Subjective cue reactivity in social drinkers: Multi-dimensional measures of alcohol desires and outcome expectancies

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Abstract

Research into subjective alcohol cue reactivity has been criticised for the use of uni-dimensional scales to assess subjective cue responses, which do not adequately represent the complexity of contemporary theories on subjective desires, cravings and urges for alcohol. A series of experiments is reported in which a recently developed multi-dimensional assessment tool (Desire for Alcohol Questionnaire, DAQ: Love et al., 1998) is used to explore subjective alcohol cue responses in social drinkers.

Experiment One exposed 86 social drinkers to the sight, smell and taste of their preferred alcoholic and soft drink and subsequently assessed subjective cue responses using the 14-item, self-report DAQ. Analyses of the data revealed significant within-subjects effects on all four DAQ subscales.

Experiment Two extended the range of assessed measures to alcohol outcome expectancies by employing the Alcohol Expectancy Questionnaire (AEQ, Brown, Christiansen & Goldman, 1987) and the Negative Alcohol Expectancy Questionnaire (NAEQ, Jones & McMahon, 1994). A between-subjects design assessed the desire and outcome expectancy responses of 88 social drinkers after exposure to the sight, smell and taste of participants' preferred alcoholic or soft drink. Significant alcohol cue effects were detected on two DAQ factors, and on a third DAQ factor (*Control over Drinking*) only when desire measurement was preceded by testing on the expectancy questionnaires. No significant effects on any of the outcome expectancy subscales were found. However, moderate correlations between the DAQ factors and positive outcome expectancies were reported.

Experiment Three investigated the effects of an alcohol priming dose by assessing desires for alcohol in 64 social drinkers after consumption of one or two alcoholic or soft drinks. The consumption of an alcohol priming dose decreased subjective feelings of control over drinking.

Experiment Four used a 2x2 between-subjects design to test whether internal or external alcohol cues exert a greater influence on desires to drink. Half of the 60 volunteer social drinkers consumed a concealed alcohol priming dose and the rest consumed non-alcoholic fruit juice during a priming phase. During a subsequent exposure phase, half the particpnants were exposed to the sight, smell and taste of

alcohol; the other half underwent soft drink cue exposure. No effects were detected for the concealed alcohol priming dose but external alcohol cues increased desires to drink on DAQ factor *Mild Intentions and Positive Reinforcement.*

The reported experiments present evidence that alcohol cue responses can be elicited on *different aspects* of subjective desires in social drinkers, and therefore a multi-dimensional approach to desire measurement should be adopted. Although outcome expectancies were not shown to be cue responsive, moderate correlations between both concepts emphasise the relationship between anticipated positive outcomes of drug use behaviour and desires to drink. The results from the final experiment stress the importance of cognitive stimuli in subjective responding, in particular knowledge of consumption. Future research could have considerable implications in applied fields (e.g. clinical, advertising) if more attention is paid to the importance of cognitive stimuli associated with alcohol use.

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Author's Declaration

I declare that this thesis is my own work carried out under normal terms of supervision.

1 Introduction

In the last two decades, research efforts trying to explain the variability between individuals in alcohol consumption focussed on the concept of motivation. Principally, research and therapy were directed towards the motivation to restrain drinking. Different theories and treatment programmes demonstrate that the motivation to restrain drinking is understood to be a fundamental element in a theoretical as well as clinical setting. A glance at current theoretical and practical approaches to social and dependent drinking behaviour will help to provide support for this statement.

Motivation to restrain from drinking stands at the beginning of every voluntarily entered therapy and is a vital element in the process of changing drinking behaviour. "Every therapist knows that motivation is a vital element of change", Miller writes (1998a, p.121) and he found that the actions undertaken in the attempt to overcome alcoholism are a strong predictor for a successful change in drinking behaviour (Miller, 1998b).

Therefore, motivation to restrain drinking is seen as a major target of several intervention strategies for alcohol dependence. Heather (1998) remarks that in delivering opportunistic brief interventions the primary objective is motivational. Another widely used treatment programme, Motivational Enhancement Therapy, intends to build motivation for accepting an abstinence goal by highlighting problems and risks associated with drinking, and by emphasising the client's ability to draw upon their own resources (Miller, Zweben, DiClemente & Rychtarik, 1992). The treatment programme used by Alcoholics Anonymous (AA), 12-Step Facilitation Therapy, focuses on motivating patients to stay sober by coming to meetings, listening to experiences of other members and following the 12 steps which outline the common identity as alcoholics, the acceptance of loss of control and the directives for actions and later self-reflection (Nowinsky, Baker & Carroll, 1992).

Although the existing treatment approaches in alcoholism differ in their assumptions, focuses and methods, the examples show that it is commonly agreed that the motivation to restrain is an important element in intervention programmes for alcohol dependence. Therapies like Motivational Enhancement Therapy and Twelve-Step-

Facilitation-Therapy concentrate on the maintenance and increase of the motivation to restrain in order to achieve abstinence from alcohol.

Theories underlying treatment concepts also expose motivation to restrain from drug use as the main feature to explain the maintenance of drug dependence, relapse and treatment progress. For instance, Miller (1998a) has identified the motivation to change as an essential element in the process of changing drinking behaviour, and this view is reflected in DiClemente and Prochaska's (1998) influential Transtheoretical Model of Change which proposes three organising constructs: (i) the five stages as the dynamic and motivational aspects of the change process, (ii) ten processes which represent change principles that are responsible for movement through the stages and (iii) five levels of change that recognise the necessity of a multidimensional problem perspective and that individuals are in different stages of change with respect to different problem areas (i.e. the levels). The model emphasises the enhancement of motivation and commitment, the implementation of change in drinking and the maintenance of new behaviours.

The 1980s saw the parallel departure of another construct, which represents the motivation to restrain drinking. The construct of motivation to restrain can also be represented by negative outcome expectancies (Adams & McNeil, 1991; Goldman, Brown & Christiansen, 1987; Jones & McMahon, 1998). Alcohol outcome expectancies are cognitive structures in long-term memory, which are formed through an individual's direct and indirect experiences with alcohol. By learning about the negative effects of alcohol an individual might expect to "get a into a fight upon drinking" or "would miss work". Negative expectancies arise from often delayed negative consequences of drinking and restrain drinking by determining the quantity consumed and by deciding to end a drinking session. Within this third parallel approach, the motivation to restrain drinking was studied in a more explicit and principled way. Social learning theory, where the construct is derived from, and more recently also cognitive psychology have provided a context for the research on such a more explicit representation for the motivation to restrain from drinking.

However, it has been another component of expectancy theory that has captured the most attention in the 1980s and 1990s: the concept of the motivation to drink. Similarly to negative outcome expectancies, learning about the positive outcomes of alcohol consumption gives rise to positive alcohol outcome expectancies. Examples for positive expectancies might be "expecting to be more satisfied with oneself upon

drinking" or "to worry less". Stimuli in the immediate drinking environment are more closely associated with positive outcome expectancies and therefore promote the consumption of alcohol, i.e. they are seen as determinants of drinking (Earleywine, 1995).

Just like positive outcome expectancies are said to promote drinking and can therefore act as a target of treatment programmes, conditioned alcohol cue responses (which represent another important aspect of motivation to drink alcohol) have been proposed as a target for intervention. Assessment and treatment programmes, like cue exposure and response prevention techniques have been developed, which are based on cue reactivity theory and the Pavlovian principles of extinction and habituation (e.g. Blakey & Baker, 1980; Glautier & Drummond, 1994b; Rankin, Hodgson, Stockwell, 1983). Alcohol researchers have started to acknowledge the common ground of both approaches to alcohol motivation. Bradizza, Stasiewicz & Maisto wrote: "Recently, cue exposure research has been broadened to incorporate elements of social learning theory in an attempt to explain how cognitive constructs, such as self-efficacy and positive outcome expectations, mediate between environmental cues and affective, behavioral and physiological reactivity" (Bradizza, Stasiewicz & Maisto, 1994, p.15). However, Carter and Tiffany recently commented (1999a, p. 350) "that it is time for researchers to look beyond strict classical conditioning explanations for cue-reactivity effects and draw on contemporary perspectives on cognitions, emotion and motivation".

This thesis will follow Carter and Tiffany's advice by exploring the common ground of the expectancy and cue reactivity concepts of motivation to drink. Initially the thesis will focus on some of the aspects of drug motivation which cue reactivity research has concerned itself with. The third chapter will introduce the concept of alcohol outcome expectancies and will show the connections between both schools of thought. An essence of cue reactivity research, which has inspired the research in this thesis, will be presented now.

1.1 The Concept of Cue Reactivity

The theory of cue reactivity proposes that through classical conditioning, a form of learning, environmental stimuli can acquire the ability to elicit conditioned drug

responses and increase the likelihood for drug self-administration (Drummond, Tiffany, Glautier & Remington, 1995). Various stimuli that accompany drinking or drug taking episodes can come to serve as drug cues through the process of classical conditioning. Classical conditioning might occur incidentally during the consumption of alcohol and would later influence the course of drug-seeking behaviours (Glautier & Remington, 1995). The same mechanisms as originally proposed by Pavlov's classical conditioning theory (1927) are thought to be responsible for this process. Pavlov's theory of classical conditioning states that over repeated pairings with the unconditioned stimulus (UCS) another stimulus can acquire conditioned stimulus properties such that the presentation of the other stimulus alone could elicit conditioned responses. The conditioned stimulus (CS) appears to act as a signal for the unconditioned stimulus. The phenomenon of conditioned drug cue responses was first described by Krylov (in Pavlov, 1927) but it was Wikler's work (1948) that promoted further research in the area, which lead to the development of several models about the nature of the conditioned response and treatment strategies based on the principals of classical conditioning.

External as well as internal stimuli can act as signals for alcohol delivery. Such drinking-related conditioned stimuli are called alcohol cues. The variety of stimuli that can achieve conditioned stimulus status ranges from the sight, the smell and the taste of alcohol to environmental or situational stimuli such as a pub or sitting in front of the TV. Internal stimuli like mood states, or thoughts can come to serve as cues for alcohol. A pharmacological priming dose of alcohol could also act as an interoceptive cue because it resembles early, drug onset effects that signal the later, larger effects of the drug (Siegel, 1999).

These alcohol stimuli which precede drug ingestion are distinctive and therefore closely associated with drugs that have powerful biological and psychological effects. For this reason drug cues can take on a special significance for someone who takes drugs or drinks regularly (Glautier, 1994). Especially cues like the sight, the smell and the taste of the alcohol are inevitably associated with every drinking experience. However, every person has had very individual experiences with alcohol, so that it comes as no surprise that the set of alcohol cues an individual responds to is specific and unique to the person and shaped by his or her experiences with the drug. Chapter two will elaborate on the importance of personal relevance of drug cues used in an experimental setting.

The strong association between alcohol cues and the act of drinking brought upon by numerous repeated parings of alcohol cues and the unconditioned stimulus (i.e. alcohol) eventually enables alcohol cues to elicit an anticipatory response before alcohol consumption or even when consumption is prevented. Such a conditioned response is called cue reactivity.

