

The Role of Cognitive Processes in Social Anxiety Risk for Problematic Drinking

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ABSTRACT

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Alcohol consumption peaks in university and is tied with numerous and often severe negative alcohol-related consequences (NACs) (e.g., blacking out; unplanned sex). Social anxiety (SA) is highly comorbid with alcohol use disorders in later adulthood, yet during the undergraduate years the link is less clear. On the one hand, those high in SA may use alcohol to relieve tension in anxiety-provoking social situations. On the other, they may be particularly attentive to potential NACs (e.g., saying regretful things) and avoid drinking. This theoretical complexity is reflected by a mixed empirical literature, with evidence for positive, negative, and null associations between SA and problematic drinking. Despite research efforts to elucidate this pathway to problematic drinking, *how* risk unfolds and *who* high on SA is at risk remain unclear. The primary goal of this dissertation was to clarify SA risk for problematic drinking. To meet this goal, in-the-moment cognitions and key moderators were incorporated into models of risk. Study 1 sought to investigate the interactive effects of SA, impulsivity, and mood on positive alcohol-related cognitions, as they unfold in-the-moment during a drinking episode. It was hypothesized that when in an anxious (vs. neutral) mood, and following a priming dose of alcohol, those high on SA and impulsivity would activate positive alcohol-related cognitions (i.e., tension reduction, social facilitation). In partial support of hypotheses, following a priming dose of alcohol, those high on SA and impulsivity activated social facilitation and enhancement (but *not* tension reduction) alcohol-related cognitions. Surprisingly, this effect was observed in the neutral but not anxious mood condition. The second study tested individual subjective evaluations of NACs as moderating SA risk for problematic drinking. It was hypothesized that individuals high on SA who evaluate NACs less negatively would be at risk for experiencing NACs but not drinking heavily.

Supporting the hypothesis, those high on SA demonstrated risk for experiencing NACs if they evaluated these consequences to be less negative. The findings contribute to a mixed but evolving picture of SA risk pathways to problematic drinking. In addition to advancing extant theoretical models, results have clinical implications for interventions targeting SA-motivated undergraduate drinking.

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CONTRIBUTIONS OF AUTHORS

The following thesis is comprised of two manuscripts:

Study 1(Chapter 2)

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Study 2 (Chapter 4)

Nitka, D., & O'Connor, R. M. (in press). Evaluations of alcohol consequences moderate social anxiety risk for problematic drinking. *Addictive behaviors*, 65, 131-136.

I selected the topic of the research program as well as each individual study focus. I secured funding to support this research, including a Fonds de la Recherche en Santé du Québec (FRSQ) graduate training award and a Centre de Réadaptation en Dépendance de Montréal: Infrastructure de Recherche Soutien Financier aux Étudiants pour Rédaction d'une Thèse award. Dr. Roisin O'Connor also contributed funds from Fonds de Recherche sur la Société et la Culture Québec (FQRSC) Établissement de Nouveaux Professeurs-Chercheurs. In collaboration with my supervisor, Dr. Roisin O'Connor, I developed and conducted the laboratory-based experiment that provided the basis for the two studies included in this dissertation.

For each study, I conducted a literature review, developed the research question, acquired ethics approval, and designed the study protocol. I conducted a pilot study to test and refine measurement tools used in the final studies. Dr. Roisin O'Connor provided theoretical, conceptual and design-related consultation during the development of the experiment. My Dissertation committee members, Dr. Adam Radomsky and Dr. Mark

Ellenbogen provided conceptual input and approval of the research project and methodology during a proposal meeting.

Once protocols were finalized, I trained honours students and undergraduate student volunteers to assist me with data collection and other administrative tasks for the laboratory experiment. I was responsible for overseeing all administrative and experimental aspects of the study, as well as writing both manuscripts. Dr. Roisin O'Connor contributed conceptual input for manuscript write-ups, and continued to provide extensive feedback and edits on written drafts. I revised the manuscripts in accordance with this feedback prepared the manuscripts for publication.

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CHAPTER 1: GENERAL INTRODUCTION

Scope of the Problem

Alcohol consumption peaks during the university years (Kandel, 1984; Taylor, 2016), with 85% of Canadian students reporting at least some alcohol use, and up to 35% reporting heavy use (Adlaf, Demers, & Glicksman, 2005; Kuo et al., 2002). Heavy drinking during this developmental stage presents particular risk for a number of potentially life-altering negative alcohol-related consequences (NACs), including drunk driving, physical and sexual assault, and academic failure (Clements, 1999; Engs & Diebold, 1996; Perkins, 2002; Wechsler et al., 2002). Heavy drinking and NACs are normative and often encouraged throughout this transition to adulthood (Dusenbury & Botvin, 1992; Fry, 2011; Hillman & Sawilowsky, 1992; Romo, 2012). Students who experience NACs have unique opportunities to bond, share jointly-narrated drinking stories with peers, offer care and protection to one another, and develop strong friendships (Taylor, 2016). Conversely, abstinence from alcohol holds stigma during this period (Romo, 2012). University is formative, presenting a cultural context that is fertile ground for developing beliefs, attitudes, and behaviours related to drinking—ones that extend beyond the undergraduate years. Indeed, while most students mature out, a subset go on to develop alcohol use disorders (Littlefield, Sher, & Wood, 2009; O'Malley & Johnston, 2002; O Malley, 2004; Zimmermann & Zimmermann, 2003). Problematic drinking, defined here to include both heavy drinking and experiencing NACs, is a public health concern. While theoretical models and empirical studies identify many trajectories to problematic drinking, the present dissertation focuses on the complex and relatively poorly understood anxiety-related pathway.

The undergraduate years present novel and challenging social situations that some individuals experience to be anxiety-provoking. Social anxiety (SA), characterized by an intense fear of being perceived negatively and judged by others (Montagne et al., 2006), is a particularly relevant presentation of anxiety in the university context. Indeed, thirteen

percent of undergraduates report experiencing SA at the symptom level, struggling with fears related to social interaction (Purdon, Antony, Monteiro, & Swinson, 2001) et al., 2001). This anxiety is consistently shown to be a temporal predecessor to problematic drinking later in life (Buckner et al., 2008; Lépine & Pélissolo, 1998; Regier, Rae, Narrow, Kaelber, & Schatzberg, 1998; Schneier, Martin, Liebowitz, Gorman, & et al., 1989). The comorbidity between SA and alcohol use in adulthood has been well-documented in the literature (Book, 2002; Carrigan & Randall, 2003; Kushner, Sher, & Beitman, 1990; Marshall, 1994), with cross cultural, epidemiological, and meta-analytic studies revealing that individuals high on SA (vs. those low) are two to three times more likely to develop an alcohol use disorder (Crum & Pratt, 2001; Himle et al., 1999; Kushner, Abrams, & Borchardt, 2000; Kushner, Abrams, Thuras, & Hanson, 2000; Kushner et al., 1990; Lai, Cleary, Sitharthan, & Hunt, 2015; Schneier et al., 2010). Moreover, when co-occurring, these disorders maintain one another, reciprocally increasing severity of symptoms and impacting quality of life (Randall, Thomas, & Thevos, 2001; Schneier et al., 1989). Combined with the social nature of university, peak drinking levels during this time make this a critical period for studying developmental risk trajectories.

The social anxiety-problematic drinking association has been widely investigated in undergraduate populations (Book, 2002; Kushner et al., 1990; Schry & White, 2013). However, the results point to a complex aetiology. There is some evidence that SA is a risk factor for problematic drinking (e.g., Kessler et al., 2007), other evidence that SA can be protective (e.g., Holroyd, 1978), and yet other work finding a null association between the two (e.g., Ham & Hope, 2005). It is possible that during the university years, those high on SA may not appear distinct from their peers with regard to amount consumed *per se*, but differ on *how* they come to drink. Participation in social events is normative and expected in the university context. Individuals high on SA experience social situations to be anxiety-provoking. Thus, these individuals may differ from their peers in that they drink to cope with anxiety—to self-medicate in-the-moment when distressed in social situations. Supporting this is evidence that drinking to cope with distress leads to NACs

in the long term (e.g., Cooper, Frone, Russell, & Mudar, 1995; Sher, Grekin, & Williams, 2004). Another possibility is that the complexity in the literature reflects a need to examine relevant moderators. While some individuals high on SA may seek relief from alcohol, others may be attentive to potential NACs and thus, motivated to avoid these. This theoretical complexity may be at the crux of the mixed empirical literature, suggesting much remains unknown regarding *how* and for *whom* this risk unfolds during this critical period. Advancing aetiological models requires systematic examinations of SA and university drinking and an unpacking of risk mechanisms. Specifically, clarifying underlying mechanisms in-the-moment and assessing who high on SA is at risk are necessary steps for developing targeted and effective interventions for SA-related problematic drinking in university.

The aim of this dissertation is to unpack SA risk for problematic drinking in undergraduates. The overarching goal of investigating SA-related drinking is twofold: to trace *how* cognitive processes unfold in-the-moment during a drinking episode, and test relevant moderators to assess *who* is at risk for problematic drinking in university. A theoretical basis for examining cognitive processes and moderators underlying aetiological risk pathways is provided.

Theoretical Background

Tension Reduction Theory. Alcohol has long been viewed as a remedy for anxiety, dating as far as Hippocrates' prescription for using "wine [and water to] put away anxiety and terrors" (Hippocrates, 1886). Tension reduction theory is rooted in early animal models outlining the effects of alcohol on broad fear and avoidance via reductions in stress hormones released in distressing situations (Conger, 1956; Pohorecky & Brick, 1983). At its origin are drive reduction models, which posit that a high energy, or "drive" state (e.g., tension) is met with motivation to reduce it with a substance (e.g., alcohol) (Conger, 1956; Levenson, Sher, Grossman, Newman, & Newlin, 1980). Early research examining the effects of alcohol on physiological stress identified reductions in electrodermal and cardiac responses to stressors (e.g., loud tones) (Greenberg & Carpenter, 1957; Lehrer & Taylor, 1974) as well as decreased muscle tension (Steffen,

Nathan, & Taylor, 1974) among other physical effects. However, in outlining these responses to alcohol, these and other studies (e.g., Pliner & Cappell, 1974; Polivy & Herman, 1976) also indicated that the physiological effects of drinking manifest alongside subjective, cognitive effects (Polivy, Schueneman, & Carlson, 1976), especially in the context of “real life” stressors occurring outside the laboratory. Recent applications of tension reduction theory postulate those high on SA are particularly sensitive to both the physiological and cognitive tension-reducing effects of alcohol (Kushner et al., 1990). These applications have provided a theoretical foundation for understanding the association between SA and drinking, with underlying mechanisms extending beyond the physiological to the cognitive.

Cognitive Mechanisms. Cognitive and social learning theories (Bandura, 1986; Maisto, Carey, Bradizza, Leonard, & Blane, 1999) complement tension reduction theory, pointing to cognitions as a central mediating mechanism of the effects of individual differences on drinking. These theories provide a conceptual framework whereby personality and dispositional traits are seen as *distal*, influencing behaviour via cognitive processes, perceived to be most *proximal* to behaviour. Individuals high on SA struggle with cognitions related to social performance (e.g., worrying about appearing “awkward”), which produce tension in social situations (Kushner et al., 1990). The anxiolytic physiological effects of alcohol should provide some relief. Moreover, alcohol also provides cognitive relief through its influence on attention (Wilson, 1987), excessive self-awareness, and more generally, by reducing the aversive impact of self-critical information (Hull, 1981). Thus, alcohol provides a welcome physical and cognitive remedy for social distress. Together, these effects foster and maintain alcohol-related cognitions that promote drinking (Carrigan & Randall, 2003; Chutuape & de Wit, 1995). Drinking is commonplace at university, making alcohol both a normative and accessible solution in these social contexts. In addition to firsthand experience, observation of peers and role models deriving affective relief by drinking also contributes to learning. In both cases, high SA individuals form cognitions related to tension reduction, which directly influence subsequent behaviour (Goldman, Del Boca, Darkes, Leonard, & Blane, 1999;

Maisto et al., 1999). These learned contingencies (e.g., memory associations) are elicited by contextual factors (e.g., drinking environments) or mood states. Once activated, they increase the urge to drink (Carrigan & Randall, 2003; Chutuape & de Wit, 1995). Behavioural decisions such as drinking are thus determined jointly by present circumstance, past memories, and future expectations regarding the effects of consuming alcohol (Abrams & Niaura, 1987; Field & Cox, 2008).

Alcohol-related cognitions, accounting for 10-19% of variance in current alcohol use and up to 35% of the variance in predicting prospective drinking (Oei & Morawska, 2004), are more robust predictors of drinking than demographic variables (Brown, 1985; Christiansen & Goldman, 1983). Further, cognitions predict risk above and beyond the physiological effects of drinking, as demonstrated by placebo studies demonstrating that even the mere belief that one has consumed alcohol is sufficient for reducing tension (e.g., Himle et al., 1999). Specific alcohol-related cognitions have been studied extensively, and include expectations that alcohol will alleviate tension (Brown, Goldman, & Christiansen, 1985), improve sociability (Ham, Bacon, Carrigan, Zamboanga, & Casner, 2015), or enhance mood (Martin & Hoffman, 1993), all of which predict drinking outcomes in undergraduates. Empirical support for these cognitions as proximal mechanistic processes suggests cognitions may help clarify underlying risk and explain some of the shared variability in the etiology of SA risk for problematic drinking risk in undergraduates.

Dual Process Model of Cognitive Processing. The cognitive literature identifies two cognitive processes that govern behaviours including alcohol use (Chaiken & Trope, 1999; Strack & Deutsch, 2004). A reflective, deliberative process engages top-down reasoning to evaluate content with intention and generate a thoughtful decision. This type of processing, labelled *explicit*, captures deliberative cognitions (Goldman, 1999) typically assessed using self-report questionnaires. A second mode of processing is thought to operate on a reflexive level, whereby the strongest associative structures formed in memory are activated by environmental cues (Stacy & Wiers, 2010) and predict risky behaviours (Greenwald & Banaji, 1995; Tran, Haaga, & Chambless, 1997)

including problematic drinking (Houben & Wiers, 2007). This impulsive process, termed *implicit*, is often measured with associative cognitive tasks such as the Implicit Associations Test¹ (IAT; Greenwald & Banaji, 1995). Theoretical and empirical progress in the cognitive literature has generated bi-directional contributions between theory and measurement, such that the *implicit/explicit* labels have come to reflect both concept *and* measurement. For simplicity, deliberative processes will be referred to as *explicit* and impulsive as *implicit* throughout this dissertation.

Dual process models have been instrumental in helping to unpack cognitive processes underlying alcohol use, integrating seamlessly in broader models of dispositional influences such as trait anxiety. Information processing models of anxiety identify a cognitive process whereby first, a primary, implicit mode of information becomes activated. Next, limited input from the explicit, top-down system is integrated, prior to its full engagement in decision-making (Beck & Clark, 1997). Similarly, in drinking contexts, environmental cues including alcohol consumption itself are thought to activate implicit alcohol-related cognitions, after which the explicit reasoning process engages (Moss & Albery, 2009). The alcohol literature identifies distinct phases—pre-(alcohol) consumption and post-(alcohol) consumption, as holding unique cognitive implications for drinking (Moss & Albery, 2009). Before drinking, situational cues may prompt mental representations or implicit alcohol-related cognitions, rendering associated behavioural responses more or less salient depending on previous experience (e.g., activation of positive memories about drinking when at a bar). It is well established that alcohol consumption compromises cognitive functions, and most notably top-down,

¹ The IAT is a dual categorization reaction time task measuring relative strength between concepts and attributes. In the original IAT, participants use keypress to categorize two object categories (e.g., black vs. white) into two conceptually opposing attribute categories (e.g., positive vs. negative). Interpreting responses in the original IAT relies on patterns of pairing in conceptual “opposites”. IAT variants include the Single Category IAT (SC-IAT; Karpinski & Steinman, 2006), designed to measure attitudes toward concepts that have no natural “opposite” (e.g., alcohol).

explicit processes (e.g., information about calculated risks of drinking less accessible) (Köpetz, Lejuez, Wiers, & Kruglanski, 2013). Thus, once alcohol consumption is initiated, explicit processes make way for implicit cognitions which then govern drinking. Over time and experience, these implicit cognitions become highly sensitized to both internal and environmental cues associated with alcohol consumption (Köpetz et al., 2013). In the moment, alcohol consumption itself impairs cognition such that only the most salient associative information is activated and processed (Moss & Albery, 2009) and explicit, top-down influences are compromised (Gawronski, Hofmann, & Wilbur, 2006). The rising salience of implicit alcohol-related cognitions, and impaired explicit processing increases the likelihood for seeking immediate reinforcement at the expense of future consequences (Field & Cox, 2008). Extensive research supports this theoretical conceptualization, demonstrating that indeed, priming doses of alcohol increase the accessibility of cognitions related to alcohol (Field & Cox, 2008) and affect inhibitory and behavioural control (Oscar-Berman & Marinković, 2007). Taken together, theoretical and empirical contributions in this literature suggest cognitive processes underlying drinking consist of a combination of chronically and temporarily active implicit cognitions. Under the influence of alcohol, explicit processes erode, leaving implicit cognitions as central influences on behaviour. While aforementioned empirical work outlines the impact of alcohol on cognitive processing, studies differentially assessing implicit processes associated with pre-consumption versus post-consumption in-the-moment are sparse.

Delay Discounting. The undergraduate years present a context that includes rampant drinking and social settings that are anxiety-provoking for some. For those high on SA who are immersed in the university drinking culture, active cognitive representations of alcohol may present conflicting information. SA-related distress and drinking environments may prompt previously learned implicit positive alcohol-related cognitions (e.g., alcohol will relieve tension or improve sociability). On the other hand, inherently anxious processing should orient those high on SA toward threat (Mogg et al., 2000), and potential NACs may become particularly salient and inhibit drinking (Merrill,

Read, & Barnett, 2013a). The delay discounting literature provides a useful framework for understanding how this conflict is resolved. *Delay discounting* refers to the tendency to favour immediate reward at the expense of future outcomes (MacKillop et al., 2011). In line with dual process models, evidence suggests temporal proximity, and by extension the salience of cognitions, determine whether immediate outcomes are chosen over potentially larger delayed ones (MacKillop et al., 2011). In other words, salient cognitions that are activated in-the-moment are attended to in favour of immediate relief or reward, while potential future negative consequences are overlooked. Accordingly, anxiety-provoking social settings involving drinking may activate implicit cognitions related to the immediate, positive effects of drinking, whereas explicit processes related to potential future negative consequences may be impaired by alcohol consumption itself. To illustrate, an undergraduate high on SA attending a social gathering (anxiety-provoking) may be enticed by positive cognitions related to tension-reducing effects or social benefits of drinking alcohol (activated in-the-moment), disregarding risk for hangovers, missed classes, or other *future* negative consequences. This conceptualization is in line with evidence from separate bodies of literature suggesting both heavy drinkers and those high on SA tend to choose more immediately-rewarding options on delay discounting procedures (e.g., Bickel & Marsch, 2001; Rounds, Beck, & Grant, 2007).

In sum, cognitive theories and empirical evidence provide a solid framework for conceptualizing aetiological risk for problematic drinking in university. During this period of emerging adulthood, and in the midst of a cultural context promoting problematic drinking practices, those high on SA develop cognitions related to drinking, which are thought to be most proximal to the decision to drink in-the-moment or to be at risk more broadly for problematic drinking. While aforementioned working theoretical models frame the momentary (mechanistic) *how*, the mixed evidence suggests that not all undergraduates high on SA are at risk for problematic drinking. In fact, the heterogeneity in individuals high on SA has been noted extensively (e.g., Heimberg, Holt, Schneier, Spitzer, & Liebowitz, 1993; Nicholls, Staiger, Williams, Richardson, & Kambouropoulos, 2014; Whiting et al., 2014). In order to develop a meaningful

theoretical understanding of risk trajectories, both the *how* as well as the *who* of risk must be addressed. Investigating the latter calls for examination of moderating state and individual-level differences.

