IGT performance is a new and important finding; it is the first study investigating how alcohol affects performance under ambiguity and risk in high socially-anxious and low socially-anxious individuals.

5.5. Methodological issues: Strengths and Limitations

The tasks conducted in this thesis had several strengths including the relatively large sample sizes and the inclusion of two test sessions in a controlled laboratory setting. Previous studies that used smaller samples to investigate attentional biases on social anxiety using a dot probe paradigm (e.g. Mogg et al., 2004 with a sample of 30 participants; Helfenstein et al., 2008 with a sample of 24 participants); as well as previous studies testing the effects of alcohol on cognitive processes in smaller samples (e.g. Birak et al., 2011 with a sample of 24 participants; Maylor et al., 1994 using a sample of 24 participants); and studies that tested the influence of alcohol using an eye tracking studies (e.g. Vorstius et al., 2012 using a sample of 20 participants; Silva et al., 2017 using a sample of 20 participants). Nevertheless,the absence of power analysis in advance (and the difficulty of identifying suitable effect sizes beforehand) does mean that the studies may be underpowered and that the effects reported for tasks 1-5 need to be corroborated with suitable replication.

An important strength of the studies in the thesis is that all tasks were counterbalanced by drinking procedure, allowing us to control for the effects of drinking variables in the designs, in which the same participants were tested repeatedly. In order to recruit an appropriate target population for research participation, the inclusion criteria specified that all participants must be social drinkers: only participants that consumed more than 8 alcohol units (for tasks 1-3) and 12 alcohol units (for tasks 4-5) were invited to attend. This was ethically necessary too, in order to minimise the risk of an adverse reaction to alcohol. Additionally, individuals who scored between 35 and 38 on the BFNE scale could not take part, in order to widen the gap between the two groups (instead of a simple median split), and in line with previous research that has used a similar cut-off score of 38 to assign participants to the HSA group (Carleton et al., 2011). Another strength is that, originally, more than one measure of social anxiety was compared. Looking at the different social anxiety scales at the satsrt allowed us to compare the results of other scales with BFNE scores and to validate the choice of BFNE as the social anxiety questionnaire to be used to divide participants into two groups.

For tasks 1-3 the EyeLink 1000 eye tracker was used (SR Research, 2016); this is widely considered to provide the highest spatial precision and accuracy among commercial eye-trackers. Eye-tracking was only used in the first set of tasks because (1) the method identified only limited effects of social anxiety and alcohol on attentional processes, given the effort required and the time involved to collect and collate data; (2) subsequent studies shifted towards the study of decision-making processes (rather than attention specifically), and other measures are more suitable in this context.

Finally, an important strength of this thesis is that participants were not aware of the purpose of each task. During the recruitment process, the studies were advertised as opportunities to investigate the effects of alcohol on cognitive processes in social drinkers. By doing this, it was possible to recruit participants with high levels of social anxiety who might not otherwise have participated.

Despite its strengths, there are also some important limitations that need to be acknowledged. First, the studies were restricted to a non-clinical population. It is assumed that social anxiety is distributed along a continuum extending from no or little social anxiety up to clinical levels of social anxiety. Chapters 2 and 3 included dot-probe paradigms based on the assumption that the attentional bias might depend on the severity of social anxiety. Therefore, an attentional bias might have been clearer in patients with SAD rather than in participants with high levels of social anxiety selected by splitting a sample of students into two groups using the BFNE. However, despite the non clinical sample we used, some effects of social anxiety were identified, and these were often in line with other studies that tested attentional biases using a dot probe task in an undergraduate sample with moderate and high social anxiety (Sluis et al., 2014). Another limitation is that in this set of tasks participants were tested in a "sterile" laboratory context. The effects of alcohol on social anxiety still need to be studied more in "real-life" situations, including more realistic social challenges, or during controlled social tasks. Some studies that have tested the effects of alcohol on social anxiety actually induced anxiety as part of the procedure (e.g. Abrams et al., 2001; Stevens et al., 2014) allowing the researchers to test the influence of alcohol on attentional processing during a more realistic social situation. The studies here did not investigate the effects of alcohol on socially-anxious individuals under conditions of induced anxiety. However, this thesis was most concerned with cognitive processes related to social anxiety, so an experimental approach was the most appropriate way of doing this. Also, all of the tasks (but not the survey) required the participants to interact personally with the experimenter, who was unknown to them, thus introducing an element of social interaction and performance scrutiny that might be considered stressful.

Additionally, especially in the last study, large proportions of the samples were female. Previous research suggested that there might be important gender differences in alcohol use (Nolen-Hoeksema, 2004), social anxiety (Xu et al., 2012), and their co-occurrence (De Boer et al., 1993), but also in the use of emotion regulation strategies (Tamres et al., 2002). A study investigating gender differences in alcohol use and mindfulness traits reported that drinking to cope was negatively associated with openness and positively associated with non-attachment to thoughts only in men, and not in women (Leigh et al., 2009). High socially-anxious women have also been reported to have more alcohol-related problems compared to high socially-anxious men (Norberg et al., 2009). These studies suggest a need to understand possible differences between genders across variables to inform prevention and intervention programs that might differ between genders.

Finally, the survey study is inevitably limited by the use of self-report measures, which can be subject to biases (e.g. social desirability). Despite this, clear relationships between relevant variables were identified, and many of these were consistent with previous research. However, it would be informative to relate these outcomes to relevant measures of actual behaviour in the same participants.

5.6. Future Studies

The main aim of this thesis was to explore the effects of alcohol on cognitive processes (attention and decision-making) in socially-anxious individuals, and the findings raise a number of suggestions for future research. For example, the hypotheses were tested using a non-clinical sample of socially-anxious individuals, with no history of alcohol use disorder. Clinical samples might reveal stronger or different effects of alcohol on social anxiety while performing the kinds of tasks used in this thesis. Second, as mentioned previously, the studies measured cognitive variables in socially-anxious participants during situations that did not require social performance or social evaluation by others. Socially-anxious individuals may experience the negative effects of social anxiety during specific performance where anxiety is activated (e.g. a speech task). Previous studies that have investigated the effects of alcohol on socially-anxious individuals while performing a speech task showed that alcohol influenced social performance and anxiety (Stevens et al., 2017). By designing a task that might require performance that includes a social component after drinking alcohol, more pronounced effects of alcohol might be revealed in HSA compared to LSAs individuals. As mentioned before, future research could also test whether or not the current findings are robust for both genders.

The final survey study reported important findings showing relationships between mindfulness traits and drinking behaviours and motives. Based on such outcomes, future studies might explore the effect of mindfulness training in HSA vs LSA individuals before performing a task during a social situation (e.g. a speech task) to increase awareness of the present moment and to teach the ability of non-reactivity during a stressful social situation. Then, socially-anxious people with high levels of mindfulness might be less motivated to consume alcohol as a way of attempting to manage mood. In conclusion, further research can shed light on the dynamics of the relationship explored throughout this thesis (social anxiety, alcohol influence and cognitive processes).

5.7. Implications

Understanding how alcohol influences social anxiety and cognitive processes might be critical to develop appropriate prevention and treatment programs and to identify individuals at risk for problem drinking. The self-report findings here have shown that socially-anxious individuals drink to cope with negative feelings. Understanding the reason why socially-anxious individuals consume alcohol is fundamental given the high exposure in the undergraduate student populations to the availability of alcohol and to the novel social situations that might lead the students to drink in order to reduce discomfort (e.g. Eggleston et al., 2004; Ham et al., 2005). The results from the final study also provide evidence that socially-anxious individuals might benefit from mindfulness-based interventions designed to teach individuals how to “stay present” and manage anxiety and alcohol cravings. Previous research supports the theory that mindfulness is a skill that can be learned, practised and improved upon (Bishop et al., 2004). Mindfulness has also been associated with goal-directed behaviours and less intrusive negative thinking (Masicampo et al., 2007), thus mindfulness based interventions might be helpful for socially-anxious individuals who are generally characterised by excessive self-focused attention and self-related judgments (Salkovskis, 1991; Clark et al., 1995; Wells et al., 1995). The survey findings also suggested that participants who reported drinking in order to cope with negative feelings and to conform in social situations, also reported being judgmental when perceiving thoughts and feelings and reported not being attentive in the present moment. These results suggest that teaching individuals who are heavy drinkers and socially-anxious to engage in the mindfulness technique of focusing on internal cues (e.g. breath) and accepting negative feelings without being critical might result in less judgment of their thoughts and feelings and increased attention to the present moment. The act of focusing on the current moment without reacting and without judgment is effectively used in the treatment of anxiety disorders (Chambless et al., 2001). A challenge with prevention and intervention programs for social anxiety is that socially-anxious individuals don’t generally seek treatment for their symptoms, despite the availability of effective treatments (Olfson et al., 2000). In 1994, a nonprofit educational program was started in the USA (National Anxiety Disorders Screening

Day) that organises screening days to help participants understand if they have symptoms of anxiety disorders; participants are then directed to particular, relevant local treatment resources and services. In the UK, interventions are facilitated by the NHS or via specific charities (e.g. Anxiety UK), who offer support groups, therapy services and anxiety management courses.

5.8. Conclusions

This thesis presented a number of studies that examined relationships between alcohol use, cognition, and social anxiety that have not been studied before. Methods adopted included eye tracking tasks to assess attentional processes, decision-making paradigms, and self-report measures of attentional styles and drinking behaviours. In summary, the thesis revealed a complex interaction between social anxiety, cognition (specifically attention and decision-making) and alcohol use. The selective effects of alcohol on people with high levels of social anxiety were relatively small, and included: a tendency to attend more to emotional face stimuli (irrespective of threat content); making more advantageous choices in a decision-making task that included emotional stimuli; and correlations between social anxiety and specific mindfulness traits. Consistently, coping motivations for alcohol consumption were stronger in people with high levels of social anxiety. The findings therefore only partly and selectively support expectations from the Self-Medication Hypothesis and the Attention Allocation Model.

Reference List

Abidin, R. R., Jenkins, C. L., & McGaughey, M. C. (1992). The relationship of early family variables to children's subsequent behavioral adjustment. *Journal of Clinical Child and Adolescent Psychology*, *21*(1), 60-69.

Abrams, K., Kushner, M., Medina, K. L., & Voight, A. (2001). The pharmacologic and expectancy effects of alcohol on social anxiety in individuals with social phobia. *Drug and alcohol dependence*, *64*(2), 219-231.

Abroms, B. D., Fillmore, M. T., & Marczinski, C. A. (2003). Alcohol-induced impairment of behavioral control: effects on the alteration and suppression of prepotent responses. *Journal of Studies on Alcohol*, *64*(5), 687-695.

Adolphs, R. (2006). Perception and emotion: How we recognize facial expressions. *Current directions in psychological science*, *15*(5), 222-226.

Ahmadi, A., Pearlson, G. D., Meda, S. A., Dager, A., Potenza, M. N., Rosen, R., ... & Wood, R. M. (2013). Influence of alcohol use on neural response to Go/No-Go task in college drinkers. *Neuropsychopharmacology*, *38*(11), 2197-2208.

Ainsworth, B., & Garner, M. (2013). Attention control in mood and anxiety disorders: evidence from the antisaccade task. *Human Psychopharmacology: Clinical and Experimental*, *28*(3), 274-280.

Alpers, G. W., & Gerdes, A. (2007). Here is looking at you: emotional faces predominate in binocular rivalry. *Emotion*, *7*(3), 495.

Alpers, G. W., Adolph, D., & Pauli, P. (2011). Emotional scenes and facial expressions elicit different psychophysiological responses. *International Journal of Psychophysiology*, *80*(3), 173-181.

Althoff, R. R., & Cohen, N. J. (1999). Eye-movement-based memory effect: a reprocessing effect in face perception. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *25*(4), 997.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Amir, N., Elias, J., Klumpp, H., & Przeworski, A. (2003). Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat?. *Behaviour research and therapy*, *41*(11), 1325-1335.

Amir, N., Klumpp, H., Elias, J., Bedwell, J. S., Yanasak, N., & Miller, L. S. (2005). Increased activation of the anterior cingulate cortex during processing of disgust faces in individuals with social phobia. *Biological psychiatry*, *57*(9), 975-981.

Amir, N., Beard, C., Taylor, C. T., Klumpp, H., Elias, J., Burns, M., & Chen, X. (2009). Attention training in individuals with generalized social phobia: A randomized controlled trial. *Journal of consulting and clinical psychology*, *77*(5), 961.

Ammerman, R. T. (1988). Fear of negative evaluation. In: M. Hersen & A. S. Bellack

(Eds.), *Dictionary of behavioral assessment techniques* (pp. 214–215). New York: Prentice-Hall.

Anokhin, A. P., & Golosheykin, S. (2010). Startle modulation by affective faces. *Biological psychology*, *83*(1), 37-40.

Ansari, T. L., Derakshan, N., & Richards, A. (2008). Effects of anxiety on task switching: Evidence from the mixed antisaccade task. *Cognitive, Affective, & Behavioral Neuroscience*, *8*(3), 229-238.

Ansari, D., Lyons, I. M., van Eimeren, L., & Xu, F. (2007). Linking visual attention and number processing in the brain: The role of the temporo-parietal junction in small and large symbolic and nonsymbolic number comparison. *Journal of Cognitive Neuroscience*, *19*(11), 1845-1853.

Antoniades, C. A., Xu, Z., Carpenter, R. H. S., & Barker, R. A. (2013). The relationship between abnormalities of saccadic and manual response times in Parkinson's disease. *Journal of Parkinson's Disease*, *3*(4), 557-563.

Aroniadou-Anderjaska, V., Qashu, F., & Braga, M. M. (2007). Mechanisms regulating GABAergic inhibitory transmission in the basolateral amygdala: implications for epilepsy and anxiety disorders. *Amino acids*, *32*(3), 305-315.

Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of experimental psychology: General*, *130*(2), 224.

Averbeck, B. B., & Duchaine, B. (2009). Integration of social and utilitarian factors in decision-making. *Emotion*, *9*(5), 599.

Bachrach, R. L., Merrill, J. E., Bytschkow, K. M., & Read, J. P. (2012). Development and initial validation of a measure of motives for pregaming in college students. *Addictive Behaviors, 37*(9), 1038-1045.

Bacon, A. K., & Ham, L. S. (2010). Attention to social threat as a vulnerability to the development of comorbid social anxiety disorder and alcohol use disorders: an avoidance-coping cognitive model. *Addictive behaviors*, *35*(11), 925-939.

Baddeley, A. D., & Hitch, G. (2001). *Working memory in perspective*. Psychology Press.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Five Facet Mindfulness Questionnaire. *Assessment*, *13*, 27-45.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, *13*(1), 27-45.

Bahill, A. T., & Stark, L. (1975). Overlapping saccades and glissades are produced by fatigue in the saccadic eye movement system. *Experimental neurology*, *48*(1), 95-106.

Baillie, A., & Sannibale, C. (2007). Anxiety and drug and alcohol problems. *Clinical handbook of co-existing mental health and drug and alcohol problems*, 197-217.

Balodis, I. M., MacDonald, T. K., & Olmstead, M. C. (2006). Instructional cues modify performance on the Iowa Gambling Task. *Brain and Cognition*, *60*(2), 109-117.

Baloh, R. W., Kumley, W. E., Sills, A. W., Honrubia, V., & Konrad, H. R. (1976). Quantitative measurement of smooth pursuit eye movements. *Annals of Otology, Rhinology & Laryngology*, *85*(1), 111-119.

Bandelow, B., & Michaelis, S. (2015). Epidemiology of anxiety disorders in the 21st century. *Dialogues in clinical neuroscience*, *17*(3), 327.

Bantin, T., Stevens, S., Gerlach, A. L., & Hermann, C. (2016). What does the facial dot-probe task tell us about attentional processes in social anxiety? A systematic review. *Journal of behavior therapy and experimental psychiatry*, *50*, 40-51.

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: a meta-analytic study. *Psychological bulletin*, *133*(1), 1.

Barlow, D. H. (1986). Causes of sexual dysfunction: The role of anxiety and cognitive interference. *Journal of consulting and clinical psychology*, *54*(2), 140.

Barry, A. E., Stellefson, M. L., Piazza-Gardner, A. K., Chaney, B. H., & Dodd, V. (2013). The impact of pregaming on subsequent blood alcohol concentrations: An event-level analysis. *Addictive behaviors*, *38*(8), 2374-2377.

Barton, R. A., Purvis, A., & Harvey, P. H. (1995). Evolutionary radiation of visual and olfactory brain systems in primates, bats and insectivores. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *348*(1326), 381-392.

Baumeister, R. F., & Tice, D. M. (1990). Point-counterpoints: Anxiety and social exclusion. *Journal of social and clinical Psychology*, *9*(2), 165-195.