1.2 Cue Reactivity Response Domains

Responses to drug cues may represent different levels of reactivity: (i) autonomic, (ii) symbolic-expressive and (iii) behavioural reactivity (Drummond, Tiffany, Glautier & Remington, 1995).

Autonomic cue responses include effects on psychophysiological measures of heart rate, galvanic skin responses, pulse transit time, blood pressure, temperature and salivation. Symbolic-expressive reactivity refers to self-report measures of alcohol-related thoughts and feelings, which are subjective in nature. Examples include anxiety, tension, difficulty in resisting to drink, cravings or urges, alcohol-related expectancies and self-efficacy beliefs.

Cue exposure experiments with dependent and social drinkers have frequently reported cue reactivity in subjective and physiological response domains. A recent meta-analysis by Carter and Tiffany (1999b) reviews and analyses physiological (heart rate, sweat gland activity and skin temperature) and subjective (craving) responses to drug cues from 41 cue exposure experiments using drug dependent subjects. For physiological measures, heart rate and sweat gland activity shown by drug addicts after cue exposure were increased; skin temperature was decreased after cue exposure compared to the responses shown after exposure to neutral stimuli. Craving was also increased after drug cue exposure. Across addict groups (alcohol, nicotine, opiate and cocaine addicts were studied), alcoholic-dependent subjects displayed the smallest effect size for subjective craving responses. In general, the meta-analysis disclosed smaller effect sizes for psychophysiological measures than for subjective measures of cue reactivity. These findings from studies with alcoholics suggest that psychophysiological effects in social drinkers, who have a less extensive conditioning history, might be smaller and difficult to measure. Nonetheless, some studies have shown psychophysiological effects in social drinkers

(e.g. Greeley, Swift, Prescott & Heather, 1993; Monti et al., 1987). However, most of the experiments with social drinkers had included them only as control participants (e.g. Laberg, 1986; McCusker & Brown, 1995; Pomerleau, Fertig, Baker & Cooney, 1983; Turkkan, Stitzer, McCaul, 1988).

In the subjective response domain, several studies have shown that the presentation of alcohol cues can increase craving for alcohol. For instance, a well-known experiment by Ludwig, Wikler and Stark (1974) showed that desire increased when alcohol-dependent participants were presented with their regular drink. Various other studies reported increased desire or craving shown by alcohol-dependent participants when they were exposed to alcohol cues (e.g. Cooney, Gillespie, Baker & Kaplan, 1987; Cooney, Litt, Morse, Bauer & Gaupp, 1997; Laberg & Ellersten, 1987; McCaul, Turkkan & Stitzer, 1989; Wallitzer & Sher, 1990). In social drinkers, several studies reported increased desire to drink after alcohol cue presentation, although some studies had included them only for control purposes (e.g. Cooney et al., 1987; Kaplan et al., 1985; Monti et al., 1987).

Behavioural reactivity refers to the exhibited behaviours after cue exposure, also known as overt actions, and is the least studied response domain, probably mainly due to a lack of standardised measurement methods. Glautier and Remington (1995, p. 43) argue that "drug seeking behaviour is the most direct assay of the motivational effects of cue presentation". Therefore it is argued that the behavioural response domain would in principle offer the most important information about the impact of cues on drug taking behaviour (Drummond et al., 1995). Nonetheless studies testing behavioural responses, especially in social drinkers, are relatively uncommon. An often-cited experiment by Ludwig et al. (1974) exposed 24 chronic alcoholics to either alcohol drink or control stimuli, and subsequently examined the effects of exteroceptive cues ('cognitively labelled' as alcohol and non-alcoholic stimuli) on alcohol acquisition behaviour. A fixed-ratio operant task was used for behavioural assessment and participants had to press a button to earn alcohol. Participants worked harder for alcohol in the alcohol-labelled condition.

Kaplan, Meyer & Stroebel (1983) presented their participants with an operant task of choosing alcohol-related rewards, and were able to predict 57% of the variance in the reward choice made by alcoholics by the variables desire, withdrawal symptoms and heart rate. De Wit and Chutuape (1993) also employed a choice procedure (ethanol or placebo), and found that social drinkers were more likely to choose an alcohol-

containing beverage after intake of a moderate dose of alcohol. Rankin, Hodgson, Stockwell (1980) developed a speed of drinking test as a behavioural measure on the grounds of the fact that alcoholics have been shown to consume their drinks faster than non-dependent drinkers (e.g. Rankin, Hodgson & Stockwell, 1979). Other studies using measures of the behavioural response domain (complex psychomotor tasks) have reported changes in behavioural task performance after alcohol cues (e.g. Beirness & Vogel-Sprott, 1984; Fillmore & Vogel-Sprott, 1996). The use of behavioural measures of cue reactivity is made difficult by the lack of standardised measurement methods. For this reason behavioural measures will not be employed as dependent variables in the research presented in this thesis.

1.3 Cue Exposure Treatment

Cue reactivity can be seen as a main mediator in the relapse process because of its effects on drug use motivation. For this reason, the theory has been put into practice by developing assessment and treatment programmes, like cue exposure and response prevention techniques (e.g. Blakey & Baker, 1980; Glautier & Drummond, 1994b; Heather, Tebbutt & Greeley, 1993; Rankin, Hodgson, Stockwell, 1983), which underlie the Pavlovian principles of extinction and habituation.

Cue exposure treatment is a behaviouristic treatment approach based on the cue reactivity paradigm. Wikler (1948) argued long before the development of this treatment approach that steps have to be taken to reduce the motivational effects of drug cues and that relapse likelihood would decrease if it were possible to reduce motivational effects of drug cues. It is clear that patients will encounter alcohol cues after they have left the cue-free, "safe" hospital environment, and cue exposure treatment might offer them a means of dealing of such cues (Marlatt, 1995). Anecdotal evidence for the role of conditioned craving in relapse initially came from opiate addicts (e.g. Childress, McLellan & O'Brien, 1985). In the alcohol field, evidence from clinical trials revealed that reactivity to alcohol cues was predictive of relapse (e.g. latency until relapse predicted: Cooney et al., 1997; frequency of drinking at follow-up predicted: Rohsenow et al., 1992, 1994; latency to heavy drinking: Drummond & Glautier, 1994).

Cue exposure treatment procedures have been modelled on exposure treatments that have been successfully used in phobic and obsessive-compulsive patients (Lee & Oei, 1993). It is argued that similar learning mechanisms are involved in the development of both disorders. The aim of cue exposure is to extinguish the conditioned responses by repeated cue presentation without drug consumption (i.e. response prevention) in order to dissociate cue and conditioned response. According to classical conditioning theory, physiological and subjective responses to drug cues decrease after repeated exposure with response prevention due to the processes of habituation and extinction (Tobena et al., 1993).

A series of clinical case studies examined the utility of the cue exposure treatment approach in the late 1970s (Hodgson & Rankin, 1976; Blakey & Baker, 1980) yet no convincing evidence for its clinical effectiveness has been shown so far (Rohsenow, Monti & Abrams, 1995).

Heather et al. (1993) reported a case study where cue exposure was aimed at a target of moderate drinking. This was done by supervised and unsupervised practice sessions with an amount of the patient's preferred beverage as a priming dose. A follow-up at 12 month after the treatment showed that the patient had been successful in his goal of moderate drinking. In another preliminary investigation, Monti et al. (1993) reported that more alcohol-dependent patients in a cue exposure group with urge coping skill training were abstinent at 3-month follow up than in a control group who received assessment only. In one of the first larger clinical cue exposure trials, Drummond and Glautier (1994) found that although cue exposure treatment patients relapsed as quickly as their controls, they did not reinstate heavy drinking levels as controls did. Glautier (1994, p. 183) argues that " given the difficulty of helping patients with addiction, a result such as this should not be dismissed out of hand". These examples show that experimental work on cue exposure, as a treatment approach has been encouraging.

Different variations of the treatment such as in vivo exposure versus imaginable exposure, and length and number of exposure sessions, have been studied but there is certainly need for more extensive research before conclusions about the overall efficacy of this treatment technique can be made (Rohsenow, Monti & Abrams, 1995). In order to be effective and to achieve generalisation to various drug stimuli, conditioned stimuli need to be extinguished in a wide range of settings (Hammersley, 1992). Spontaneous recovery of conditioned responses after extinction should be

accounted for by teaching alternative responses to patients. Hammersley (1992) concludes that cognitive therapy strategies will have to be included in cue exposure programmes, and cue exposure will probably end up less radically behavioustic in nature than it originally appeared.

G.A. Marlatt (1995, p.xiv) summarises in the same vein: "Recent programs that combine cue exposure with active coping skill training for relapse prevention appear more promising in terms of post-treatment outcomes. As one modality in a behavioral treatment program, cue exposure offers considerable promise for both assessment and intervention."

1.4 Cue Reactivity Models of the Response Form

Traditional models of cue reactivity have focussed on the type of cue response and the mechanisms responsible for its occurrence. Three traditional models have been postulated: the conditioned withdrawal model (Wikler, 1948, 1965), the conditioned compensatory response model (Siegel, 1975, 1983) and the appetitive motivational model (Stewart, de Wit & Eikelboom, 1984). The models suggest mechanisms by which cues might operate. They differ regarding the specific role of the conditioned response but agree that a common effect is the increase in motivation to consume the drug and therefore the risk for relapse is amplified.

The models will now be shortly introduced. For a more extensive summary, see Niaura et al. (1988) or Glautier and Remington (1995).

Conditioned Withdrawal Model (Wikler, 1948, 1965)

Wikler's (1948, 1965) model of the conditioned withdrawal response was the first and most influential model of the cue reactivity models of the response form. Through his work on morphine addiction in rats, Wikler believed that various kinds of drug cues could elicit a conditioned response, which resembles the adaptive responses to the drug, i.e. withdrawal symptoms, rather than the immediate drug effects. The desire to reduce conditioned withdrawal symptoms explains, according to Wikler, the motivation of a person to drink or to relapse from abstinence. Several studies support the view that the presentation of a drug conditioned stimulus will

elicit a withdrawal-like response (e.g. alcohol studies: Glautier & Drummond, 1994a; Kaplan et al., 1985; opiates: Powell, Gray & Bradley, 1993).

In experiments using heart rate and skin conductance measures to assess the effects of alcohol cues, interpretation problems are caused by alcohol withdrawal symptoms and actual alcohol effects being very similar, therefore making the model difficult to test (Niaura et al., 1988). On subjective measures though, responses to drug cues that are associated with withdrawal states, like anxiety and tension, have been found (Glautier & Drummond, 1994a).

Although this model has been most influential because it was the first to propose that drug abuse is maintained by conditioned responses to drug stimuli, the idea that conditioned withdrawal states motivate drug consumption receives little contemporary support (Niaura et al., 1988).