State and Individual-Level variables

Cognitive processes operate within a broader framework, whereby state variables as well as distal individual-level traits affect behavioural choices. At the most proximal level, state variables (e.g., mood) influence cognitive processes occurring in-the-moment. More distal, individual-level differences can affect both momentary processes as well as decisions regarding broader drinking practices. The present work investigates distal and proximal variables thought to be central to SA-related risk for problematic drinking. These moderators are outlined next.

Mood State. There is evidence that negative mood activates alcohol-related cognitions on both explicit (Hufford, 2001) and implicit levels of processing (Stewart, Hall, Wilkie, & Birch, 2002). More specifically, it is thought that intense mood strains cognitive load (Kron, Schul, Cohen, & Hassin, 2010; Verbruggen & De Houwer, 2007) and influences attentional processes (Sedikides, 1992), leaving implicit processes at the forefront of decision-making. Distressed mood may direct attention away from potential future negative outcomes to the immediately rewarding properties of alcohol. Thus, when distressed, individuals high on SA may be most vulnerable to activating positive alcohol-related cognitions and overlooking potential NACs in favour of immediate relief.

Empirical tests of these suppositions have utilized mood manipulations that are visual (i.e., images) or musical in nature (e.g., Hufford, 2001; Stewart et al., 2002). Although these studies support the role of negative mood in priming alcohol-related cognitions, the manipulations lack ecological validity. Other, more interactive and anxiety-specific manipulations in the literature are more ecologically valid but employ performance and competence-based (e.g., speech) tasks to elicit anxiety. Results from these studies are typically mixed (Ham, Casner, Bacon, & Shaver, 2011) with some evidence that induced performance anxiety is associated with lower levels of drinking

prior to, and higher levels of drinking subsequent to the performance task (Abrams, Kushner, Medina, & Voight, 2002). Although these tasks elicit anxiety, they are poorly suited to examinations of SA risk for problematic drinking, given that individuals high on SA report using alcohol to cope with situations that provoke *social* rather than *competence/performance*-related anxiety (Thomas, Randall, & Carrigan, 2003). Given their biased orientation to threat, individuals high on SA are likely to be particularly wary of any potential compromising effects of alcohol on their perceived competence in performing the task at hand. While theory and evidence suggest mood state plays an important role in the cognitive processes associated with drinking, no study to date has investigated effects of *socially-relevant* and *ecologically valid* mood manipulations on implicit cognitive processes across levels of SA. Examinations of mood effects on cognitions call for more specificity in testing the effects of mood on alcohol-related cognitions in those high on SA, and unpacking these processes in-the-moment.

Other Individual-level differences. Not all high SA individuals are at risk for problematic drinking in university, or will go on to develop alcohol use disorders. Research on SA subtypes differentiates the impulsive, approach oriented and risk prone subtype from those shy, inhibited and avoidant high SA individuals (Nicholls et al., 2014). According to acquired preparedness models, these dispositional trait-level differences are central in shaping learning and accessibility of alcohol-related cognitions in-the-moment (Settles, Cyders, & Smith, 2010). More broadly, impulsivity is an individual-level factor that has been identified in personality risk related to alcohol use disorders (Dick et al., 2010; Fu, Ko, Wu, Cherng, & Cheng, 2007; McCarthy, Miller, Smith, & Smith, 2001) via alcohol-related learning (Smith & Anderson, 2001). Individuals high on SA who are also more impulsive tend to experience more alcohol-related problems (Kashdan & Hofmann, 2008). This specific dispositional personality trait may be central to overlooking potential NACs in favour of regulating emotions in-the-moment by those individuals high on SA. Specifically, impulsivity may direct attention toward positive environmental cues, with a significant bias toward rewarding effects of alcohol and limited attention to potential adverse effects (Meier, Slutske, Arndt,

& Cadoret, 2007). Impulsivity has indeed been found to moderate the relation between positive implicit cognitions and alcohol use (Burton, Pedersen, & McCarthy, 2012).

While impulsivity is thought to play a role in momentary drinking decisions, other dispositional variables may be central to broader drinking practices at university. Value theories (e.g., expectancy value theories; Bandura, 1977; Hays, 1985) point to individual-level differences associated with the importance ascribed to cognitions and expected outcomes (Hays, 1985; Wigfield & Eccles, 2000). Through experience or peer observation, individuals high on SA may develop valuations that lead them to continue engaging in drinking practices despite experiencing NACs. Values ascribed to cognitions regarding outcomes hold motivational implications of cost and benefit in behavioural choices (Patrick & Maggs, 2008). Drawing on learning theories, it is hypothesized that based on the values attributed to cognitions, individuals come to expect rewarding or punishing effects of momentary decisions (Bandura, 1986), highlighting the role of *valence* of cognitions in addition to their content. Consequently, strongly valued positive cognitions or outcomes would be reinforcing whereas strongly valued negative ones would be punishing (Bandura, 1977). Conversely, the reinforcing or punishing properties ascribed to cognitions and outcomes held at low valence would be limited. Consistent with these hypotheses is evidence that heavy drinkers view negative effects of alcohol as more benign than light drinkers (Williams & Ricciardelli, 1996). Given that heavy drinking is promoted and abstinence from alcohol is stigmatized in the university cultural context (Romo, 2012), it is possible that some individuals high on SA may come to value positive effects of drinking or devalue negative outcomes related to drinking. Despite some past efforts to incorporate valence in examining cognitions in the alcohol literature (e.g., Brown, Goldman, Inn, & Anderson, 1980; Fromme, Stroot, & Kaplan, 1993), subjective evaluations of cognitions or perceived effects of alcohol continue to be overlooked in contemporary research. The present work aims to address this oversight by incorporating subjective evaluations of drinking consequences as central to the study of SA risk for problematic drinking.

Trait-level impulsivity, state mood, and individual differences in evaluations of alcohol-related consequences have been theoretically and empirically supported as potential moderators of the SA risk pathway to problematic drinking. Mood state has been consistently shown to influence cognitive processes, but the nature and direction of its effect, as well as how these are influenced by dispositional traits such as impulsivity are unclear. For instance, when in an anxious mood, it may be impulsivity that drives the activation of positive alcohol-related cognitions in-the-moment as individuals drink. On a broader level, individual-level differences in how NACs are perceived or whether they are devalued may be central in determining why those high on SA continue to drink despite experiencing these consequences.

Overview of the Current Research

Alcohol use peaks at university, where problematic drinking patterns are learned socially, and for some, extend beyond the undergraduate years. SA-related aetiological risk pathways have been modeled in an extensive, yet perpetually mixed literature. The importance of cognitive processes underlying drinking has been well-established, yet due to the theoretical and empirical complexity in undergraduate populations, the role of these cognitions remains poorly understood. Advancing these risk models calls for examination of *how* and for *whom* these cognitive processes unfold, both in-the-moment and more broadly. In university, individuals high on SA face anxiety-provoking social situations where alcohol is readily accessible and its use encouraged. Across a single drinking episode, both state (e.g., mood) and trait-level (e.g., impulsivity) variables may give rise to or promote the activation of specific learned positive alcohol-related cognitions. Repeated drinking episodes involve learning, setting in place potentially problematic alcohol use patterns for undergraduates high on SA, who in distress, may struggle to navigate social situations. Despite an attention bias toward negative outcomes and experiencing even severe NACs, it remains to be understood how and why some of these individuals continue to drink. Examining subjective evaluations of drinking practices may shed some light on these decisions. The overarching goal of this

dissertation is to clarify these inconsistencies and contribute to aetiological risk models of SA and problematic drinking. Two studies have been designed for this purpose.

The first study is an experimental investigation of the roles of SA, trait impulsivity, and mood state in examining how cognitive processes unfold in-the-moment over a drinking episode (See Figure 1). A laboratory-based procedure aimed to assess the activation of implicit positive alcohol-related cognitions across SA and impulsivity and prior to and following drinking initiation, in a socially-relevant anxious (versus neutral) mood. It was hypothesized that those high on both SA and impulsivity, and when in an anxious mood, would activate tension reduction and social facilitation implicit alcohol cognitions. This effect was expected to be most pronounced following a priming dose of alcohol. A second study targets broader SA risk for problematic drinking outcomes by examining the role of an overlooked moderator which may help explain why some individuals high on SA continue to drink despite experiencing NACs. Subjective evaluations of negative alcohol-related consequences were tested as moderating SA risk for alcohol use and related consequences, which are seen as independent outcomes in the literature (See Figure 2). The primary hypothesis was that those high on SA who evaluate NACs as less negative would be at risk for experiencing NACs but not drinking heavily. Together, these studies aim to provide insight into *how* and for *whom* SA presents risk for problematic drinking, advancing aetiological models of risk.

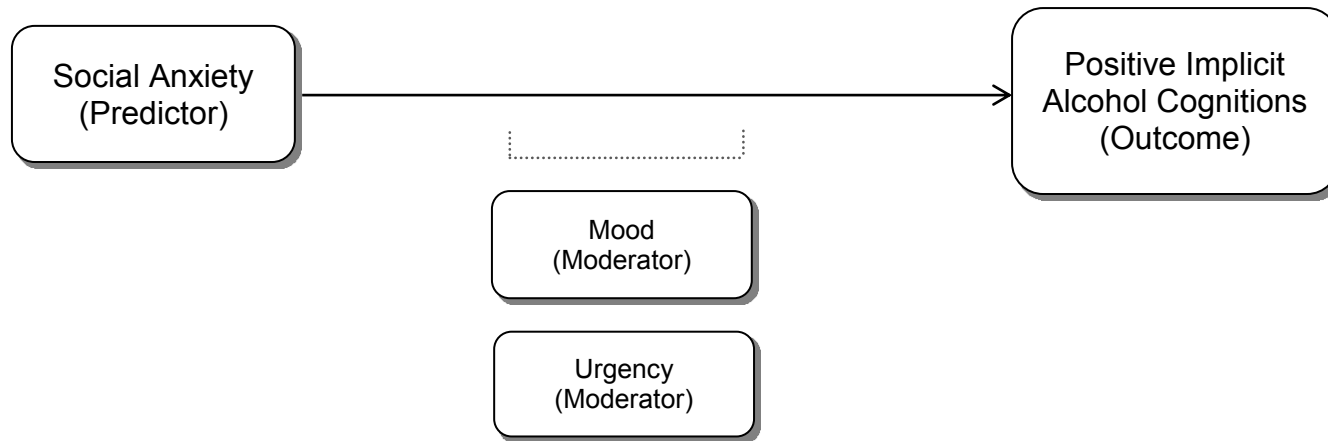


Figure 1. Study 1: Conceptual model of the moderating effects of urgency and mood on positive implicit alcohol-related cognitions

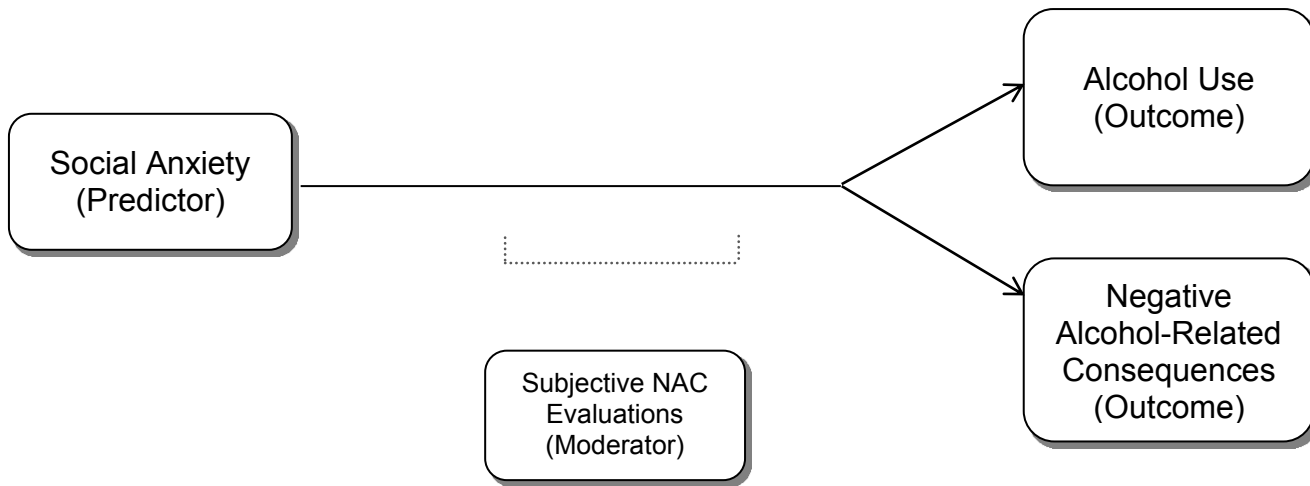


Figure 2. Study 2: Conceptual model of the moderating effect of NAC evaluations on alcohol use and negative alcohol-related consequences

**CHAPTER 2:
STUDY 1**

**Social Anxiety and Implicit Alcohol Cognitions: Moderating effects of
Impulsivity during a Drinking Episode**

Nitka, D., & O'Connor, R. M., (manuscript in preparation). *Alcoholism: Clinical and
Experimental Research*.

Abstract

Social Anxiety (SA) risk for undergraduate problematic drinking is theoretically complex, reflected by a mixed empirical literature. On the one hand, these individuals should be drawn to potential tension-reducing or socially lubricating effects of alcohol yet on the other hand; anxious individuals are known to attend to potential negative consequences and therefore, should avoid drinking. Theoretical models and empirical evidence point to impulsivity and mood as key variables influencing cognitive processes underlying drinking in undergraduates high on SA. The present study is an experimental investigation of these influences on implicit positive alcohol-related cognitions as they unfold throughout a drinking episode. Undergraduate drinkers ($N=130$, 80 women) were randomly assigned to neutral or anxious mood condition and completed baseline questionnaires including measures of SA and urgency. Implicit positive alcohol cognitions were then assessed using a reaction-time task, which was completed both prior to and following alcohol administration. We found no evidence for the activation of implicit alcohol-related cognitions prior to alcohol consumption in both the neutral and anxious mood conditions. However, after drinking, those high on both SA and urgency activated social facilitation, and unexpectedly, enhancement, but not tension reduction implicit positive alcohol cognitions. Surprisingly, this effect was observed in neutral rather than anxious mood. Results support SA and urgency as central and interactive trait variables influencing the activation of enhancement and social facilitation implicit cognitions unfolding over a drinking episode. Although the role of anxious mood state remains to be investigated further, evidence for the activation of implicit cognitions holds important implications for clinical intervention.

Introduction

Problematic drinking, defined here as heavy drinking and experiencing alcohol-related consequences, is commonplace among undergraduates. Almost one third of students report heavy, frequent drinking and more than 40% experience alcohol-related problems such as having unplanned sex when intoxicated (Adlaf et al., 2005). Social anxiety (SA) is defined broadly as a fear of being negatively judged by others (Montagne et al., 2006) and has been linked to undergraduate problematic drinking (Morris, Stewart, & Ham, 2005). In university, 13% of students report experiencing SA at a symptom level, struggling with a fear of social interactions (Purdon et al., 2001). The university context presents a plethora of social situations which are at the same time distressing for those high in SA and conducive to problematic drinking.

Tension reduction (Kushner et al., 1990) and expectancy theories (Hays, 1985; Wigfield & Eccles, 2000) posit those high in SA are drawn to alcohol for its self-medication (i.e., alleviates anxiety) and social facilitation (i.e., eases interpersonal interaction) effects. Complementing this, social learning theory highlights the proximal role of cognitions such that alcohol memory associations and outcome expectancies mediate the effects of individual differences, such as SA (Bandura, 1977, 1986; Wall, Thrussell, & Lalonde, 2003), on drinking. Together, these theories suggest those high in SA respond to and come to rely on the anxiolytic (reducing anxiety) and disinhibiting (increasing sociability) effects of alcohol when emotionally distressed (Carrigan & Randall, 2003; Chutuape & de Wit, 1995; Ham, 2009) and this in turn puts them at risk for problematic drinking.

Although extant work implicates SA as a risk factor for problematic drinking (Booth & Hasking, 2009; Buckner, Leen-Feldner, Zvolensky, & Schmidt, 2009; Gilles, 2007; Kessler et al., 2007; Kessler et al., 1996; Kidorf & Lang, 1999; Lewis & O'Neill, 2000; Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996; Morris, 2004), other research reveals negative (Eggleston, Woolaway-Bickel, & Schmidt, 2004; Ham, Bonin, & Hope, 2007; Ham & Hope, 2006; Holroyd, 1978; Stewart, Morris, Mellings, & Komar, 2006) and null (Ham & Hope, 2005) SA-drinking associations. This complexity may

originate with the cognitions associated with SA risk. On the one hand, some research suggests that those high on SA report using alcohol as a way to cope with uncomfortable social situations (Thomas et al., 2003). Similarly, there is evidence that anticipating positive effects (e.g., tension reduction, social assertion) mediates SA risk for drinking heavily (Ham, 2009; Tran et al., 1997). In contrast, other studies find no relation between SA and tension reduction cognitions (Ham, 2009), or a negative correlation between SA and overall positive alcohol cognitions (Ham & Hope, 2006).

Unpacking cognitions might lend itself to some resolution in this literature. For individuals high on SA to engage in problematic drinking, they must temporarily disregard potential negative consequences, consequences that we would expect those high in SA to be particularly attentive to (Beck & Clark, 1997). Extant work demonstrates that negative affect (including anxious mood) influences the accessibility of positive alcohol-related cognitions (Hufford, 2001) and that those who drink to cope with negative affect only show an attentional bias toward alcohol when cued by anxious mood (Grant, Stewart, & Birch, 2007). Moreover, it is established that individuals high on SA struggle to disengage attention from socially-relevant threat (Amir, Elias, Klumpp, & Przeworski, 2003) and seek alcohol for social facilitation reasons (Fromme et al., 1993). These affective biases extend beyond the cognitive to behaviour. There is some evidence that individuals high on SA drink more when anticipating a stressful, socially-relevant performance task than when in a comparable neutral circumstance (Kidorf & Lang, 1999). Similarly, other studies show evidence for increased drinking related to anxious anticipation (e.g., Higgins & Marlatt, 1973; Smail, Stockwell, Canter, & Hodgson, 1984). Nevertheless, findings from other work complicate the clinical picture with evidence that elevated SA is associated with reduced drinking during stressful in-lab social interactions (Holroyd, 1978) and that those high on SA actually drink less in anticipation of a stressful task than following it, noting that they wish to avoid alcohol-related impairments in performance (Abrams et al., 2002). This literature suggests the link between SA and positive alcohol-related cognitions may be complex, pointing to heterogeneity in those high on SA. When distressed, some high SA individuals may ignore potential negative

consequences in favour of immediate relief whereas others would withdraw in response to anxiety. Consistent with this conceptualization, research on SA subtypes differentiates high SA individuals who are shy, behaviourally inhibited and risk averse (Beidel, Turner, & Morris, 1998; Crozier & Alden, 2001), from a more impulsive, disinhibited subtype (Kashdan & Hofmann, 2008; Kashdan & McKnight, 2010). Impulsivity may therefore hold promise as a broad dispositional construct that may help explain these differences.