Bechara, A., & Damasio, H. (2002). Decision-making and addiction (part I): impaired activation of somatic states in substance dependent individuals when pondering decisions with negative future consequences. *Neuropsychologia*, *40*(10), 1675-1689.

Bechara, A., Damasio, A. R., Damasio, H., & Anderson, S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, *50*, 1-3.

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behaviour research and therapy*, *35*(1), 49-58.

Beesdo, K., Bittner, A., Pine, D. S., Stein, M. B., Höfler, M., Lieb, R., & Wittchen, H. U. (2007). Incidence of social anxiety disorder and the consistent risk for secondary depression in the first three decades of life. *Archives of general psychiatry*, *64*(8), 903-912.

Beesdo-Baum, K., & Knappe, S. (2012). Developmental epidemiology of anxiety disorders. *Child and Adolescent Psychiatric Clinics*, *21*(3), 457-478.

Beidel, D. C., Turner, S. M., & Morris, T. L. (1998). *Social phobia and anxiety inventory for children: SPAI-C*. North Tonawanda, NY: Multi-Health Systems.

Beidel, D. C., & Turner, S. M. (2007). *Shy children, phobic adults: Nature and treatment of social anxiety disorders*. American Psychological Association.

Bickel, W. K., Miller, M. L., Yi, R., Kowal, B. P., Lindquist, D. M., & Pitcock, J. A. (2007). Behavioral and neuroeconomics of drug addiction: competing neural systems and temporal discounting processes. *Drug and alcohol dependence*, *90*, S85-S91.

Birak, K. S., Terry, P., & Higgs, S. (2010). Effect of cues associated with an alcoholic beverage on executive function. *Journal of studies on alcohol and drugs*, *71*(4), 562-569.

Birak, K. S., Higgs, S., & Terry, P. (2011). Conditioned tolerance to the effects of alcohol on inhibitory control in humans. *Alcohol and alcoholism*, *46*(6), 686-693.

Birbaumer, N., Grodd, W., Diedrich, O., Klose, U., Erb, M., Lotze, M., ... & Flor, H. (1998). fMRI reveals amygdala activation to human faces in social phobics. *Neuroreport*, *9*(6), 1223-1226.

Bishop, S. J. (2009). Trait anxiety and impoverished prefrontal control of attention. *Nature neuroscience*, *12*(1), 92-98.

Blais, C., Jack, R. E., Scheepers, C., Fiset, D., & Caldara, R. (2008). Culture shapes how we look at faces. *PloS one*, *3*(8), e3022.

Blekher, T., Ramchandani, V. A., Flury, L., Foroud, T., Kareken, D., Yee, R. D., ... & O'Connor, S. (2002). Saccadic eye movements are associated with a family history of alcoholism at baseline and after exposure to alcohol. *Alcoholism: Clinical and Experimental Research*, *26*(10), 1568-1573.

Bodenlos, J. S., Noonan, M., & Wells, S. Y. (2013). Mindfulness and alcohol problems in college students: The mediating effects of stress. *Journal of American College Health*, *61*(6), 371-378.

Bögels, S. M., & Mansell, W. (2004). Attention processes in the maintenance and treatment of social phobia: hypervigilance, avoidance and self-focused attention. *Clinical psychology review*, *24*(7), 827-856.

Bögels, S. M., Alden, L., Beidel, D. C., Clark, L. A., Pine, D. S., Stein, M. B., & Voncken, M. (2010). Social anxiety disorder: questions and answers for the DSM-V. *Depression and anxiety*, *27*(2), 168-189.

Book, S. W., & Randall, C. L. (2002). Social anxiety disorder and alcohol use. *Alcohol Research & Health*, *26*(2), 130.

Booth, C., & Hasking, P. (2009). Social anxiety and alcohol consumption: The role of alcohol expectancies and reward sensitivity. *Addictive behaviors*, *34*(9), 730-736.

Borkovec, T. D., Wilkinson, L., Folensbee, R., & Lerman, C. (1983). Stimulus control applications to the treatment of worry. *Behaviour research and therapy*, *21*(3), 247-251.

Borkovec, T. D. (2002). Life in the future versus life in the present. *Clinical Psychology: Science and Practice, 9*(1), 76-80.

Borkovec, T. D., Alcaine, O., & Behar, E. W. E. L. Y. N. (2004). Avoidance theory of worry and generalized anxiety disorder. *Generalized anxiety disorder: Advances in research and practice*, *2004*.

Borkovec, T. D., & Sharpless, B. (2004). Generalized Anxiety Disorder: Bringing Cognitive-Behavioral Therapy into the Valued Present.

Bowen, S., & Enkema, M. C. (2014). Relationship between dispositional mindfulness and substance use: findings from a clinical sample. Addictive Behaviors, 39, 532–537.

Bradley, B. P., Mogg, K., Falla, S. J., & Hamilton, L. R. (1998). Attentional bias for threatening facial expressions in anxiety: Manipulation of stimulus duration. *Cognition & emotion*, *12*(6), 737-753.

Brand, M., Fujiwara, E., Borsutzky, S., Kalbe, E., Kessler, J., & Markowitsch, H. J. (2005). Decision-making deficits of korsakoff patients in a new gambling task with explicit rules: associations with executive functions. *Neuropsychology*, *19*(3), 267.

Brand, M., Recknor, E. C., Grabenhorst, F., & Bechara, A. (2007). Decisions under ambiguity and decisions under risk: correlations with executive functions and comparisons of two different gambling tasks with implicit and explicit rules. *Journal of clinical and experimental neuropsychology*, *29*(1), 86-99.

Breiter, H. C., Etcoff, N. L., Whalen, P. J., Kennedy, W. A., Rauch, S. L., Buckner, R. L., ... & Rosen, B. R. (1996). Response and habituation of the human amygdala during visual processing of facial expression. *Neuron*, *17*(5), 875-887.

Broadbent, D. E., Cooper, P. F., FitzGerald, P., & Parkes, K. R. (1982). The cognitive failures questionnaire (CFQ) and its correlates. *British journal of clinical psychology*, *21*(1), 1-16.

Brockveld, K. C., Perini, S. J., & Rapee, R. M. (2014). Social anxiety and social anxiety disorder across cultures. In *Social Anxiety* (pp. 141-158). Academic Press.

Brown, E. J., Heimberg, R. G., & Juster, H. R. (1995). Social phobia subtype and avoidant personality disorder: Effect on severity of social phobia, impairment, and outcome of cognitive behavioral treatment. *Behavior Therapy*, *26*(3), 467-486.

Brown, T. A., Di Nardo, P. A., Lehman, C. L., & Campbell, L. A. (2001). Reliability of DSM-IV anxiety and mood disorders: implications for the classification of emotional disorders. *Journal of abnormal psychology*, *110*(1), 49.

Bryant, B., & Trower, P. E. (1974). Social difficulty in a student sample. *British Journal of Educational Psychology*, *44*(1), 13-21.

Brysbaert, M., & Nazir, T. (2005). Visual constraints in written word recognition: evidence from the optimal viewing-position effect. *Journal of Research in Reading*, *28*(3), 216-228.

Bruce, V., & Young, A. (1986). Understanding face recognition. *British journal of psychology*, *77*(3), 305-327.

Bruce, S. E., Yonkers, K. A., Otto, M. W., Eisen, J. L., Weisberg, R. B., Pagano, M., ... & Keller, M. B. (2005). Influence of psychiatric comorbidity on recovery and recurrence in generalized anxiety disorder, social phobia, and panic disorder: a 12-year prospective study. *American Journal of psychiatry*, *162*(6), 1179-1187.

Bublatzky, F., Gerdes, A., White, A. J., Riemer, M., & Alpers, G. W. (2014). Social and emotional relevance in face processing: happy faces of future interaction partners enhance the late positive potential. *Frontiers in human neuroscience, 8*, 493.

Buckner, J. D., Eggleston, A. M., & Schmidt, N. B. (2006). Social anxiety and problematic alcohol consumption: The mediating role of drinking motives and situations. *Behavior therapy*, *37*(4), 381-391.

Buckner, J. D., Schmidt, N. B., Lang, A. R., Small, J. W., Schlauch, R. C., & Lewinsohn, P. M. (2008). Specificity of social anxiety disorder as a risk factor for alcohol and cannabis dependence. *Journal of psychiatric research*, *42*(3), 230-239.

Buckner, J. D., & Heimberg, R. G. (2010). Drinking behaviors in social situations account for alcohol-related problems among socially-anxious individuals. *Psychology of Addictive Behaviors*, *24*(4), 640.

Buckner, J. D., Maner, J. K., & Schmidt, N. B. (2010). Difficulty disengaging attention from social threat in social anxiety. *Cognitive therapy and research*, *34*(1), 99-105.

Burke, R. S., & Stephens, R. S. (1999). Social anxiety and drinking in college students: A social cognitive theory analysis. *Clinical psychology review*, *19*(5), 513-530.

Burstein, M., He, J. P., Kattan, G., Albano, A. M., Avenevoli, S., & Merikangas, K. R. (2011). Social phobia and subtypes in the National Comorbidity Survey–Adolescent Supplement: prevalence, correlates, and comorbidity. *Journal of the American Academy of Child & Adolescent Psychiatry*, *50*(9), 870-880.

Burstein, M., Beesdo-Baum, K., He, J. P., & Merikangas, K. R. (2014). Threshold and subthreshold generalized anxiety disorder among US adolescents: prevalence, sociodemographic, and clinical characteristics. *Psychological medicine*, *44*(11), 2351.

Brick, J., Pohorecky, L. A., & DeTurck, K. (1987). Cardiac lipase: effect of ethanol and stress. *Life sciences*, *40*(19), 1897-1901.

Burton, C. M., Pedersen, S. L., & McCarthy, D. M. (2012). Impulsivity moderates the relationship between implicit associations about alcohol and alcohol use. *Psychology of addictive behaviors*, *26*(4), 766.

Butler, S. H., & Harvey, M. (2006). Perceptual biases in chimeric face processing: eye-movement patterns cannot explain it all. *Brain research*, *1124*(1), 96-99.

Byrne, A., & Eysenck, M. W. (1995). Trait anxiety, anxious mood, and threat detection. *Cognition & Emotion*, *9*(6), 549-562.

Burns, L., & Teesson, M. (2002). Alcohol use disorders comorbid with anxiety, depression and drug use disorders: Findings from the Australian National Survey of Mental Health and Well Being. *Drug and alcohol dependence, 68*(3), 299-307.

Bjork, J. M., Smith, A. R., & Hommer, D. W. (2008). Striatal sensitivity to reward deliveries and omissions in substance dependent patients. *Neuroimage, 42*(4), 1609-1621.

Calvo, M. G. (1985). Effort, aversive representations and performance in test anxiety. *Personality and individual differences*, *6*(5), 563-571.

Calvo, M. G., & Carreiras, M. (1993). Selective influence of test anxiety on reading processes. *British Journal of Psychology*, *84*(3), 375-388.

Calvo, M. G., Eysenck, M. W., Ramos, P. M., & Jiménez, A. (1994). Compensatory reading strategies in test anxiety. *Anxiety, Stress, and Coping*, *7*(2), 99-116.

Calvo, M. G., Gutiérrez-García, A., & Fernández-Martín, A. (2018). Time course of selective attention to face regions in social anxiety: eye-tracking and computational modelling. *Cognition and Emotion*.

Canino, G., Shrout, P. E., Rubio-Stipec, M., Bird, H. R., Bravo, M., Ramírez, R., ... & Ribera, J. (2004). The dsm-iv rates of child and adolescent disordersin puerto rico: prevalence, correlates, service use, and the effects of impairment. *Archives of general psychiatry*, *61*(1), 85-93.

Carleton, R. N., Collimore, K. C., McCabe, R. E., & Antony, M. M. (2011). Addressing revisions to the Brief Fear of Negative Evaluation scale: Measuring fear of negative evaluation across anxiety and mood disorders. *Journal of anxiety disorders*, *25*(6), 822-828.

Carrigan, M. H., & Randall, C. L. (2003). Self-medication in social phobia: A review of the alcohol literature. *Addictive behaviors*, *28*(2), 269-284.

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: the BIS/BAS scales. *Journal of personality and social psychology*, *67*(2), 319.

Caswell, A. J., Morgan, M. J., & Duka, T. (2013). Acute alcohol effects on subtypes of impulsivity and the role of alcohol-outcome expectancies. *Psychopharmacology*, *229*(1), 21-30.

Chambless, D. L., Cherney, J., Caputo, G. C., & Rheinstein, B. J. (1987). Anxiety disorders and alcoholism:: A study with inpatient alcoholics. *Journal of Anxiety Disorders*, *1*(1), 29-40.

Chambless, D. L., & Ollendick, T. H. (2001). Empirically supported psychological interventions: Controversies and evidence. *Annual review of psychology*, *52*(1), 685-716.

Chen, Y. P., Ehlers, A., Clark, D. M., & Mansell, W. (2002). Patients with generalized social phobia direct their attention away from faces. *Behaviour research and therapy*, *40*(6), 677-687.

Cheng, D. T., Knight, D. C., Smith, C. N., & Helmstetter, F. J. (2006). Human amygdala activity during the expression of fear responses. *Behavioral neuroscience*, *120*(6), 1187.

Cherny, N. I., & Portenoy, R. K. (1994). Sedation in the management of refractory symptoms: guidelines for evaluation and treatment. *Journal of palliative care*, *10*(2), 31-38.

Chiesa, A., & Serretti, A. (2014). Are mindfulness-based interventions effective for substance use disorders? A systematic review of the evidence. Substance Use & Misuse, 49, 492–512.

Chutuape, M. A. D., & de Wit, H. (1995). Preferences for ethanol and diazepam in anxious individuals: an evaluation of the self-medication hypothesis. *Psychopharmacology*, *121*(1), 91-103.

Cisler, J. M., & Koster, E. H. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. *Clinical psychology review*, *30*(2), 203-216.

Clark, D. M., & McManus, F. (2002). Information processing in social phobia. *Biological psychiatry*, *51*(1), 92-100.

Clerkin, E. M., Sarfan, L. D., Parsons, E. M., & Magee, J. C. (2017). Mindfulness facets, social anxiety, and drinking to cope with social anxiety: testing mediators of drinking problems. *Mindfulness*, *8*(1), 159-170.

Cockburn, J., & Smith, P. T. (1994). Anxiety and errors of prospective memory among elderly people. *British Journal of Psychology*, *85*(2), 273-282.

Collette, F., & Van der Linden, M. (2002). Brain imaging of the central executive component of working memory. *Neuroscience & Biobehavioral Reviews*, *26*(2), 105-125.

Collewijn, H., Van der Mark, F., & Jansen, T. C. (1975). Precise recording of human eye movements. *Vision research*.

Conger, J. J. (1951). The effects of alcohol on conflict behavior in the albino rat. *Quarterly Journal of Studies on Alcohol*, *12*(1), 1-29.

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological assessment*, *6*(2), 117.

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *Journal of personality and social psychology*, *69*(5), 990.

Cooper, M. L., Kuntsche, E., Levitt, A., Barber, L. L., & Wolf, S. (2016). Motivational models of substance use: A review of theory and research on motives for using alcohol, marijuana, and tobacco.

Cooper, R. M., & Langton, S. R. (2006). Attentional bias to angry faces using the dot-probe task? It depends when you look for it. *Behaviour research and therapy*, *44*(9), 1321-1329.

Corbetta, M., & Shulman, G. L. (2002). Control of goal-directed and stimulus-driven attention in the brain. *Nature reviews neuroscience*, *3*(3), 201-215.

Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of abnormal psychology*, *97*(2), 168.

Crevits, L., Hanse, M. C., Tummers, P., & Van Maele, G. E. O. R. G. E. S. (2000). Antisaccades and remembered saccades in mild traumatic brain injury. *Journal of neurology*, *247*(3), 179-182.

Damasio, A. R., Tranel, D., & Damasio, H. C. (1991). Behavior: theory and preliminary testing. *Frontal lobe function and dysfunction*, *217*.

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Memory and Language*, *19*(4), 450.

Darke, S. (1988). Anxiety and working memory capacity. *Cognition and emotion*, *2*(2), 145-154.

Davidson, J. R., Hughes, D. L., George, L. K., & Blazer, D. G. (1993). The epidemiology of social phobia: findings from the Duke Epidemiological Catchment Area Study. *Psychological medicine*, *23*(3), 709-718.

Davidson, K. M., & Ritson, E. B. (1993). The relationship between alcohol dependence and depression. *Alcohol and Alcoholism*, *28*(2), 147-155.

Davis, M., & Whalen, P. J. (2001). The amygdala: vigilance and emotion. *Molecular psychiatry*, *6*(1), 13-34.