Conditioned Appetitive Motivational / Incentive Model (Stewart, de Wit & Eikelboom, 1984)

Stewart, de Wit & Eikelboom's model (1984) is emphasising the incentive properties of drugs for the motivation to consume them. Conditioned responses to drug stimuli are thought of as positive, drug agonistic, or drug like effects in the appetitive motivation model rather than as aversive effects which can be terminated by drug use. Conditioned drug stimuli are suggested to elicit a positive motivational state, similar to the one elicited by the drug itself. In the model, drug cues are thought to activate the same reward pathway that the administration of the drug would activate. The model can explain observations that responding or craving for a drug can occur in the absence of deprivation, acute withdrawal symptoms and without ever experiencing withdrawal (Niaura et al., 1988). Various experiments reported proposed drug-like appetitive responses but, as noted above, it is difficult to interpret results in alcohol studies. Glautier & Drummond (1994a) and Kaplan et al. (1985) reported results supporting the model using skin conductance and heart rate measures. Newlin (1985) and O'Brien (1976) reported drug-like subjective responses after placebo intake (placebo beer and saline injections, respectively) which lends further support to the model.

An evaluation of the various relapse models by Niaura et al. (1988), concluded that the appetitive model of relapse is better supported by experimental evidence than the

other models, and additionally offers more accurate predictions about the drug stimuli that elicit craving or can lead to relapse.

Conditioned Opponent Process Model (Siegel, 1975, 1983)

Similar to Wikler's model (1948), Siegel (1975, 1983) describes conditioned drug responses as adaptive responses, opposite in direction to the drug effect. In his theory, conditioned responses are homeostatic responses which follow shortly after the initial agonistic drug effects and are opposite in direction to them (for a review, see Siegel, 1989). Drug-opposite responses resemble withdrawal states, or are interpreted as withdrawal states, and are therefore unpleasant and call for relieve through drug consumption. Siegel (1989) suggested the term drug-opposite preparatory responses as a better description for the elicited states. It is argued that drug cues play a part in drug use motivation by contributing to craving, tolerance and non-pharmacological effects of withdrawal symptoms (Macrae, Scoles & Siegel, 1987; Shapiro & Nathan, 1986).

The predictions of both, Siegel's and Wikler's models would be the same when drug and withdrawal effects are opposite in direction, e.g. in response to nicotine administration, heart rate accelerates whereas it decelerates during nicotine withdrawal (Glautier, 1993). Different experiments have lent support to Siegel's view. For instance, Newlin (1985) reported decreases in heart rate and skin conductance as effects to placebo beer and because agonistic and withdrawal-like effects for alcohol are manifested by increases in heart rate and skin conductance, this result presents opposite physiological effects rather than withdrawal-like conditioned responses. McCaul, Turkkan and Stitzer (1989) also reported skin conductance and heart rate decreases as responses to a placebo drink. Niaura et al. (1988) in their comparison of relapse models conclude though, that Siegel's model is not supported by as much experimental evidence as the appetitive model by Stewart, de Wit and Eikelboom (1984).

Comments to the Models of the Response Form

Research has brought up controversial data in respect to the existing models. There is evidence that supports all of the above models, and the few selected studies mentioned above emphasise this point. Niaura et al. (1988) conclude in their review of the various models that the appetitive model is best supported in the cue reactivity

literature; the compensatory model is least supported. Rohsenow et al. (1992) also report that the results from three of their studies supported the appetitive-motivation model.

Glautier (1993) takes a different approach to evaluating the models by pointing out that there is no simple answer to the complex problem of which one is the correct model. He argues that the characteristics of the unconditioned stimulus and the conditioned stimulus and the contingency between them are important determinants of the form of the conditioned response, and the various models do not account for them. Glautier and Remington (1995) remark that no valid generalisation of the form of the conditioned response can be found unless all characteristics of the conditioning situation are taken into account.

To demonstrate the importance of the cue characteristics on the conditioned response, Glautier, Drummond and Remington (1992) summarised 12 cue reactivity studies to examine the physiological effects of alcohol. They found that stimuli without consumption of the drug produced arousal, while drug ingestion stimuli produced decreases in arousal. Considering the large number of potential conditioned stimuli in the natural environment, there are also a very large number of stimuli that could potentially be used in cue reactivity experiments. Taken this information into account, it is not surprising that studies have yielded contradictory results when trying to explain the nature and direction of conditioned drug responses. Glautier and Remington (1995) note that it is unlikely that a single theory will be able to predict the response form of conditioned responses in multiple response system. They also point out that the form of the drug response will in general not allow a prediction of the effect it has on the actual drug seeking behaviour.

The publication of the meta-analysis by Carter and Tiffany (1999b) revived the argument of the best-supported model of cue reactivity and relapse. In the comments, prominent cue reactivity researchers discussed the findings and implications of the meta-analysis results. In particular the supporters of an appetitive motivational model argued that the findings supported an incentive model (Rohsenow & Niaura, 1999; Stewart, 1999). Glautier (1999) in response reiterated the points made in earlier publications (Glautier, 1993; Glautier & Remington, 1995) and expressed his doubt that the observed response pattern index positive, incentive states. Carter and Tiffany (1999a, p. 350) conclude by stating that the "meta-analysis

was not designed to synthesis all the evidence for or against the incentive-motivational model".

For the complex issues mentioned above, some authors have argued that the emphasis of cue reactivity research should be shifted away from response forms to the advancement of treatment approaches and the effect of alcohol cues on behaviour (e.g. Robbins, Ehrman, Childress, O'Brien, 1997). As Jansma (1998) notes, a pragmatic attitude is often taken and research concentrates on the question if a conditioned response occurs and what its effects on behaviour are, rather than further studying the direction of the response itself. The same pragmatic approach will be adopted in the research reported in this thesis.

1.5 Alcoholics versus Social Drinkers

Most research in the cue reactivity area has been carried out with alcoholics, using social drinkers only as control participants. However, in recent years the cue responses that are shown by social drinkers have attracted growing interest. Rees and Heather (1995) argue that fundamental differences between dependent and non-dependent drug users could be identified by studying the cue responses of social drinkers, and more importantly, the relationship between cue reactivity and drug consumption history could be explored and modelled on a social drinking level. This introduces the question whether it is possible to extrapolate knowledge gained in a social drinking population to a clinical population. What reasons are there for expecting that the same principles apply in social drinkers and dependent drinkers, and how can be assumed that both populations are not qualitatively different?

Qualitative differences between both groups would be predicted by the influential, classical medical approach to alcoholism, Jellinek's Disease Model (1952). George and Marlatt (1983) summarised the basic assumptions of the contemporary disease model of alcoholism:

1. Alcoholism is a unitary, identifiable phenomenon.
2. Alcoholics and pre-alcoholics differ from non-alcoholics in important constitutional factors. This difference exists prior to alcohol use and manifests

itself in the form of alcoholic drinking behaviour when the person is exposed to alcohol.

3. Because of "loss of control", abstinence is the only goal of treatment intervention.
4. The alcoholic is a helpless victim of internal physiological mechanisms beyond his or her control.

Point 2 explicitly states the difference between alcoholics and non-alcoholics. However, research has shown over the last 40 years that the disease model does not conform to contemporary findings and theories of drug dependence. The main problem of the disease model is that the nature of the disease has never been identified (McKim, 1991). Another criticism of the model is that research into the differences between alcoholics and non-alcoholics has not identified characteristics which may provide more information about the nature of alcoholism (McKim, 1991). Research which has shown that animals readily self-administer drugs without prior dependence to the drug (Schuster, 1970) challenges the disease model and the physical dependence model of drug dependence (based on the principle of negative reinforcement). Such results from self-administration studies suggest that humans also self-administer drugs for their positive reinforcing effects. This positive reinforcement model can, for example, explain why alcoholics still show cravings for alcohol after detoxification, or why cravings and drug-seeking behaviour occur without dependence to the drug, e.g. as it occurs with cocaine (e.g. Pickens & Thompson, 1968). A disease or physical dependence model cannot easily explain such findings.

A contemporary approach to alcohol use and abuse would assume continuity between the states of social drinking and problem drinking (with an endless number of states points in-between). This approach makes it possible to model the influences of cues on a social drinking level and extrapolate the gained knowledge from one point of the continuum (social drinking) to another point (alcoholism).

Within a conditioning model, it would be predicted that cue reactivity and conditioning history are directly related (Rees & Heather, 1995). The more exposure a person had to alcohol cues, the greater the conditioned responses to alcohol cues should be. Conditioning history/ experience with alcohol can be measured as levels of alcohol consumption, and cue reactivity can be measured as physiological,

behavioural or subjective responses. Some experimental evidence exists to support those assumptions. Differences in physiological and subjective responses of alcoholics and non-alcoholics were found: studies using physiological measures of cue reactivity have shown higher responses of dependent drinkers on measures of skin conductance (Kaplan et al., 1983; Kaplan et al., 1985), heart rate (Kaplan et al., 1985, McCusker & Brown, 1991) and salivation (McCusker & Brown, 1991; Monti et al. 1987). These findings suggest that there is a relationship between physiological reactivity and the drinking history. Although some studies could not differentiate non-dependent and dependent drinkers on physiological measures (Abrams et al., 1991), social drinkers never displayed higher reactivity than dependent drinkers and most studies supported the predictions of the conditioning theory that dependent drinkers with an extensive conditioning history would show higher reactivity than social drinkers with a modest conditioning history (Rees & Heather, 1995).

The prediction is also supported by subjective cue reactivity data. Subjective measures in some studies were found to be higher in dependent drinkers (Abrams et al., 1991; McCusker & Brown, 1991). In general though, the results on subjective measures of cue reactivity are less consistent. Other studies found no differences between dependent and non-dependent groups (Corty, O'Brien & Mann, 1988; Kaplan et al., 1985; Monti et al., 1987; Turkkan, Stitzer & McCaul, 1988) but both groups showed increased levels of reactivity after cue exposure. Rees and Heather (1995) state several reasons why subjective data might not have been able to yield a clearer picture. Firstly, they suggest that social drinkers might have similar (high) levels of desires to drink as dependent drinkers. This could be due to a non-linear relationship between desires and drinking history, where desire to drink quickly reaches an asymptotic level. This would mean that desires to drink are high in social drinkers because they still had various opportunities to learn the alcohol and cue association. Secondly, they refer to an observation by Cooney et al. (1987) who suggested that alcoholics interpret urges to drink differently than social drinkers, and therefore desire ratings by both groups might be qualitatively different but equal in ratings. Thirdly, they suggest that alcohol stimuli in experiments represent positive reinforcers to which both participant groups experience similar levels of reactivity. According to Wise (1988) positive and negative reinforcement have separate neural pathways from which drug desires and urges arise. Alcohol-dependent participants often drink due to negative reinforcement but this is rarely seen in social drinkers.

According to Rees and Heather (1995), both groups do not differ in terms of their drinking because of positive reinforcement and should therefore not display differences in desire responses to alcohol cues associated with positive reinforcement. Overall, the subjective nature of desires to drink and their measurement make it difficult to evaluate these suggestions and find a conclusive solution to the problem.