Both theory and extant research suggest impulsivity, characterized by a lack of planning and a propensity to seek immediate gratification (Magid, MacLean, & Colder, 2007; Read, Wood, Kahler, Maddock, & Palfai, 2003), is a key individual difference influencing drinking behaviour (Settles et al., 2010; Smith & Anderson, 2001). Urgency is a facet of impulsivity that captures a tendency to experience and act on impulses in response to strong affect or environmental cues that signal reward, in order to relieve aversive affect in-the-moment (Whiteside & Lynam, 2003). In the literature, urgency has been associated with binge drinking (Cyders, Flory, Rainer, & Smith, 2009), experiencing alcohol-related problems (Corbin, Iwamoto, & Fromme, 2011), and with heavy drinking in response to negative affect (Dick et al., 2010). Taken together with evidence that two subtype profiles of SA exist, the research suggests impulsive, high SA individuals may be those attending to immediate positive alcohol-related cognitions and ignoring potential negative outcomes when experiencing socially-relevant distress (Meier et al., 2007; Settles et al., 2010). Thus, these individuals may be particularly enticed to seek alcohol to temper their affect and improve their sociability in the moment. Clarifying the relation between SA and alcohol-related cognitions requires an experimental examination of urgency and moderating role as these cognitive processes unfold in-the-moment.

Investigation of cognitive processes must address the complexity of the drinking experience, taking into account the interplay between cognition and physiology. Physiological response to alcohol consumption is biphasic (Morean & Corbin, 2010; Pohorecky, 1977; Wilson, 1988), with increases in heart rate (Levenson, 1987; Naitoh, 1972) and skin conductance (Jones, Parsons, & Rundell, 1976) at low doses (typically at

0.04 gm%; Lang, 1999), and a depressant effect including reduced arterial blood pressure at higher doses (Knott & Beard, 1972; Levenson, 1987). Physiological and cognitive responses to alcohol shift as individuals move from initiation to heavy consumption, with these initial effects typically mimicking anxiety. To illustrate, those high on SA and urgency may initiate drinking for a number of reasons including but not limited to self-medication (e.g., to conform). However, sensitivity to the initial physiological effects of alcohol may promote the salience of positive memory associations with alcohol, and cue individuals to continue drinking. Gaps in the literature warrant an examination of positive alcohol-related cognitions unfolding as individuals begin with a priming dose of alcohol and continue along the drinking episode. Extant research suggests these cognitions ought to be operationalized and disaggregated given evidence for improved consistency across studies when cognitions are specific (Tran et al., 1997). Contemporary cognitive theories including dual process models contribute to a growing evidence base on the role of these specific cognitions.

Dual process models categorize alcohol-related cognitions as reflective and deliberative or reflexive and associative (Chaiken & Trope, 1999; Strack & Deutsch, 2004). With the interest of tapping into the unfolding, in-the-moment cognitive processes, the focus of the current study is to unpack the interaction between trait level SA and impulsivity in predicting alcohol associations through drinking initiation. These cognitions comprise of strong associations formed in memory, responsive to cues (Stacy & Wiers, 2010) and playing a unique role in predicting risky behaviour (Greenwald & Banaji, 1995; Houben & Wiers, 2007; Jajodia & Earleywine, 2003; Reich, Below, & Goldman, 2010; Tran et al., 1997). Examining these implicit cognitions may be most relevant to capturing the unfolding mood-sensitive alcohol-related cognitions underlying risk for problematic drinking (Houben & Wiers, 2007).

The goal of the current study was to test the effect of SA on unfolding alcohol-related cognitions prior to and following a priming dose of alcohol (0.04 gm% breath alcohol concentration-BrAC) at anxious and neutral mood. Given its theoretical alignment with state affect and processes of interest, the urgency facet of impulsivity was

tested as a moderator of SA on activation of positive alcohol-related cognitions in anxious (vs. neutral) mood. Alcohol-related cognitions of interest were tension reduction and social facilitation. Enhancement cognitions were examined to ensure specificity—that the effects are not a function of broad *positive* cognitions overall. It was hypothesized that prior to drinking initiation, no interactive effects of SA, urgency, and mood on these cognitions would be observed. However, following a priming dose of alcohol, it high SA was expected to be associated with increased activation of tension reduction and social facilitation alcohol associations (when controlling for baseline, pre-manipulation levels) but only in a socially-relevant anxious (vs. neutral) mood. It was hypothesized that the increase in strength of positive alcohol associations would be most apparent at high relative to low levels of urgency.

Method

Participants

Participants were undergraduate students from Montreal universities, recruited through a participant pool system, online ads, and flyers. Those who contacted the lab for participation were directed to an online screening. Eligible participants included 130 (62% women) full time undergraduate students who were 18 (legal drinking age) to 25 years old ($M=20.77$; $SD=1.73$), and self-identified as drinkers (>1 drink in past month, Battista et al., 2010), fluent in English, had no history of problematic drinking, and did not have medical conditions contraindicated for alcohol use. The majority of participants identified as White (68%), with 12% identifying as Asian, 5% Middle Eastern, 3% South Asian, 3% Aboriginal Canadian, 3% Hispanic or Latino and 5% “Other”. Participants most frequently reported living on their own off campus (65%), with 23% reporting living at home with family, and 12% on campus. There was a relatively even distribution across year of study, with 27% in their first year, 29% in their second, 29% in their third, and 13% in their fourth year of university.

Materials

Social anxiety. The 19-item Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) was used to measure anxiety characterized by a fear of interaction with

others (e.g., When mixing socially, I am uncomfortable). Responses were made on 5-point scales (0=Not at all characteristic or true of me, 4=Extremely characteristic or true of me). A mean SA score was computed. The SIAS has very good internal consistency ($\alpha=.88$) and excellent retest reliability ($r=.92$) (Habke, 1997; Mattick & Clarke, 1998). In the current sample, internal consistency was excellent ($\alpha=.92$).

Mood. The Visual Analogue Scale (VAS; Martin, 1990; Mongrain & Trambakoulos, 2007) assessed state affect prior to and following the mood manipulation. The VAS was adapted to include anxious (“nervous”, “anxious”, “tense”, “distressed”, “uncomfortable”) and positive (“cheerful”, “glad”, “pleased”, “happy”, “excited”) mood (Shacham, 1983; Grant et al., 2007; Birch et al., 2004). Participants rated each adjective using a slider on a horizontal 100-point line (0=not at all, 100=very much). Filler mood items were included to dilute the focus on anxiety. Mean anxious and positive scores were computed. The VAS has very good internal consistency ($\alpha=.86-.95$) (Dannahy & Stopa, 2007; Mongrain & Trambakoulos, 2007). In the present sample, pre-manipulation ($\alpha=0.86$, anxious scale; $\alpha=.88$, positive scale) and post-manipulation ($\alpha=.92$, both scales) internal consistencies were very good to excellent.

Urgency. The 12-item urgency subscale of the Impulsive Behaviour Scale (Urgency Subscale) (Whiteside & Lynam, 2001) was used to assess rash responding to intense affect (e.g., *I often make matters worse because I act without thinking when I am upset*). Responses were made on a 5-point scales (1=*not at all*, 5=*Extremely*). A mean score was computed. The urgency scale has excellent consistency ($\alpha=.90$) (Anestis, Selby, & Joiner, 2007; Whiteside & Lynam, 2001). In the current sample, internal consistency was excellent ($\alpha=.90$).

Implicit alcohol cognitions. The Single Category Implicit Associations Test (SC-IAT; Karpinski & Steinman, 2006) was administered pre and post-drink. Three separate SC-IATs were administered consecutively with alcohol as the concept category (6 pictures). In each of the three SC-IATs, alcohol and distinct positive alcohol-related attribution categories (social facilitation: “sociable”, tension reduction: “relaxed”, and enhancement: “energetic”) were contrasted with negative alcohol-related attributions

(e.g., “sick”). Stimuli in attribute categories (5 words per category) were selected based on ratings from a pilot study. The words presented were matched across categories in subtitle frequency (Bluemke & Fiedler, 2009; Brysbaert & New, 2009), syllabic content and word length (Francis & Kucera, 1967; O'Connor & Colder, 2009).

Consistent with Karpinski and Steinman (2006), for each SC-IAT, each block included 24 practice trials followed by 72 test trials. Participants were presented with stimuli in the center of the screen, which they then categorized with keypresses. On the first block, alcohol was paired with positive (e.g., tension reduction) vs. negative, and for second block, the pairing switched such that alcohol now shared same response key as the negative stimuli. See O'Connor, Lopez, and Colder (2012) and O'Connor and Colder (2015) for more detailed descriptions of the SC-IAT. Comparative performance on these blocks is thought to reflect relative positive versus negative associations with alcohol. D-scores reflecting tension reduction (TR), social facilitation (SF) and enhancement (EN) were of interest.

Procedure

All procedures were approved by the institutional Ethics Review Board. Lab sessions took place in a “bar lab” setting for ecological validity and lasted between 3.5 and 5.5 hours. Compensation was course credit or cash (\$10 per hour). Participants provided informed consent and were weighed to determine dose of alcohol required to achieve a breath alcohol level (BrAC) of 0.04gm%. BrAC levels were tested using a hand-held breathalyzer to ensure that participants' initial alcohol levels were at 0.00gm%.

Participants completed pre-mood manipulation measures, including VAS-1, SIAS, Urgency and baseline BrAC to ensure 0.00gm%. They were then randomly assigned to either the socially-relevant anxious or neutral mood condition. Those in the anxious mood condition viewed videos featuring confident and accomplished same-aged confederates, anticipating having to complete a videotaped and evaluated first impressions task with one of the interviewees. Those assigned to the neutral mood condition viewed a video on napkin folding techniques. Previous work (Nitka, 2011) has

demonstrated that the mood manipulation successfully elicits anxious mood and that the neutral mood condition causes no increase in anxiety.

Next, participants completed post-mood manipulation/pre-alcohol measures, including VAS-2 and *pre-drink* SC-IAT. Participants' BrAC was brought to 0.04gm% (Lang, Patrick, & Stritzke, 1999) using a formula adapted from Fisher, Simpson, and Kapur (1987). Following a 10 minute absorption period, BrAC was assessed and then re-assessed every 10 minutes until participants reached .04gm%, typically 10-20 minutes following administration. Those who did not reach the .04gm% mark during this time range were given up to an additional 10 minutes (30 minutes total following absorption) prior to proceeding to the next part of the experiment. Next, participants completed post-alcohol measures, including VAS-3 and the *post-drink* SC-IAT.

Results

Data Screening and Analytic Overview

Data was screened prior to analysis for violation of assumptions. Visual inspection of histograms suggested a normal distribution for predictor variables, supported by skew and kurtosis values within acceptable range (Skew < 3, Kurtosis < 10; Kline, 2010). No outliers (± 3.29) were identified. The D-scores were computed based on the Greenwald, Nosek, and Banaji (2003) algorithm adapted for the SC-IAT by Karpinski and Steinman (2006). Accordingly, no data from practice trials was included in computing the final scores, responses below 350ms were eliminated and error responses were replaced with the block mean for all correct responses + 400ms (Karpinski & Steinman, 2006). Mean substitution was used to replace scores (Bluemke & Fiedler, 2009; Tabachnick & Fidell, 2013) for participants with overall error rates above 25% (Hummert, Garstka, O'Brien, Greenwald, & Mellott, 2002; Rudman & Ashmore, 2007). Specifically, average response times for the Alcohol+Positive blocks were subtracted from the average response times for the Alcohol+Negative blocks and divided by the pooled standard deviation of correct responses within each respective block. Positive D-scores reflected higher positive than negative associations with alcohol.

Following data screening, the hypothesized moderation models were tested with regressions using Proc GLM in SAS version 9.4 (SAS Institute Inc., 2002, Cary, NC). Guidelines by Aiken and West (1991) were followed in testing moderation. In three separate models, *pre-drink* (prior to alcohol administration) tension-reduction, enhancement, and social facilitation SC-IAT D-scores (criterion variables) were regressed on first order effects (SA, urgency, mood condition), and all two-way (SA x urgency, SA x mood condition, urgency x mood condition) and three-way (SA x urgency x mood condition) interactions terms. Next, three additional models tested these effects, this time regressing *post-drink* (following alcohol administration) SC-IAT D-scores on first order effects and interactions. Predictor variables were centered to facilitate interpretation and to reduce multicollinearity (Kline, 2010). Moderation effects were followed up with tests of simple slopes when statistically significant ($p < .05$) or when relevant to interpretation. The simple slope of SA predicting *post-drink* SC-IAT D-scores at time one and SC-IAT D-scores at time two were conditioned on high (+1 *SD* above mean) and low (-1 *SD* below mean) levels of urgency and on anxious and neutral mood condition. Effect sizes were computed and small, medium and large effects respectively were $f^2 = .02$, $f^2 = .15$ and $f^2 = .35$ (Cohen, 1988).

Preliminary Analyses

Descriptive Statistics and Bivariate Correlations. See Table 1. SIAS and Urgency scores for this sample were comparable to those reported in similar undergraduate studies (Anestis et al., 2007; Keough, 2015; Whiting et al., 2014). SIAS was uncorrelated with tension reduction, social facilitation and enhancement SC-IAT D-scores, both at *pre-drink* and *post-drink*. Tension reduction SC-IAT D-scores were negative both *pre* and *post-drink*, suggesting that participants had stronger negative compared to tension reduction alcohol cognitions at both instances. In contrast, social facilitation SC-IAT D-scores were positive both *pre* and *post-drink*, indicating that participants had stronger social facilitation compared to negative alcohol cognitions at both instances. Enhancement SC-IAT D-scores revealed that while negative cognitions

were stronger at *pre-drink*, D-scores were positive *post-drink*, suggesting enhancement cognitions were stronger *post-drink*.

Mood Manipulation. SIAS levels did not differ between the anxious ($M=2.241$, $SD=0.779$) and neutral ($M=2.237$, $SD=0.656$), $F(1, 128)=0.00$, $p=.974$, $d=.006$, mood conditions. Responses on the anxious and positive VAS-1 scales pre-manipulation did not differ across mood condition (anxious mood condition: $M=27.673$, $SD=19.787$; neutral mood condition: $M=26.609$, $SD=16.986$, $F(1, 128)=0.11$, $p=.743$, $d=0.060$). Moreover, the pre-manipulation state positive mood ratings on the VAS-1 did not differ between anxious ($M=60.936$, $SD=15.255$) and neutral mood condition ($M=62.316$, $SD=14.937$, $F(1, 128)=0.27$, $p=.604$, $d=-0.091$). However, a repeated measures ANOVA revealed a statistically significant time (pre-manipulation, post-manipulation) by mood condition (anxiety rating) interaction, supporting a change in mood across time by condition $F(1,128)=67.08$, $p<.0001$. Follow-up simple effects analyses revealed a statistically significant increase in anxious mood for those in the anxious mood condition, (post-anxiety induction: $M=46.439$, $SD=22.373$, $t(65)=7.20$, $p<.0001$), with a large effect size ($d=0.506$) (Cohen, 1988) Anxious mood decreased in the neutral mood condition ($M=21.213$, $SD=16.438$, $t(65)=-4.07$, $p<.0001$), with a medium effect size ($d=-0.323$) (Cohen, 1988). An ANOVA was also conducted to examine group differences following the mood manipulation. Post-mood induction anxiety ratings were higher for those in the anxious mood ($M=46.439$, $SD=22.372$) compared to those in the neutral mood condition ($M=21.215$, $SD=16.438$; $F(1,128)=53.41$, $p<.0001$), with a large effect size ($d=1.300$). State anxiety scores for those in the anxious mood condition are consistent with scores reported elsewhere in the literature (e.g., $M=46.80$; Grant et al., 2007). To ensure that the mood manipulation was effective across SIAS levels, we tested the effect of SIAS and mood condition on post-manipulation mood (controlling for pre-manipulation mood) and found no evidence to suggest the mood manipulation differed across SIAS levels ($F(1,128)=2.21$, $p=.140$).

We also examined the shift in positive mood to test whether the increased anxiety may have resulted from an overall change in arousal level. A repeated measures ANOVA

was conducted to assess change in positive mood from pre to post-manipulation mood across the anxious and neutral mood conditions. The time by mood interaction term was not statistically significant, suggesting change in positive mood did not differ by mood condition $F(1,128)=1.23, p=.269$. However, a main effect of time was supported $F(1,128)=98.20, p<.0001$ such that across mood condition, there was a decrease in positive mood from pre to post-manipulation (pre-manipulation: $M=61.615, SD=15.057$, post-manipulation mood: $M=48.914, SD=18.948, d=-0.747$).

Hypothesis Testing

Tension Reduction SC-IAT D-Scores. In the first model tested, as hypothesized, the three-way interaction term was not a statistically significant predictor of *pre-drink* tension reduction SC-IAT D-scores (See Table 2) and accounted for approximately 5% of the variance. In the second model, contrary to hypotheses, the three-way interaction term was not a statistically significant predictor of *post-drink* tension reduction SC-IAT D-scores, accounting for 17% of the variance.

Social Facilitation SC-IAT D-Scores. In the third model, as expected, the three-way interaction term was not a statistically significant predictor of *pre-drink* social facilitation SC-IAT D-scores (See Table 3), accounting for 4% of the variance. Although the interaction term was not statistically significant, to aid in interpretation of models that follow, simple slopes for this model are presented in Figure 3. The fourth model revealed, as hypothesized, that the three-way interaction term was a statistically significant predictor of *post-drink* social facilitation SC-IAT D-scores, accounting for 11% of the variance. The three-way interaction term was probed by social anxiety at high and low levels of urgency and by mood condition. SIAS was positively associated with social facilitation SC-IAT D-scores for those high on urgency ($B[SE]=.361 [.142]; t=2.54, 129$ df, $p=.012, f^2=0.053$) compared to those low on urgency ($B[SE]=-0.020 [.081]; t=-0.25, 129$ df, $p=.803, f^2=0.000$) in the neutral condition but not anxious mood condition (where at high urgency: $B[SE]=-0.067 [.072]; t=-0.93, 129$ df, $p=.353, f^2=0.007$, and at low urgency: $B[SE]=.127 [.093]; t=1.36, p=.175, 129$ df, $f^2=0.015$ (see Figure 4)).

Enhancement SC-IAT D-Scores. In the fifth model, unsurprisingly, the three-way interaction term was not a statistically significant predictor of *pre-drink* enhancement SC-IAT D-scores (See Table 4), accounting for 9% of the variance. Again, to facilitate interpretation of models to follow, simple slopes are presented in Figure 5. In the sixth model, the three-way interaction term was unexpectedly a statistically significant predictor of *post-drink* enhancement SC-IAT D-scores, accounting for 7% of the variance. The three-way interaction term was probed by social anxiety at high and low levels of urgency and by mood condition (See Figure 6). Although not statistically significant, the pattern of slopes suggested elevated SIAS was associated with stronger enhancement SC-IAT D-scores (B[SE]=.220 [.134]; $t=1.64$, 129 df, $p=.104$, $f^2=0.022$) vs. low (B[SE]=-0.082 [.078]; $t=-1.05$, 129 df, $p=.29$, $f^2=0.009$) for those high on urgency in the neutral condition. In the anxious mood condition, the pattern suggested elevated SIAS was associated with higher enhancement scores for those high on urgency (B[SE]=-0.056 [.068]; $t=-0.81$, 129 df, $p=.420$, $f^2=0.005$) compared to low (B[SE]=0.086 [.089]; $t=0.97$, 129 df, $p=.332$, $f^2=0.008$).