De Wit, H. (2000). Laboratory-based assessment of alcohol craving in social drinkers. *Addiction*, *95*(8s2), 165-169.

Derakshan, N., & Eysenck, M. W. (2009). Anxiety, processing efficiency, and cognitive performance: New developments from attentional control theory. *European Psychologist*, *14*(2), 168-176.

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of abnormal psychology*, *111*(2), 225.

Desrosiers, A., Klemanski, D. H., & Nolen-Hoeksema, S. (2013). Mapping mindfulness facets onto dimensions of anxiety and depression. Behavior Therapy, 44, 373–384.

Dickinson, E. R., Adelson, J. L., & Owen, J. (2012). Gender balance, representativeness, and statistical power in sexuality research using undergraduate student samples. *Archives of Sexual Behavior*, *41*(2), 325-327.

Dom, G., D'haene, P., Hulstijn, W., & Sabbe, B. G. C. C. (2006). Impulsivity in abstinent early-and late-onset alcoholics: differences in self-report measures and a discounting task. *Addiction*, *101*(1), 50-59.

Domschke, K., Tidow, N., Schrempf, M., Schwarte, K., Klauke, B., Reif, A., ... & Deckert, J. (2013). Epigenetic signature of panic disorder: a role of glutamate decarboxylase 1 (GAD1) DNA hypomethylation?. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *46*, 189-196.

Dougherty, D. M., Marsh, D. M., Moeller, F. G., Chokshi, R. V., & Rosen, V. C. (2000). Effects of moderate and high doses of alcohol on attention, impulsivity, discriminability, and response bias in immediate and delayed memory task performance. *Alcoholism: Clinical and Experimental Research*, *24*(11), 1702-1711.

Dougherty, D. M., Marsh-Richard, D. M., Hatzis, E. S., Nouvion, S. O., & Mathias, C. W. (2008). A test of alcohol dose effects on multiple behavioral measures of impulsivity. *Drug and alcohol dependence*, *96*(1-2), 111-120.

Drechsler, R., Rizzo, P., & Steinhausen, H. C. (2008). Decision-making on an explicit risk-taking task in preadolescents with attention-deficit/hyperactivity disorder. *Journal of neural transmission*, *115*(2), 201-209.

Dugas, M. J., Gagnon, F., Ladouceur, R., & Freeston, M. H. (1998). Generalized anxiety disorder: A preliminary test of a conceptual model. *Behaviour research and therapy*, *36*(2), 215-226.

Dunn, B. D., Galton, H. C., Morgan, R., Evans, D., Oliver, C., Meyer, M., ... & Dalgleish, T. (2010). Listening to your heart: How interoception shapes emotion experience and intuitive decision-making. *Psychological science*, *21*(12), 1835-1844.

Dusek, J. B., Kermis, M. D., & Mergler, N. L. (1975). Information processing in low-and high-test-anxious children as a function of grade level and verbal labeling. *Developmental Psychology*, *11*(5), 651.

Dusek, J. B., Mergler, N. L., & Kermis, M. D. (1976). Attention, encoding, and information processing in low-and high-test-anxious children. *Child Development*, 201-207.

Dyckman, K. A., & McDowell, J. E. (2005). Behavioral plasticity of antisaccade performance following daily practice. *Experimental brain research*, *162*(1), 63-69.

Eckstein, M. K., Guerra-Carrillo, B., Singley, A. T. M., & Bunge, S. A. (2017). Beyond eye gaze: What else can eyetracking reveal about cognition and cognitive development?. *Developmental cognitive neuroscience*, *25*, 69-91.

Eggleston, A. M., Woolaway-Bickel, K., & Schmidt, N. B. (2004). Social anxiety and alcohol use: Evaluation of the moderating and mediating effects of alcohol expectancies. *Journal of Anxiety Disorders*, *18*(1), 33-49.

Egloff, B., & Hock, M. (2001). Interactive effects of state anxiety and trait anxiety on emotional Stroop interference. *Personality and Individual Differences*, *31*(6), 875-882.

Egloff, B., & Hock, M. (2003). Assessing attention allocation toward threat-related stimuli: A comparison of the emotional Stroop task and the attentional probe task. *Personality and Individual Differences*, *35*(2), 475-483.

Eisenbarth, H., & Alpers, G. W. (2011). Happy mouth and sad eyes: scanning emotional facial expressions. *Emotion*, *11*(4), 860.

Eley, T. C., Lichtenstein, P., & Stevenson, J. (1999). Sex differences in the etiology of aggressive and nonaggressive antisocial behavior: Results from two twin studies. *Child development*, *70*(1), 155-168.

Ellis, J., Brandimonte, M., Einstein, G. O., & McDaniel, M. A. (1996). Prospective memory: Theory and applications. *Prospective memory or the realization of delayed intentions: A conceptual framework for research. Mahwah, NJ: Erlbaum*.

Elsesser, K., Heuschen, I., Pundt, I., & Sartory, G. (2006). Attentional bias and evoked heart-rate response in specific phobia. *Cognition and Emotion*, *20*(8), 1092-1107.

Eng, W., Coles, M. E., Heimberg, R. G., & Safren, S. A. (2005). Domains of life satisfaction in social anxiety disorder: Relation to symptoms and response to cognitive-behavioral therapy. *Journal of anxiety disorders*, *19*(2), 143-156.

Erwin, B. A., Heimberg, R. G., Schneier, F. R., & Liebowitz, M. R. (2003). Anger experience and expression in social anxiety disorder: Pretreatment profile and predictors of attrition and response to cognitive-behavioral treatment. *Behavior Therapy*, *34*(3), 331-350.

Ettinger, S. M., Nechyba, M. C., Ifju, P. G., & Waszak, M. (2003). Vision-guided flight stability and control for micro air vehicles. *Advanced Robotics*, *17*(7), 617-640.

Eysenck, H. J., Barrett, P., & Eysenck, S. B. G. (1985). Indices of factor comparison for homologous and non-homologous personality scales in 24 different countries. *Personality and Individual Differences*, *6*(4), 503-504.

Eysenck, M. W., MacLeod, C., & Mathews, A. (1987). Cognitive functioning and anxiety. *Psychological research*, *49*(2-3), 189-195.

Eysenck, N. D. M. W. (1998). Working memory capacity in high trait-anxious and repressor groups. *Cognition & Emotion*, *12*(5), 697-713.

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & emotion*, *6*(6), 409-434.

Eysenck, M. W., & Byrne, A. (1992). Anxiety and susceptibility to distraction. *Personality and Individual Differences*, *13*(7), 793-798.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: attentional control theory. *Emotion*, *7*(2), 336.

Everling, S., Krappmann, P., & Flohr, H. (1997). Cortical potentials preceding pro-and antisaccades in man. *Electroencephalography and clinical Neurophysiology*, *102*(4), 356-362.

Everling, S., & Fischer, B. (1998). The antisaccade: a review of basic research and clinical studies. *Neuropsychologia*, *36*(9), 885-899.

Fein, G., & Chang, M. (2008). Smaller feedback ERN amplitudes during the BART are associated with a greater family history density of alcohol problems in treatment-naive alcoholics. *Drug and alcohol dependence*, *92*(1-3), 141-148.

Fein, G., McGillivray, S., & Finn, P. (2004). Mismatch negativity: no difference between treatment-naive alcoholics and controls. *Alcoholism: Clinical and Experimental Research*, *28*(12), 1861-1866.

Fellows, L. K. (2006). Deciding how to decide: ventromedial frontal lobe damage affects information acquisition in multi-attribute decision-making. *Brain*, *129*(4), 944-952.

Fergusson, D. M., & Horwood, L. J. (1999). Prospective childhood predictors of deviant peer affiliations in adolescence. *Journal of Child Psychology and Psychiatry*, *40*(4), 581-592.

Fernandes-Jesus, M., Beccaria, F., Demant, J., Fleig, L., Menezes, I., Scholz, U., ... & Cooke, R. (2016). Validation of the drinking motives questionnaire-revised in six European countries. *Addictive behaviors*, *62*, 91-98.

Fernandez, A. C., Wood, M. D., Stein, A. R., & Rossi, J. S. (2010). Measuring mindfulness and examining its relationship with alcohol use and negative consequences. Psychology of Addictive Behaviors, 24, 608–616.

Field, M., & Duka, T. (2002). Cues paired with a low dose of alcohol acquire conditioned incentive properties in social drinkers. *Psychopharmacology, 159*(3), 325-334.

Fillmore, M. T., & Vogel-Sprott, M. (1999). An alcohol model of impaired inhibitory control and its treatment in humans. *Experimental and clinical psychopharmacology*, *7*(1), 49.

Fillmore, M. T., & Weafer, J. (2013). Behavioral inhibition and addiction.

Finn, P. R., & Pihl, R. O. (1988). Risk for alcoholism: A comparison between two different groups of sons of alcoholics on cardiovascular reactivity and sensitivity to alcohol. *Alcoholism: Clinical and Experimental Research*, *12*(6), 742-747.

Finger, E. C., Marsh, A. A., Blair, K. S., Reid, M. E., Sims, C., Ng, P., ... & Blair, R. J. R. (2011). Disrupted reinforcement signaling in the orbitofrontal cortex and caudate in youths with conduct disorder or oppositional defiant disorder and a high level of psychopathic traits. *American Journal of Psychiatry, 168*(2), 152-162.

Fischer, B., Gezeck, S., & Huber, W. (1995). The three-loop model: a neural network for the generation of saccadic reaction times. *Biological Cybernetics, 72*(3), 185-196.

Fischer, B., & Weber, H. (1997). Effects of stimulus conditions on the performance of antisaccades in man. *Experimental Brain Research*, *116*(2), 191-200.

Ford, T., Goodman, R., & Meltzer, H. (2003). The British child and adolescent mental health survey 1999: the prevalence of DSM-IV disorders. *Journal of the American academy of child & adolescent psychiatry*, *42*(10), 1203-1211.

Foster, J. H., & Ferguson, C. (2014). Alcohol 'pre-loading': A review of the literature. *Alcohol and alcoholism*, *49*(2), 213-226.

Fox, E., Lester, V., Russo, R., Bowles, R. J., Pichler, A., & Dutton, K. (2000). Facial expressions of emotion: Are angry faces detected more efficiently?. *Cognition & emotion*, *14*(1), 61-92.

Fox, E., Russo, R., Bowles, R., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety?. *Journal of experimental psychology: General*, *130*(4), 681.

Franken, I. H. (2002). Behavioral approach system (BAS) sensitivity predicts alcohol craving. *Personality and Individual Differences*, *32*(2), 349-355.

Freitas-Ferrari, M. C., Hallak, J. E., Trzesniak, C., Santos Filho, A., Machado-de-Sousa, J. P., Chagas, M. H. N., ... & Crippa, J. A. S. (2010). Neuroimaging in social anxiety disorder: a systematic review of the literature. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *34*(4), 565-580.

Frewen, P. A., Dozois, D. J., Joanisse, M. F., & Neufeld, R. W. (2008). Selective attention to threat versus reward: Meta-analysis and neural-network modeling of the dot-probe task. *Clinical psychology review*, *28*(2), 308-338.

Frick, A., Gingnell, M., Marquand, A. F., Howner, K., Fischer, H., Kristiansson, M., ... & Furmark, T. (2014). Classifying social anxiety disorder using multivoxel pattern analyses of brain function and structure. *Behavioural brain research*, *259*, 330-335.

Fukushima, K. (1988). Neocognitron: A hierarchical neural network capable of visual pattern recognition. *Neural networks*, *1*(2), 119-130.

Furl, N., Gallagher, S., & Averbeck, B. B. (2012). A selective emotional decision-making bias elicited by facial expressions. *PLoS One*, *7*(3), e33461.

Garner, M., Mogg, K., & Bradley, B. P. (2006). Orienting and maintenance of gaze to facial expressions in social anxiety. *Journal of abnormal psychology*, *115*(4), 760.

Galen, L. W., & Rogers, W. M. (2004). Religiosity, alcohol expectancies, drinking motives and their interaction in the prediction of drinking among college students. *Journal of Studies on Alcohol*, *65*(4), 469-476.

Gan, G., Guevara, A., Marxen, M., Neumann, M., Jünger, E., Kobiella, A., ... & Smolka, M. N. (2014). Alcohol-induced impairment of inhibitory control is linked to attenuated brain responses in right fronto-temporal cortex. *Biological psychiatry*, *76*(9), 698-707.

Garland, E. L., Gaylord, S. A., Boettiger, C. A., & Howard, M. O. (2010). Mindfulness training modifies cognitive, affective, and physiological mechanisms implicated in alcohol dependence: results of a randomized controlled pilot trial. Journal of Psychoactive Drugs, 42, 177–192.

Gaymard, B., Ploner, C. J., Rivaud, S., Vermersch, A. I., & Pierrot-Deseilligny, C. (1998). Cortical control of saccades. *Experimental brain research*, *123*(1-2), 159-163.

Gentili, C., Gobbini, M. I., Ricciardi, E., Vanello, N., Pietrini, P., Haxby, J. V., & Guazzelli, M. (2008). Differential modulation of neural activity throughout the distributed neural system for face perception in patients with Social Phobia and healthy subjects. *Brain Research Bulletin*, *77*(5), 286-292.

Gerdes, A. B., Wieser, M. J., Alpers, G. W., Strack, F., & Pauli, P. (2012). Why do you smile at me while I'm in pain?—Pain selectively modulates voluntary facial muscle responses to happy faces. *International Journal of Psychophysiology*, *85*(2), 161-167.

Gerlach, A. L., Schiller, A., Wild, C., & Rist, F. (2006). Effects of alcohol on the processing of social threat-related stimuli in socially phobic women. *British journal of clinical psychology*, *45*(3), 279-295.

Gilbert, Paul. "Evolution and social anxiety: The role of attraction, social competition, and social hierarchies." *Psychiatric Clinics* 24.4 (2001): 723-751.

Gilbertson, R., Prather, R., & Jo Nixon, S. (2010). Acute alcohol administration and placebo effectiveness in older moderate drinkers: influences on cognitive performance. *Journal of studies on alcohol and drugs*, *71*(3), 345-350.

Gilboa-Schechtman, E., Presburger, G., Marom, S., & Hermesh, H. (2005). The effects of social anxiety and depression on the evaluation of facial crowds. *Behaviour research and therapy*, *43*(4), 467-474.

Gilles, D. M., Turk, C. L., & Fresco, D. M. (2006). Social anxiety, alcohol expectancies, and self-efficacy as predictors of heavy drinking in college students. *Addictive behaviors*, *31*(3), 388-398.

Gilman, J. M., Smith, A. R., Ramchandani, V. A., Momenan, R., & Hommer, D. W. (2012). The effect of intravenous alcohol on the neural correlates of risky decision-making in healthy social drinkers. *Addiction biology*, *17*(2), 465-478.

Godijn, R., & Kramer, A. F. (2007). Antisaccade costs with static and dynamic targets. *Perception & psychophysics*, *69*(5), 802-815.

Goel, V., Gold, B., Kapur, S., & Houle, S. (1997). The seats of reason? An imaging study of deductive and inductive reasoning. *NeuroReport*, *8*(5), 1305-1310.

Goldin, P., Ramel, W., & Gross, J. (2009). Mindfulness meditation training and self-referential processing in social anxiety disorder: Behavioral and neural effects. *Journal of Cognitive Psychotherapy*, *23*(3), 242-257.

Goldin, P., & Gross, J. (2010). Effect of mindfulness meditation training on the neural bases of emotion regulation in social anxiety disorder. *Emotion*, *10*(1), 83-4.

Goldman, M. S., Del Boca, F. K., & Darkes, J. (1999). Alcohol expectancy theory: The application of cognitive neuroscience.

Gooding, D. C., & Tallent, K. A. (2001). The association between antisaccade task and working memory task performance in schizophrenia and bipolar disorder. *The Journal of nervous and mental disease*, *189*(1), 8-16.

Gopher, D., Armony, L., & Greenshpan, Y. (2000). Switching tasks and attention policies. *Journal of Experimental Psychology: General*, *129*(3), 308.

Gotlib, I. H., Kasch, K. L., Traill, S., Joormann, J., Arnow, B. A., & Johnson, S. L. (2004). Coherence and specificity of information-processing biases in depression and social phobia. *Journal of abnormal psychology*, *113*(3), 386.

Goudriaan, A. E., Grekin, E. R., & Sher, K. J. (2007). Decision-making and binge drinking: a longitudinal study. *Alcoholism: clinical and experimental research*, *31*(6), 928-938.

Gowin, J. L., Sloan, M. E., Stangl, B. L., Vatsalya, V., & Ramchandani, V. A. (2017). Vulnerability for alcohol use disorder and rate of alcohol consumption. *American Journal of Psychiatry*, *174*(11), 1094-1101.