Other approaches to explore the relationship between cue reactivity and conditioning history have tried to identify a relationship between the severity of alcohol dependence and cue reactivity (Glautier & Drummond, 1994a). In general it appears though, that the relationship between cue reactivity and drinking history is not of a linear nature and seems to be less straightforward than previously thought (McCusker & Brown, 1991). Researchers have attempted to study the relationship between cue reactivity and drinking history because if the nature of the relationship could be identified, this would enable one to predict or assess the severity of alcohol dependence.

1.6 Individual Differences in Cue Reactivity

Generally, responses in cue reactivity experiments show a great variability between individuals, even when manifold variables are controlled for. Drummond (1999) observed that the role of individual differences in the modulation of cue reactivity is still a relatively unexplored area. Many factors can influence the variability in cue responses between individuals, for example:

(i) Drug use history, i.e. conditioning history, which has already been discussed in the previous section on differences in cue responses between social drinkers and alcoholics.

(ii) Experience of drug effects after drug ingestion, which are represented as outcome expectancies, and knowledge of alcohol consumption. Several studies have shown that expectations of drug effects influence responding or performance on a subsequent task (e.g. Fillmore, Carscadden & Vogel-Sprott, 1998; Laberg, 1986; McCusker & Brown, 1990).

(iii) Personality traits. McCusker & Brown (1991) found that more variance in cue reactivity responses of individuals could be explained when considering

Eysenckian personality traits rather than drug use history measures such as severity of dependence or number of drinking years (Eysenck, 1969; Eysenck & Eysenck, 1964). Bradizza et al. (1999) have recently shown that private self-consciousness is affecting responding in cue reactivity experiments. They explain the fact that some individuals are more cue responsive than others by the observation that self-reports depend on the attention paid to internal states and events, and people differ in their attention to internal stimuli.

(iv) Mood states. Negative mood is often reported by alcohol-dependent patients as a frequent precipitant of relapse (Connors, Longabaugh & Miller, 1996; Hodgins, el-Guebaly & Armstrong, 1995) and cue responses have been proposed to be elevated in negative mood states (Laberg, 1990). For those reasons, negative emotional cues have been incorporated into cue exposure treatment programmes (e.g. Stasiewicz et al., 1997).

(v) Family history. A recent study showed that social drinkers with a family history of alcoholism had higher subjective cue responses to alcohol cues than people without such a family history (Schulze, 1998; Schulze & Jones, 1999b).

1.7 Cravings and Desires for Alcohol

The concept of craving is a prominent one in various theories that try to explain relapse after a period of abstinence from the drug (Baker, Cooney & Pomerleau, 1987, el-Guebaly & Hodgins, 1998). For this reason, most cue reactivity studies use a subjective measure to assess craving or desire to drink. Craving can be defined as a subjective state in which an individual experiences the desire to engage in drug taking (Kozlowski & Wilkinson, 1987). A more technical definition describes craving as the incentive motivation to self-administer a psychoactive substance (Markou et al., 1993). Various synonyms for the term 'craving' are used, which include desire-to-drink, urge or need. Although the World Health Organisation (WHO) Expert Committee meeting on drug craving in 1954 (WHO, 1955) suggested the exclusion of the term from scientific use, the concept has been popular in research and treatment of drug addiction (Wise, 1988). The term's persistent and widespread use suggests its intuitive appeal and communicative power (Markou et

al., 1993). To systematically investigate the incentive-motivational value of drugs (i.e. craving), animal models have been developed (Markou et al., 1993).

Cravings are thought to arise from either the positive reinforcing properties of the drug (e.g. Bindra, 1968; Bolles, 1972; Rescorla & Solomon, 1967) or from negative reinforcing properties (e.g. O'Brien , Childress, McLellan & Ehrman, 1992), which are related to withdrawal effects, or from both (e.g. Wise, 1988). Some authors (e.g. Kozlowski & Wilkinson, 1987) also argue that craving is independent of reinforcement mechanisms, others explain craving in a cognitive context (Tiffany, 1990, 1992). Tiffany (1990) describes cognitive processes associated with drug use as automated through repeated practice. He interprets cue reactivity as a non-automatic process, which occurs instead of the automatic process when drug ingestion is prevented. Non-automatic processes manifest themselves as physiological arousal and desire to drink, according to Tiffany.

Although there is controversy in the addictions literature about whether craving is associated with relapse and drug use (e.g. Drummond, Cooper & Glautier, 1990), the construct receives much attention from the research and treatment field. Drug- and alcohol-dependent patients often describe subjective states of 'craving' preceding lapse or relapse, but it has proved to be difficult to find physiological or behavioural correlates for the subjective states known as craving (Sinha & O'Malley, 1999).

In recent years, therapy research has often concentrated on the development of new pharmacotherapies like naltrexone or acamprosate in an attempt of reducing cravings in alcoholics (e.g. Koob, 1999; O'Malley et al., 1992, Rohsenow & Monti, 1999).

Measuring craving and other subjective conditioned responses has to rely on self-reports due to their subjective nature. Most cue reactivity studies have used uni-dimensional rating scales to assess subjective responses. Likert scales and analogue scales have been used for measurement (e.g. Greeley et al., 1993; Litt, Cooney, Kadden & Gaupp, 1990). In the last years, criticisms on uni-dimensional measuring approaches have grown.

As a response to the criticisms, multi-dimensional craving and desire questionnaires started to surface. Modell, Glaser, Mountz, Schmaltz and Cyr (1992) differentiated between thoughts and compulsions when they developed the Yale-Brown Obsessive Compulsive Scale - Heavy Drinkers (YBOCS-hd), the predecessor of the Obsessive Compulsive Drinking Scale (Anton, Moak & Lotham, 1996). They based this

assumption on the observation that thought patterns and behaviours in alcoholic patients were similar to those in patients with obsessive-compulsive disorders.
Craving questionnaires for smoking and cocaine also appeared which suggested that a multi-dimensional solution is indeed more appropriate (Tiffany & Drobes, 1991; Tiffany, Singleton, Haertzen & Henningfield, 1993). It was argued that complex craving hypotheses require sophisticated instruments for measurement and one or two uni-dimensional rating scales cannot effectively be used for evaluation.
A new alcohol craving questionnaire, the *Desire for Alcohol Questionnaire* (DAQ) (Clark et al., 1996; Willner, Field, Pitts & Reeve, 1998; Schulze & Jones, 1999c), has been argued to represent the complexity of craving more appropriately in a multi-factorial manner. Craving measurement will be discussed in more detail in chapter two.

1.8 Subjective Measures of Cue Reactivity as a Way to a Broader Picture of Alcohol Motivation

History has shown that exploring and researching a problem or a disease at a different level can explain its nature and therefore provide angles on how to tackle the problem, or develop a cure for the disease. Examples for such approaches are manifold in the medical field: for example, when research concentrates on the bacteria or the viruses that cause a disease, a cure or a vaccine can often be found.
In the alcohol cue reactivity field, inconsistent results from cue exposure studies with social drinkers and alcoholics call for a different approach, or a new angle to tackle the problem. Evidence from other domains of psychology shows that the progression from a simple measures to a more refined, sophisticated measurements often goes hand in hand with the discovery of new information.
Attempts to understand alcohol-dependence by investigating objective physiological measures could not deliver explanations for a wider picture of motivation and desire to drink. The earlier cited meta-analysis by Carter and Tiffany (1999b) reported that studies which have measured both physiological and subjective cue responses have rarely found correlations between those responses domains (Tiffany, 1990). The difference between physiological and craving effect sizes emphasises that the assumption of a strong relationship between physiological and subjective responses, as proposed by many conventional addiction models, needs to be revised (Carter &

Tiffany, 1999a). In the comments to the aforementioned meta-analysis, Drummond (1999, p. 347) argues that "one needs to exercise caution in drawing conclusions about the motivational relevance of cues on the basis of physiological cue reactivity". Piasecki, Smith and Baker (1999, p. 342) take the argument a step further by asking "Why does research in the area continue to collect measures such as heart rate and skin conductance that are known to be complexly determined and inconsistent indices of an acquisitive motivational set?". They go on by stating that "the aim of cue exposure research is to permit strong inference regarding stimulus control over drug motivational processes..." (Piasecki, Smith & Baker, 1999, p.342). Further, Carter and Tiffany (1999a, p. 350) express their scepticism that any physiological measure, no matter how advanced, "will provide a one-to-one mapping of psychological states and physiological responses". Given the lack of evidence for a relationship between physiological and subjective substrates of motivation, one starts to wonder if concentrating the investigation on the subjective, cognitive nature of the problem might be a more promising solution. If measurement methods for subjective reactivity can be refined and advanced, exciting findings can be expected in the study of motivation to drink.

A look at the cue reactivity literature for social and dependent drinkers shows that such an approach is not completely new. As shown earlier in this chapter, subjective measures of cue reactivity were assessed in most cue exposure studies, and craving for alcohol was frequently elicited in alcoholics and social drinkers by various alcohol cues. However, progress of research on subjective alcohol cue reactivity has been held back by the use of inappropriately limited reactivity representations. Glautier and Tiffany (1995) argue that the multi-dimensional complexities of craving, urges and desires cannot be represented satisfactorily by any uni-dimensional (and usually single item) assessment that has traditionally been used. They write "... an unreliable, insensitive measure of any sort cannot accurately reflect the impact of cue manipulations, reveal the true magnitude of the relationships between one measure and another, or provide a meaningful evaluation of the relative influence of cue manipulation on one variable versus another" (Glautier & Tiffany, p. 85). Responding to this challenge, Clark et al. (1996) have developed the multi-dimensional Desire for Alcohol Questionnaire (DAQ); and Willner et al. (1998) and Schulze and Jones (1999c) have reported its first use in measuring subjective alcohol cue responses in social drinkers.

Investigating the microstructure of subjective cue reactivity using a multi-dimensional questionnaire will allow us to explore global structures as cognitive, motivational responses to an alcohol context. Global structures need to be studied in a social drinking population using better measurement methods, such as the DAQ, to provide us with a wider picture of alcohol motivation.

2 Experiment One: Assessment of Subjective Cue Reactivity in Social Drinkers using a Multi-dimensional Measure of Desires for Alcohol

Previous cue reactivity studies have mainly concentrated on investigating the conditioned responses of drug-dependent participants. Some studies have suggested that conditioned responses also play an important role for social drinkers' motivation to consume alcohol. Methodological discussions evolving from review articles and meta-analyses have pointed to the fact that only few cue reactivity studies have accounted for the complexity of craving hypotheses by employing multi-dimensional measures of craving and desire for alcohol.

The reported experiment utilises a newly developed, multi-dimensional assessment tool, the Desire for Alcohol Questionnaire (DAQ), to investigate subjective cue responses in social drinkers. Eighty-six volunteer social drinkers attended to the cues of sight, smell and taste of their favourite soft and alcoholic drink during a cue exposure experiment. Soft and alcoholic drink stimuli were presented in a counterbalanced order. Participants' subjective cue responses were recorded with the 14-item, self-report DAQ.