Discussion

The primary objective of the study was to clarify SA risk for problematic drinking by examining the interactive effects of SA, impulsivity, and anxious mood on in-the-moment implicit alcohol cognitions during a drinking episode. Results indicated that following drinking initiation, those high on SA and urgency activated social facilitation and enhancement alcohol-related cognitions (but not tension reduction), and that this was observed in the neutral rather than anxious mood condition.

Consistent with hypotheses, no effects of SA and urgency on positive implicit alcohol-related cognitions were observed at *pre-drink*. These findings are aligned with a vast literature highlighting contextual cues (e.g., alcohol) as critical to unfolding cognitive processes, and more specifically, to the activation of implicit cognitive or appetitive processes (Field, Schoenmakers, & Wiers, 2008; Krank & Wall, 2006). Prior to alcohol administration, contextual cues including the laboratory bar and induced

socially-relevant anxious mood were insufficient in eliciting activation of positive alcohol-related cognitions.

At *post-drink* however, it was somewhat surprising that socially-relevant anxious mood did not elicit the activation of positive alcohol-related cognitions. This runs contrary to theory and evidence suggesting implicit alcohol-related processes are influenced by mood state (Greeley & Oei, 1999; Simons, Gilbert, Owen, Fletcher, & Burgess, 2005). Thus, we expected that consistent with theory and previous work (e.g., Grant et al., 2007), anxious mood would activate tension reduction and social facilitation cognitions for individuals high on SA and impulsivity. Interestingly, there is evidence that other negative mood inductions in the literature have failed to influence alcohol-related cognitions at the implicit level (Birch et al., 2008), suggesting mood-related changes in these cognitions may be difficult to assess at this level of processing, raising a potential measurement issue. It has been hypothesized that the specific tasks used to assess these implicit cognitions are failing to capture the implicit associations elicited by negative mood. It has been proposed that this may be remedied with tasks such as the IAT or its variants, which would capture these associations more directly (Birch et al., 2008). Nevertheless, the current data fail to support the SC-IAT as a more suitable measure to this end.

An alternative explanation is that in less experienced undergraduate drinkers, the impact of negative mood on implicit alcohol cognitions has not yet been sufficiently automatized and is therefore less detectable (Birch et al., 2008). There may be fewer exposures to pairings of negative mood with drinking and relief outcomes than positive mood, drinking and rewarding outcomes (Birch et al., 2008). Broadly, the research suggests heavier drinkers show greater activation of positive alcohol expectancies than light drinkers (e.g., Dunn & Goldman, 2000). There is also evidence that in a sample of students with considerable alcohol problems, coping-motivated undergraduate drinkers in an anxious mood condition did activate implicit alcohol-related cognitions (Grant et al., 2007). Further, other work has demonstrated that coping-motivated undergraduate drinkers who drink heavily and experience above average levels of problems overall

showed activation in alcohol concepts following negative semantic primes (Stewart et al., 2002).

An additional consideration is that experimental mood induction literature has relied largely on visual or musical mood manipulations (e.g., Hufford, 2001; Stewart et al., 2002), or examining effects of negative mood rather than anxious mood specifically (e.g., Birch et al., 2004; Grant et al., 2007). Further, extant mood manipulations designed to elicit anxiety with increased ecological validity often employ performance and competence-based (e.g., speech) tasks, with mixed effects on drinking outcomes (Ham et al., 2011). The present study aimed to elicit anxiety related to *social interaction with peers* more specifically, as per the university context. To ensure a sufficient level of anxiety was elicited, participants were told they would be evaluated on their social interaction. It is possible that significant, imminent, and potentially overwhelming anxiety caused by the additional evaluative component of the interaction masked implicit alcohol-related cognitions that are otherwise observable in a neutral or positive mood, interfering with adequate assessment of implicit processes. Indeed, some studies that have shown mood-related activation of alcohol concepts or positive cognitions have been observed in positive (e.g., Birch et al., 2008; Grant et al., 2007) and neutral (e.g., Goldstein, Wall, McKee, & Hinson, 2004) rather than negative mood conditions. Although we did not specifically induce positive mood in the current study, it is possible that our neutral mood manipulation is comparable to musically-induced positive mood in other work. The pattern of our findings suggests both enhancement and social facilitation alcohol-related cognitions are observable in the neutral condition, consistent with extant research highlighting the accessibility of positive, enhancement-related alcohol cognitions in neutral or positive mood (Birch et al., 2004; Birch et al., 2008; Grant et al., 2007). Further, to our knowledge, our study is the only study to date that tests mood and implicit associations in a *bar* setting, simulating the drinking environment with higher fidelity than typical laboratory testing rooms. A neutral mood state combined with a bar environment may be most representative of typical university drinking, and thus, any potentially detectable implicit processes may be masked by anxiety. Given the

complexity of mood states and implicit associations, additional experimental research is needed to elucidate effects.

We expected that when in an anxious mood, those high on SA and urgency would activate tension reduction cognitions following a priming dose of alcohol but not prior to drinking. There was no evidence to support this hypothesis, nor the activation of tension reduction cognitions altogether. These results are somewhat inconsistent with theory and extant cognitive research. Specifically, these findings are at odds with predictions based on mood priming and state dependent learning theories (Bower, 1981), which contend that concepts and emotions encoded together are stored together, and are simultaneously accessible (Forgas, 1995). Reducing anxiety is commonly reported as an expectancy and reason for drinking (Burke & Stephens, 1999) and negative mood inductions have been shown to elicit primed alcohol schemas (e.g., Stewart et al., 2002) in those reporting drinking to cope with distress. Thus, we predicted that in an anxious mood, individuals high on SA will easily access alcohol-related cognitions, and more specifically, tension reduction associations previously associated with anxious mood states. Anxious individuals are motivated to drink to cope with their anxiety (e.g., Stewart & Devine, 2000) and thus, it is surprising that no activation of tension reduction cognitions occurred, even following an alcohol cue. Nonetheless, the current study results are consistent with research demonstrating coping-motivated drinkers do not activate alcohol-related words nor show an association between alcohol and relief when primed with negative mood (Birch et al., 2008). An important commonality between the current study and the aforementioned work is the implicit assessment of alcohol-related associations. Much of the previous work investigating mood and alcohol-related cognitions in undergraduate drinkers has relied on explicit report (e.g., Birch et al., 2004; Hufford, 2001), often measured following exposure to motives questionnaires whereby participants respond to explicit statements regarding their drinking, and may be primed to endorse or generate similar statements. It is therefore possible that the effects of negative mood manipulation on tension reduction cognitions may only be detectable on self-report or explicit levels (e.g., Birch et al., 2004; Birch et al., 2008). Ample evidence (e.g., Ham

et al., 2007; Kidorf & Lang, 1999; Lewis & O'Neill, 2000) supports the link between SA and self-reported tension reduction expectancies or coping-related motivations.

We also predicted that when in an anxious mood, those high on SA and urgency would activate social facilitation cognitions after drinking initiation (but not prior to alcohol consumption). As expected, those low on SA did not hold social facilitation associations with alcohol prior to drinking initiation. Interestingly, the data suggest that following a priming dose, those low on SA showed even weaker social facilitation associations. However, contrary to our expectation, we found that after drinking initiation, those high on SA and urgency activated social facilitation associations in the neutral rather than the anxious mood condition. Despite evidence that those high on SA report drinking to cope with social situations (Thomas et al., 2003) and may be particularly attentive to these rewarding effects if high on urgency, we did not observe an effect of anxious mood on these associations in-the-moment. Nonetheless, results are somewhat consistent with extant work suggesting social and situational enhancement expectancies are not activated in negative mood (Goldstein et al., 2004). Given previous research suggesting positive cognitions are activated in a positive mood and inhibited in negative mood, it is possible that here, social facilitation cognitions were incongruent with negative mood and thus, not activated (Forgas, 1995; Goldstein et al., 2004). Alternatively, others contend that social facilitation cognitions are altogether not directly mood relevant (Wardell, Read, Curtin, & Merrill, 2012). The link between SA, urgency and social facilitation cognitions may be thus be most easily observed following drinking initiation and least detectable when masked by anxious or other strong moods.

In examining enhancement cognitions, we found no evidence that those high on SA and urgency activate enhancement associations prior to drinking initiation, but did observe an effect following *post-drink*. Specifically, we found that those high on SA and urgency activated enhancement associations in the neutral mood condition but not in the anxious mood condition. This effect was surprising given that we tested enhancement associations to support construct validity and establish specificity to tension reduction in examining implicit positive alcohol cognitions. Similar to findings with social facilitation

cognitions, intense negative (anxious) mood may have masked the priming effect of alcohol on enhancement cognitions, and therefore, these were more readily observed in the more congruent, neutral state. However, consistent with our findings is research suggesting those who drink for enhancement reasons (i.e., drinking to “feel good”) activate alcohol constructs following positive and neutral mood primes both at explicit (e.g., Birch et al., 2004) and implicit (e.g., Birch et al., 2008; Grant et al., 2007) levels of processing and measurement. The activation of enhancement cognitions in those high on urgency *post-drink* suggests that rather than mood, trait anxiety and alcohol cue priming may be more central influences in-the-moment. Although we expected those high on SA to activate tension reduction rather than enhancement cognitions, the conceptual difference between these cognitions may be too subtle at the implicit level. At this level, it may be particularly difficult to parse alcohol constructs relating to increases in positive mood (i.e., “enhancing mood”) from reducing negative mood (i.e., alleviating or tempering tension). The distinction between drinking to *feel good* and to *feel less bad* may therefore be too sophisticated to process at an implicit level. Conceptualizing drinking as a means to reduce tension may occur on a propositional, explicit level of processing, one where more advanced reasoning processes are at the forefront. This explanation is consistent with evidence that reductions in subjective anxiety are accompanied by increases in positive thoughts rather than decreases in negative thoughts (Abrams, Kushner, Lisdahl Medina, & Voight, 2001). There is also evidence suggesting that indeed, anxious individuals implicitly associate alcohol with enhancing mood state rather than with reducing tension (e.g., Stewart et al., 2002). Our findings here align with previous work demonstrating that those high on SA and in anxious mood activate enhancement cognitions and report cravings to drink (Nitka, 2011).

The current study has several notable limitations. First, it is possible that although the anxiety mood manipulation was designed to be socially-relevant rather than competence based, the evaluative component may still have exerted an influence, potentially suppressing the effect on positive alcohol-related cognitions. Anxiety regarding performance, especially when elevated, may have drawn attention away from

potential rewarding aspects to the negative or inhibiting effects of drinking (see Nitka, 2011). Future work in this area should aim to refine mood manipulations such that they simulate socially-relevant anxiety that is sufficient to elicit an anxious response, but not so anxiety-provoking that it masks effects on cognitive processes. Second, although we examined cognitions in-the-moment over a drinking episode and the bar lab provides ecological validity, the environment may fail to adequately replicate the social context in which these students drink (e.g, with peers). Adapting these experiments to increase the fidelity to the context and examining cognitions as they unfold outside the lab using daily diary methods are important steps in advancing risk models (Engels, Wiers, Lemmers, & Overbeek, 2005; Krank, Wall, Stewart, Wiers, & Goldman, 2005; Terlecki, Ecker, & Buckner, 2014). A further consideration is that some associative processes of interest may only be detectable in more experienced drinkers who have strengthened positive associations with alcohol through experience. Extending this work to heavier drinkers or clinical populations may allow for easier detection of these associations (Stewart et al., 2002). Finally, although implicit cognitions were assessed prior to and following drinking initiation, explicit expectancies were only measured only at baseline, prior to both the mood manipulation and drinking initiation. Given recent work suggesting negative mood manipulations shift explicit expectancies, future research can aim to cautiously incorporate both implicit and explicit measurements in experimental designs.

Despite these limitations, results from the current experimental study provide additional clarity regarding the role of trait SA and urgency, mood and implicit alcohol-related cognitions. The findings highlight the roles of trait SA and urgency for drinking behaviour, suggesting that these trait-level constructs are central to cognitions related to drinking in-the-moment. Further, to our knowledge, our study is the first to examine implicit alcohol-related cognitions both prior to and following drinking initiation, pointing to the importance of minding cognitive processes throughout drinking episodes.

Table 1.

Descriptive Statistics and Bivariate Correlations (Study 1)

	1	2	3	4	5	6	7	8
1. Social Anxiety	1.00	.252**	-.144	-.062	-.098	.057	.125	.002
2. Urgency		1.00	-.065	.028	.016	.099	.175*	.014
3. T1 Tension Reduction SC-IAT D-scores			1.00	.186*	.134	.049	.209*	.124
4. T2 Tension Reduction SC-IAT D-scores				1.00	.250**	.050	.030	.124
5. T1 Social Facilitation SC-IAT D-scores					1.00	.122	.261**	.256**
6. T2 Social Facilitation SC-IAT D-scores						1.00	.018	.291**
7. T1 Enhancement SC-IAT D-scores							1.00	.112
8. T2 Enhancement SC-IAT D-scores								1.00
<i>M</i>	2.238	2.444	-0.043	-0.010	0.002	0.048	-0.030	0.022
<i>SD</i>	0.718	0.774	0.297	0.399	0.466	0.371	0.348	0.347
<i>Skew</i>	0.387	0.641	-0.057	-0.176	0.123	-0.117	-0.039	-0.552
<i>Kurtosis</i>	-0.507	-0.215	0.291	0.022	3.071	0.026	-0.038	1.113

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

Table 2.

Urgency and mood condition as moderators of the effect of SIAS on tension reduction SC-IAT D-scores

Predictors	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Pre-drink Tension Reduction SC-IAT D-scores				
SIAS	-0.048	0.066	-0.730	0.465
Urgency	-0.049	0.063	-0.780	0.439
Mood Condition (0=Anxious, 1=Neutral)	-0.070	0.073	-0.960	0.337
SIAS x Urgency	-0.124	0.077	-1.600	0.112
SIAS x Mood Condition	-0.003	0.111	-0.020	0.982
Urgency x Mood Condition	0.059	0.095	0.620	0.534
SIAS x Urgency x Mood Condition	0.163	0.133	1.220	0.224
Post-drink Tension Reduction SC-IAT D-scores				
Pre-drink tension reduction SC-IAT D-scores	0.178	0.087	2.040	0.044
SIAS	0.047	0.063	0.750	0.456
Urgency	-0.130	0.061	-2.120	0.036
Mood Condition (0=Anxious, 1=Neutral)	-0.041	0.070	-0.590	0.556
SIAS x Urgency	0.088	0.075	1.170	0.243
SIAS x Mood Condition	-0.165	0.107	-1.540	0.127
Urgency x Mood Condition	0.319	0.092	3.480	0.001
SIAS x Urgency x Mood Condition	0.029	0.129	0.230	0.822

Note. Tension reduction SC-IAT D-scores were regressed on the predictors.

^a95% confidence interval

Table 3.

Urgency and Mood Condition as Moderators of the Effect of SIAS on Social Facilitation SC-IAT D-scores

Predictors	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Pre-drink Social Facilitation SC-IAT D-scores				
SIAS	-0.054	0.080	-0.680	0.501
Urgency	0.009	0.077	0.120	0.906
Mood Condition (0=Anxious, 1=Neutral)	0.063	0.088	0.720	0.475
SIAS x Urgency	-0.113	0.094	-1.210	0.231
SIAS x Mood Condition	-0.073	0.135	-0.540	0.590
Urgency x Mood Condition	0.079	0.115	0.690	0.492
SIAS x Urgency x Mood Condition	-0.034	0.162	-0.210	0.833
Post-drink Social Facilitation SC-IATD- scores				
Pre-drink social facilitation SC-IAT D-scores	0.109	0.070	1.560	0.121
SIAS	0.030	0.061	0.480	0.630
Urgency	0.048	0.059	0.810	0.421
Mood Condition (0=Anxious, 1=Neutral)	-0.140	0.068	-2.070	0.041
SIAS x Urgency	-0.126	0.073	-1.730	0.087
SIAS x Mood Condition	0.141	0.104	1.350	0.179
Urgency x Mood Condition	-0.070	0.089	-0.790	0.431
SIAS x Urgency x Mood Condition	0.372	0.125	2.980	0.004

Note. Social facilitation SC-IAT D-scores were regressed on the predictors.

^a95% confidence interval

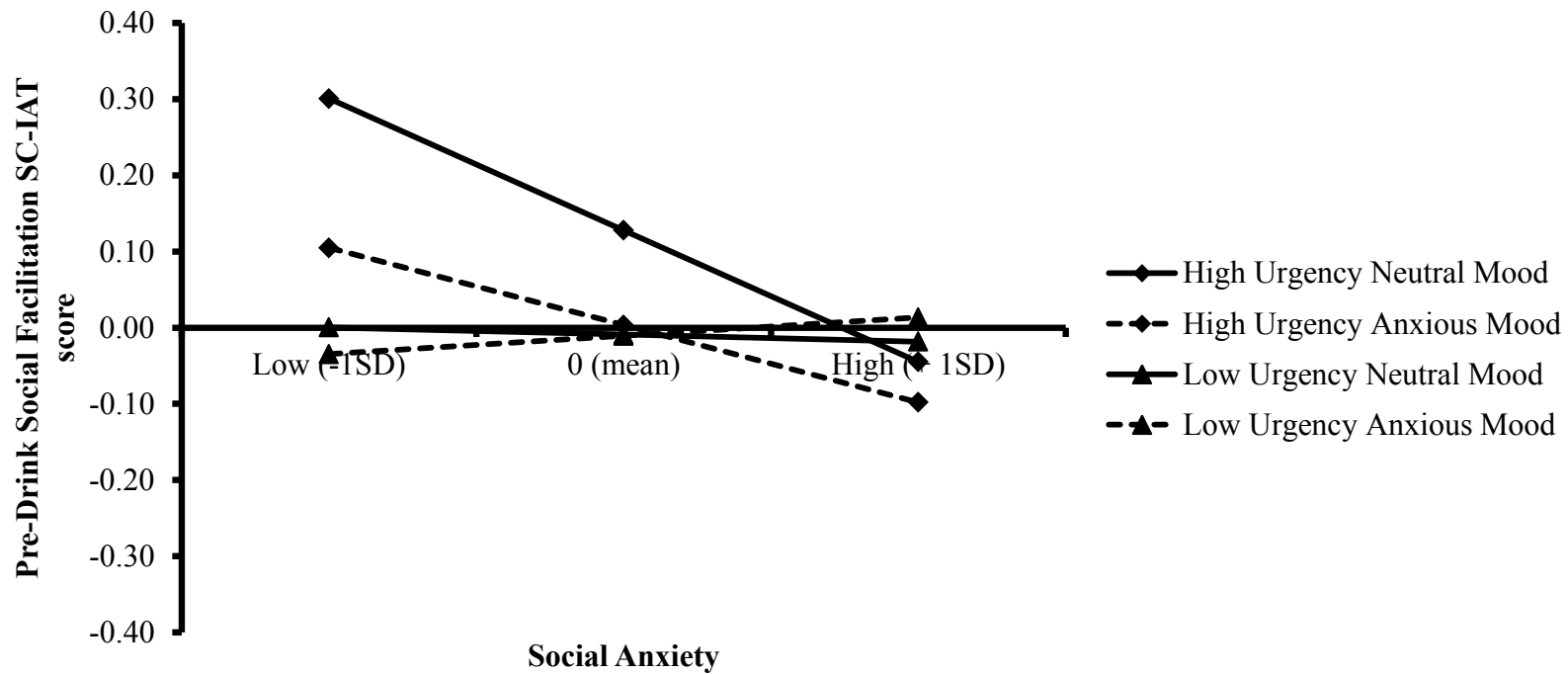


Figure 3. Simple slopes for SIAS scores predicting pre-drink social facilitation SC-IAT D-scores at high (+1SD) and low (-1SD) levels of urgency and in anxious and neutral mood conditions ($n=130$). SIAS = Social Interaction Anxiety Scale, SC-IAT = Single Category Implicit Associations Test