Grant, B. F., & Harford, T. C. (1995). Comorbidity between DSM-IV alcohol use disorders and major depression: results of a national survey. *Drug and alcohol dependence*, *39*(3), 197-206.

Grant, J. D., Scherrer, J. F., Lynskey, M. T., Lyons, M. J., Eisen, S. A., Tsuang, M. T., & Bucholz, K. K. (2005). Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: evidence from a twin design.

Graf, P., & Uttl, B. (2001). Prospective memory: A new focus for research. *Consciousness and cognition*, *10*(4), 437-450.

Grattan-Miscio, K. E., & Vogel-Sprott, M. (2005). Effects of alcohol and performance incentives on immediate working memory. *Psychopharmacology*, *181*(1), 188-196.

Gray, J. A. (1970). The psychophysiological basis of introversion-extraversion. *Behaviour research and therapy, 8*(3), 249-266.

Greeley, J., & Oei, T. (1999). Alcohol and tension reduction. *Psychological theories of drinking and alcoholism*, *2*, 14-53.

Greist, J. H. (1995). The diagnosis of social phobia. *The Journal of clinical psychiatry*.

Guitton, D., Buchtel, H. A., & Douglas, R. M. (1985). Frontal lobe lesions in man cause difficulties in suppressing reflexive glances and in generating goal-directed saccades. *Experimental brain research*, *58*(3), 455-472.

Gul, F., & Pesendorfer, W. (2005). *The case for mindless economics* (pp. 01-48). mimeo.

Gustafson, R. (1986). Effect of moderate doses of alcohol on simple auditory reaction time in a vigilance setting. *Perceptual and Motor Skills, 62*(3), 683-690.

Habke, A. M., Hewitt, P. L., Norton, G. R., & Asmundson, G. (1997). The Social Phobia and Social Interaction Anxiety Scales: An exploration of the dimensions of social anxiety and sex differences in structure and relations with pathology. *Journal of Psychopathology and Behavioral Assessment*, *19*(1), 21-39.

Hallett, P. E. (1978). Primary and secondary saccades to goals defined by instructions. *Vision research*, *18*(10), 1279-1296.

Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical psychology review*, *23*(5), 719-759.

Ham, L. S., & Hope, D. A. (2005). Incorporating social anxiety into a model of college student problematic drinking. *Addictive behaviors*, *30*(1), 127-150.

Ham, L. S., Bonin, M., & Hope, D. A. (2007). The role of drinking motives in social anxiety and alcohol use. *Journal of Anxiety Disorders*, *21*(8), 991-1003.

Hamilton, S. B., Keilin, W. G., Knox, T. A., & Naginey, J. L. (1989). When Thoughts Turn Toward Nuclear War: Stress Responses, Coping Strategies, and the Importance of Trait Anxiety in Moderating Effects on "Mental Health" 1. *Journal of Applied Social Psychology*, *19*(2), 111-139.

Hanby, M. S., Fales, J., Nangle, D. W., Serwik, A. K., & Hedrich, U. J. (2012). Social anxiety as a predictor of dating aggression. *Journal of Interpersonal violence*, *27*(10), 1867-1888.

Harris, L. M., Robinson, J., & Menzies, R. G. (1999). Evidence for fear of restriction and fear of suffocation as components of claustrophobia. *Behaviour research and therapy*, *37*(2), 155-159.

Harris, L. M., & Cumming, S. R. (2003). An examination of the relationship between anxiety and performance on prospective and retrospective memory tasks. *Australian Journal of Psychology*, *55*(1), 51-55.

Hartman, L. M. (1983). A metacognitive model of social anxiety: Implications for treatment. *Clinical Psychology Review*, *3*(4), 435-456.

Hasin, D. S., Stinson, F. S., Ogburn, E., & Grant, B. F. (2007). Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of general psychiatry*, *64*(7), 830-842.

Hauck-Filho, N., Teixeira, M. A. P., & Cooper, M. L. (2012). Confirmatory factor analysis of the Brazilian version of the Drinking Motives Questionnaire-Revised (DMQ-R). *Addictive behaviors*, *37*(4), 524-527.

Hayes, S., Hirsch, C., & Mathews, A. (2008). Restriction of working memory capacity during worry. *Journal of abnormal psychology*, *117*(3), 712.

Heeren, A., De Raedt, R., Koster, E. H., & Philippot, P. (2013). The (neuro) cognitive mechanisms behind attention bias modification in anxiety: proposals based on theoretical accounts of attentional bias. *Frontiers in Human Neuroscience*, *7*, 119.

Heeren, A., & McNally, R. J. (2016). An integrative network approach to social anxiety disorder: The complex dynamic interplay among attentional bias for threat, attentional control, and symptoms. *Journal of Anxiety Disorders*, *42*, 95-104.

Heimberg, R. G., Liebowitz, M. R., Hope, D. A., Schneier, F. R., Holt, C. S., Welkowitz, L. A., ... & Fallon, B. (1998). Cognitive behavioral group therapy vs phenelzine therapy for social phobia: 12-week outcome. *Archives of General Psychiatry*, *55*(12), 1133-1141.

Heimberg, R. G., Horner, K. J., Juster, H. R., Safren, S. A., Brown, E. J., Schneier, F. R., & Liebowitz, M. R. (1999). Psychometric properties of the Liebowitz social anxiety scale. *Psychological medicine*, *29*(1), 199-212.

Heinrichs, N., & Hofmann, S. G. (2001). Information processing in social phobia: A critical review. *Clinical psychology review*, *21*(5), 751-770.

Helfinstein, S. M., White, L. K., Bar-Haim, Y., & Fox, N. A. (2008). Affective primes suppress attention bias to threat in socially-anxious individuals. *Behaviour Research and Therapy*, *46*(7), 799-810.

Henderson, J. M., Williams, C. C., & Falk, R. J. (2005). Eye movements are functional during face learning. *Memory & cognition*, *33*(1), 98-106.

Henning, E. R., Turk, C. L., Mennin, D. S., Fresco, D. M., & Heimberg, R. G. (2007). Impairment and quality of life in individuals with generalized anxiety disorder. *Depression and anxiety*, *24*(5), 342-349.

Herbert, J. D., & Cardaciotto, L. A. (2005). An acceptance and mindfulness-based perspective on social anxiety disorder. In *Acceptance and mindfulness-based approaches to anxiety* (pp. 189-212). Springer, Boston, MA.

Hermans, E. J., Battaglia, F. P., Atsak, P., de Voogd, L. D., Fernández, G., & Roozendaal, B. (2014). How the amygdala affects emotional memory by altering brain network properties. *Neurobiology of learning and memory*, *112*, 2-16.

Himle, J. A., Abelson, J. L., Haghightgou, H., Hill, E. M., Nesse, R. M., & Curtis, G. C. (1999). Effect of alcohol on social phobic anxiety. *American Journal of Psychiatry*, *156*(8), 1237-1243.

Hochman, S. H. (1967). The effects of stress on Stroop color-word performance. *Psychonomic Science*, *9*(8), 475-476.

Hochman, S. H. (1969). Stress and response competition in children's color-word performance. *Perceptual and Motor Skills*, *28*(1), 115-118.

Hofmann, S. G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive behaviour therapy*, *36*(4), 193-209.

Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H., & Van de Weijer, J. (2011). *Eye tracking: A comprehensive guide to methods and measures*. OUP Oxford.

Hope, D. A., Heimberg, R. G., & Turk, C. L. (2010). *Managing social anxiety: A cognitive-behavioral therapy approach*. Oxford University Press, USA.

Horenstein, M., & Segui, J. (1997). Chronometrics of attentional processes in anxiety disorders. *Psychopathology*, *30*(1), 25-35.

Horley, K., Williams, L. M., Gonsalvez, C., & Gordon, E. (2003). Social phobics do not see eye to eye:: A visual scanpath study of emotional expression processing. *Journal of anxiety disorders*, *17*(1), 33-44.

Horstmann, G. (2003). What do facial expressions convey: Feeling states, behavioral intentions, or actions requests?. *Emotion*, *3*(2), 150.

Horley, K., Williams, L. M., Gonsalvez, C., & Gordon, E. (2004). Face to face: visual scanpath evidence for abnormal processing of facial expressions in social phobia. *Psychiatry research*, *127*(1-2), 43-53.

Hsu, M., Bhatt, M., Adolphs, R., Tranel, D., & Camerer, C. F. (2005). Neural systems responding to degrees of uncertainty in human decision-making. *Science*, *310*(5754), 1680-1683.

Huang, J. H., Jacobs, D. F., & Derevensky, J. L. (2010). Sexual risk-taking behaviors, gambling, and heavy drinking among US college athletes. *Archives of sexual behavior*, *39*(3), 706-713.

Huettel, S. A., Stowe, C. J., Gordon, E. M., Warner, B. T., & Platt, M. L. (2006). Neural signatures of economic preferences for risk and ambiguity. *Neuron*, *49*(5), 765-775.

Hughes, K., Quigg, Z., Bellis, M. A., van Hasselt, N., Calafat, A., Kosir, M., ... & Voorham, L. (2011). Drinking behaviours and blood alcohol concentration in four European drinking environments: a cross-sectional study. *BMC Public Health*, *11*(1), 918.

Hyman, S. E., Malenka, R. C., & Nestler, E. J. (2006). Neural mechanisms of addiction: the role of reward-related learning and memory. *Annu. Rev. Neurosci.*, *29*, 565-598.

Ikeda, M., Iwanaga, M., & Seiwa, H. (1996). Test anxiety and working memory system. *Perceptual and motor skills*, *82*(3_suppl), 1223-1231.

Ingram, R. E. (1990). Self-focused attention in clinical disorders: review and a conceptual model. *Psychological bulletin*, *107*(2), 156.

Jääskeläinen, I. P., Pekkonen, E., Alho, K., Sinclair, J. D., Sillanaukee, P., & Näätänen, R. (1995). Dose-related effect of alcohol on mismatch negativity and reaction time performance. *Alcohol*, *12*(6), 491-495.

Janelle, C. M. (1999). Ironic mental processes in sport: Implications for sport psychologists. *The Sport Psychologist*, *13*(2), 201-220.

Jäntti, V., Lang, A. H., Keskinen, E., Lehtinen, I., & Pakkanen, A. (1983). Acute effects of intravenously given alcohol on saccadic eye movements and subjective evaluations of intoxication. *Psychopharmacology, 79*(2-3), 251-255.

Jazaieri, H., Goldin, P. R., Werner, K., Ziv, M., & Gross, J. J. (2012). A randomized trial of MBSR versus aerobic exercise for social anxiety disorder. *Journal of clinical psychology*, *68*(7), 715-731.

Johnsen, B. H., Thayer, J. F., & Hugdahl, K. (1995). Affective judgment of the Ekman faces: A dimensional approach. *Journal of Psychophysiology*.

Johnson, S. L., Turner, R. J., & Iwata, N. (2003). BIS/BAS levels and psychiatric disorder: An epidemiological study. *Journal of psychopathology and behavioral assessment*, *25*(1), 25-36.

Judah, M. R., Grant, D. M., Mills, A. C., & Lechner, W. V. (2014). Factor structure and validation of the attentional control scale. *Cognition & emotion*, *28*(3), 433-451.

Kabat-Zinn, J. (1990). Full catastrophe living: using the wisdom of your body and mind to face stress, pain and illness. New York: Delacorte.

Kabat-Zinn, J. (1994). Wherever you go, there you are: mindfulness meditation in everyday life. New York: Hyperion.

Kalivas, P. W., & Volkow, N. D. (2005). The neural basis of addiction: a pathology of motivation and choice. *American Journal of Psychiatry*, *162*(8), 1403-1413.

Kamboj, S. K., Irez, D., Serfaty, S., Thomas, E., Das, R. K., & Freeman, T. P. (2017). Ultra-brief mindfulness training reduces alcohol consumption in at-risk drinkers: A randomized double-blind active-controlled experiment. *International Journal of Neuropsychopharmacology*, *20*(11), 936-947.

Karyadi, K. A., & Cyders, M. A. (2015). Elucidating the association between trait mindfulness and alcohol use behaviors among college students. Mindfulness, 6, 1242–1249.

Kashdan, T. B. (2004). The neglected relationship between social interaction anxiety and hedonic deficits: Differentiation from depressive symptoms. *Journal of Anxiety Disorders*, *18*(5), 719-730.

Kashdan, T. B., Zvolensky, M. J., & McLeish, A. C. (2008). Anxiety sensitivity and affect regulatory strategies: Individual and interactive risk factors for anxiety-related symptoms. *Journal of anxiety disorders*, *22*(3), 429-440.

Kashdan, T. B., Morina, N., & Priebe, S. (2009). Post-traumatic stress disorder, social anxiety disorder, and depression in survivors of the Kosovo War: Experiential avoidance as a contributor to distress and quality of life. *Journal of anxiety disorders*, *23*(2), 185-196.

Kashdan, T. B., & McKnight, P. E. (2010). The darker side of social anxiety: When aggressive impulsivity prevails over shy inhibition. *Current Directions in Psychological Science*, *19*(1), 47-50.

Kavanagh, D., Andrade, J., & May, J. (2005). Imaginary relish and exquisite torture: the elaborated intrusion theory of desire. Psychological Review, 112, 446–467. d

Keane, T. M., & Lisman, S. A. (1980). Alcohol and social anxiety in males: Behavioral, cognitive, and physiological effects. *Journal of Abnormal Psychology*, *89*(2), 213.

Kendler, K. S., Thornton, L. M., & Gardner, C. O. (2001). Genetic risk, number of previous depressive episodes, and stressful life events in predicting onset of major depression. *American Journal of Psychiatry*, *158*(4), 582-586.

Keogh, E., & French, C. C. (2001). Test anxiety, evaluative stress, and susceptibility to distraction from threat. *European Journal of Personality*, *15*(2), 123-141.

Kerns, K. A. (2000). The CyberCruiser: An investigation of development of prospective memory in children. *Journal of the International Neuropsychological Society*, *6*(1), 62-70.

Kessler, R. C., Stein, M. B., & Berglund, P. (1998). Social phobia subtypes in the National Comorbidity Survey. *American Journal of Psychiatry*, *155*(5), 613-619.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of general psychiatry*, *62*(6), 593-602.

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International journal of methods in psychiatric research*, *21*(3), 169-184.

Keough, M. T., Battista, S. R., O'Connor, R. M., Sherry, S. B., & Stewart, S. H. (2016). Getting the party started—Alone: Solitary predrinking mediates the effect of social anxiety on alcohol-related problems. *Addictive behaviors*, *55*, 19-24.

Khan, S. A., Ford, K., Timney, B., & Everling, S. (2003). Effects of ethanol on anti-saccade task performance. *Experimental Brain Research*, *150*(1), 68-74.

Khantzian, E. J. (1985). Psychotherapeutic interventions with substance abusers—The clinical context. *Journal of Substance Abuse Treatment*, *2*(2), 83-88.

Khouja, J. N., Attwood, A. S., Penton-Voak, I. S., & Munafò, M. R. (2019). Effects of acute alcohol consumption on emotion recognition in social alcohol drinkers. *Journal of psychopharmacology*, *33*(3), 326-334.

Kidorf, M., & Lang, A. R. (1999). Effects of social anxiety and alcohol expectancies on stress-induced drinking. *Psychology of Addictive behaviors*, *13*(2), 134.

Kim, Y. T., Sohn, H., & Jeong, J. (2011). Delayed transition from ambiguous to risky decision-making in alcohol dependence during Iowa Gambling Task. *Psychiatry research*, *190*(2-3), 297-303.

King, A. C., Houle, T., De Wit, H., Holdstock, L., & Schuster, A. (2002). Biphasic alcohol response differs in heavy versus light drinkers. *Alcoholism: Clinical and Experimental Research*, *26*(6), 827-835.

Klein, C., & Foerster, F. (2001). Development of prosaccade and antisaccade task performance in participants aged 6 to 26 years. *Psychophysiology*, *38*(2), 179-189.

Klumpp, H., & Amir, N. (2009). Examination of vigilance and disengagement of threat in social anxiety with a probe detection task. *Anxiety, Stress & Coping*, *22*(3), 283-296.

Knutson, B., Taylor, J., Kaufman, M., Peterson, R., & Glover, G. (2005). Distributed neural representation of expected value. *Journal of Neuroscience*, *25*(19), 4806-4812.

Knutson, B., Adams, C. M., Fong, G. W., & Hommer, D. (2001). Anticipation of increasing monetary reward selectively recruits nucleus accumbens. *Journal of Neuroscience*, *21*(16), RC159-RC159.

Kocovski, N. L., Fleming, J. E., & Rector, N. A. (2009). Mindfulness and acceptance based group therapy for social anxiety disorder: an open trial. Cognitive and Behavioral Practice, 16, 276–289.