All aspects of desire as indicated by the DAQ factors showed significant responses to the sight, smell and taste of alcohol. Desire scores on three factors increased after alcohol exposure; perceived *Control over Drinking* (factor 4) decreased after smelling and tasting the alcoholic beverage. The discussion points to the fact that the DAQ factors of *Mild Intentions and Positive Reinforcement* (factor 1) and *Negative Reinforcement* (factor 3) represent alcohol outcome expectancies rather than sheer desires to drink. Through a novel approach of measuring subjective cue responses, this experiment could demonstrate that *different aspects* of subjective desire for alcohol are responsive to cue manipulation. It is therefore concluded that multi-dimensional instruments should be employed to assess subjective cue reactivity.

2.1 Introduction

In the past, cue exposure experiments have mainly been carried out using alcoholic participants looking at the role of alcohol cues in relapse and at cue exposure's potential role as a treatment programme. Social drinkers sometimes acted as control participants in such studies, in which attention was paid to the difference between their responses and the responses of alcoholics. Less attention has been paid to the responses of social drinkers themselves and this experiment is intended to fill this gap.

Some relevant methodological issues have emerged from past cue reactivity studies that should be considered in the design of any new cue reactivity experiment. Those methodological issues will be discussed now. Carter and Tiffany (1999b) reported from a meta-analysis of cue reactivity studies that more than 90% of the studies reviewed had used a single-item instrument to assess drug desire. Glautier and Tiffany (1995) have criticised the common use of what must be an "unreliable, insensitive" measure to evaluate the influence of cue manipulation on a variable (Glautier & Tiffany, p. 85). They call for the adoption of multi-dimensional instruments to measure desire or craving for alcohol to accommodate the complexity of desire and craving models. In response to this call, some multi-dimensional instruments for craving measurement have appeared, and these will be introduced in detail later in the chapter.

In a methodological review of cue reactivity studies, Robbins and Ehrman (1992) describe two different types of experiment that have been employed to investigate the effects of alcohol cues: *laboratory conditioning studies* and *naturalistic cue assessments*.

During conditioning studies in the laboratory, neutral stimuli are transformed into signals for a drug (conditioned stimulus, CS) by pairing the neutral stimulus with drug administration (unconditioned stimulus, UCS). The acquisition of conditioned responses and the form of drug responses can be studied following conditioning in the controlled laboratory setting (Robbins & Ehrman, 1992). Glautier (1993) favours this approach as "most satisfactory for providing interpretable data in terms of a conditioning model" (p. 59). A problem of this method however is that it requires several laboratory sessions for the participants to be conditioned to novel drug

stimuli before cue responses can be assessed. Further, few conditioning trials in a fixed laboratory setting, compared to thousands of conditioning experiences in various settings with various stimuli, appear limited to represent the real world. A laboratory based conditioning experiment can never demonstrate that conditioning did actually take place in the natural environment

The second research method, opportunistic studies, relies on extra-experimental conditioning of drug stimuli in the natural environment. In such studies, responses to naturalistic drug stimuli are compared with responses to non-drug stimuli to investigate the extent to which conditioning might have occurred in the natural environment. Naturalistic cue assessments are much easier to carry out since they only require one or two experimental sessions, and they provide a picture of the "real world" rather than the one created by a restricted laboratory environment. On the other hand, this picture of the 'real world' contains a lot of 'noise' such as additional information and other, unknown conditioning experiences which makes results from naturalistic studies problematic to interpret. Nevertheless, naturalistic cue reactivity studies have been able to show physiological and subjective responses elicited by alcohol cues in alcoholic drinkers.

Robbins and Ehrman (1992) criticised the designs of opportunistic studies by pointing to the fact that many of them do not allow the conclusion that the observed conditioned response to a drug stimulus is indeed conditioned, or simply an unlearned response to a drug stimulus.

They suggest that particularly craving responses might be reported as mislabelling of general arousal produced by the experimental stimuli. Demand effects, imposed on the participants by the aim of the experiment to report craving, according to Robbins and Ehrman further strengthens the tendency to mislabel general arousal. Alternatively, they suggest that craving in response to arousing experimental stimuli could be reported by individuals who use drugs as a way of coping with changes in arousal. In any case, the reported craving response would *not* be a *conditioned* response to a drug cue.

Unlearned responses also contribute significantly to the response magnitude of a conditioned response to a drug stimulus. In the absence of baseline data before conditioning (which we can never obtain in naturalistic designs), inferences need to be made that the current response is indeed the result of a conditioning process.

Therefore Robbins and Ehrman (1992) call to pay more attention to control procedures in cue reactivity studies.

To draw inferences about the question whether a response elicited by an alcohol stimulus is a conditioned response, comparisons with a response to a similar stimulus not associated with a conditioning process need to be made. Some researchers have chosen to compare the alcohol response with a pre-stimulus baseline only (e.g. Powell, 1995) but in the absence of a neutral comparison it is impossible to determine how much, if any, of the response variance can be explained by conditioning processes. The fact that participants respond to an alcohol stimulus is not a justification for a conditioning explanation. Most stimuli will elicit some sort of response, may it be a startle, an orienting or an affective response.

Using a basic comparison design, theoretically both alcohol and neutral stimuli should elicit an unconditioned response of about the same size when matched properly. But if conditioning processes have occurred before, the response to the alcohol stimulus should be greater than the one to the unconditioned stimulus (Figure 2-1).

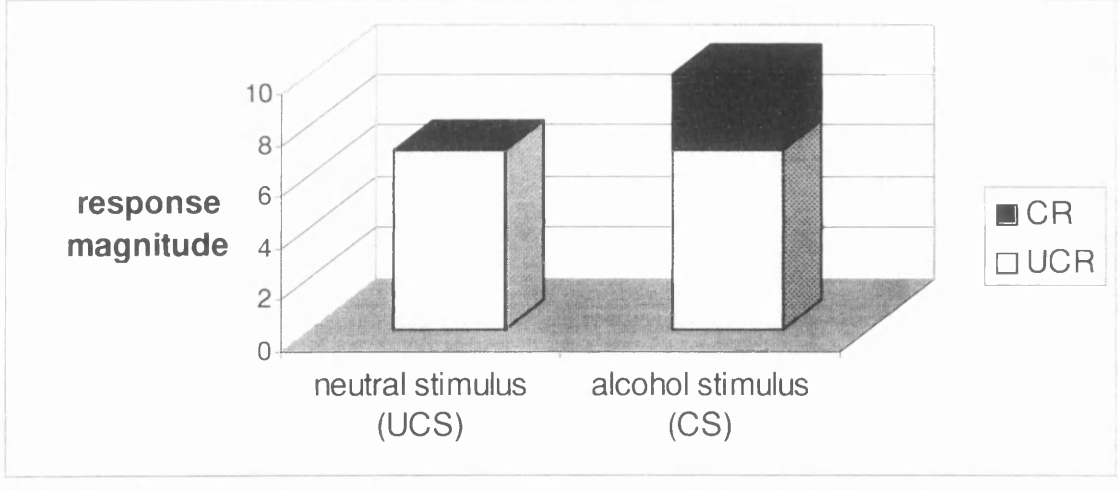


Figure 2-1. Changes from baseline (conditioned [CR] and unconditioned [UCR] responding) after neutral (unconditioned stimulus, UCS) and alcohol cue exposure (conditioned stimulus, CS) in basic comparison experiments (schematic)

For naturalistic cue assessments involving basic comparisons it is therefore crucial that experimental and neutral stimuli are carefully chosen and matched in their properties. The most important stimulus characteristic is personal relevance. Cook, Melamed, Cuthbert, McNeil and Lang (1988) showed that personally relevant stimuli elicited stronger physiological responses than standardised stimuli. Conditioning theory would predict such an outcome. According to the theory, response magnitude and conditioning history are positively related. In order to elicit a conditioned response, it is essential that the participant had a conditioning history with the experimental stimulus. It is common in alcohol cue exposure experiments to use stimuli that are highly likely to be encountered by *everyone* during drinking. Such stimuli are the sight, the smell and the taste of the participants' regular drink. Many studies have used alcoholics' regular drink as the experimental stimulus (e.g. Glautier & Drummond, 1994a; Rohsenow et al., 1994), but similarly, studies have also used standardised experimental stimuli (e.g. McCusker & Brown, 1991).

The same concern should meet the neutral stimulus. It should be matched for personal relevance too - the only difference between neutral and experimental stimulus being the alcohol conditioning effects. Most studies do not attend to this fact, for instance giving all participants water or cedar chips as a standardised control stimulus (e.g. Cooney, Gillespie, Baker & Kaplan, 1987; Rohsenow et al., 1992).

McCaul, Turkkan and Stitzer (1989) demonstrated that unlearned responses to stimuli with similar "sensory intensities", but different conditioning histories (whisky versus pepper juice), could elicit similar physiological responses (in this case: heart rate and skin conductance). The responses elicited by water, which had no alcohol conditioning history (like whisky) and was rated less 'intense' than whisky or pepper juice, were significantly smaller.

Therefore, it can be concluded that stimuli in cue exposure experiments need to be matched in their "sensory intensities" when comparing physiological conditioned responses. McCaul, Turkkan & Stitzer (1989) could not confirm a similar influence of "sensory intensity" on subjective responses. Subjective responses to alcohol stimuli were found to be significantly higher than responses to pepper juice or water. Carter and Tiffany (1999b) describe cravings to have a high level of cue specificity, whereas physiological measures of cue reactivity reflect only general measures of physiological responses, just a small part of which is the conditioned response to the cue and which therefore contain a high level of noise. Unconditioned cue responses

explain another part of the variance of the measured physiological response. Since "sensory intensity" contributes only to the noise measured in the response, and there is a generally lower level of noise recorded in subjective responses, matching stimulus intensity should be much less of a concern for a experiment which measures subjective cravings and desires.

Further, Carter and Tiffany (1999b) point out that only the minority of cue reactivity studies (31%) had been controlling for order effects of cue presentation. The cue reactivity literature reflects some disagreement over the issue of counterbalancing stimulus material. McCusker and Brown (1991) concluded from a experiment by Monti et al. (1987) that cue responses would generally lower over the time of the experiment whereas Monti et al. had reported a decrease in salivation responses over time and gave physiological explanations for a decline in salivation responses only. As a result McCusker and Brown suggested presenting drug cues always last in the stimulus sequence. Carter and Tiffany (1999b) criticise this procedure as a threat to the internal validity of the experiment, and which in addition produces smaller effect sizes. They conclude by suggesting within-participant designs, which make use of multiple cue presentations. Within-participants designs are not always possible to carry out because of the time and resources they require. As an alternative, between-participants designs with multiple, counterbalanced stimulus presentations have been employed by researchers [neutral-neutral-alcohol versus neutral, alcohol, neutral] (Cooney, Gillespie, Baker & Kaplan, 1987).