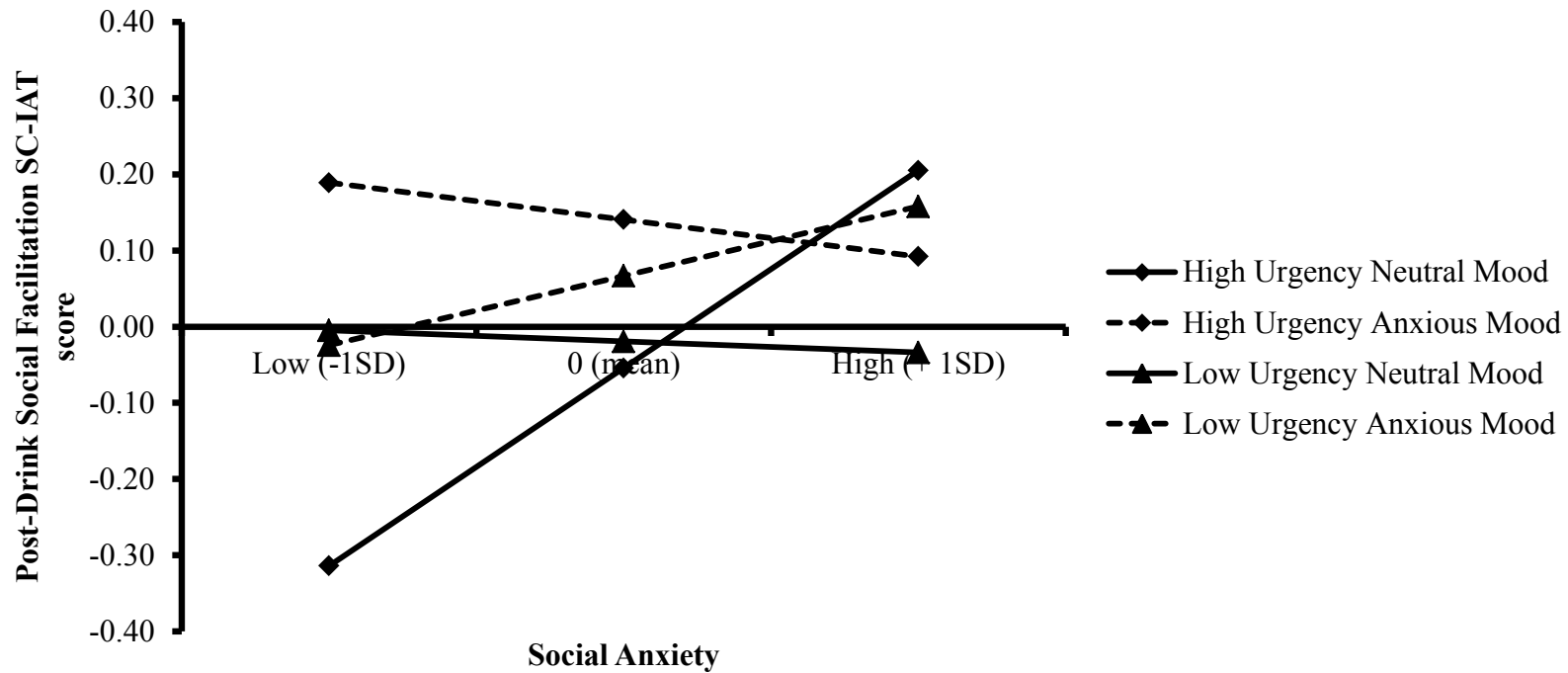


Figure 4. Simple slopes for SIAS predicting post-drink social facilitation SC-IAT D-scores at high (+1SD) and low (-1SD) levels of urgency and in anxious and neutral mood conditions ($n=130$). SIAS = Social Interaction Anxiety Scale, SC-IAT = Single Category Implicit Associations Test.

Note. Pre-drink Social Facilitation SC-IAT D-scores entered as a covariate.

Table 4.

Urgency and mood condition as moderators of the effect of SIAS on enhancement SC-IAT D-scores

Predictors	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Pre-drink Enhancement SC-IAT D-scores				
SIAS	0.011	0.058	0.190	0.853
Urgency	-0.002	0.056	-0.040	0.964
Mood Condition (0=Anxious, 1=Neutral)	-0.046	0.064	-0.730	0.470
SIAS x Urgency	-0.036	0.068	-0.520	0.602
SIAS x Mood Condition	0.069	0.098	0.700	0.485
Urgency x Mood Condition	0.144	0.084	1.720	0.088
SIAS x Urgency x Mood Condition	-0.020	0.118	-0.170	0.864
Post-drink Enhancement SC-IAT D-scores				
Pre-drink enhancement SC-IAT D-scores	0.109	0.091	1.190	0.236
SIAS	0.016	0.058	0.270	0.791
Urgency	-0.035	0.056	-0.620	0.536
Mood Condition (0=Anxious, 1=Neutral)	0.004	0.065	0.060	0.950
SIAS x Urgency	-0.091	0.069	-1.330	0.187
SIAS x Mood Condition	0.054	0.099	0.540	0.589
Urgency x Mood Condition	0.071	0.086	0.830	0.409
SIAS x Urgency x Mood Condition	0.287	0.119	2.420	0.017

Note. Enhancement SC-IAT D-scores were regressed on the predictors.

^a95% confidence interval

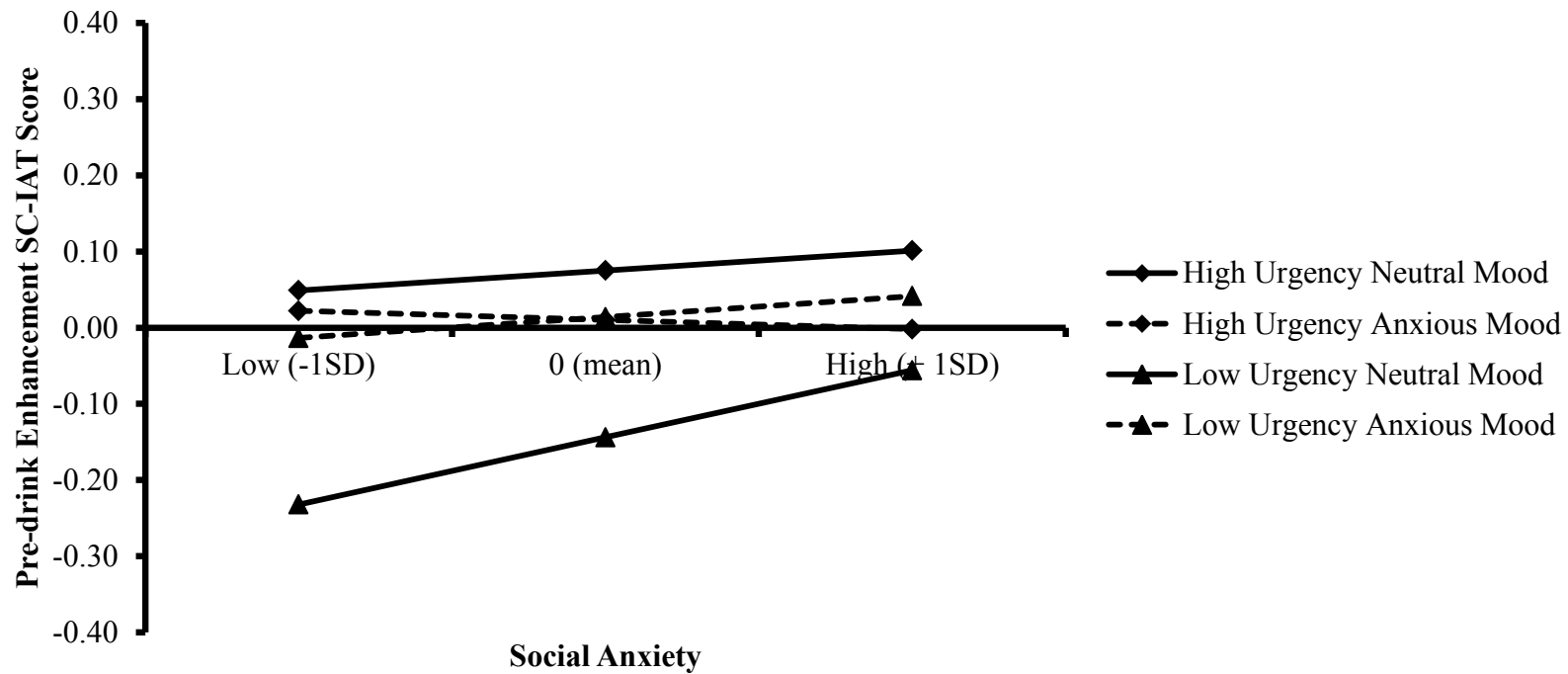


Figure 5. Simple slopes for SIAS predicting pre-drink enhancement SC-IAT D-scores at high (+1SD) and low (-1SD) levels of urgency and in anxious and neutral mood conditions ($n=130$). SIAS = Social Interaction Anxiety Scale, SC-IAT = Single Category Implicit Associations Test

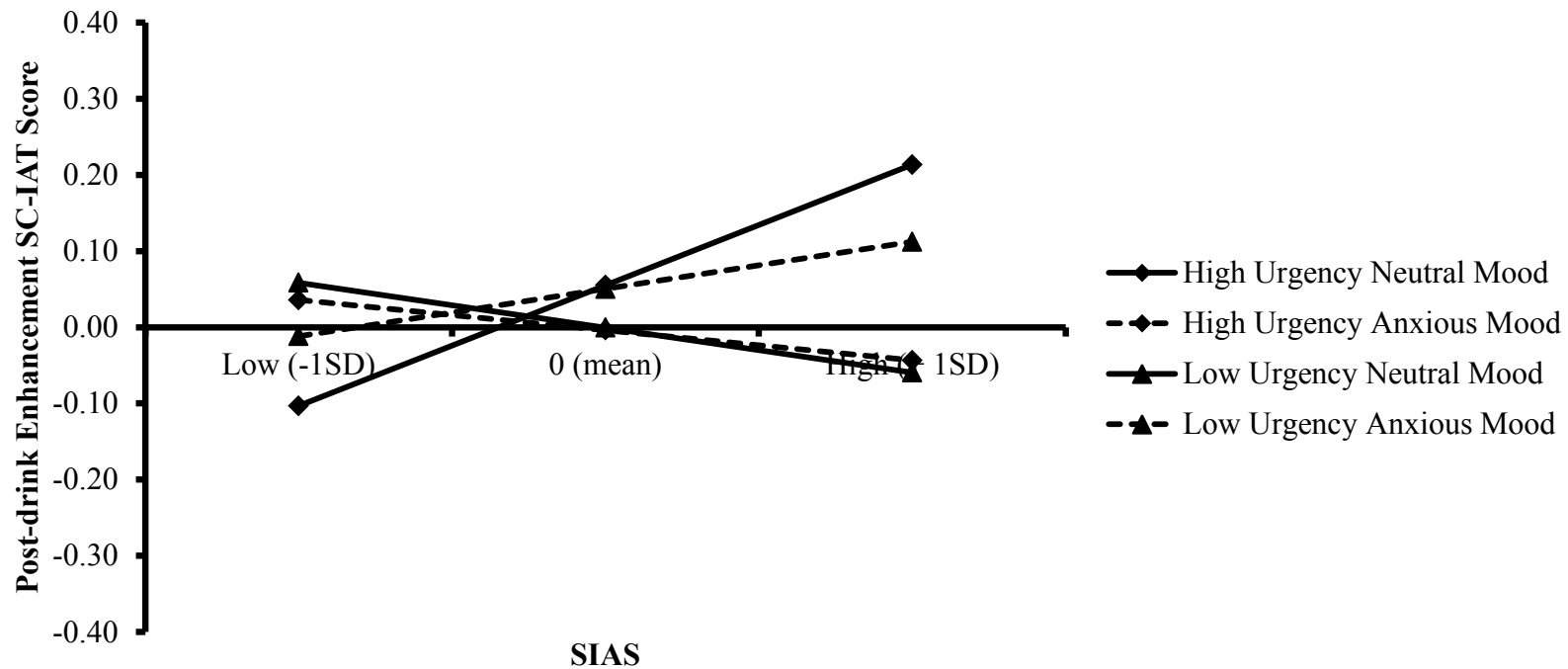


Figure 6. Simple slopes for SIAS predicting post-drink enhancement SC-IAT D-scores at high (+1SD) and low (-1SD) levels of urgency and in anxious and neutral mood conditions ($n=130$). SIAS = Social Interaction Anxiety Scale, SC-IAT = Single Category Implicit Associations Test. Pre-drink enhancement SC-IAT D-scores entered as a covariate.

CHAPTER 3: TRANSITION TO STUDY 2

The first study was an experimental investigation of SA risk for problematic drinking in undergraduates. SA, urgency, and mood were examined as trait individual difference and state variables influencing implicit positive alcohol-related cognitions that unfold in-the-moment over a drinking episode. It was expected that in anxious mood and after initiating drinking, those high on SA who are also high on urgency would activate implicit social facilitation and tension reduction (but not enhancement) cognitions. Results showed that while there were no observable effects prior to drinking initiation, following a priming dose of alcohol, high SA and impulsivity predicted social facilitation and *enhancement* (but *not* tension reduction) cognitions. Surprisingly, these effects were observed for those in the neutral rather than the anxious mood state condition. The data support SA and urgency as driving forces for the activation of positive implicit alcohol-related cognitions, detectable only after alcohol is initiated. This experimental investigation advances SA risk models for problematic drinking by tracing the interactive effects of personality-level traits on positive alcohol-related cognitions that unfold through a drinking episode.

Findings from the first study shed light on risk by modeling the trait and state-level influences on cognitive mechanisms *in-the moment*. This is a first step to elucidating SA-related risk for problematic drinking *outcomes*. Results help clarify who is at risk for activating in-the-moment cognitions, conceptualized as most proximal to SA-relevant problematic drinking outcomes. Next, a broader-lens examination of who on high SA is likely to continue experiencing these outcomes is warranted. Understanding risk for both proximal in-the-moment cognitive processes and broader problematic drinking outcomes is central to establishing a unifying model of SA risk in undergraduates.

In Canadian universities, drinking is pervasive, with 85% of students reporting using alcohol, and 32% drinking at risky levels (Adlaf et al., 2005). The mixed link between SA and drinking outcomes suggests the relationship is complex. Although

individuals high on SA should be particularly sensitive to NACs and therefore avoid drinking, they continue to drink and experience negative consequences (Morris, 2004; Schry & White, 2013). Traditionally, researchers have assumed that these consequences are undesirable and unpleasant and therefore, that undergraduates are typically motivated to avoid them. However, more recent evidence has emerged to suggest that NACs are not universally perceived to be negative. In fact many students view NACs as normative, benign, and even positive (Lee, Geisner, Patrick, & Neighbors, 2010a; Mallett, Bachrach, & Turrisi, 2008). Further, there is evidence to suggest students are willing to take the risk and perceive doing so to be socially beneficial (Mallett, Varvil-Weld, Turrisi, & Read, 2011; Park, 2004). Less negative and even positive perceptions of NACs, as well as a willingness to experience consequences have been consistently associated with problematic drinking (Lee et al., 2010b; Mallett et al., 2011). This consideration offers some direction for resolving inconsistencies in the literature, yet, until recently, it has been largely overlooked. Specifically, although recent work has drawn increased attention to subjective NAC evaluations, studies have been slow to incorporate these systematically or extend SA risk models to account for these valuations. In the context of SA risk for problematic drinking, these evaluations may be particularly relevant. Individuals high on SA are concerned with norms, fitting in and being accepted by their peers (Neighbors, Fossos, Woods, Fabiano, & Sledge, 2007). Accordingly, it may be those high on SA who perceive consequences as *not so bad* who may be at risk for problematic drinking. The main purpose of the second study was to test evaluations of NACs as moderating SA risk for problematic drinking.

CHAPTER 4:
STUDY 2

**Evaluations of Alcohol Consequences Moderate Social Anxiety Risk for Problematic
Drinking.**

Nitka, D., & O'Connor, R. M. (in press). *Addictive behaviors*, 65, 131-136.

Abstract

The link between social anxiety (SA) and problematic drinking is complex; this seems predominantly true among young adults. Individuals high on SA are thought to be particularly sensitive to the negative effects of alcohol, which should deter them from drinking. Yet, some evidence suggests that those high on SA continue to drink despite experiencing negative alcohol-related consequences (NACs) (Morris et al., 2005). Although traditionally, researchers assume NACs are perceived as aversive, emerging evidence suggests these are not categorically viewed as negative by undergraduates. The study goal was to test whether evaluations of NACs moderate the effect of SA on problematic drinking. It was hypothesized that high SA would predict elevated alcohol use and number of NACs experienced, but only for those who evaluate NACs as less negative. Undergraduate drinkers ($N=130$, 80 women) completed self-reports of social anxiety, NAC evaluations (ratings of how 'bad' experiencing each alcohol-related consequence would be), alcohol use, and NACs experienced. Regression analyses revealed that NAC evaluations moderated the effect of SA on number of NACs experienced but not the effect of SA on weekly alcohol use. Simple slopes analyses showed that high SA was associated with elevated NACs experienced for those with weak negative NAC evaluations, controlling for alcohol use. These findings help explain the mixed SA—problematic drinking literature by identifying perceptions of NACs as an important moderator of SA risk for experiencing NACs. Moreover, clinical interventions aimed at reducing SA risk for undergraduate problematic drinking may benefit from targeting NAC evaluations.

Introduction

Social anxiety (SA) is characterized by a fear of being judged by others (Montagne et al., 2006) and has been identified as a risk factor of problematic drinking (Burke & Stephens, 1999). Problematic drinking is defined here as a continuous construct that includes both heavy drinking (elevated levels of alcohol use) and experiencing negative alcohol-related consequences (NACs) (e.g., hangovers). In adult populations, the comorbidity between SA and alcohol use disorders is high (Crum & Pratt, 2001; Schneider et al., 2001). However, earlier in the risk trajectory, the link between SA and problematic drinking is less clear. Among undergraduates – >5% experience clinical SA (Wittchen, Stein, & Kessler, 1999), >13% experience SA symptoms (Purdon et al., 2001) – evidence supports a positive (Buckner, Eggleston, & Schmidt, 2006), negative (Ham & Hope, 2005) and null (Ham et al., 2007) SA-problematic drinking association. These findings suggest the SA risk pathway for problematic drinking is complex, particularly at the early stages.

According to tension reduction theory, those high on SA are sensitive to the positive, anxiety-reducing effects of alcohol, and drink to self-medicate when distressed (Conger, 1956). Students in university face novel, anxiety-provoking social situations unique to this context (Terlecki et al., 2014), situations that may be particularly distressing for those high on SA. Drinking is normative and present in many of these social settings (e.g., parties), and thus, may prove to be especially risky for those high on SA. Undergraduates high on SA indeed report drinking to reduce anxiety (Ham & Hope, 2005) and do so in distressing university contexts (Adlaf et al., 2005). However, cognitive theories (Clark & Wells, 1995) suggest high SA individuals should be sensitive to the negative effects of alcohol intoxication (e.g., embarrassing oneself, risk of unplanned sex), and be deterred from drinking. This theoretical complexity is reflected in the inconsistent empirical support of the SA-problematic drinking risk pathway.