Kohn, N., Hermans, E. J., & Fernández, G. (2017). Cognitive benefit and cost of acute stress is differentially modulated by individual brain state. *Social cognitive and affective neuroscience*, *12*(7), 1179-1187.

Koval, M. J., Ford, K. A., & Everling, S. (2004). Effect of stimulus probability on anti-saccade error rates. *Experimental Brain Research*, *159*(2), 268-272.

Krain, A. L., Wilson, A. M., Arbuckle, R., Castellanos, F. X., & Milham, M. P. (2006). Distinct neural mechanisms of risk and ambiguity: a meta-analysis of decision-making. *Neuroimage*, *32*(1), 477-484.

Krull, K. R., Smith, L. T., Sinha, R., & Parsons, O. A. (1993). Simple reaction time event-related potentials: effects of alcohol and sleep deprivation. *Alcoholism: Clinical and Experimental Research*, *17*(4), 771-777.

Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical psychology review*, *25*(7), 841-861.

Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2006). Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive behaviors*, *31*(10), 1844-1857.

Kuntsche, E., Stewart, S. H., & Cooper, M. L. (2008). How stable is the motive–alcohol use link? A cross-national validation of the Drinking Motives Questionnaire Revised among adolescents from Switzerland, Canada, and the United States. *Journal of Studies on Alcohol and Drugs*, *69*(3), 388-396.

Kushner, M. G., Sher, K. J., & Beitman, B. D. (1990). The relation between alcohol problems and the anxiety disorders. *The American Journal of Psychiatry*.

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: a review of major perspectives and findings. *Clinical psychology review*, *20*(2), 149-171.

Lane, S. D., Cherek, D. R., Pietras, C. J., & Tcheremissine, O. V. (2004). Alcohol effects on human risk taking. *Psychopharmacology*, *172*(1), 68-77.

Lawrence, N. S., Wooderson, S., Mataix-Cols, D., David, R., Speckens, A., & Phillips, M. L. (2006). Decision-making and set shifting impairments are associated with distinct symptom dimensions in obsessive-compulsive disorder. *Neuropsychology*, *20*(4), 409.

Lawrence, P. J., Rooke, S. M., & Creswell, C. (2017). Prevention of anxiety among at-risk children and adolescents–a systematic review and meta-analysis. *Child and adolescent mental health*, *22*(3), 118-130.

Lazarov, A., Abend, R., & Bar-Haim, Y. (2016). Social anxiety is related to increased dwell time on socially threatening faces. *Journal of Affective Disorders*, *193*, 282-288.

Lazarov, A., Ben-Zion, Z., Shamai, D., Pine, D. S., & Bar-Haim, Y. (2018). Free viewing of sad and happy faces in depression: A potential target for attention bias modification. *Journal of affective disorders*, *238*, 94-100.

Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin*, *9*(3), 371-375.

Leary, M. R., Kowalski, R. M., & Campbell, C. D. (1988). Self-presentational concerns and social anxiety: The role of generalized impression expectancies. *Journal of Research in Personality*, *22*(3), 308-321.

Leber, S., Heidenreich, T., Stangier, U., & Hofmann, S. G. (2009). Processing of facial affect under social threat in socially-anxious adults: mood matters. *Depression and Anxiety*, *26*(2), 196-206.

Ledley, D. R., & Heimberg, R. G. (2006). Cognitive vulnerability to social anxiety. *Journal of Social and Clinical Psychology*, *25*(7), 755-778.

Lehtinen, I., Lang, A. H., Jäntti, V., & Keskinen, E. (1979). Acute effects of alcohol on saccadic eye movements. *Psychopharmacology*, *63*(1), 17-23.\

Leigh, J., & Neighbors, C. (2009). Enhancement motives mediate the positive association between mind/body awareness and college student drinking. *Journal of social and clinical psychology*, *28*(5), 650-669.

Leland, D. S., & Paulus, M. P. (2005). Increased risk-taking decision-making but not altered response to punishment in stimulant-using young adults. *Drug and alcohol dependence*, *78*(1), 83-90.

Lemon, J., Chesher, G., Fox, A., Greeley, J., & Nabke, C. (1993). Investigation of the “hangover” effects of an acute dose of alcohol on psychomotor performance. *Alcoholism: Clinical and Experimental Research*, *17*(3), 665-668.

Lewis, M. A., Hove, M. C., Whiteside, U., Lee, C. M., Kirkeby, B. S., Oster-Aaland, L., ... & Larimer, M. E. (2008). Fitting in and feeling fine: Conformity and coping motives as mediators of the relationship between social anxiety and problematic drinking. *Psychology of Addictive Behaviors*, *22*(1), 58.

Li, C. S. R., Luo, X., Yan, P., Bergquist, K., & Sinha, R. (2009). Altered impulse control in alcohol dependence: neural measures of stop signal performance. *Alcoholism: Clinical and Experimental Research*, *33*(4), 740-750.

Li, X., Lu, Z. L., D'Argembeau, A., Ng, M., & Bechara, A. (2010). The Iowa gambling Task in fMRI images. *Human brain mapping*, *31*(3), 410-423.

Liang, C. W., Tsai, J. L., & Hsu, W. Y. (2017). Sustained visual attention for competing emotional stimuli in social anxiety: An eye tracking study. *Journal of behavior therapy and experimental psychiatry*, *54*, 178-185.

Liebherr, M., Schiebener, J., Averbeck, H., & Brand, M. (2017). Decision making under ambiguity and objective risk in higher age–a review on cognitive and emotional contributions. *Frontiers in psychology*, *8*, 2128.

Liebowitz, M. R., & Pharmacopsychiatry, M. P. (1987). Social phobia.

Loeber, S., & Duka, T. (2009). Acute alcohol impairs conditioning of a behavioural reward-seeking response and inhibitory control processes—implications for addictive disorders. *Addiction*, *104*(12), 2013-2022.

Loeber, S., Duka, T., Welzel, H., Nakovics, H., Heinz, A., Flor, H., & Mann, K. (2009). Impairment of cognitive abilities and decision-making after chronic use of alcohol: the impact of multiple detoxifications. *Alcohol & Alcoholism*, *44*(4), 372-381.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological bulletin*, *127*(2), 267.

Lott, M., Greist, J. H., Jefferson, J. W., Kobak, K. A., Katzelnick, D. J., Katz, R. J., & Schaettle, S. C. (1997). Brofaromine for social phobia: a multicenter, placebo-controlled, double-blind study. *Journal of Clinical Psychopharmacology*, *17*(4), 255-260.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of abnormal psychology*, *95*(1), 15.

MacLeod, C., & Donnellan, A. M. (1993). Individual differences in anxiety and the restriction of working memory capacity. *Personality and Individual Differences*, *15*(2), 163-173.

Maner, J. K., Richey, J. A., Cromer, K., Mallott, M., Lejuez, C. W., Joiner, T. E., & Schmidt, N. B. (2007). Dispositional anxiety and risk-avoidant decision-making. *Personality and Individual Differences*, *42*(4), 665-675.

Mansell, W., Clark, D. M., Ehlers, A., & Chen, Y. P. (1999). Social anxiety and attention away from emotional faces. *Cognition & Emotion*, *13*(6), 673-690.

Mansell, W., Ehlers, A., Clark, D., & Chen, Y. P. (2002). Attention to positive and negative social-evaluative words: Investigating the effects of social anxiety, trait anxiety and social threat. *Anxiety, Stress & Coping*, *15*(1), 19-29.

Mansell, W., Clark, D. M., & Ehlers, A. (2003). Internal versus external attention in social anxiety: An investigation using a novel paradigm. *Behaviour research and therapy*, *41*(5), 555-572.

Marczinski, C. A., Combs, S. W., & Fillmore, M. T. (2007). Increased sensitivity to the disinhibiting effects of alcohol in binge drinkers. *Psychology of Addictive Behaviors*, *21*(3), 346.

Marinkovic, K., Rickenbacher, E., Azma, S., Artsy, E., & Lee, A. K. (2013). Effects of acute alcohol intoxication on saccadic conflict and error processing. *Psychopharmacology*, *230*(3), 487-497.

Marlatt, G. A., & Rohsenow, D. J. (1980). Cognitive processes in alcohol use: Expectancy and the balanced placebo design. *Advances in substance abuse: Behavioral and biological research*, *1*, 159-199.

Marlatt, G. A. (1994). Addiction, mindfulness, and acceptance. In S. C. Hayes, N. S. Jacobson, V. Follette M, & M. J. Dougher (Eds.), Acceptance and change: content and context in psychotherapy (pp. 175–197). Reno: Context Press.

Marlatt, G. A., & Witkiewitz, K. (2005). Relapse prevention for alcohol and drug problems.

Markham, R., & Darke, S. (1991). The effects of anxiety on verbal and spatial task performance. *Australian Journal of Psychology*, *43*(2), 107-111.

Markowitz, A. (1969). Influence of the repression-sensitization dimension, affect value, and ego threat on incidental learning. *Journal of personality and social psychology*, *11*(4), 374.

Marsh, A. A., Adams Jr, R. B., & Kleck, R. E. (2005). Why do fear and anger look the way they do? Form and social function in facial expressions. *Personality and Social Psychology Bulletin*, *31*(1), 73-86.

Martens, M. P., Rocha, T. L., Martin, J. L., & Serrao, H. F. (2008). Drinking motives and college students: Further examination of a four-factor model. *Journal of Counseling Psychology*, *55*(2), 289.

Martin, I., Marks, I. M., & Gelder, M. (1969). Conditioned eyelid responses in phobic patients. *Behaviour research and therapy*, *7*(1), 115-124.

Masicampo, E. J., & Baumeister, R. F. (2007). Relating mindfulness and self-regulatory processes. *Psychological Inquiry*, *18*(4), 255-258.

Massen, C. (2004). Parallel programming of exogenous and endogenous components in the antisaccade task. *Quarterly Journal of Experimental Psychology Section A*, *57*(3), 475-498.

Massion, A. O., Warshaw, M. G., & Keller, M. B. (1993). Quality of life and psychiatric morbidity in panic disorder and generalized anxiety disorder. *The American journal of psychiatry*.

Matthews, G., Davies, D. R., & Holley, P. J. (1990). Extraversion, arousal and visual sustained attention: The role of resource availability. *Personality and Individual Differences*, *11*(11), 1159-1173.

Matthews, G., & Gilliland, K. (1999). The personality theories of HJ Eysenck and JA Gray: A comparative review. *Personality and Individual differences*, *26*(4), 583-626.

Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour research and therapy*, *36*(4), 455-470.

Maylor, E. A., Rabbitt, P. M. A., James, G. H., & Kerr, S. A. (1990). Effects of alcohol and extended practice on divided-attention performance. *Perception & Psychophysics*, *48*(5), 445-452.

Mayo-Wilson, E., Dias, S., Mavranezouli, I., Kew, K., Clark, D. M., Ades, A. E., & Pilling, S. (2014). Psychological and pharmacological interventions for social anxiety disorder in adults: a systematic review and network meta-analysis. *The Lancet Psychiatry*, *1*(5), 368-376.

Mazas, C. A., Finn, P. R., & Steinmetz, J. E. (2000). Decision-making biases, antisocial personality, and early-onset alcoholism. *Alcoholism: Clinical and Experimental Research*, *24*(7), 1036-1040.

McCray, J. A., King, A. R., & Bailly, M. D. (2005). General versus gender-specific attributes of the psychology major. *The Journal of general psychology*, *132*(2), 139-150.

McNeil, D. W., Ries, B. J., & Turk, C. L. (1995). Behavioral assessment: Self-report, physiology, and overt behavior.

Mendlowicz, M. V., & Stein, M. B. (2000). Quality of life in individuals with anxiety disorders. *American Journal of Psychiatry*, *157*(5), 669-682.

Mertens, I., Siegmund, H., & Grüsser, O. J. (1993). Gaze motor asymmetries in the perception of faces during a memory task. *Neuropsychologia*, *31*(9), 989-998.

Mezquita, L., Stewart, S. H., Ibáñez, M. I., Ruipérez, M. A., Villa, H., Moya, J., & Ortet, G. (2011). Drinking motives in clinical and general populations. *European addiction research*, *17*(5), 250-261.

Miranda Jr, R., MacKillop, J., Meyerson, L. A., Justus, A., & Lovallo, W. R. (2009). Influence of antisocial and psychopathic traits on decision-making biases in alcoholics. *Alcoholism: Clinical and Experimental Research*, *33*(5), 817-825.

Mitchell, J. P., Macrae, C. N., & Gilchrist, I. D. (2002). Working memory and the suppression of reflexive saccades. *Journal of cognitive neuroscience*, *14*(1), 95-103.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive psychology*, *41*(1), 49-100.

Mogg, K., Mathews, A., Bird, C., & Macgregor-Morris, R. (1990). Effects of stress and anxiety on the processing of threat stimuli. *Journal of Personality and Social Psychology*, *59*(6), 1230.

Mogg, K., Bradley, B. P., De Bono, J. O., & Painter, M. (1997). Time course of attentional bias for threat information in non-clinical anxiety. *Behaviour research and therapy*, *35*(4), 297-303.

Mogg, K., Millar, N., & Bradley, B. P. (2000). Biases in eye movements to threatening facial expressions in generalized anxiety disorder and depressive disorder. *Journal of abnormal psychology*, *109*(4), 695.

Mogg, K., Philippot, P., & Bradley, B. P. (2004). Selective attention to angry faces in clinical social phobia. *Journal of abnormal psychology*, *113*(1), 160.

Mohlman, J., Carmin, C. N., & Price, R. B. (2007). Jumping to interpretations: Social anxiety disorder and the identification of emotional facial expressions. *Behaviour research and therapy*, *45*(3), 591-599.

Monsell, S., & Driver, J. (Eds.). (2000). *Control of cognitive processes: Attention and performance XVIII* (Vol. 18). MIT Press.

Monahan, J. L., & Lannutti, P. J. (2000). Alcohol as social lubricant: Alcohol myopia theory, social self-esteem, and social interaction. *Human Communication Research*, *26*(2), 175-202.

Monsell, S. (2003). Task switching. *Trends in cognitive sciences*, *7*(3), 134-140.

Montagne, B., Schutters, S., Westenberg, H. G., van Honk, J., Kessels, R. P., & de Haan, E. H. (2006). Reduced sensitivity in the recognition of anger and disgust in social anxiety disorder. *Cognitive Neuropsychiatry*, *11*(4), 389-401.

Moroz, G., Davidson, J. R., Liebowitz, M. R., Davidson, A., Siegel, J., Bell, J., ... & Mallinger, A. G. (1997). Moclobemide in social phobia: a controlled dose-response trial.

Morris, E. P., Stewart, S. H., & Ham, L. S. (2005). The relationship between social anxiety disorder and alcohol use disorders: A critical review. *Clinical psychology review*, *25*(6), 734-760.

Moscovitch, D. A., Antony, M. M., & Swinson, R. P. (2009). Exposure-based treatments for anxiety disorders: Theory and process. *Oxford handbook of anxiety and related disorders*, 461-475.

Moselhy, H. F., Georgiou, G., & Kahn, A. (2001). Frontal lobe changes in alcoholism: a review of the literature. *Alcohol and alcoholism*, *36*(5), 357-368.

Moukheiber, A., Rautureau, G., Perez-Diaz, F., Soussignan, R., Dubal, S., Jouvent, R., & Pelissolo, A. (2010). Gaze avoidance in social phobia: objective measure and correlates. *Behaviour research and therapy*, *48*(2), 147-151.

Moukheiber, A., Rautureau, G., Perez-Diaz, F., Soussignan, R., Dubal, S., Jouvent, R., & Pelissolo, A. (2010). Gaze avoidance in social phobia: objective measure and correlates. *Behaviour research and therapy*, *48*(2), 147-151.

Mueller, E. M., Nguyen, J., Ray, W. J., & Borkovec, T. D. (2010). Future-oriented decision-making in Generalized Anxiety Disorder is evident across different versions of the Iowa Gambling Task. *Journal of Behavior Therapy and Experimental Psychiatry*, *41*(2), 165-171.

Munjack, D. J., Bruns, J., Baltazar, P. L., Brown, R., Leonard, M., Nagy, R., ... & Schafer, S. (1991). A pilot study of buspirone in the treatment of social phobia. *Journal of Anxiety Disorders*, *5*(1), 87-98.

Munoz, D. P., & Everling, S. (2004). Look away: the anti-saccade task and the voluntary control of eye movement. *Nature Reviews Neuroscience*, *5*(3), 218-228.

Murphy, C., & MacKillop, J. (2012). Living in the here and now: interrelationships between impulsivity, mindfulness, and alcohol misuse. *Psychopharmacology*, *219*(2), 527-536.