Valid observations about the drug conditioning process can also be expected from basic comparisons between responses of drug users and people with no such conditioning history. For alcohol, the drug in question, it would be very difficult to find participants who have never experienced the effects of alcohol. Studies have been carried out comparing the responses of alcoholics and non-alcoholics on the basis of the difference in conditioning history between the groups. In accordance with the conditioning theory, alcoholics' responses to alcohol cues should be stronger than non-alcoholics' responses, since alcoholics had many more opportunities to learn the CS – CR connection. Studies often have confirmed the difference between alcoholics and social drinkers in responses to alcohol cues (e.g. Kaplan, Meyer & Stroebel, 1983; Stormark, Laberg, Bjerland, Nordby & Hughdahl, 1995). Nevertheless, the relationship between conditioning history and conditioned response was not found to be as straightforward as previously thought.

Within a social drinking group, the influence of conditioning history can be considerable. Therefore, one still needs to be aware of possible variations in current and past alcohol consumption of participants (i.e. their conditioning history), and if necessary, to control for them.

2.1.1 Desire or Craving Questionnaires

In the past, desire and craving measurement has mostly been of a single-item or uni-dimensional nature. As already discussed in the Introduction of this thesis, the measurement of cravings and desires has been under debate in the recent years. Criticism on the use of single-item representations and calls for the use of multi-dimensional instruments to measure drug desire have given rise to the development of several craving questionnaires for a variety of drug cravings. Although alcohol research is an influential and extensive research field, the first craving questionnaires that have been developed were questionnaires for nicotine and cocaine craving. Those questionnaires have influenced the development of alcohol craving questionnaires, which mainly focussed on cravings, desires and urges in alcoholics. Because of this influence, the following short review of craving questionnaires also includes the nicotine and cocaine craving questionnaires that have been influential in the development of other craving questionnaires.

2.1.1.1 Nicotine Craving

Tiffany and Drobes' (1991) Questionnaire on Smoking Urges (QSU) is a 32-item instrument concerned with four areas relevant to nicotine craving: desire to smoke, anticipation of positive outcomes, relief of withdrawal or negative affect, and intention to smoke. Items from the questionnaire contribute to two factors: (i) *intention and desire to smoke and anticipation of pleasure* and (ii) *overwhelming desire to smoke and anticipation of relief from negative affect and withdrawal.* This questionnaire was the first among a number of craving questionnaires for various drugs. It was used as a starting point for the development of other craving questionnaires.

2.1.1.2 Cocaine Craving

A multi-dimensional measure was also developed for the craving for cocaine (Cocaine Craving Questionnaire, CCQ: Tiffany, Singleton, Haertzen and Henningfield, 1993). Four factors were discovered: (i) *desire, intention and plan to use cocaine*, (ii) *a representation of all categories apart from anticipation of relief*, (iii) *lack of control* and (iv) a mixture of *anticipation of specific positive outcomes and relief from specific negative outcomes* as a consequence of cocaine use.

2.1.1.3 Alcohol Craving

Singleton, Henningfield and Tiffany (1994) reported a multi-dimensional factor structure discovered in 47 items about urges and desires to drink, intentions to drink, anticipation of positive outcomes, relief of withdrawal, and items relating to (lack of) control over alcohol consumption. This questionnaire by Singleton et al. is known as the Alcohol Craving Questionnaire (ACQ) and was developed to assess craving in alcoholics. The factor structure of the Alcohol Craving Questionnaire has not been published.

In Germany, a craving questionnaire for alcoholics (Lübecker Craving–Risiko-Rückfall-Fragebogen [LCRR]: Veltrup, 1994) uncovered four subscales for alcohol craving in alcoholics: (i) *depressed affect*, (ii) *elation, high spirits*, (iii) *anger and tension* and (iv) *content and relaxation.* The 33 items measuring frequency, severity and situational conditions of alcohol craving were administered to 146 alcoholics in treatment. The LCRR is mainly aimed at predicting relapse and researching coping strategies for craving in relapse prevention.

Around the same time, Bohn, Krahn and Staehler (1995) administered the 49-item Alcohol Urge Questionnaire (AUQ) relating to desire for a drink, expectations of positive effects from drinking, relief of withdrawal and negative affect and the intention to drink to 351 abstinent alcoholics in treatment. They discovered an internally consistent, reliable and psychometrically valid 8-item factor representing urges that are "only partly reflective of craving for a drink" (Bohn et al., 1995, p. 604). The AUQ showed strong relationships with severity of alcohol dependence and cognitive preoccupation with alcohol.

Anton, Moak and Latham (1996) developed the Obsessive Compulsive Drinking Scale (OCDS) as a method of assessing outcome in the treatment of alcoholism. The scale was based on the Yale-Brown Obsessive Compulsive Scale – Heavy Drinkers (YBOCS-hd) by Modell et al. (1992), which differentiated between two components of alcohol craving: (i) thoughts (cognitive component) and (ii) compulsions (motoric and action component). This model was based on the observation that alcohol-dependent patients displayed similar thought and behaviour patterns as patients with obsessive-compulsive disorders. Anton et al. modified the YBOCS, which was originally a 10-item, interview based assessment tool, into a quick 14-item, self-report scale. The OCDS scale delivers three scores, one total and two subscale scores (obsessive and compulsive), that assess cognitive aspects of craving.

In Britain, Clark et al. (1996) designed a questionnaire aimed at assessing desire for alcohol in *social drinkers*. As a result, the Desire for Alcohol Questionnaire (DAQ) was developed, featuring 36 items that were derived from the areas concerned with craving used in the QSU. The questionnaire was administered to 302 social drinkers and a four-dimensional factor structure was discovered: (i) *mild intentions and positive reinforcement*, (ii) *strong intentions and desires*, (iii) *anticipation of negative reinforcement* and (iv) *control over drinking*.

Love, James and Willner (1998) compared the Desire for Alcohol Questionnaire (DAQ) with the Alcohol Craving Questionnaire (ACQ), using 380 recreational drinkers. They could only confirm a three-factor structure, but not the fourth factor *controllability*. The *controllability* scale was found to have face validity in an alcohol dependent population, and it was suggested that it should therefore be retained for research purposes. The DAQ appeared superior over the ACQ in a number of ways: DAQ factors were more reliable, explained more of the variance (79.3% versus 71.5%) and the factor inter-correlations were slightly lower in the DAQ.

From this short review of recent craving questionnaires, it is clear that all efforts have been devoted to the development of a scale to assess craving in alcoholics for treatment purposes. Only one desire questionnaire (DAQ) was aimed at a social drinking population, recognising that non-dependent drinkers can also develop "cravings" and desires for alcohol. In a comparison with the ACQ using a social drinking population the DAQ was found to be more reliable and its factors accounted for more of the variance (Love et al., 1998). Therefore, it should be tested whether

the DAQ offers any advantage as a desire assessment tool in cue reactivity experiments.

This thesis will concentrate on the DAQ as a desire assessment tool in social drinkers. The first experiment in this thesis aims to explore subjective conditioned responses in social drinkers, taking advantage of the newly developed DAQ's multi-dimensional approach to measuring desire for alcohol in social drinkers. It seeks to investigate whether the questionnaire can be used to assess subjective alcohol cue reactivity in social drinkers.

2.2 Method

2.2.1 Participants

Eighty-six social drinkers (65 male, 21 female) were recruited to take part in a cue exposure experiment. Participants were predominantly students of the University of Glasgow, with an average age of 23.3 years (*SD* = 5.2). A mean consumption of 26.0 units of alcohol (*SD* = 18.8) on 3.6 drinking occasions (*SD* = 1.7) during the week prior to the experiment was reported. The participants had been drinking for *M* = 5.2 years (*SD* = 4.3) at the current levels. Twenty-six participants (30 %) reported that a family member (apart from their parents) had a drinking problem; 11 of them (12.8 %) stated that they had an alcohol dependent parent. Participation was based on voluntary, informed consent. A copy of the consent form can be found in the appendix (Appendix A.01). Participants were paid for taking part in the experiment.

2.2.2 Stimuli and Measures

Cue exposure was carried out using stimuli from participants' most frequently consumed, preferred alcoholic and soft drinks. Participants gave their choice of drink when they signed up for the experiment, and drinks were individually prepared before the experiment. Each chilled drink was hidden with a half-pint glass under a box labelled 'A' or 'B'. The cue exposure stimuli for each drink consisted of looking at, holding, smelling and tasting the drink.

Subjective responses were measured with the Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996). The short version of the DAQ was used, which consists of 14 items on four factors:

I. *Mild Intentions and Positive Reinforcement* (e.g. "Drinking now would be satisfying")
II. *Strong Intentions and Desires* (e.g. "My desire to drink right now seems overwhelming")
III. *Negative Reinforcement* (e.g. "Even major problems in my life would not bother me if I drank right now")
IV. *Control over Drinking* (e.g. "If I had a drink now I would be able to stop")

Each item requires a responses on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). A copy of the DAQ is included in the appendix (Appendix A.02). The appendix also includes instructions on how to calculate the factor scores for the DAQ (Appendix A.13).
Additionally quantity and frequency of alcohol consumption in the week prior to the experiment were measured with an adaptation of the Time-Line-Follow-Back Drinking Diary (Sobell & Sobell, 1992). Demographic measures were also recorded. A copy of the Time-Line-Follow-Back Drinking Diary and of associated demographic questions used in the experiment can be found in the appendix (Appendix A.03 and A.04).

2.2.3 Design

A 2x2 mixed within-subjects design with one repeated measure, *Cues* (2 levels: alcoholic drink cues, soft drink cues), was employed for the cue exposure experiment. The between-subjects factor, *Order* of Cue Presentation, was counterbalanced across participants (2 levels: soft/alcohol, alcohol/soft). The dependent measures were the subjective responses to alcohol and soft drink cues measured by the Desire for Alcohol Questionnaire (DAQ) after cue exposure.

2.2.4 Procedures

Individual testing took place in a quiet laboratory room in the University of Glasgow. Before the experiment, informed consent was obtained and demographic and alcohol consumption information and baseline desire recordings were taken. All participants were exposed to both cue conditions. Half the participants were exposed to alcoholic drink stimuli first, and then soft drink stimuli; the other half received soft drink cue exposure first and then alcohol cue exposure. Cue exposure instructions came from a tape. The tape instructed the participants to lift the box labelled 'A' and then directed the participants' attention to their preferred soft or alcoholic drink container (1 minute), then it instructed the participant to open and pour the drink into the glass provided, to look at the drink while holding it (1 minute), to smell it (1 minute), and to taste the drink by sipping it twice (1 minute). Desire responses were recorded after cue exposure. After a 5-minute resting period, the tape instructed the participants to lift Box 'B' and the cue exposure procedure was repeated. For a schematic description of the design and procedure of this experiment, see Figure 2-2. In total, three desire recordings were taken (i.e. baseline, after soft drink and after alcoholic drink). After the experiment, participants were thanked and paid for their participation.