In order for those high on SA to drink (heavily), it would seem that they must either temporarily disregard NACs or undervalue the negativity of these consequences, potentially perceiving these to be *not so bad*. The first possibility suggests that when

distressed, these individuals drink to alleviate their tension *despite* the prospect of experiencing NACs. Supporting this is evidence that those high on SA drink to cope with negative affect (Lewis et al., 2008) and that when distressed, attention is directed to immediate reward over long-term threat (Vassilopoulos, 2005). The delayed discounting literature also shows that those high on anxiety make hazardous or impulsive decisions for immediate reward, the cost of negative outcomes (Rounds et al., 2007). The second, less explored possibility is that these so called ‘negative outcomes’ of drinking may not be unanimously perceived as aversive. Undervaluing the ‘negativity’ of NACs, or perceiving these to be benign would mean these are not a deterrent. Without this deterrent, alcohol may be a particularly attractive coping strategy for those high on SA. The current study aims to investigate this possibility.

Although extant research and drinking interventions typically assume students perceive NACs as undesirable, emerging evidence highlights the variability of NAC evaluations among students. The university context presents a culture whereby drinking is not only normalized, but where light drinking or abstinence from alcohol can lead to social rejection and stigma (Peralta, 2007; Romo, 2012). Recent work reveals that students perceive NACs to be commonplace, and evaluate them as neutral and even positive (Mallett et al., 2008). Mallett et al. (2008) found that less than half of university students who experienced hangovers and unintentionally waking up in someone else’s bed evaluated these as negative. They also found that almost half of students who had blacked out or got into physical fights after drinking perceived these to be neutral or positive outcomes. There is evidence that evaluating NACs as less negative is associated with risky drinking (Mallett, Lee, Neighbors, Larimer, & Turrisi, 2006) and experiencing NACs (Gaher & Simons, 2007). Further, the norms literature suggests that undergraduates overestimate the frequency with which their peers experience NACs, and underestimate how negatively others view NACs (Lee et al., 2010a). High SA individuals are specifically attuned to their social surroundings and preoccupied with what others consider to be socially desirable, and thus may be particularly influenced by perceived norms. Given that drinking and experiencing NACs are perceived as a rite of passage by

undergraduates (Crawford & Novak, 2006; Schulenberg et al., 1996), high SA individuals may come to view NACs as a measure of ‘fitting in’ and adjust their perceptions to align with those believed to be held by their peers.

Variability in NAC evaluations is consistent with expectancy value theory (Wigfield & Eccles, 2000). Accordingly, individual differences and experiences shape evaluative interpretation of behavioural outcomes (Stevenson, 1986). In turn, evaluations influence subsequent behaviour (Maisto et al., 1999). Extending theory to alcohol use, depending on experience, some individuals high on SA may come to perceive NACs as extremely negative and be deterred from drinking, while others may come to evaluate these outcomes as benign and thus continue to use alcohol for its anxiolytic effects (Mallett et al., 2011).

In sum, theory and recent work on NAC evaluations suggest that SA may be linked to problematic drinking not because NACs are disregarded, but rather because they are not viewed as negative. The goal of the current study was to test NAC evaluations as moderating SA risk for problematic drinking. It is well established that those high on SA are at risk for experiencing NACs independent of alcohol quantity/frequency (Gilles, Turk, & Fresco, 2006; Morris et al., 2005). As such, amount of alcohol consumed and number of NACs experienced were considered as unique problematic drinking outcomes in the current study. We hypothesized that SA would be a positive predictor of alcohol use and NACs (independent of each other), and that this relation would be observed only for those who evaluate NACs as less negative.

Materials and Method

Participants and Procedure

Participants were undergraduates from mid-sized Canadian universities. Data for the current study was part of the baseline assessment for a larger lab-based alcohol administration study. Participants completed an online screening. Eligibility criteria included alcohol use in past month (non-alcohol abstainer), ≤ 35 drinks per week (no indication of alcohol abuse), no medical condition/medication contraindicated for alcohol use, English fluency, and 18-25 years old. Participants were sampled across levels of SA.

Sixty-three percent of students screened met eligibility criteria, of which 38% completed the study. The final sample included 130 undergraduates (62% women, $M_{age}=20.77$ yrs; $SD_{age}=1.73$) (see Table 5). T-tests confirmed that those eligible who did and did not take part in the study did not differ on critical study variables (i.e., SA, alcohol use). As expected, those who were ineligible reported heavier alcohol use (due to exclusion criteria) but not higher SA than those included in the study.

The testing session took place in a simulated bar lab. Written informed consent was obtained. Participants were compensated \$10/hour or course credit. The baseline questionnaires (relevant to current study) were completed within the first 90 minutes; the full study typically took 3.75 hours. The study was approved by the institutional ethics review board.

Questionnaire Measures

Social anxiety. The Social Interaction Anxiety Scale (SIAS; Mattick and Clarke (1998)), which is a 19-item questionnaire (e.g., I worry about expressing myself in case I appear awkward), was used to assess anxiety characterized by a fear of interacting with others. Participants indicated how representative each statement was of them using a 5-point scale (0=Not at all characteristic or true of me to 4=Extremely characteristic or true of me). A mean SA score was computed. This measure has been validated with undergraduate students (Habke, 1997) and has demonstrated very good internal consistency ($\alpha=.88$) and excellent retest reliability ($r=.92$) (Mattick & Clarke, 1998). In the current sample, internal consistency was excellent ($\alpha=.92$).

Alcohol use. Weekly alcohol use over the past month was derived using two measures. Participants were instructed to consider one drink of alcohol as 12 oz. of beer or wine cooler, 4 oz. of wine, or 1 oz. of hard liquor (straight or in a mixed drink). In the first measure, using a 1-week calendar, participants indicated the number of drinks they typically consumed on each day of the week during the previous month (adapted from Collins, Parks, and Marlatt (1985)). In the second measure, using 11-point scales, participants indicated their frequency (1=Did not drink in the past 30 days to 11=Six times a week) and quantity (1=Did not drink at all in the past 30 days to 11=Ten drinks

per occasion) of alcohol use in the past month. Frequency and quantity items were derived from each measure, adjusted to be on the same scale, and then averaged. The resulting frequency and quantity items were then multiplied to create a single composite score, reflecting participants' typical weekly alcohol use. Similar measures have shown good convergent validity (Collins et al., 1985). In the current study, responses on the calendar and frequency/quantity measures were highly correlated ($r=.68$, $p<.0001$), suggesting very good internal consistency.

NACs experienced. The Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong, and Colder (2006)), which is a 48-item questionnaire (e.g., When drinking, I have done impulsive things that I regretted later), was used to assess NACs experienced in the past year. Participants indicated whether they experienced each consequence with a dichotomous yes/no. 'Yes' responses were summed. The YAACQ has demonstrated excellent internal consistency ($\alpha=.92-.98$) (Read, Merrill, Kahler, & Strong, 2007), good retest reliability ($r=.86$) and concurrent and predictive validity (Read et al., 2007). The tetrachoric correlation, appropriate given the dichotomous response scale, supported excellent internal consistency of the YAACQ in the current study ($\alpha=.96$).

NAC evaluations. The Brief YAACQ (Kahler, Strong, & Read, 2005), which is a 24-item questionnaire, and corresponding evaluation items (Barnett, Goldstein, Murphy, Colby, & Monti, 2006; Longabaugh et al., 1995; Merrill et al., 2013a) were adapted to assess NAC evaluations. Participants evaluated each of the NAC experiences (e.g., becoming very rude, obnoxious, or insulting after drinking) on how bad (5 items) they perceived it to be (e.g., How bad do you think it would be if this experience were to happen to you?). Responses were made on a 7-point scale (1=not at all to 7=extremely). A mean evaluations score was computed; a high score reflected negative perceptions of NACs. Similar NAC evaluation items have shown good to excellent internal consistencies ($\alpha=.83-.91$) and predictive validity (Merrill et al., 2013a). In the current study, the internal consistency of the aggregate evaluation measure was excellent ($\alpha=.97$).

Results

Data Analytic Overview and Screening

Data were screened following the recommendations of Kline (2010). No variable had outliers ($SD > 3.29$) exceeding 2% of n (Tabachnick & Fidell, 2006) thus no imputations were made. All variable distributions were within acceptable skew and kurtosis range (± 3 and ± 10 , respectively; Kline (2010)) (see Table 5). The hypothesized moderation models were tested following the guidelines of Aiken and West (1991). The models tested the effect of SA on alcohol outcomes (alcohol use, NACs experienced) as moderated by NAC evaluations and controlling for the other alcohol outcome. For clarity of interpretation and to reduce multicollinearity, predictors were centered (Aiken & West, 1991).

In the first model, alcohol use was regressed on the first order effects of NACs experienced (covariate), SA (predictor) and NAC evaluations (moderator), and the SA by NAC evaluations interaction term. In the second model, NACs experienced was regressed on the first order effects of alcohol use (covariate), SA (predictor) and NAC evaluations (moderator), and the SA by NAC evaluations interaction term. Statistically supported ($p < .05$) moderation effects were followed up with tests of simple slopes, with the simple slope of SA predicting the outcome conditioned on *high* (+1 SD above mean) and *low* (-1 SD below mean) levels of NAC evaluations. The effect sizes of the simple slopes were examined, where small, medium and large effects respectively were $f^2 = .02$, $f^2 = .15$ and $f^2 = .35$ (Cohen, 1988).

Descriptive Statistics and Bivariate Correlations

See Table 5. The current sample mean for SA is similar to that reported in other undergraduate studies (Whiting et al., 2014). Alcohol use and related problems reported by the study sample are also comparable to other North American undergraduate studies ($M = 6.4$ drinks; Adlaf et al. (2005); $M = 14.7$ problems; Read, Beattie, Chamberlain, and Merrill (2008)). SA and alcohol use were marginally correlated ($p = .06$), while SA and NACs experienced were not correlated ($p = .81$).

Hypothesis Testing

Alcohol Use. Contrary to hypothesis, NAC evaluations were not supported as a statistically significant moderator of the effect of SA on alcohol use (controlling for NACs experienced) (see Table 6). However, at the first order, SA was a statistically significant predictor, such that elevated SA led to reduced alcohol use.

NACs experienced. Consistent with hypotheses, NAC evaluations were supported as a statistically significant moderator of the effect of SA on NACs experienced (see Table 6), and this effect occurred above and beyond the effect of alcohol use. Simple slopes analyses (see Figure 7) revealed that high SA was associated with increased number of NACs experienced, but only at a low level of NAC evaluations ($B [SE]=2.87 [1.19]$; $t(129)=2.42, p=.02, f^2=.05$). Thus, when NACs were perceived as less negative (i.e., not so bad), SA was linked with risk for experiencing NACs. In contrast, SA was not associated with number of NACs experienced at a high level of NAC evaluations ($B [SE]=-0.81 [1.07]$; $t(129)=-0.75, p=.45, f^2=.00$). Therefore, when NACs were perceived as negative, SA was not a risk factor for experiencing NACs.

Discussion

The link between high SA and problematic drinking among young adults has received mixed support. We proposed that subjective outcome evaluations (i.e., NAC evaluations) would moderate, and thus help to resolve this potential risk pathway. Our results suggest that high SA may be predictive of alcohol-related problems, but only for those who perceive these problems as *not so bad*.

We found that NAC evaluations moderated the effect of SA on alcohol-related problems (i.e., experienced NACs) but not amount consumed. Moreover, we found that SA risk for NACs was present above and beyond the effects of amount consumed. This is in line with previous work which widely finds those high on SA are at risk for experiencing NACs independent of alcohol quantity/frequency (Ham & Hope, 2005; Morris et al., 2005). Our findings suggest that those high on SA, who evaluate NACs to be less negative, may be at risk for experiencing NACs notwithstanding how much they

drink. While this may seem counterintuitive, it may reflect that those high on SA do not stand apart from their heavy drinking, less socially anxious, peers. Or, as found in the current study, drink less overall than their peers. The pathology of SA may only become evident when alcohol-related problems are examined. According to skills deficit models (Schlenker & Leary, 1982), those high on SA struggle with social discourse (Bellack & Hersen, 1979). Consuming alcohol in social situations that they feel ill-equipped to deal with may amplify risk for experiencing NACs. Moreover, given that SA risk for experiencing NACs is specific to when these outcomes are viewed as *not so bad*, it may be that downplaying potential negative consequences results in a less cautious approach to alcohol use in these situations. The simulated bar environment may have been instrumental in detecting context-relevant effects of NAC evaluations in the SA-problematic drinking risk pathway.

An alternative explanation to account for the unique effects of SA on alcohol-related problems, despite use, stems from biologically-based supersensitivity and vulnerability models (Mueser, Drake, & Wallach, 1998; Zubin & Spring, 1977). Accordingly, those high on SA may have better recall of, or possibly over-report NACs (vs. low SA peers). The current study suggests this theory is more nuanced, as why would those who perceive NACs as less negative over-attend to them? This may be an issue of cognitive dissonance, such that those who experience many NACs rationalize this by reporting the effects as *not so bad*. Prospective studies are needed to clarify these effects.

At the zero-order, SA was not associated with number of NACs experienced in our study, thus pointing to the pivotal role of NAC evaluations in explaining the SA-NACs risk pathway. These results are in line with expectancy value (Wigfield & Eccles, 2000) and social learning (Bandura, 1986) theories, which posit that it is not the experience of consequences in itself that affects subsequent behaviour, but the cognitive appraisal, or here, the subjective evaluation of NACs (Sobell, Sobell, Toneatto, & Leo, 1993). These theories – and our empirical findings – highlight the role of attitudes, beliefs, and values related to the costs and benefits of using alcohol in relation to the behaviour itself. In this cultural context, where drinking is promoted and NACs

downplayed, those high on SA may come to evaluate these experiences as benign or central to ‘fitting in’. Specifically, with positive feedback from peers after experiencing NACs, those high on SA may solidify less negative/more positive evaluations of NACs. This reciprocity between experience and evaluations, while not assessed in this study, likely promotes and maintains less negative perceptions of NACs (Neighbors, Dillard, Lewis, Bergstrom, & Neil, 2006). Again, to unravel developmental risk, and establish temporal precedence, future research would benefit from prospective designs. Another question that remains unanswered is why only *some* individuals high on SA view NACs as *not so bad*. Examinations early on in the risk trajectory may clarify whether some high SA individuals avoid alcohol use altogether, or whether early experiences of NACs were not reinforced by peers. Personality models characterized by individual differences in impulsivity (Stautz & Cooper, 2013) and reinforcement sensitivity (Nicholls et al., 2014) may offer some clarity when considering early stages of risk.

Distinguishing NAC evaluations from experiences, as done here, and consistent with work by Merrill and colleagues (2013), builds upon the alcohol expectancies literature. Decades ago, the difference between valenced (good-to-bad) and probability ratings of alcohol expectancies was recognized (Brown et al., 1980; Connors, O’Farrell, Cutter, & Thompson, 1986). Measurement tools were adapted accordingly (Fromme et al., 1993), and evidence supported the unique role of evaluations in predicting young adult drinking (Patrick, Wray-Lake, Finlay, & Maggs, 2010). Given our findings and prior evidence that NAC evaluations predict binge drinking and negative consequences (Merrill et al., 2013a), like the expectancies literature, models of risk for experiencing NACs need to consider a similar cognitive complexity. Evidence that NACs as severe as blacking out are evaluated as neutral or positive (Mallett et al., 2008) amplifies potential contextual and developmental nuances of risk, which we can tap by assessing subjective evaluations in addition to experiences.

The current study findings suggest that clinical interventions may benefit from targeting NAC evaluations; increasing the salience of the negativity of these outcomes may mitigate high SA risk for alcohol-related problems. Furthermore, if future research

corroborates our speculation that those high on SA are particularly responsive to the normalization of NACs, then interventions should target perceived prevalence and peer approval of NACs. Surprisingly, despite extensive research on the college cultural context, interventions aimed at creating a shift in this context are sparse. There is some recent evidence that norms-based interventions targeting NACs leads to reduced number of alcohol-related problems (Miller et al., 2013). This is promising, and may inform extensions to clinical interventions specific to undergraduates high on SA. Other work has shown that promoting protective behaviours (e.g., alternating between alcoholic and non-alcoholic beverages) can reduce risk for NACs even when controlling for drinking levels (Ray, Turrisi, Abar, & Peters, 2009). These strategies may prove particularly useful for high SA individuals, given their unique risk for NACs (vs. heavy drinking).

The current study has limitations. The findings may not generalize beyond undergraduates. However, the university years are a pivotal period, when lifelong patterns of alcohol (mis)use are formed. Studying undergraduate drinking may be germane to understanding development of alcohol use disorders. We used retrospective self-reports of alcohol use and NACs. While the validity of self-reports of drinking has been established (Laforge, Borsari, & Baer, 2005), it is possible that there is added difficulty in disaggregating NAC evaluations and experiences when asked about these constructs simultaneously and after-the-fact. The cross-sectional nature of the study is another limitation. Related to the previous point, we are unable to determine temporal precedence of the evaluations. It is possible that we tapped post-hoc evaluations of NACs, which were influenced by NACs experienced. Daily diary methods may be suited to addressing these limitations.

In sum, the present study extends SA risk models of undergraduate problematic drinking. Results speak to the central role of NAC evaluations. In part, these findings address the theoretical question of whether high SA individuals who engage in problematic drinking ostensibly underappreciate the negativity of NACs. Though often overlooked in the literature, NAC evaluations may be central to clarifying the mixed SA

and drinking research, and ought to be considered in research investigating negative alcohol-related outcomes.

Table 5.

Descriptive Statistics and Bivariate Correlations (Study 2)

	1	2	3	4
1. Social anxiety	1.00	-.17	-.02	.04
2. Alcohol use		1.00	.57**	-.27*
3. NACs experienced			1.00	-.27*
4. NAC evaluations				1.00
<i>M</i>	2.24	7.68	12.30	4.64
<i>SD</i>	0.72	5.59	7.99	0.74
<i>Skew</i>	0.39	1.48	0.76	-0.28
<i>Kurtosis</i>	-0.51	3.17	0.31	0.58

²Note. $N = 130$; * $p < .01$, ** $p < .001$

² The majority of participants identified as White (68%). Other ethnic groups included Asian (12%), Middle Eastern (5%), South Asian (3%), Indigenous Canadian (3%), Hispanic/Latino (3%) [5% indicated 'other']. Participants primarily lived on their own off-campus (65%), with a smaller number living at home with family (23%), and on campus (12%). There was a relatively even distribution across year of undergraduates study (27% first, 29% second, 29% third, 13% fourth year).

Table 6.