Myers, M. G., Aarons, G. A., Tomlinson, K., & Stein, M. B. (2003). Social anxiety, negative affectivity, and substance use among high school students. *Psychology of addictive behaviors*, *17*(4), 277.

Naftolowitz, D. F., Vaughn, B. V., Ranc, J., & Tancer, M. E. (1994). Response to alcohol in social phobia. *Anxiety*, *1*(2), 96-99.

Naveh-Benjamin, M., McKeachie, W. J., Lin, Y. G., & Holinger, D. P. (1981). Test anxiety: deficits in information processing. *Journal of educational psychology*, *73*(6), 816.

Neumann, R., Schulz, S. M., Lozo, L., & Alpers, G. W. (2014). Automatic facial responses to near-threshold presented facial displays of emotion: Imitation or evaluation?. *Biological psychology*, *96*, 144-149.

Nieuwenhuis, S., Broerse, A., Nielen, M. M., & de Jong, R. (2004). A goal activation approach to the study of executive function: An application to antisaccade tasks. *Brain and cognition*, *56*(2), 198-214.

Nikolaou, K., Field, M., & Duka, T. (2013). Alcohol-related cues reduce cognitive control in social drinkers. *Behavioural Pharmacology*, *24*(1), 29-36.

Nikolaou, K., Critchley, H., & Duka, T. (2013). Alcohol affects neuronal substrates of response inhibition but not of perceptual processing of stimuli signalling a stop response. *PLoS One*, *8*(9), e76649.

Nitschke, J. B., Sarinopoulos, I., Oathes, D. J., Johnstone, T., Whalen, P. J., Davidson, R. J., & Kalin, N. H. (2009). Anticipatory activation in the amygdala and anterior cingulate in generalized anxiety disorder and prediction of treatment response. *American Journal of Psychiatry*, *166*(3), 302-310.

Noël, X., Van der Linden, M., d'Acremont, M., Bechara, A., Dan, B., Hanak, C., & Verbanck, P. (2007). Alcohol cues increase cognitive impulsivity in individuals with alcoholism. *Psychopharmacology*, *192*(2), 291-298.

Nolen-Hoeksema, S. (2004). Gender differences in risk factors and consequences for alcohol use and problems. *Clinical psychology review*, *24*(8), 981-1010.

Norberg, M. M., Norton, A. R., Olivier, J., & Zvolensky, M. J. (2010). Social anxiety, reasons for drinking, and college students. *Behavior therapy*, *41*(4), 555-566.

Nyberg, S., Wahlström, G., Bäckström, T., & Poromaa, I. S. (2004). Altered sensitivity to alcohol in the late luteal phase among patients with premenstrual dysphoric disorder. *Psychoneuroendocrinology*, *29*(6), 767-777.

O'Hara, R. E., Armeli, S., & Tennen, H. (2015). College students' drinking motives and social-contextual factors: Comparing associations across levels of analysis. *Psychology of addictive behaviors*, *29*(2), 420.

Oakman, J., Van Ameringen, M., Mancini, C., & Farvolden, P. (2003). A confirmatory factor analysis of a self-report version of the Liebowitz Social Anxiety Scale. *Journal of Clinical Psychology*, *59*(1), 149-161.

Ohayon, M. M., & Schatzberg, A. F. (2010). Social phobia and depression: prevalence and comorbidity. *Journal of psychosomatic research*, *68*(3), 235-243.

Öhman, A. (1986). Face the beast and fear the face: Animal and social fears as prototypes for evolutionary analyses of emotion. *Psychophysiology*, *23*(2), 123-145.

Öhman, A., Lundqvist, D., & Esteves, F. (2001). The face in the crowd revisited: a threat advantage with schematic stimuli. *Journal of personality and social psychology*, *80*(3), 381.

Ólafsson, R. P., Smári, J., Guðmundsdóttir, F., Ólafsdóttir, G., Harðardóttir, H. L., & Einarsson, S. M. (2011). Self reported attentional control with the Attentional Control Scale: Factor structure and relationship with symptoms of anxiety and depression. *Journal of anxiety disorders*, *25*(6), 777-782.

Olatunji, B. O., Cisler, J. M., & Tolin, D. F. (2007). Quality of life in the anxiety disorders: a meta-analytic review. *Clinical psychology review*, *27*(5), 572-581.

Olfson, M., Guardino, M., Struening, E., Schneier, F. R., Hellman, F., & Klein, D. F. (2000). Barriers to the treatment of social anxiety. *American Journal of Psychiatry*, *157*(4), 521-527.

Olincy, A., Ross, R. G., Youngd, D. A., & Freedman, R. (1997). Age diminishes performance on an antisaccade eye movement task. *Neurobiology of Aging*, *18*(5), 483-489.

Olivares, J., García-López, L. J., & Hidalgo, M. D. (2001). The social phobia scale and the social interaction anxiety scale: factor structure and reliability in a Spanish-speaking population. *Journal of Psychoeducational Assessment*, *19*(1), 69-80.

Olk, B., & Kingstone, A. (2003). Why are antisaccades slower than prosaccades? A novel finding using a new paradigm. *Neuroreport*, *14*(1), 151-155.

O'Regan, J. K., Lévy-Schoen, A., Pynte, J., & Brugaillère, B. É. (1984). Convenient fixation location within isolated words of different length and structure. *Journal of Experimental Psychology: Human Perception and Performance*, *10*(2), 250.

Oscar-Berman, M., Clancy, J. P., & Weber, D. A. (1993). Discrepancies between IQ and memory scores in alcoholism and aging. *The Clinical Neuropsychologist*, *7*(3), 281-296.

Oscar-Berman, M., Shagrin, B., Evert, D. L., & Epstein, C. (1997). Impairments of brain and behavior: the neurological effects of alcohol. *Alcohol Health and Research World*, *21*(1), 65.

Pallak, M. S., Pittman, T. S., Heller, J. F., & Munson, P. (1975). The effect of arousal on Stroop color-word task performance. *Bulletin of the Psychonomic Society*, *6*(3), 248-250.

Paschall, M. J., & Saltz, R. F. (2007). Relationships between college settings and student alcohol use before, during and after events: a multi-level study. *Drug and Alcohol Review*, *26*(6), 635-644.

Pedersen, E. R., & LaBrie, J. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American college health*, *56*(3), 237-245.

Peters, A., McEwen, B. S., & Friston, K. (2017). Uncertainty and stress: Why it causes diseases and how it is mastered by the brain. *Progress in neurobiology*, *156*, 164-188.

Phan, K. L., Fitzgerald, D. A., Nathan, P. J., & Tancer, M. E. (2006). Association between amygdala hyperactivity to harsh faces and severity of social anxiety in generalized social phobia. *Biological psychiatry*, *59*(5), 424-429.

Pierrot-Deseilligny, C. H., Rivaud, S., Gaymard, B., & Agid, Y. (1991). Cortical control of reflexive visually-guided saccades. *Brain*, *114*(3), 1473-1485.

Pierrot-Deseilligny, C., Rivaud, S., Gaymard, B., Müri, R., & Vermersch, A. I. (1995). Cortical control of saccades. *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society*, *37*(5), 557-567.

Pineles, S. L., & Mineka, S. (2005). Attentional biases to internal and external sources of potential threat in social anxiety. *Journal of abnormal psychology*, *114*(2), 314.

Pishyar, R., Harris, L. M., & Menzies, R. G. (2004). Attentional bias for words and faces in social anxiety. *Anxiety, Stress & Coping*, *17*(1), 23-36.

Pishyar, R., Harris, L. M., & Menzies, R. G. (2008). Responsiveness of measures of attentional bias to clinical change in social phobia. *Cognition and Emotion*, *22*(7), 1209-1227.

Pittig, A., Pawlikowski, M., Craske, M. G., & Alpers, G. W. (2014). Avoidant decision-making in social anxiety: the interaction of angry faces and emotional responses. *Frontiers in psychology*, *5*, 1050.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, *88*(5), 879.

Pollack, M. H., Kornstein, S. G., Spann, M. E., Crits-Christoph, P., Raskin, J., & Russell, J. M. (2008). Early improvement during duloxetine treatment of generalized anxiety disorder predicts response and remission at endpoint. *Journal of Psychiatric Research*, *42*(14), 1176-1184.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual review of neuroscience*, *13*(1), 25-42.

Pratt, J., & Trottier, L. (2005). Pro-saccades and anti-saccades to onset and offset targets. *Vision Research*, *45*(6), 765-774.

Randall, C. L., Thomas, S., & Thevos, A. K. (2001). Concurrent alcoholism and social anxiety disorder: a first step toward developing effective treatments. *Alcoholism: Clinical and Experimental Research*, *25*(2), 210-220.

Ramaekers, J. G., & Kuypers, K. P. (2006). Acute effects of 3, 4-methylenedioxymethamphetamine (MDMA) on behavioral measures of impulsivity: alone and in combination with alcohol. *Neuropsychopharmacology*, *31*(5), 1048-1055.

Rao, P. A., Beidel, D. C., Turner, S. M., Ammerman, R. T., Crosby, L. E., & Sallee, F. R. (2007). Social anxiety disorder in childhood and adolescence: Descriptive psychopathology. *Behaviour Research and Therapy*, *45*(6), 1181-1191.

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour research and therapy*, *35*(8), 741-756.

Rapee, R. M., & Spence, S. H. (2004). The etiology of social phobia: Empirical evidence and an initial model. *Clinical psychology review*, *24*(7), 737-767.

Rasmussen, M. K., & Pidgeon, A. M. (2011). The direct and indirect benefits of dispositional mindfulness on self-esteem and social anxiety. *Anxiety, Stress, & Coping*, *24*(2), 227-233.

Reich, J., & Yates, W. (1988). Family history of psychiatric disorders in social phobia. *Comprehensive Psychiatry*, *29*(1), 72-75.

Reinholdt-Dunne, M. L., Mogg, K., Benson, V., Bradley, B. P., Hardin, M. G., Liversedge, S. P., ... & Ernst, M. (2012). Anxiety and selective attention to angry faces: An antisaccade study. *Journal of Cognitive Psychology*, *24*(1), 54-65.

Reuter, B., & Kathmann, N. (2004). Using saccade tasks as a tool to analyze executive dysfunctions in schizophrenia. *Acta psychologica*, *115*(2-3), 255-269.

Reynolds, B., Richards, J. B., & de Wit, H. (2006). Acute-alcohol effects on the Experiential Discounting Task (EDT) and a question-based measure of delay discounting. *Pharmacology Biochemistry and Behavior*, *83*(2), 194-202.

Richards, A., & French, C. C. (1990). Central versus peripheral presentation of stimuli in an emotional Stroop task. *Anxiety Research*, *3*(1), 41-49.

Richards, A., French, C. C., Keogh, E., & Carter, C. (2000). Test-anxiety, inferential reasoning and working memory load. *Anxiety, Stress and Coping*, *13*(1), 87-109.

Richardson, F. C., & Tasto, D. L. (1976). Development and factor analysis of a social anxiety inventory. *Behavior Therapy*, *7*(4), 453-462.

Ries, B. J., McNeil, D. W., Boone, M. L., Turk, C. L., Carter, L. E., & Heimberg, R. G. (1998). Assessment of contemporary social phobia verbal report instruments. *Behaviour Research and Therapy*, *36*(10), 983-994.

Robinson, D. A. (1964). The mechanics of human saccadic eye movement. *The Journal of physiology*, *174*(2), 245.

Robinson, T. E., & Berridge, K. C. (2008). The incentive sensitization theory of addiction: some current issues. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1507), 3137-3146.

Roche, D. J., & King, A. C. (2010). Alcohol impairment of saccadic and smooth pursuit eye movements: impact of risk factors for alcohol dependence. *Psychopharmacology*, *212*(1), 33-44.

Rogers, R. D., & Monsell, S. (1995). Costs of a predictible switch between simple cognitive tasks. *Journal of experimental psychology: General*, *124*(2), 207.

Rohrbaugh, J. W., Stapleton, J. M., Parasuraman, R., Frowein, H. W., Adinoff, B., Varner, J. L., ... & Linnoila, M. (1988). Alcohol intoxication reduces visual sustained attention. *Psychopharmacology*, *96*(4), 442-446.

Rounds, J. S., Beck, J. G., & Grant, D. M. (2007). Is the delay discounting paradigm useful in understanding social anxiety?. *Behaviour research and therapy*, *45*(4), 729-735.

Roos, C. R., Pearson, M. R., & Brown, D. B. (2015). Drinking motives mediate the negative associations between mindfulness facets and alcohol outcomes among college students. Psychology of Addictive Behaviors, 29, 176–183.

Ruiz-Padial, E., Mata, J. L., Rodríguez, S., Fernández, M. C., & Vila, J. (2005). Non-conscious modulation of cardiac defense by masked phobic pictures. *International journal of psychophysiology*, *56*(3), 271-281.

Safren, S. A., Heimberg, R. G., Brown, E. J., & Holle, C. (1996). Quality of life in social phobia. *Depression and anxiety*, *4*(3), 126-133.

Salgado, J. V., Malloy-Diniz, L. F., Campos, V. R., Abrantes, S. S. C., Fuentes, D., Bechara, A., & Correa, H. (2009). Neuropsychological assessment of impulsive behavior in abstinent alcohol-dependent subjects. *Brazilian Journal of Psychiatry*, *31*(1), 4-9.

Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural and Cognitive Psychotherapy*, *19*(1), 6-19.

Sanderson, W. C., DiNardo, P. A., Rapee, R. M., & Barlow, D. H. (1990). Syndrome comorbidity in patients diagnosed with a DSM-III—R anxiety disorder. *Journal of Abnormal Psychology*, *99*(3), 308.

Santos, R., Wall, M. B., & Eysenck, M. W. (2006). Anxiety and processing efficiency: fMRI evidence. *Manuscript submitted for publication*.

Sartory, G., MacDonald, R., & Gray, J. A. (1990). Effects of diazepam on approach, self-reported fear and psychophysiological responses in snake phobics. *Behaviour Research and Therapy*, *28*(4), 273-282.

Saunders, J. B., Aasland, O. G., Babor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*, *88*(6), 791-804.

Sayette, M. A., Smith, D. W., Breiner, M. J., & Wilson, G. T. (1992). The effect of alcohol on emotional response to a social stressor. *Journal of Studies on Alcohol*, *53*(6), 541-545.

Sayette, M. A. (1993). An appraisal-disruption model of alcohol's effects on stress responses in social drinkers. *Psychological bulletin*, *114*(3), 459.

Sayette, M. A., Martin, C. S., Perrott, M. A., Wertz, J. M., & Hufford, M. R. (2001). A test of the appraisal-disruption model of alcohol and stress. *Journal of Studies on Alcohol*, *62*(2), 247-256.

Selzer, M. L. (1971). The Michigan Alcoholism Screening Test: The quest for a new diagnostic instrument. *American journal of Psychiatry*, *127*(12), 1653-1658.

Sher, K. J., & Levenson, R. W. (1982). Risk for alcoholism and individual differences in the stress-response-dampening effect of alcohol. *Journal of Abnormal Psychology*, *91*(5), 350.

Scheurich, A. (2005). Neuropsychological functioning and alcohol dependence. *Current Opinion in Psychiatry*, *18*(3), 319-323.

Schmertz, S. K., Masuda, A., & Anderson, P. L. (2012). Cognitive processes mediate the relation between mindfulness and social anxiety within a clinical sample. *Journal of clinical psychology*, *68*(3), 362-371.

Schneier, F. R., Martin, L. Y., Liebowitz, M. R., Gorman, J. M., & Fyer, A. J. (1989). Alcohol abuse in social phobia. *Journal of Anxiety Disorders*, *3*(1), 15-23.

Schneier, F. R., Foose, T. E., Hasin, D. S., Heimberg, R. G., Liu, S. M., Grant, B. F., & Blanco, C. (2010). Social anxiety disorder and alcohol use disorder comorbidity in the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological medicine*, *40*(6), 977.

Schultz, L. T., & Heimberg, R. G. (2008). Attentional focus in social anxiety disorder: Potential for interactive processes. *Clinical psychology review*, *28*(7), 1206-1221.

Shapiro, K. L., & Johnson, T. L. (1987). Effects of arousal on attention to central and peripheral visual stimuli. *Acta Psychologica*, *66*(2), 157-172.

Shapiro, K. L., & Lim, A. (1989). The impact of anxiety on visual attention to central and peripheral events. *Behaviour research and therapy*, *27*(4), 345-351.

Sher, K. J., & Levenson, R. W. (1982). Risk for alcoholism and individual differences in the stress-response-dampening effect of alcohol. *Journal of Abnormal Psychology*, *91*(5), 350.