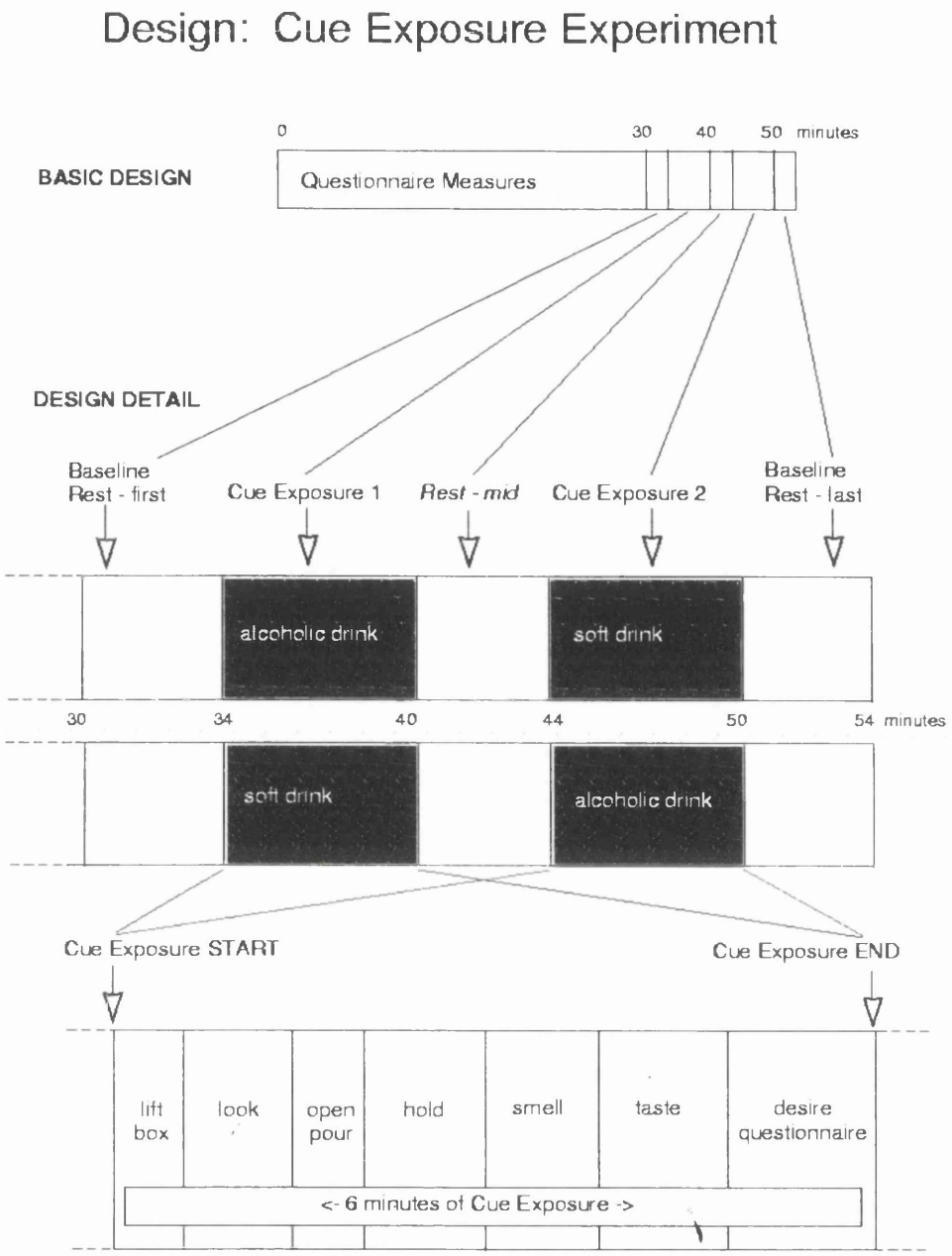


Figure 2-2. Schematic description of the experimental procedure: Experiment One[1]

[1] From "Social drinkers' pulse discriminates between alcohol and soft drink stimuli" by D. Schulze & B.T. Jones, 1998a, 106th Convention of the American Psychological Association, San Francisco, CA, 14 -18 August 1998.

2.3 Results

The data were analysed using the General Linear Model procedure of SPSS for Windows 7.0. The significance level for all tests was set to $\alpha = .05$. All tests were 2-tailed.

2.3.1 *Group Differences in Demographic Measures and Alcohol Consumption*

One-way analyses of variance were carried out with *Order of Cue Presentation* (2 levels: alcohol/soft, soft/alcohol) as the between-subjects variable to test group differences in demographic variables and alcohol consumption. No significant differences were detected between groups that received drinks in different orders (see Table 2-1 for a summary of descriptive statistics and Table 2-2 for the results of the analyses of variance).

Table 2-1. Descriptive Statistics for Demographic Measures and Alcohol Consumption for *Order* of Cue Presentation Groups

Demographic + Consumption Variables	Order of Cue Presentation	Mean	Standard Deviation	Minimum	Maximum	*N*
Age	alcohol/soft	22.8	3.6	19	34	44
	soft/alcohol	23.9	6.4	18	52	42
	total	23.3	5.1	18	52	86
Drinking Frequency	alcohol/soft	3.6	1.8	1	7	44
in days	soft/alcohol	3.6	1.7	0	6	42
	total	3.6	1.7	0	7	86
Drinking Quantity	alcohol/soft	28.2	21.1	2	93	44
in units	soft/alcohol	23.6	16.0	0	77	42
	total	26.0	18.8	0	93	86
Years drinking at	alcohol/soft	4.6	3.7	1	16	44
this level	soft/alcohol	5.8	4.9	1	22	42
	total	5.2	4.3	1	22	86

Table 2-2. One-Way Analyses of Variance on Demographic and Consumption Variables for the Independent Variable *Order* of Cue Presentation

Dependent Variable	Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Age	Between Groups	27.537	1	27.537	1.034	0.312
	Within Groups	2237.346	84	26.635		
	Total	2264.884	85			
Drinking	Between Groups	0.001	1	0.001	0.001	0.988
Frequency in days	Within Groups	250.337	84	2.980		
	Total	250.337	85			
Drinking Quantity	Between Groups	454.074	1	454.074	1.290	0.259
in units	Within Groups	29570.604	84	352.031		
	Total	30024.677	85			
years drinking at	Between Groups	27.748	1	27.748	1.493	0.225
this level	Within Groups	1561.057	84	18.584		
	Total	1588.805	85			

2.3.2 Group Differences in Baseline Desire

One-way analyses of variance were carried out with *Order of Cue Presentation* as the between-subjects variable to test group differences in baseline desire for alcohol, measured by the DAQ before cue exposure. No significant differences were found, indicating that both groups were comparable in their baseline (resting) desire for alcohol. A summary of descriptive statistics and the results of the analyses of variance can be found in Table 2-3 and Table 2-4.

Table 2-3. Baseline Desire for Alcohol for *Order* of Cue Presentation Groups and across all Participants

DAQ Factor	Order of Cue Presentation	Mean	Standard Deviation	*N*
Desire total	alcohol/soft	50.0	11.3	44
	soft/alcohol	50.4	12.3	42
	total	50.2	11.7	86
DAQ 1 *Mild Intentions and*	alcohol/soft	5.1	1.3	44
Positive Reinforcement	soft/alcohol	5.0	1.3	42
	total	5.1	1.3	86
DAQ 2 *Strong Intentions*	alcohol/soft	2.1	1.1	44
and Desires	soft/alcohol	2.2	1.3	42
	total	2.2	1.2	86
DAQ 3 *Negative*	alcohol/soft	2.6	1.1	44
Reinforcement	soft/alcohol	2.6	1.1	42
	total	2.6	1.1	86
DAQ 4 *Control over*	alcohol/soft	5.4	1.5	44
Drinking	soft/alcohol	5.5	1.5	42
	total	5.5	1.5	86

Table 2-4. One-Way Analyses of Variance on Baseline Desire Variables for the Independent Variable *Order* of Cue Presentation

Dependent Variable	Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Total Desire Score	Between Groups	2.741	1	2.741	0.020	0.889
	Within Groups	11659.643	84	138.805		
	Total	11662.384	85			
DAQ 1 *Mild Intentions*	Between Groups	0.009	1	0.009	0.006	0.940
Positive Reinforcement	Within Groups	139.005	84	1.655		
	Total	139.015	85			
DAQ 2 *Strong*	Between Groups	0.130	1	0.130	0.089	0.766
Intentions and Desires	Within Groups	123.253	84	1.467		
	Total	123.384	85			
DAQ 3 *Negative*	Between Groups	0.020	1	0.020	0.017	0.897
Reinforcement	Within Groups	102.325	84	1.218		
	Total	102.346	85			
DAQ 4 *Control over*	Between Groups	0.342	1	0.342	0.157	0.693
Drinking	Within Groups	182.266	84	2.170		
	Total	182.608	85			

2.3.3 Cue Exposure and Desire for Alcohol

Because no significant differences were detected in the baseline desires to drink across *Order* conditions (see ANOVA Table 2-4), there was no need to correct the soft and alcohol exposure desire scores for baseline differences.

Mixed Analyses of Variance were carried out on the five dependent variables (total DAQ score and 4 factors, as described in 2.2.2 Stimuli and Measures) with the within-subjects variable *Cues* (2 levels: alcoholic drink cues, soft drink cues) and the between-subjects variable *Order* of Cue Presentation (2 levels: alcohol/soft, soft/alcohol).

The differences between soft drink cue exposure responses and alcohol cue exposure responses were significant on *all* DAQ factors:

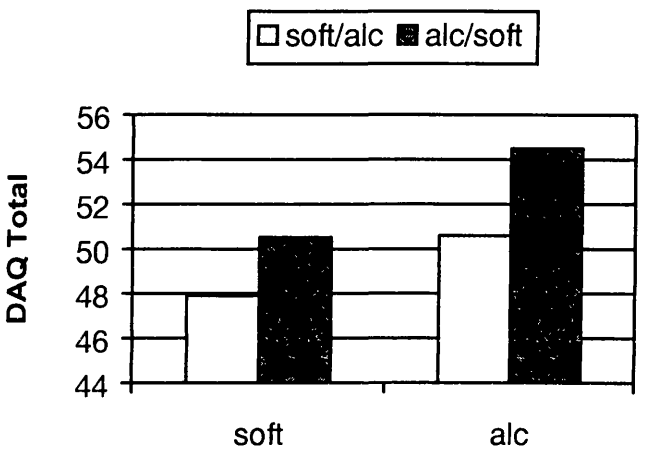
- ✧ the total DAQ score, $F(1, 84) = 13.470$, $p = .001$, as presented in Figure 2-3 and Table 2-6,
- ✧ factor 1 (*Mild Intentions and Positive Reinforcement*), $F(1, 84) = 13.306$, $p = .001$, as shown in Figure 2-4 and Table 2-7,
- ✧ factor 2 (*Strong Intentions and Desires*), $F(1, 84) = 12.894$, $p = .001$, as depicted in Figure 2-5 and Table 2-8,
- ✧ factor 3 (*Negative Reinforcement*), $F(1, 84) = 11.076$, $p = .001$, as shown in Figure 2-6 and Table 2-9, and
- ✧ factor 4 (*Control over Drinking*), $F(1, 84) = 8.470$, $p = .005$, as presented in Figure 2-7 and Table 2-10.