NAC Evaluations as Moderating the Effect of SA on Drinking Outcomes

Predictors	<i>B</i>	β	<i>SE</i>	<i>R</i> ²	<i>t</i>	<i>p</i>
Alcohol Use						
NACs experienced	0.38	0.54	0.53		7.19	<.00
Social anxiety	-1.22	-0.16	0.56		-2.19	.03
NAC evaluations	-0.87	-0.12	0.56		-1.55	.12
Social anxiety x NAC evaluations	0.51	0.05	0.77		0.67	.51
				.36 [.24 - .49] ^a		
NACs Experienced						
Alcohol use	0.77	0.54	0.11		7.19	<.00
Social anxiety	1.03	0.09	0.81		1.28	.20
NAC evaluations	-1.45	-0.13	0.80		-1.82	.07
Social anxiety x NAC evaluations	-2.48	-0.17	1.07		-2.32	.02
				.37 [.24 - .50] ^a		

Note. *N*=130; ^a95% confidence interval

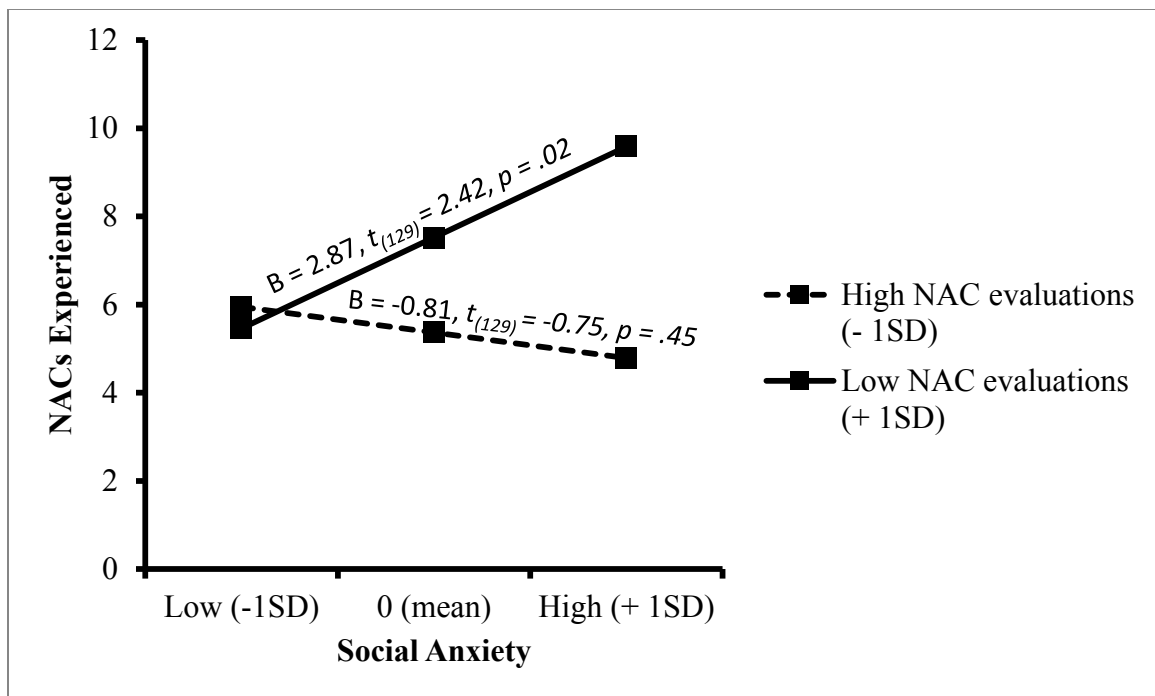


Figure 7. Simple slopes of social anxiety predicting number of NACs experienced at high (i.e., more negative evaluations) and low (i.e., less negative evaluations) levels of NAC evaluations. Means plotted are adjusted for the covariate (alcohol use). $N = 130$.

CHAPTER 5: GENERAL DISCUSSION

Summary of Findings

SA and problematic drinking are consistently linked in adulthood. The primary aim of this dissertation was to advance aetiological models of SA risk for problematic drinking by investigating this link in the earlier stages of risk. The university period is a time when drinking levels peak. Despite research efforts to both disaggregate and pull together variables thought to be germane to this risk pathway (Morris et al., 2005; Schry & White, 2013), the link between SA and undergraduate problematic drinking remains poorly understood. The goal of this dissertation was to help clarify the empirical picture by examining *how* and for *whom* SA risk for problematic drinking unfolds. To this end, key variables were integrated into theoretically and empirically-rooted risk models.

A cognitive model provided a theoretical framework for both studies. The first study sought to assess the role of dispositional and state variables as they influence alcohol-related cognitive processes unfolding in-the-moment over a drinking episode. Findings suggest that for those high on SA, individual difference variables (i.e., impulsivity), but not mood, are critical to activation of unfolding implicit cognitions. Moreover, risk seems to escalate only once alcohol has been initiated. The second study modeled risk at a broader level, incorporating cognitive NAC evaluations as moderating the link between SA and problem drinking in an undergraduate population. Results indicated that those high on SA who evaluated NACs as less negative were at risk for experiencing NACs but not for drinking heavily. Taken together, results highlight the role of cognitions in advancing aetiological risk models of SA-related problematic drinking and hold implications for clinical interventions.

Study 1. The main objective of this study was to examine impulsivity and mood state as moderating the effect of SA on implicit alcohol-related cognitions. An experimental study was used to assess these cognitions as they unfold in-the-moment over a drinking episode. Results suggest that prior to alcohol initiation the interplay of trait and state variables does not account for drinking risk. Specifically, prior to the

alcohol priming dose, those high on SA and impulsivity did not show increased activation of social facilitation, tension reduction, or even enhancement implicit cognitions. This null effect was observed despite mood condition. However, once alcohol was consumed, even at a light level, the risky effects of this combination of factors become evident. That is, those high on SA and impulsivity showed increased activation of social facilitation and enhancement alcohol associations. Surprisingly, these effects were observed only in the neutral (*not* the anxious) mood condition, and the interplay of SA and impulsivity has no effect on implicit tension-reduction alcohol cognitions.

Taken together, the results of Study 1 point to impulsivity as a trait-level difference that is critical to continued drinking for those high in SA. The finding that implicit cognitions are activated in individuals high on SA who are also impulsive aligns with theory given that self-control is thought to regulate these implicit processes (Wiers & Stacy, 2006). However, observation of these effects in the neutral rather than anxious mood condition runs somewhat contrary to theory and some extant research. It is thought that due to constraints related to cognitive load (Kron et al., 2010; Meier et al., 2007) when in an anxious mood those high on impulsivity would attend to immediate rewarding effects of alcohol and disregard potential consequences. Nonetheless, for those already high on SA, the combined effects of participating in a laboratory study and the potentially overwhelming anxiety resulting from the mood manipulation may have led to opposite effects—such that positive implicit alcohol cognitions were dampened. Overall, the findings are consistent with theory and evidence suggesting appetitive, alcohol-related implicit processes are sensitive to environmental cues (Köpetz et al., 2013), and activate upon drinking initiation (Moss & Albery, 2009; Wiers et al., 2007). In other words, drinking initiation activates implicit memory associations in a conditioned response to what has previously been rewarding (Köpetz et al., 2013). This study contributes to advancing theoretical models by tracing these cognitive processes in-the-moment over a drinking episode.

Study 2. The goal of the second study was to test whether those high on SA who devalue NACs are at risk for problematic drinking. The moderating effect of NAC

evaluations in SA risk for drinking heavily and experiencing NACs was tested. Interestingly, the data suggest those high on SA who perceive NACs as *not so bad* are at risk for experiencing these consequences, but not for consuming alcohol at higher levels. Results corroborate existing evidence suggesting risk pathways from SA to alcohol use and to experiencing NACs are distinct (Ham & Hope, 2005; Morris et al., 2005; Schry & White, 2013) and that NAC evaluations do not necessarily play a role in predicting alcohol use levels (Park, 2004). Empirically, these individuals have not consistently stood out among their peers with regard to drinking levels (e.g., Eggleston et al., 2004; Ham & Hope, 2005). Individuals high on SA may feel ill-equipped to navigate anxiety-provoking social situations in the university context. Those high on SA who downplay potential NACs may behave more recklessly in these high-risk situations, putting themselves at risk for experiencing NACs. Overall, the findings point to the value of incorporating subjective evaluations in studying risk, with implications for furthering aetiological models and clinical interventions.

Theoretical Implications and Future Directions

The first study demonstrated that after (but not *before*) initiating alcohol on a drinking occasion, individuals high on SA and impulsivity activated positive implicit alcohol-related cognitions. This study addresses a gap in the literature, as previous work in this area was limited to assessing alcohol-related cognitions either prior to (e.g., Wardell et al., 2012) or following (e.g., Himle et al., 1999) alcohol consumption. Evidence of the effect at a light level of intoxication is consistent with dual process and delay discounting models. Together, these suggest that with alcohol consumption, the implicit process and activation of immediate reward cues are at the forefront, whereas distal potential NACs may be less accessible. Given that cognitive processes are dynamic and shift in response to alcohol consumption, examining these cognitions in-the-moment and incorporating relevant dispositional variables are beneficial to developing more nuanced and accurate models of risk.

One surprising finding was the lack of evidence for the activation of implicit alcohol-related cognitions in anxious mood. The mood manipulation was designed to

address the shortcomings of extant mood inductions, which have typically induced performance-related anxiety using speech or other performance-based tasks (Ham et al., 2011; Himle et al., 1999). Findings from this literature suggest participants fear impairing their performance and as a result, avoid drinking prior to these tasks. The manipulation developed for the present study emphasized performance in the context of a *social interaction* specifically, with the intention to capture anxiety elicited in social university contexts involving drinking. To ensure sufficient anxiety was elicited, participants were also told their interaction would be evaluated by the research team. In hindsight, the level of anxiety elicited by this additional evaluative component may have been too high, directing attention away from positive alcohol-related cognitions and masking expected effects. At a high level of intensity, anxiety has been shown to direct attention to potential danger (Beck, Emery, & Greenberg, 1985; Mogg et al., 2000), and shift risk preferences to aversion (Lerner & Keltner, 2001; Raghunathan & Pham, 1999). Thus, it is possible that while the nature of the mood manipulation task targeted anxiety related to social interaction specifically, the additional evaluative component amplified anxiety to an excessive degree. Future work can aim to fine tune mood manipulations by inducing anxiety incrementally to determine levels of sufficient but not excessive intensity effecting drinking cognitions and behaviour.

While the null results in the anxious mood may have been a function of the experimental manipulation, it is also possible that rather than mood state, it is the trait-level influences (i.e., SA and impulsivity) that are most central to driving the activation implicit alcohol-related cognitions in-the-moment. Research investigating mood manipulation effects on cognitions suggests that these effects vary based on trait-level dispositional differences (e.g., Birch et al., 2004), with some evidence that alcohol-related cognitions are most likely accessed in a neutral mood (Goldstein et al., 2004). Alternatively, positive-alcohol-related cognitions may only be activated in anxious mood for drinkers who consume alcohol more heavily. This is consistent with evidence that heavy drinkers activate these cognitions more readily (Dunn & Goldman, 2000). The present study sample excluded very heavy drinkers (for ethical reasons, due to alcohol

administration component), and thus those included may not represent the processes of their heavy drinking counterparts. Additional research is needed to assess the effect of mood on these unfolding cognitions in other populations, possibly with more experienced or heavier drinkers.

SA and impulsivity predicted the activation of social facilitation alcohol-related cognitions following alcohol initiation. The finding that social facilitation cognitions are activated in social contexts aligns with a sizeable literature demonstrating implicit alcohol-related processes are dynamic and become activated in situations or contexts relevant to previous experiences (Krank & Wall, 2006; Stacy & Wiers, 2010), in this case, a drinking experience and a social interaction. Further, the activation of social facilitation cognitions specifically in a drinking context fits within broader theoretical models of SA risk. Previous work supports an association between SA and self-reported social facilitation cognitions, which in turn predict risky drinking practices (Ham, 2009). More recent work supports social facilitation expectancies as mediating SA risk for both heavy drinking and alcohol-related problems (Ham et al., 2015). The present research extends findings related to SA and social facilitation cognitions to implicit levels of processing, demonstrating that in social drinking situations, SA and impulsivity jointly predict the activation of social facilitation cognitions.

No evidence was found for the effect of SA and impulsivity on activation of tension reduction cognitions in either mood condition at pre- or post-alcohol initiation. Nonetheless, following drinking initiation, individuals high on SA and impulsivity showed activation in *enhancement* cognitions, which were included for discriminant validity. The lack of support for the activation of tension reduction cognitions runs somewhat contrary to theory and a sizeable body of research specifically implicating these in anxiety-relevant risk pathways to drinking. In fact, there is evidence that undergraduates in a neutral mood condition are more likely to access explicit self-reported tension reduction cognitions (Goldstein et al., 2004; Noll, Steinberg, Del Boca, Darkes, & Goldman, 1999). Level of assessment (i.e., *explicit* vs. *implicit*) in examining tension reduction cognitions may be critical here; the distinction between enhancement

and tension reduction may be too sophisticated to detect at the implicit level. In other words, although the difference between drinking to *feel less bad* and drinking to *feel good* may be evident on an explicit level, it may be too nuanced and therefore difficult to capture on an implicit measurement level. This higher level conceptualization may be a propositional one that may not operate or be detectable at the implicit level, and therefore, is best studied with explicit self-report. In the explicit cognitive literature, the role of tension reduction cognitions has indeed been well-established (Booth & Hasking, 2009; Brown et al., 1985; Tran et al., 1997). This finding contributes to extant knowledge of cognitive processes by pointing to differential characteristics of implicit versus explicit cognitions. Future work can aim to investigate these differences further with comparative tests of implicit and explicit tension reduction implicit alcohol-related cognitions.

An additional measurement consideration in interpreting Study 1 findings is that implicit alcohol-related cognitions were assessed with D-scores. While D-scores are traditionally used to measure cognitions at the implicit level, it is also thought that these scores capture a broader array of cognitive processes, including some deliberative processing (O'Connor et al., 2012). Therefore, it is possible that implicit cognitions assessed in the present study include some processes that extend beyond the fully automatic. Further disaggregating these levels of processing in future research using frameworks such as the Quad model (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005) can hold promise for extending work on these cognitive risk pathways. Moreover, in the past decade, studies from an emerging literature point to an interaction between explicit and implicit processes (Wiers & Stacy, 2010). These systems are believed to jointly and interactively affect decision-making in the moment. It is posited that environmental stimuli inputs activate potentially relevant pre-existing associated structures, whereas explicit systems assess the validity of such propositions (Gawronski & Bodenhausen, 2006). Accordingly, future research applications may assess explicit alcohol-related cognitions alongside the implicit and develop theoretical models of these interactions as they unfold.

The second study of this dissertation aimed to bring broader scope resolution to the undergraduate SA-problematic drinking literature, one that has been mixed for decades. Personality-level individual differences and other moderators have been proposed and tested in attempts to clarify SA risk for problematic drinking in young adults. Meanwhile, a separate but related body of literature has built on cognitive valuation theories and incorporates subjective evaluations of drinking variables in examinations of problematic drinking in university more broadly (Mallett et al., 2008; Merrill, Read, & Colder, 2013b; Park, 2004). The present work bridges these growing literatures, extending SA risk models to include subjective evaluations. The findings support incorporating NAC evaluations into SA models of problematic drinking risk.

Study 2 findings suggest that those high on SA who perceive NACs to be less negative are at risk for experiencing these (negative) consequences but not for drinking heavily. These results align with evidence that SA is a risk factor for NACs, irrespective of drinking levels. University-related social discourse is challenging for undergraduates high on SA (Bellack & Hersen, 1979). Immersed in the novel social environments, these individuals may not feel equipped to succeed in these social situations, amplifying risk for consequences. During these anxiety-provoking situations, drinking even at low levels may be sufficient for impairing the ability to navigate these social contexts. Skills deficit models posit that anxiety experienced in social situations results from a limited repertoire of social skills (Bellack & Hersen, 1979). This distress in turn leads to mismanagement of social interactions, reinforcing the initial anxiety.

Individuals high on SA who perceive NACs less negatively may exercise less caution in social drinking situations, in turn leading to risk for experiencing NACs. One future research direction would be to elucidate the role of social skills in predicting NACs and their evaluations. Further, given that not all undergraduates high on SA perceive NACs to be *not so bad*, an additional step would be to determine who high on SA comes to perceive these less negatively. These questions call for research modeling underlying learning processes and unpacking risk for evaluating NACs as benign. Investigations identifying SA subtypes differentiate the disinhibited, impulsive from the inhibited,

avoidant subtype (Kashdan & Hofmann, 2008; Nicholls et al., 2014), and provide direction for these examinations.

An alternative explanation for the finding that those high on SA are at risk for experiencing more NACs if they perceive these less negatively pertains to a potential bias in reporting. Cognitive and hypervigilance theories (Beck & Clark, 1997; Beck & Haigh, 2014; Eysenck, Derakshan, Santos, & Calvo, 2007) suggest that high SA individuals are more likely to over-attend to NACs, or recall these more easily in self-reports due to a negative bias. However it is also possible that individuals high on SA experience more NACs, but downplay their severity. This latter conceptualization aligns with theories of positive memory bias, which posit that events tend to be recalled in a more positive light than they were experienced (Walker, Skowronski, & Thompson, 2003). There is also evidence to suggest that frequent or recent NACs reported are associated with more positive or less negative evaluations by students (Gaher & Simons, 2007; Lee et al., 2010b; Logan, Henry, Vaughn, Luk, & King, 2012). Cognitive dissonance (Festinger, 1957) may help explain this. These individuals may re-assess NACs as less negative in an attempt to resolve the conflict arising as they experience NACs yet continue to drink. Future work aiming to clarify these underlying cognitive processes is warranted. Specifically, this research area may benefit from incorporating daily diary or observational studies to help determine whether NACs are over-attended to or over-recalled, and whether NAC evaluations are adjusted after the fact due to cognitive dissonance.

Results from the second study extend cognitive valuation models (Wigfield & Eccles, 2000) and contribute to a growing literature by highlighting the role of individual appraisal and subjective evaluation of NACs (Mallett et al., 2013; Sobell et al., 1993). Although some efforts to incorporate subjective evaluations in measurement tools have been made over the past decades (e.g., Fromme et al., 1993), studies integrating these valuations in empirical tests of risk models for problematic drinking have been sparse. There is a need to adapt current questionnaires, or develop new ones that incorporate these subjective evaluations. Combined with recent work on subjective NAC evaluations,

Study 2 results may be critical to unpacking prospective SA risk for problematic drinking (Merrill et al., 2013b). The present work contributes to growing evidence suggesting these evaluations can no longer be ignored in examinations of undergraduate risk for problematic drinking.

Taken together, findings from the two studies advance conceptual models and provide future direction for studying SA risk for problematic drinking. Results provide insight regarding SA-relevant risk factors for activating implicit cognitions in the moment, and for experiencing NACs more broadly. The first study highlights the role of alcohol consumption in activating implicit social facilitation and enhancement cognitions in individuals high on SA and impulsivity. In the broader drinking literature, alcohol-related cognitions have been theoretically and empirically supported as central to predicting drinking behaviours. The second study underscores the importance of valuations in drinking practices and experiencing NACs. One important next step would be to bridge these findings, by integrating and mapping these relations in a comprehensive and unifying model (See Figure 8). In other words, an important future direction is to build on these models by examining activation of implicit cognitions as mediating SA risk for alcohol use and NACs. Experimental, prospective, and daily diary studies designed to assess the influence of these cognitions on subsequent behaviour are needed. An overarching hypothesis is that individuals high on SA and specific personality-level traits such as impulsivity activate positive alcohol-related implicit cognitions when primed with alcohol. In turn, these individuals would engage in risky behaviour and experience NACs if they perceive these less negatively.

Clinical Implications

In addition to theoretical implications, the current research program points to clinical applications for evidence-based interventions aimed at reducing SA-related drinking risk in undergraduates. A more nuanced understanding of dispositional and cognitive factors contributing to problematic drinking risk can inform psychoeducational, cognitive, and skills-based interventions. Findings from this dissertation can help

improve upon existing efforts as well as direct new interventions by pointing to the utility in adapting treatments to target specific personality and cognitive risk profiles.