Shields, A. L., Howell, R. T., Potter, J. S., & Weiss, R. D. (2007). The Michigan Alcoholism Screening Test and its shortened form: A meta-analytic inquiry into score reliability. *Substance use & misuse*, *42*(11), 1783-1800.

Shin, L. M., & Liberzon, I. (2010). The neurocircuitry of fear, stress, and anxiety disorders. *Neuropsychopharmacology*, *35*(1), 169-191.

Schönpflug, W. (1992). Anxiety and effort. *Anxiety: Recent developments in health research*, 51-62.

Schmidt, A. F., Eulenbruch, T., Langer, C., & Banger, M. (2013). Interoceptive awareness, tension reduction expectancies and self-reported drinking behavior. *Alcohol and alcoholism*, *48*(4), 472-477.

Schneider, F., Weiss, U., Kessler, C., Müller-Gärtner, H. W., Posse, S., Salloum, J. B., ... & Birbaumer, N. (1999). Subcortical correlates of differential classical conditioning of aversive emotional reactions in social phobia. *Biological psychiatry*, *45*(7), 863-871.

Schofield, C. A., Johnson, A. L., Inhoff, A. W., & Coles, M. E. (2012). Social anxiety and difficulty disengaging threat: Evidence from eye-tracking. *Cognition & emotion*, *26*(2), 300-311.

Schultz, L. T., & Heimberg, R. G. (2008). Attentional focus in social anxiety disorder: Potential for interactive processes. *Clinical psychology review*, *28*(7), 1206-1221.

Schweizer, T. A., Vogel-Sprott, M., Danckert, J., Roy, E. A., Skakum, A., & Broderick, C. E. (2006). Neuropsychological profile of acute alcohol intoxication during ascending and descending blood alcohol concentrations. *Neuropsychopharmacology*, *31*(6), 1301-1309.

Seidel, E. M., Habel, U., Kirschner, M., Gur, R. C., & Derntl, B. (2010). The impact of facial emotional expressions on behavioral tendencies in women and men. *Journal of Experimental Psychology: Human Perception and Performance, 36*(2), 500.

Semple, W. E., Goyer, P. F., McCORMICK, R. I. C. H. A. R. D., Donovan, B., Muzic Jr, R. F., Rugle, L., ... & Vapenik, K. (2000). Higher brain blood flow at amygdala and lower frontal cortex blood flow in PTSD patients with comorbid cocaine and alcohol abuse compared with normals. *Psychiatry*, *63*(1), 65-74.

Silva, J. B. S., Cristino, E. D., Almeida, N. L. D., Medeiros, P. C. B. D., & Santos, N. A. D. (2017). Effects of acute alcohol ingestion on eye movements and cognition: a double-blind, placebo-controlled study. *PloS one*, *12*(10), e0186061.

Silvia, P. J., Allan, W. D., Beauchamp, D. L., Maschauer, E. L., & Workman, J. O. (2006). Biased recognition of happy facial expressions in social anxiety. *Journal of Social and Clinical Psychology*, *25*(6), 585-602.

Simons, J., Correia, C. J., & Carey, K. B. (2000). A comparison of motives for marijuana and alcohol use among experienced users. *Addictive behaviors*, *25*(1), 153-160.

Singer, A. R., & Dobson, K. S. (2007). An experimental investigation of the cognitive vulnerability to depression. *Behaviour research and therapy*, *45*(3), 563-575.

Sluis, R. A., Boschen, M. J., Neumann, D. L., & Murphy, K. (2017). Anticipatory processing in social anxiety: Investigation using attentional control theory. *Journal of behavior therapy and experimental psychiatry*, *57*, 172-179.

Skinner, H. A. (1982). The drug abuse screening test. *Addictive behaviors*, *7*(4), 363-371.

Smillie, L. D., & Jackson, C. J. (2006). Functional impulsivity and reinforcement sensitivity theory. *Journal of Personality*, *74*(1), 47-84.

Smyrnis, N., Evdokimidis, I., Stefanis, N., Constantinidis, T., Avramopoulos, D., Theleritis, C., ... & Stefanis, C. (2002). The antisaccade task in a sample of 2,006 young males. *Experimental Brain Research*, *147*(1), 53-63.

Solso, R. L., Johnson, J. E., & Schatz, G. C. (1968). Perceptual perimeters and generalized drive. *Psychonomic Science*, *13*(2), 71-72.

Sorg, B. A., & Whitney, P. (1992). The effect of trait anxiety and situational stress on working memory capacity. *Journal of Research in Personality*, *26*(3), 235-241.

Spielberger, C. D., & Starr, L. M. (1994). Curiosity and exploratory behavior. *Motivation: Theory and research*, 221-243.

Sposari, J. A., & Rapee, R. M. (2007). Attentional bias toward facial stimuli under conditions of social threat in socially phobic and nonclinical participants. *Cognitive Therapy and Research*, *31*(1), 23-37.

Springer, U. S., Rosas, A., McGetrick, J., & Bowers, D. (2007). Differences in startle reactivity during the perception of angry and fearful faces. *Emotion*, *7*(3), 516.

Stapleton, J. M., Guthrie, S., & Linnoila, M. (1986). Effects of alcohol and other psychotropic drugs on eye movements: relevance to traffic safety. *Journal of studies on alcohol*, *47*(5), 426-432.

Starcke, K., Tuschen-Caffier, B., Markowitsch, H. J., & Brand, M. (2009). Skin conductance responses during decisions in ambiguous and risky situations in obsessive-compulsive disorder. *Cognitive neuropsychiatry*, *14*(3), 199-216.

Staugaard, S. R. (2010). Threatening faces and social anxiety: a literature review. *Clinical psychology review*, *30*(6), 669-690.

Stein, M. B., & Kean, Y. M. (2000). Disability and quality of life in social phobia: epidemiologic findings. *American Journal of Psychiatry*, *157*(10), 1606-1613.

Stein, M. B., Goldin, P. R., Sareen, J., Zorrilla, L. T. E., & Brown, G. G. (2002). Increased amygdala activation to angry and contemptuous faces in generalized social phobia. *Archives of general psychiatry*, *59*(11), 1027-1034.

Stein, M. B., Simmons, A. N., Feinstein, J. S., & Paulus, M. P. (2007). Increased amygdala and insula activation during emotion processing in anxiety-prone subjects. *American Journal of Psychiatry*, *164*(2), 318-327.

Stein, M. B., & Paulus, M. P. (2009). Imbalance of approach and avoidance: the yin and yang of anxiety disorders. *Biological psychiatry*, *66*(12), 1072-1074

Stein, D. J., Medeiros, L. F., Caumo, W., & Torres, I. L. (2020). Transcranial direct current stimulation in patients with anxiety: current perspectives. *Neuropsychiatric Disease and Treatment*, *16*, 161.

Steele, C. M., & Josephs, R. A. (1988). Drinking your troubles away: II. An attention-allocation model of alcohol's effect on psychological stress. *Journal of abnormal psychology*, *97*(2), 196.

Steele, C. M., & Josephs, R. A. (1990). Alcohol myopia: Its prized and dangerous effects. *American psychologist*, *45*(8), 921.

Stevens, S., Rist, F., & Gerlach, A. L. (2009). Influence of alcohol on the processing of emotional facial expressions in individuals with social phobia. *British Journal of Clinical Psychology*, *48*(2), 125-140.

Stevens, S., Rist, F., & Gerlach, A. L. (2011). Eye movement assessment in individuals with social phobia: Differential usefulness for varying presentation times?. *Journal of Behavior Therapy and Experimental Psychiatry*, *42*(2), 219-224.

Stevens, S., Peters, A., Abraham, A., & Hermann, C. (2014). Enhanced avoidance behavior in social anxiety: Evidence from a probabilistic learning task. *Journal of behavior therapy and experimental psychiatry*, *45*(1), 39-45.

Stevens, S., Cooper, R., Bantin, T., Hermann, C., & Gerlach, A. L. (2017). Feeling safe but appearing anxious: Differential effects of alcohol on anxiety and social performance in individuals with social anxiety disorder. *Behaviour research and therapy*, *94*, 9-18.

Stewart, S. H., Morris, E., Mellings, T., & Komar, J. (2006). Relations of social anxiety variables to drinking motives, drinking quantity and frequency, and alcohol-related problems in undergraduates. *Journal of mental health*, *15*(6), 671-682.

Stins, J. F., Roelofs, K., Villan, J., Kooijman, K., Hagenaars, M. A., & Beek, P. J. (2011). Walk to me when I smile, step back when I'm angry: emotional faces modulate whole-body approach–avoidance behaviors. *Experimental brain research*, *212*(4), 603-611.

Straube, T., Mentzel, H. J., & Miltner, W. H. (2006). Neural mechanisms of automatic and direct processing of phobogenic stimuli in specific phobia. *Biological psychiatry*, *59*(2), 162-170.

Sullivan, E. V. (2003). Compromised pontocerebellar and cerebellothalamocortical systems: speculations on their contributions to cognitive and motor impairment in nonamnesic alcoholism. *Alcoholism: Clinical and Experimental Research*, *27*(9), 1409-1419.

Sullivan, E. V., & Pfefferbaum, A. (2005). Neurocircuitry in alcoholism: a substrate of disruption and repair. *Psychopharmacology*, *180*(4), 583-594.

Suzuki, A., Hirota, A., Takasawa, N., & Shigemasu, K. (2003). Application of the somatic marker hypothesis to individual differences in decision-making. *Biological psychology*, *65*(1), 81-88.

Tamres, L. K., Janicki, D., & Helgeson, V. S. (2002). Sex differences in coping behavior: A meta-analytic review and an examination of relative coping. *Personality and social psychology review*, *6*(1), 2-30.

Tatler, B. W., & Hutton, S. B. (2007). Trial by trial effects in the antisaccade task. *Experimental Brain Research*, *179*(3), 387-396.

Taylor, C. T., Cross, K., & Amir, N. (2016). Attentional control moderates the relationship between social anxiety symptoms and attentional disengagement from threatening information. *Journal of behavior therapy and experimental psychiatry*, *50*, 68-76.

Teesson, M., Hall, W., Slade, T., Mills, K., Grove, R., Mewton, L., ... & Haber, P. (2010). Prevalence and correlates of DSM-IV alcohol abuse and dependence in Australia: findings of the 2007 National Survey of Mental Health and Wellbeing. *Addiction*, *105*(12), 2085-2094.

Terlecki, M. A., Ecker, A. H., & Buckner, J. D. (2014). College drinking problems and social anxiety: The importance of drinking context. *Psychology of addictive behaviors*, *28*(2), 545.

Teng, M. H., Hou, Y. M., Chang, S. H., & Cheng, H. J. (2019). Home-delivered attention bias modification training via smartphone to improve attention control in sub-clinical generalized anxiety disorder: A randomized, controlled multi-session experiment. *Journal of Affective Disorders*, *246*, 444-451.

Thomas, S. E., Randall, C. L., & Carrigan, M. H. (2003). Drinking to cope in socially-anxious individuals: A controlled study. *Alcoholism: Clinical and Experimental Research*, *27*(12), 1937-1943.

Thurstone, L. L., & Thurstone, T. G. (1930). A neurotic inventory. *The Journal of Social Psychology*, *1*(1), 3-30.

Ticku, M. K. (1990). Alcohol and GABA-benzodiazepine receptor function. *Annals of medicine*, *22*(4), 241-246.

Tillfors, M., Furmark, T., Marteinsdottir, I., Fischer, H., Pissiota, A., Långström, B., & Fredrikson, M. (2001). Cerebral blood flow in subjects with social phobia during stressful speaking tasks: a PET study. *American journal of psychiatry*, *158*(8), 1220-1226.

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., ... & Nelson, C. (2009). The NimStim set of facial expressions: judgments from untrained research participants. *Psychiatry research*, *168*(3), 242-249.

Tran, G. Q., & Haaga, D. A. (2002). Coping responses and alcohol outcome expectancies in alcohol abusing and nonabusing social phobics. *Cognitive Therapy and Research*, *26*(1), 1-17.

Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent?. *Journal of memory and language*, *28*(2), 127-154.

Turner, D., Laier, C., Brand, M., Bockshammer, T., Welsch, R., & Rettenberger, M. (2018). Response inhibition and impulsive decision-making in sexual offenders against children. *Journal of abnormal psychology*, *127*(5), 471.

Unsworth, N., Schrock, J. C., & Engle, R. W. (2004). Working memory capacity and the antisaccade task: individual differences in voluntary saccade control. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*(6), 1302.

Valentine, T. (1988). Upside‐down faces: A review of the effect of inversion upon face recognition. *British journal of psychology*, *79*(4), 471-491.

Van Ameringen, M., Mancini, C., Styan, G., & Donison, D. (1991). Relationship of social phobia with other psychiatric illness. *Journal of affective disorders*, *21*(2), 93-99.

Van den Heuvel, O. A., Veltman, D. J., Groenewegen, H. J., Witter, M. P., Merkelbach, J., Cath, D. C., ... & van Dyck, R. (2005). Disorder-specific neuroanatomical correlates of attentional bias in obsessive-compulsive disorder, panic disorder, and hypochondriasis. *Archives of general psychiatry*, *62*(8), 922-933.

Van der Linden, D., Taris, T. W., Beckers, D. G., & Kindt, K. B. (2007). Reinforcement sensitivity theory and occupational health: BAS and BIS on the job. *Personality and Individual Differences*, *42*(6), 1127-1138.

Vassallo, S., & Abel, L. A. (2002). Ethanol effects on volitional versus reflexive saccades. *Clinical & Experimental Ophthalmology*, *30*(3), 208-212.

Veiel, H. O. (1997). A preliminary profile of neuropsychological deficits associated with major depression. *Journal of clinical and experimental neuropsychology*, *19*(4), 587-603.

Vera, B. D. V., Pilatti, A., Garimaldi, J., & Pautassi, R. M. (2018). Acute effects of alcohol intoxication on decision-making and impulsivity in at-risk gamblers with or without problematic drinking. *Psychology & Neuroscience*, *11*(3), 252

Verdejo-García, A., Bechara, A., Recknor, E. C., & Pérez-García, M. (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and alcohol dependence*, *91*(2-3), 213-219.

Versiani, M., Nardi, A. E., Mundim, F. D., Alves, A. B., Liebowitz, M. R., & Amrein, R. (1992). Pharmacotherapy of social phobia. *The British journal of psychiatry*, *161*(3), 353-360.

Volz, K. G., Schubotz, R. I., & von Cramon, D. Y. (2005). Variants of uncertainty in decision-making and their neural correlates. *Brain research bulletin*, *67*(5), 403-412.

Vorstius, C., Radach, R., Lang, A. R., & Riccardi, C. J. (2008). Specific visuomotor deficits due to alcohol intoxication: evidence from the pro-and antisaccade paradigms. *Psychopharmacology*, *196*(2), 201-210.

Vorstius, C., Radach, R., & Lang, A. R. (2012). Effects of acute alcohol intoxication on automated processing: evidence from the double-step paradigm. *Journal of psychopharmacology*, *26*(2), 262-272.

Vujanovic, A. A., Bonn-Miller, M. O., & Marlatt, G. A. (2011). Posttraumatic stress and alcohol use coping motives among a trauma-exposed community sample: the mediating role of nonjudgmental acceptance. Addictive Behaviors, 36, 707–712.

Walker-Smith, G. J., Gale, A. G., & Findlay, J. M. (1977). Eye movement strategies involved in face perception. *Perception*, *6*(3), 313-326.

Walls, G. L. (1962). The evolutionary history of eye movements. *Vision Research*, *2*(1-4), 69-80.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of consulting and clinical psychology*, *33*(4), 448.

Weafer, J., & Fillmore, M. T. (2013). Acute alcohol effects on attentional bias in heavy and moderate drinkers. *Psychology of addictive behaviors*, *27*(1), 32.

Weierich, M. R., Treat, T. A., & Hollingworth, A. (2008). Theories and measurement of visual attentional processing in anxiety. *Cognition and Emotion*, *22*(6), 985-1018.

Weinstock, L. S. (1999). Gender differences in the presentation and management of social anxiety disorder. *Journal of Clinical Psychiatry*, *60*(9), 9-13.

Wells, A., Clark, D. M., Salkovskis, P., Ludgate, J., Hackmann, A., & Gelder, M. (1995). Social phobia: The role of in-situation safety behaviors in maintaining anxiety and negative beliefs. *Behavior Therapy*, *26*(1), 153-161.

Wells, A. (1999). A metacognitive model and therapy for generalized anxiety disorder. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice*, *6*(2), 86-95.

Wells, S., Graham, K., & Purcell, J. (2009). Policy implications of the widespread practice of 'pre-drinking'or 'pre-gaming'before going to public drinking establishments—are current prevention strategies backfiring?. *Addiction*, *104*(1), 4-9.