This dissertation may contribute to existing evidence-based psychoeducational interventions for undergraduate students. Personalized feedback interventions typically involve providing undergraduates with tailored information regarding their drinking practices in comparison to peer norms. These intervention efforts have been supported time and again as effective in diminishing risk for problematic drinking (Cronce & Larimer, 2011), and are among the gold standards for clinical interventions with undergraduates (Merrill et al., 2013a). Incorporating data pertaining to dispositional and cognitive risk factors may be central to refining these preventative interventions. Broadly, studies demonstrate that clinical interventions that integrate motivational, psychoeducational, and cognitive-behavioural strategies, and target specific personality characteristics (e.g., impulsivity) decrease problematic drinking in high school students (Conrod, Stewart, Comeau, & Maclean, 2006). Thus, one potential application may be to identify personality-based risk profiles and adapt these interventions accordingly for undergraduates. Tailoring interventions to undergraduates high on SA who tend to behave impulsively, hold positive alcohol-related cognitions, and perceive NACs less negatively may improve outcomes for these individuals. Moreover, adapting interventions to these specific cognitions and incorporating relevant skills training may be advantageous. For example, individuals high on SA who associate alcohol with social facilitation may benefit from social skills training. Improvements in these core skill areas may reduce undergraduate students' vulnerability to problematic drinking (Scheier, Diaz, Botvin, & Griffin, 1999).

Other clinical applications may include targeting NAC evaluations as they develop, and using psychoeducational strategies to increase their salience. These may be particularly promising in reducing risk in those high on SA given evidence that NACs salience is a catalyst of change in drinking patterns (Barnett, Merrill, Kahler, & Colby, 2015; Ramsey et al., 2000). However, these programs need to be developed thoughtfully. There is evidence that a focus on these NACs in existing interventions can reduce

effectiveness of some feedback interventions (Miller et al., 2013). This is likely a function of defensive bias and cognitive dissonance (Festinger, 1957; Leffingwell, Neumann, Leedy, & Babitzke, 2007), as students may defend their behaviour by adjusting their perceptions regarding the severity of these consequences. Integrating these interventions within a motivational interviewing framework may address this caveat, given that this approach entails a non-confrontational and person-centered stance. Another potential avenue for addressing NAC evaluations is emphasizing comparisons against norms. Students tend to overestimate how often their peers experience NACs and underestimate how negatively their peers evaluate these consequences (Lee et al., 2010a). Thus, negative outcomes are often perceived to be normative (McMahon et al., 1994). Individuals high on SA are particularly attentive to social norms and worry about fitting in, making them more likely to match their drinking to perceived peer habits (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). Reflecting accurate information regarding norms and peer attitudes toward alcohol-related consequences may help reduce biases that promote risk in these individuals.

Findings from this dissertation also highlight the potential for incorporating newer methodologies in clinical interventions, ones that target cognitive processes at the implicit level. Overall, cognitions are both malleable and amenable to intervention (Goldman, 1999). Implicit cognitive processes have been conceptualized as critical to and uniquely predictive of risky behaviour (Reich et al., 2010). In recent decades, budding intervention efforts targeting these cognitions with attentional retraining and evaluative conditioning have shown promise, with unique effects on clinical outcomes (Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Houben, Havermans, and Wiers (2010) demonstrated an evaluative conditioning task can successfully modify implicit biases and change drinking behaviours in university students. In clinical populations of heavy drinkers, interventions targeting implicit cognitions have been successful in reducing alcohol approach biases and improve treatment outcomes (Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011). These procedures present new possibilities for intervention, ones which can benefit from contributions of the present work. Findings can

inform cognitive interventions as they develop, providing additional nuance and direction. Targeting specific cognitions (e.g., social facilitation) and retraining NAC evaluations at implicit levels of processing may be particularly promising avenues.

Conclusion

This program of research investigated SA risk for problematic drinking in university—an early stage in the risk trajectory, and a time during which social events and drinking are at the forefront. The present work identifies key cognitive processes in *how* risk unfolds and individual-level moderating variables in clarifying *who* is at risk for SA-related problematic drinking. The findings suggest that as individuals high on SA begin to drink, dispositional trait-level differences (i.e., impulsivity) influence the activation of positive alcohol-related cognitions. Further, broader SA risk for experiencing NACs depends on how these NACs are evaluated subjectively. Together, these studies offer some insight into the complex and mixed link between SA and problematic drinking in university, demonstrating that not all individuals high on SA are at risk for problematic drinking. This work also suggests that specific risk comes into play once alcohol has been initiated on a given occasion. This work provides future direction for modeling SA-problematic risk trajectories and implementing clinical interventions for undergraduate students.

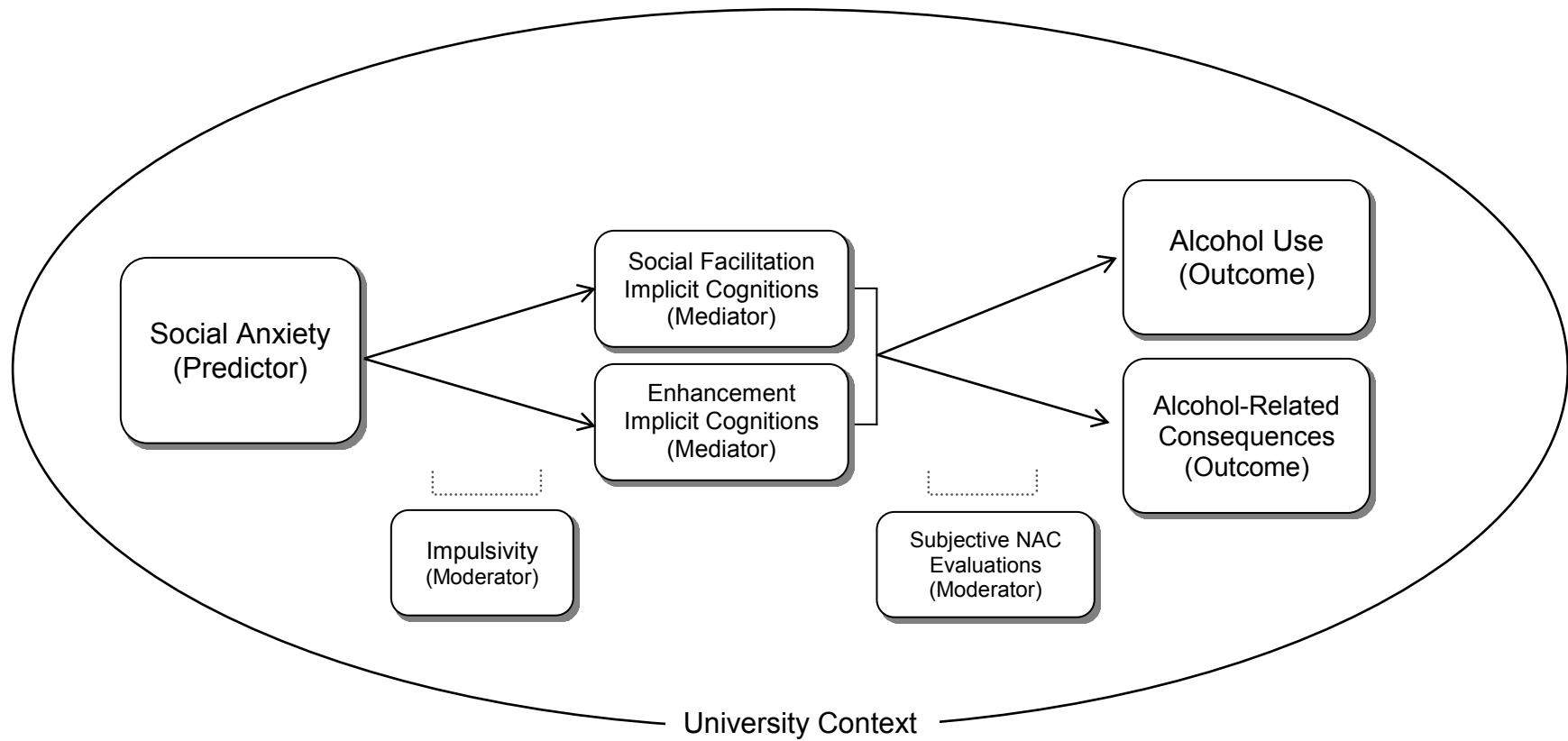


Figure 8. Unified conceptual model: SA risk for problematic drinking in undergraduate students

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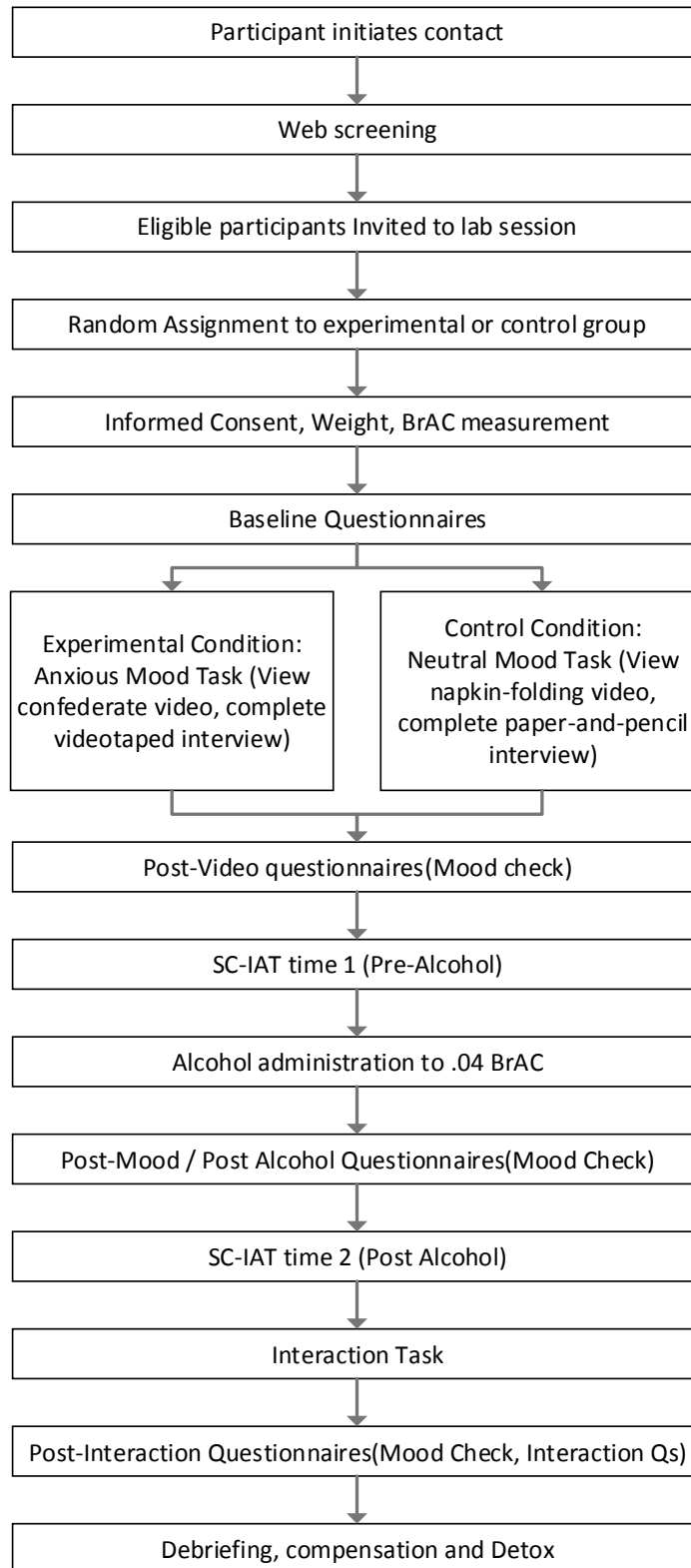
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APPENDIX A: Experiment Participation Flowchart



APPENDIX B: Single Category IAT (SC-IAT)

SC-IAT Alcohol Stimuli

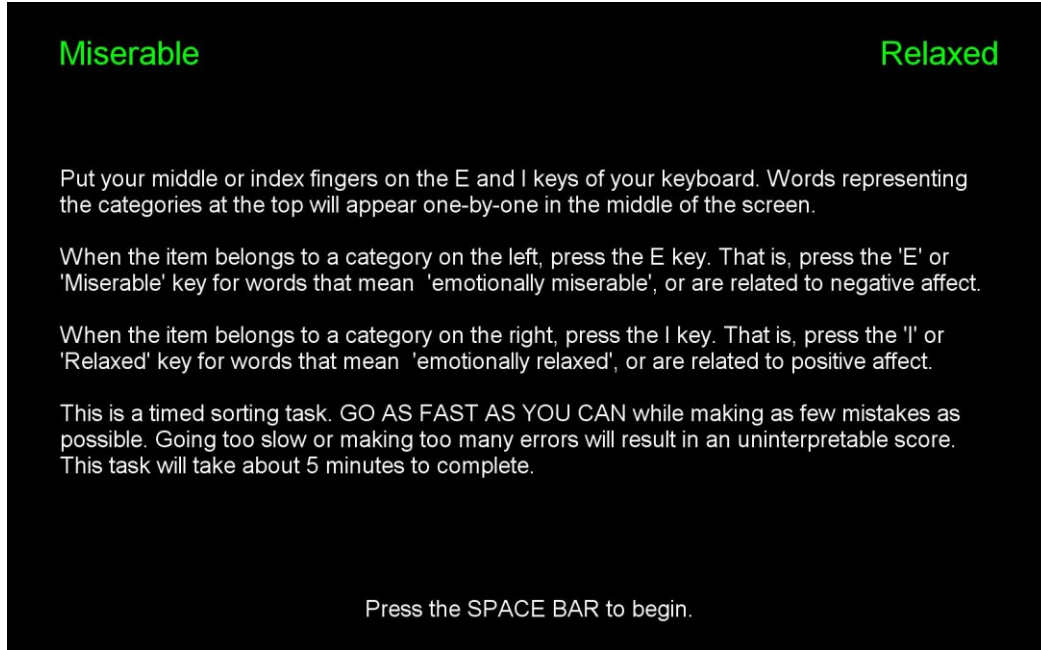


SC-IAT Stimuli Words

Stimuli Words

Positive: Tension Reduction "Relaxed"	Relaxed	Calm	Soothed	Relieved	Peaceful
Positive: Enhancement "Energetic"	Lively	Euphoric	Energetic	Excited	Thrilled
Positive: Social Facilitation "Sociable"	Friendly	Confident	Likeable	Outgoing	Sociable
Negative "Miserable"	Sick	Angry	Depressed	Miserable	Guilty

Sample Instruction Screen

A black rectangular box containing white text instructions for a sorting task. At the top left is the word 'Miserable' and at the top right is 'Relaxed', both in green. The text explains that words representing these categories will appear one-by-one in the middle of the screen. It instructs the user to press the 'E' key for 'Miserable' and the 'I' key for 'Relaxed'. It also states that this is a timed task where speed and accuracy are important, and that the task will take about 5 minutes to complete. At the bottom, it says to press the SPACE BAR to begin.

Miserable **Relaxed**

Put your middle or index fingers on the E and I keys of your keyboard. Words representing the categories at the top will appear one-by-one in the middle of the screen.


When the item belongs to a category on the left, press the E key. That is, press the 'E' or 'Miserable' key for words that mean 'emotionally miserable', or are related to negative affect.

When the item belongs to a category on the right, press the I key. That is, press the 'I' or 'Relaxed' key for words that mean 'emotionally relaxed', or are related to positive affect.

This is a timed sorting task. **GO AS FAST AS YOU CAN** while making as few mistakes as possible. Going too slow or making too many errors will result in an uninterpretable score. This task will take about 5 minutes to complete.

Press the SPACE BAR to begin.

Sample Test Screens

<p>Miserable or Alcohol</p> <p>relaxed</p> <p>Calm</p>	<p>Miserable or Alcohol</p>  <p>Calm</p>
<p>Miserable or Alcohol</p> <p>sick</p> <p>Calm</p>	<p>Miserable or Alcohol</p>  <p>X</p> <p>Calm</p>

APPENDIX C: Alcohol Use Measure

For the next set of questions:

1 drink =



1 Glass of

1 Can or

1 Shot of

1 Cooler

Wine

bottle of beer

hard liquor

For the next set of questions you should think about your typical alcohol use over the **PAST 30 DAYS (1 MONTH)**. Remember: A drink of alcohol refers to a regular sized bottle of beer or wine cooler, a small glass of wine, or a shot.

Use the format below to describe your drinking pattern during a **TYPICAL** week in the **PAST 30 DAYS (1 MONTH)**. Please fill in a number (use the number pad) for each day of the week indicating the average number of drinks you consumed that day. For days when you typically do not drink, enter a zero. If you are a non-drinker, enter all zeros. For the next few questions you **DO NOT** have the option to change your answer (cannot 'Go Back') once you have entered your response. So please **DO NOT** go to the next screen until you are satisfied with your response.

Monday_____

Tuesday_____

Wednesday_____

Thursday_____

Friday_____

Saturday_____

Sunday_____

In the PAST 30 DAYS (1 MONTH), on AVERAGE how often did you have some kind of beverage containing alcohol?

- | | |
|-----------------------------------|---------------------------|
| 1. Not at all in the past 30 days | 7. Three times a week |
| 2. Once in past 30 days | 8. Four times a week |
| 3. Twice in past 30 days | 9. Five times a week |
| 4. Three times in past 30 days | 10. Six times a week |
| 5. Once a week | 11. Every day of the week |
| 6. Twice a week | |

How many drinks did you **USUALLY** have on any one occasion in the **PAST 30 DAYS (1 MONTH)**? USE THE MOUSE to click on the box that corresponds with your answer

- | | |
|---|--|
| 1. Did not drink at all in past 30 days | 8. Seven drinks per occasion |
| 2. One drink per occasion | 9. Eight drinks per occasion |
| 3. Two drinks per occasion | 10. Nine drinks per occasion |
| 4. Three drinks per occasion | 11. Ten drinks per occasion |
| 5. Four drinks per occasion | 12. Other. Please indicate typical number of drinks per occasion |
| 6. Five drinks per occasion | |
| 7. Six drinks per occasion | |

APPENDIX D: NAC Evaluations Measure

In each of the following items, you will be asked some questions about how you would react to certain experiences related to your alcohol use. Please read each question carefully. Answer as completely and honestly as you can.

Stem:

If you had experienced the following:

Items

1. While drinking, I have said or done embarrassing things.
2. I have had a hangover (headache, sick stomach) the morning after drinking.
3. I have felt very sick to my stomach or thrown up after drinking.
4. I often have ended up drinking on nights when I had planned not to drink.
5. I have taken foolish risks when I have been drinking.
6. I have passed out from drinking.
7. I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.
8. While drinking, I have done impulsive things that I regretted later.
9. I've not been able to remember large stretches of time while drinking heavily.
10. I have driven a car when I knew I had too much to drink to drive safely.
11. I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.
12. My drinking has got me into sexual situations that I later regretted.
13. I have often found it difficult to limit how much I drink.
14. I have become very rude, obnoxious, or insulting after drinking.
15. I have woken up in an unexpected place after heavy drinking.
16. I have felt badly about myself because of my drinking.
17. I have had less energy or felt tired because of my drinking.
18. The quality of my work or schoolwork has suffered because of my drinking.
19. I have spent too much time drinking.
20. I have neglected my obligations to family, work, or school because of my drinking.
21. My drinking has created problems with my boyfriend/girlfriend/spouse, parents, or other near relatives.
22. I have been overweight because of my drinking.
23. My physical appearance has been harmed by my drinking.
24. I have felt like I needed a drink after I'd gotten up (that is, before breakfast).

Follow-up questions for each item in scale:

1. How **negative** do you think this experience *would be*?
2. Given the range of problems that may result from alcohol use, **how severe** do you think this type of experience is?
3. To what extent do you think the experience *would upset you*?
4. How **badly** do you *would feel* about the experience?
5. How **bad** do you think it *would be* if this experience *were* to happen to you?