Westra, H. A., & Stewart, S. H. (2001). The validity of the Fear of Negative Evaluation Scale—Brief Version. In *Annual Meeting of the American Psychological Society, Toronto, ON*.

Whalen, P. J., Johnstone, T., Somerville, L. H., Nitschke, J. B., Polis, S., Alexander, A. L., ... & Kalin, N. H. (2008). A functional magnetic resonance imaging predictor of treatment response to venlafaxine in generalized anxiety disorder. *Biological psychiatry*, *63*(9), 858-863.

Wieser, M. J., Pauli, P., & Mühlberger, A. (2009). Probing the attentional control theory in social anxiety: An emotional saccade task. *Cognitive, Affective, & Behavioral Neuroscience*, *9*(3), 314-322.

Williams, J. H., Waiter, G. D., Perra, O., Perrett, D. I., & Whiten, A. (2005). An fMRI study of joint attention experience. *Neuroimage*, *25*(1), 133-140.

Wittchen, H. U., Zhao, S., Kessler, R. C., & Eaton, W. W. (1994). DSM-III-R generalized anxiety disorder in the National Comorbidity Survey. *Archives of general psychiatry*, *51*(5), 355-364.

Wittchen, H. U., & Fehm, L. (2003). Epidemiology and natural course of social fears and social phobia. *Acta Psychiatrica Scandinavica*, *108*, 4-18.

Wittmann, B. C., Daw, N. D., Seymour, B., & Dolan, R. J. (2008). Striatal activity underlies novelty-based choice in humans. *Neuron*, *58*(6), 967-973.

WOLPE, J., & LANG, P. (1964). A fear survey schedule for use in behaviour therapy. Be/tar. *Res. & Thcrupy 2, 2, 30*.

Wright, N. R., & Cameron, D. (1998). The influence of habitual alcohol intake on breath-alcohol concentrations following prolonged drinking. *Alcohol and alcoholism*, *33*(5), 495-501.

Wright, C. I., Martis, B., McMullin, K., Shin, L. M., & Rauch, S. L. (2003). Amygdala and insular responses to emotionally valenced human faces in small animal specific phobia. *Biological Psychiatry*, *54*(10), 1067-1076.

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *The Quarterly Journal of Experimental Psychology Section A*, *54*(3), 665-681.

Yoshida, W., & Ishii, S. (2006). Resolution of uncertainty in prefrontal cortex. *Neuron*, *50*(5), 781-789.

Xu, Y., Schneier, F., Heimberg, R. G., Princisvalle, K., Liebowitz, M. R., Wang, S., & Blanco, C. (2012). Gender differences in social anxiety disorder: Results from the national epidemiologic sample on alcohol and related conditions. *Journal of anxiety disorders*, *26*(1), 12-19.

Zgierska, A., Rabago, D., Chawla, N., Kushner, K., Koehler, R., & Marlatt, A. (2009). Mindfulness meditation for substance use disorders: A systematic review. *Substance Abuse*, *30*(4), 266-294.

Zhang, F., Xiao, L., & Gu, R. (2017). Does gender matter in the relationship between anxiety and decision-making?. *Frontiers in psychology*, *8*, 2231.

Zhang, Y., Zhu, C., Chen, H., Duan, X., Lu, F., Li, M., ... & Zhang, W. (2015). Frequency-dependent alterations in the amplitude of low-frequency fluctuations in social anxiety disorder. *Journal of affective disorders*, *174*, 329-335.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, *67*(6), 361-370.

Appendix

Appendix A: Dot probe task eye movements results

Table showing average Dwell Times on Angry faces and neutral faces during placebo and alcohol conditions.

Placebo Condition	**DT on Angry Faces**	**DT on Neutral Faces**
HSA Group	Mean = 504.85 SD = 196.87	Mean = 501.78 SD = 194.21
LSA Group	Mean = 405.43 SD = 207.1	Mean = 396.43 SD = 193.88
Alcohol Condition	**DT on Angry Faces**	**DT on Neutral Faces**
HSA Group	Mean = 783.86	Mean = 750.41

	SD = 299.24	SD = 266.59
LSA Group	Mean = 594.92 SD = 181.80	Mean = 573.26 SD = 141.80

Table showing average dwell times on happy and neutral faces in HSA and LSA participants during alcohol and placebo conditions.

Placebo Condition	**DT on Happy Faces**	**DT on Neutral Faces**
HSA Group	Mean = 501.78 SD = 194.21	Mean = 498.61 SD = 180.99
LSA Group	Mean = 396.43 SD = 193.88	Mean = 451.46 SD = 198.59
Alcohol Condition	**DT on Angry Faces**	**DT on Neutral Faces**
HSA Group	Mean = 752.84 SD = 280.93	Mean = 750.41 SD = 266.59
LSA Group	Mean = 594.74	Mean = 573.24

	SD = 182.23	SD = 141.80

Appendix B: Antisaccade Results

B 1: Error rates

Table showing average error rates for face type and drug condition.

Face Type	**Placebo Condition**	**Alcohol Condition**
Angry	M=.111, SD=.016	M=.158, SD=.021
Neutral	M=.099, SD=.014	M=.130, SD=.019
Inverted	M=.103, SD=.014	M=.109, SD=.016

B2: Dwell Times Face

Table showing average dwell times around face for high and low socially anxious individuals.

Social Anxiety	Placebo Condition	Alcohol Condition
HSA	M=131.73, SD=19.37	M=206.98, SD=16.2
LSA	M=150.9, SD=20.12	M=162.26,SD=16.83

B 3: Dwell Times Eyes

Table showing average dwell times around eyes during placebo and alcohol condition

Face Type	Placebo Condition	Alcohol Condition

Angry Eyes	M=112.04, SD=16.75	M=156.16, SD=16.82
Neutral Eyes	M=105.78, SD=11.61	M=154.61, SD=17.21
Inverted Eyes	M=47.71, SD=6.58	M=142.87, SD=18.73

Table showing average dwell times around angry, neutral and inverted eyes for high and low socially anxious participants

Face Type	HSA	LSA
Angry Eyes	M=128.66, SD=17.59	M=139.54, SD=18.28
Neutral Eyes	M=157.57, SD=16.58	M=102.82, SD=17.23
Inverted Eyes	M=110.51, SD=13.81	M=89.07, SD=14.35

B4: Dwell Times Mouth

Table showing average dwell times around angry, neutral and inverted mouth after drinking alcohol or placebo.

Face Type	Placebo Condition	Alcohol Condition
Angry Mouth	M=11.46, SD=7.2	M=19.51, SD=9.67
Neutral Mouth	M=44.72, SD=6.62	M=13.91, SD=6.14
Inverted Mouth	M=26.6, SD=13.41	M=14.92, SD=8.64

B5: Latencies

Table showing average latencies for the HAS and LSA participants

Social Anxiety Group	Latencies Means
HSA	M=406.55, SD=23.59
LSA	M=393.3, SD=24.11

Appendix C: Prosaccade Results

C 1: Error Rates

Table showing mean of error rates for HSA compared to LSA participants (N=40, repeated measures).

Social Anxiety Group	Error Rates Mean
HSA	M= .331, SD= .01
LSA	M= .344, SD= .01

C2: Dwell Times

Table showing average dwell times around faces for control and treatment groups during placebo and alcohol conditions.

Social Anxiety Group	Placebo Condition	Alcohol Condition
HSA	M=763.77, SD=8.75	M=719.62, SD=14.93
LSA	M= 771.02, SD=8.62	M= 764.6, SD=14.72

Table showing average dwell times for 1) anxiety groups and 2) face types.

1)

Social Anxiety Group	Dwell Times Means
HSA	M=741.7, SD= 10.63
LSA	M= 767.81, SD=10.48

2)

Face Type	Dwell Times Means
Angry	M= 758.86, SD= 7.52
Neutral	M= 756.56, SD= 7.77
Inverted	M= 748.84, SD= 7.71

C3: Dwell Times Eyes

Table showing average dwell times for each condition (1) Face Type, (2) Drug Condition, (3) Social Anxiety group, (4) interaction between Face Type and Drug Condition.

Face Type	Dwell Times Means
Angry	M=617.11, SD=19.4
Neutral	M=628.07, SD=20.39
Inverted	M=486.95, SD=14.45

Drug Condition	Dwell Times Means
Placebo Condition	M=540.98, SD=18.25
Alcohol Condition	M=613.76, SD= 17.68

Social Anxiety Group	Dwell Times Means
HSA	M=587.25, SD=22.61
LSA	M=567.5, SD=22.3

Face Type	Placebo Condition	Alcohol Condition
Angry	M=613.71, SD= 24.82	M=620.51, SD=20.04
Neutral	M=627, SD= 25.71	M=629.13, SD=19.98
Placebo	M=382.24, SD=13.99	M=591.65, SD= 22.52

C4: Dwell Times Mouth

Table showing average dwell times for each condition (1) Face Type, (2) Drug Condition, (3) Social Anxiety group and (4) interaction between Face Type and Drug Condition.

Face Type	Dwell Times Means
Angry	M=87.18, SD=11.87
Neutral	M=74.07, SD=11.22
Inverted	M=282.4, SD=14.2

Drug Condition	Dwell Times Means
Placebo Condition	M=186.28, SD= 9.6
Alcohol Condition	M=109.49, SD=12.16

Social Anxiety Group	Dwell Times Means
HSA	M=140.73, SD=12.85
LSA	M=155.03, SD=12.67

Face Type	Placebo Condition	Alcohol Condition
Angry	M=98.23, SD=14.98	M=76.13, SD=14.09
Neutral	M=79.26, SD=14.11	M=68.88, SD=13.96
Inverted	M=381.35, SD=15.45	M=183.45, SD=24.61

Appendix D: Study 6

Table showing correlations among social anxiety, drinking motives, preloading behaviours and alcohol units.

	BFNE	PPGQ	DMQR Social	DMQR Coping	DMQR Confimty	DMQR Enhancement	Alcohol Units
BFNE	_	.299**	.247**	.307**	.327**	.159**	0.048
PPGQ	.299**	_	.492**	.574**	.319**	.428**	0.025
DMQR Social	.247**	.492**	_	652**	.370**	.804**	.194**
DMQR Coping	.307**	.574**	.652**	_	.430**	.603**	.170**
DMQR Confimty	.327**	.319**	.370**	.430**	_	.279**	0.027
DMQR Enhancement	.159**	.428**	.804**	.603**	.279**	_	.205**
Alcohol Units	0.048	0.025	.194**	.170**	0.027	.205**	_

Table showing correlations among social anxiety, attentional control and mindfulness facets.

	BFNE	ACS Focus	ACS Shifting	FMTQ Observing	FFMQ Describing	Q Acting with awareness	FFMQ Non Judging	FFMQ Non Reactivity
BFNE	_	-0.094	-0.099	.116*	-0.102	-.288**	-.375**	-.178**
ACS Focus	-0.094	_	.729**	.119*	.297**	.457**	.286**	.267**
ACS Shifting	-0.099	.729**	_	.236**	.441**	.398**	.281**	.325**
FFMTQ Observing	.116*	.119*	.236**	_	.467**	0.107	-0.04	.529**
FFMQ Describing	-0.102	.297**	.441**	.467**	_	.443**	.274**	.452**
FFMQ Acting with awareness	-.288**	.457**	.398**	0.107	.443**	_	.567**	.258**
FFMQ Non Judging	-.375**	.286**	.281**	-0.04	.274**	.567**	_	.186**
FFMQ Non Reactivity	-.178**	.267**	.325**	.529**	.452**	.258**	.186**	_

Table showing correlations among mindfulness facets, drinking pre-gaming behaviours and alcohol units.

	FFMTQ Observing	FFMQ Describing	FFMQ Acting with awareness	FFMQ Non Judging	FFMQ Non Reactivity	PPGQ	Alcohol Units
FFMTQ Observing	_	.467**	0.107	-0.04	.529**	0.031	.157**
FFMQ Describing	.467**	_	.443**	.274**	.452**	-0.052	.132*
FFMQ Acting with awareness	0.107	.443**	_	.567**	.258**	-.219**	0.021
FFMQ Non Judging	-0.04	.274**	.567**	_	.186**	-.229**	0.007
FFMQ Non Reactivity	.529**	.452**	.258**	.186**	_	-0.031	0.05
PPGQ	0.031	-0.052	-.219**	-.229**	-0.031	_	.146**
Alcohol Units	.157**	.132*	0.021	0.007	0.05	.146**	_

Appendix E: Questionnaires

E1: PPGM Reasons for Preloading

1	To make an awkward situation at the event easier to deal with
2	Because you are underage and cannot otherwise obtain alcohol at the event
3	To get buzzed before going to the event
4	To become more social before going to the event
5	Because you don't like the alcohol provided at the event
6	To start the night earlier
7	To feel less anxious at the event
8	It helps me "hook up" (i.e., get together sexually with someone else)
9	To get drunk at a more accelerated pace
10	Because you are stressed
11	To socialize with friends
12	University/Society parties do not supply enough alcohol
13	Because there will not be enough alcohol at the event
14	To have fun
15	To loosen up before going to the event

E2: Attentional Control Scale (ACS;

1	It is very hard for me to concentrate on a difficult task when there are noises around
2	When I need to concentrate and solve a problem, I have trouble focusing my attention

3	When I am working hard on something, I still get distracted by events around me
4	My concentration is good even if there is music in the room around me
5	When concentrating, I can focus my attention so that I become unaware of what's going on in the room around me
6	When I am reading or studying, I am easily distracted if there are people talking in the same room
7	When trying to focus my attention on something, I have difficulty blocking out distracting thoughts
8	I have a hard time concentrating when I am excited about something
9	When concentrating I ignore feelings of hunger or thirst
10	I can quickly switch from one task to another
11	It takes me a while to get really involved in a new task
12	it is difficult for me to coordinate my attention between the listening and writing required when taking notes during lectures
13	I can become interested in a new topic very quickly when I need to
14	It is easy for me to read or write while I'm also talking on the phone
15	I have trouble carrying on two conversations at once
16	I have a hard time coming up with new ideas quickly
17	After being interrupted or distracted, I can easily shift my attention back to what I was doing before
18	When a distracting thought comes to mind, it is easy for me to shift my attention away from it
19	It is easy for me to alternate between two different tasks
20	It is hard for me to break from one way of thinking about something and look at it from another point of view

E3: Five Facet Mindfulness Questionnaire

1	When I'm walking, I deliberately notice the sensations of my body moving
2	I'm good at finding words to describe my feelings
3	I criticize myself for having irrational or inappropriate emotions

4	I perceive my feelings and emotions without having to react to them
5	When I do things, my mind wanders off and I’m easily distracted
6	When I take a shower or bath, I stay alert to the sensations of water on my body
7	I can easily put my beliefs, opinions, and expectations into words
8	I don’t pay attention to what I’m doing because I’m daydreaming, worrying, or otherwise distracted
9	I watch my feelings without getting lost in them
10	I tell myself I shouldn’t be feeling the way I’m feeling
11	I notice how foods and drinks affect my thoughts, bodily sensations, and emotions
12	It’s hard for me to find the words to describe what I’m thinking
13	I am easily distracted
14	I believe some of my thoughts are abnormal or bad and I shouldn’t think that way
15	I pay attention to sensations, such as the wind in my hair or sun on my face
16	I have trouble thinking of the right words to express how I feel about things
17	I make judgments about whether my thoughts are good or bad
18	I find it difficult to stay focused on what’s happening in the present
19	When I have distressing thoughts or images, I “step back” and am aware of the thought or image without getting taken over by it
20	I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing
21	In difficult situations, I can pause without immediately reacting

22	When I have a sensation in my body, it’s difficult for me to describe it because I can’t find the right words
23	It seems I am “running on automatic” without much awareness of what I’m doing
24	When I have distressing thoughts or images, I feel calm soon after
25	I tell myself that I shouldn’t be thinking the way I’m thinking
26	I notice the smells and aromas of things
27	Even when I’m feeling terribly upset, I can find a way to put it into words
28	I rush through activities without being really attentive to them
29	When I have distressing thoughts or images I am able just to notice them without reacting
30	I think some of my emotions are bad or inappropriate and I shouldn’t feel them
31	I notice visual elements in art or nature, such as colours, shapes, textures, or patterns of light and shadow
32	My natural tendency is to put my experiences into words
33	When I have distressing thoughts or images, I just notice them and let them go
34	I do jobs or tasks automatically without being aware of what I’m doing
35	When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about
36	I pay attention to how my emotions affect my thoughts and behaviour
37	I can usually describe how I feel at the moment in considerable detail
38	I find myself doing things without paying attention
39	I disapprove of myself when I have irrational ideas