In summary, desire for alcohol was significantly higher on factor 1, 2 and 3, and feelings of control over drinking (factor 4) significantly decreased after alcohol exposure. A summary of the significant within-subject effects' mean desire scores after alcohol and soft drink exposure can be found in Table 2-5.

Table 2-5. Mean DAQ Responses after Alcohol and Soft Drink Exposure

DAQ Factor	Cue Exposure Group	Group Mean	Standard Deviation	*N*
Desire Total	alcohol	52.6	12.8	86
	soft	49.2	11.8	86
DAQ 1 *Mild Intentions + Positive Reinforcement*	alcohol	5.3	1.3	86
	soft	4.9	1.4	86
DAQ 2 *Strong Intentions and Desires*	alcohol	2.5	1.4	86
	soft	2.2	1.3	86
DAQ 3 *Negative Reinforcement*	alcohol	2.7	1.2	86
	soft	2.4	1.0	86
DAQ 4 *Control over Drinking*	alcohol	5.3	1.6	86
	soft	5.6	1.5	86

No main effects for the *Order* of Cue Presentation were found for any of the DAQ factors, nor were any interactions between within- and between-subjects variables. The order of stimulus presentation did not influence desire ratings. ANOVA results for all DAQ factors can be found in Tables 2-6 to 2-10.

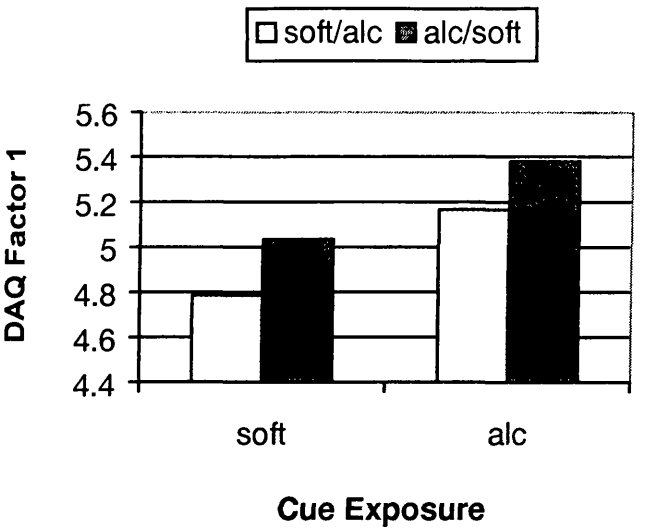


Cues: F(1, 84) = 13.470, p = .001; Order: F(1, 84) = 1.705, p = .195
Cues x Order: F(1, 84) = 0.487, p = .487

Figure 2-3. DAQ mean total scores for the *Order* of Cue Presentation after exposure to soft drink cues and after exposure to alcohol cues

Table 2-6. Analysis of Variance for Total Desire Score

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Tests of Within-Subjects Effects					
Cues	474.424	1	474	13.470	**0.001**
Cues* x *Order	17.168	1	17	0.487	0.487
Error(*Cues*)	2958.443	84	35		
Tests of Between-Subjects Effects					
Order	453.942	1	453.942	1.705	0.195
Error	22369.250	84	266.301		

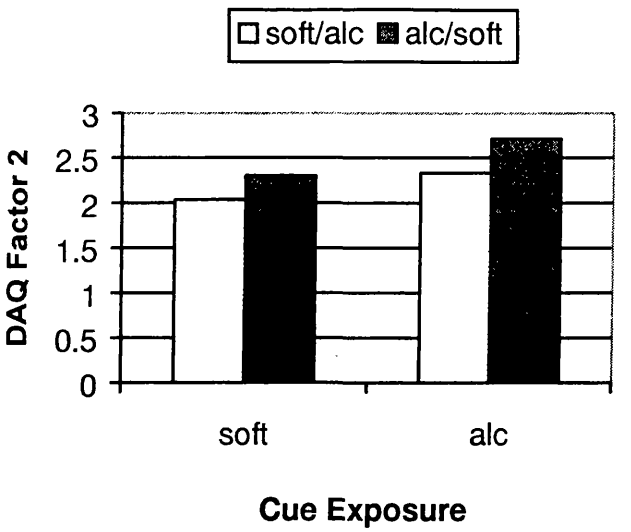


Cues: $F(1, 84) = 13.306$, $p = .001$; *Order:* $F(1, 84) = 0.730$, $p = .395$
Cues x Order: $F(1, 84) = 0.030$, $p = .864$

Figure 2-4. DAQ Factor 1 *Mild Intentions and Positive Reinforcement* mean scores for the *Order* of Cue Presentation after exposure to soft drink cues and after exposure to alcohol cues

Table 2-7. Analysis of Variance for DAQ Factor 1 *Mild Intentions and Positive Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Tests of Within-Subjects Effects					
Cues	5.687	1	5.687	13.306	**0.001**
Cues* x *Order	0.013	1	0.013	0.030	0.864
Error(*Cues*)	35.903	84	0.427		
Tests of Between-Subjects Effects					
Order	2.297	1	2.297	0.730	0.395
Error	264.511	84	3.149		

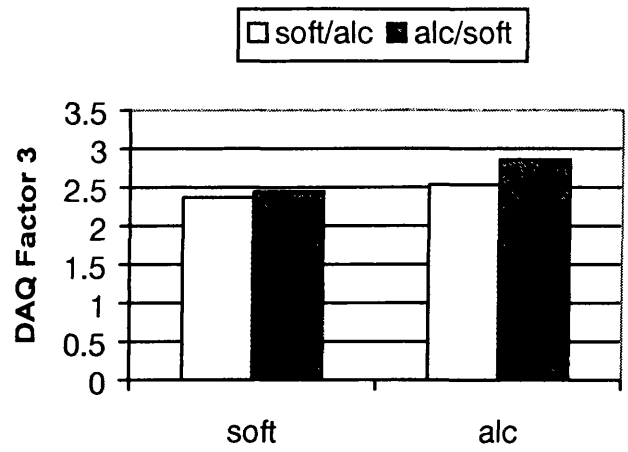


Cues: $F(1, 84) = 12.894$, $p = .001$; *Order:* $F(1, 84) = 1.406$, $p = .239$
Cues x Order: $F(1, 84) = .321$, $p = .573$

Figure 2-5. DAQ Factor 2 *Strong Intentions and Desires* mean scores for the *Order* of Cue Presentation after exposure to soft drink cues and after exposure to alcohol cues

Table 2-8. Analysis of Variance for DAQ Factor 2 *Strong Intentions and Desires*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Tests of Within-Subjects Effects					
Cues	5.366	1	5.366	12.894	**0.001**
Cues* x *Order	0.134	1	0.134	0.321	0.573
Error(*Cues*)	34.958	84	0.416		
Tests of Between-Subjects Effects					
Order	4.433	1	4.433	1.406	0.239
Error	264.887	84	3.153		

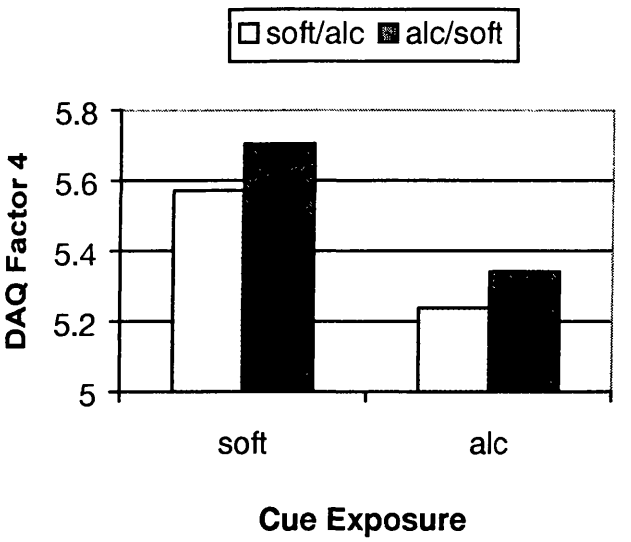


Cues: $F(1, 84) = 11.076$, $p = .001$; *Order:* $F(1, 84) = 0.807$, $p = .372$
Cues x Order: $F(1, 84) = 2.159$, $p = .145$

Figure 2-6. DAQ Factor 3 *Negative Reinforcement* mean scores for the *Order* of Cue Presentation after exposure to soft drink cues and after exposure to alcohol cues

Table 2-9. Analysis of Variance for DAQ Factor 3 *Negative Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Tests of Within-Subjects Effects					
Cues	3.558	1	3.558	11.076	**0.001**
Cues* x *Order	0.693	1	0.693	2.159	0.145
Error(*Cues*)	26.985	84	0.321		
Tests of Between-Subjects Effects					
Order	1.739	1	1.739	0.807	0.372
Error	181.102	84	2.156		



Cues: $F(1, 84) = 8.470$, $p = .005$; *Order:* $F(1, 84) = 0.137$, $p = .712$
Cues x Order: $F(1, 84) = 0.016$, $p = .900$

Figure 2-7. DAQ Factor 4 *Control over Drinking* mean scores for the *Order* of Cue Presentation after exposure to soft drink cues and after exposure to alcohol cues

Table 2-10. Analysis of Variance for DAQ Factor 4 *Control over Drinking*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Tests of Within-Subjects Effects					
Cues	5.219	1	5.219	8.470	**0.005**
Cues* x *Order	0.010	1	0.010	0.016	0.900
Error(*Cues*)	51.758	84	0.616		
Tests of Between-Subjects Effects					
Order	0.598	1	0.598	0.137	0.712
Error	367.193	84	4.371		

2.4 Discussion

The reported experiment was designed to explore subjective cue reactivity in social drinkers measured by the multi-dimensional Desire for Alcohol Questionnaire (DAQ), employing a within-participants design which counterbalanced personally relevant alcohol and neutral drink stimuli. It was possible to demonstrate significant alcohol cue effects on the DAQ total score and all DAQ factors in a social drinking population after cue exposure. Desire scores were higher after alcohol cue exposure than after soft drink exposure. Exposure had the reverse effect on feelings of *Control over Drinking*; after alcohol exposure feelings of control decreased.

The current experiment adopted a novel approach to measuring desire for alcohol by using a multi-dimensional instrument with known psychometric properties. Through this approach, it was possible to demonstrate that *different aspects* of subjective desire reactivity are responsive to cue manipulation.

On a general level, these results confirm the findings from previous studies (e.g. Greeley et al., 1993) that alcohol cues are able to elicit subjective craving responses in social drinkers using similar cues for alcoholic drinks (sight, smell and taste of alcoholic drink).

The total desire score displays higher reactivity after alcohol cue exposure than after exposure of the neutral soft drink stimulus. This finding is not inconsistent with Glautier & Tiffany's (1995) claim that uni-dimensional representations are likely to be insensitive and unreliable for exploring desire reactivity because the DAQ total score explicitly integrates data from different desire dimensions (i.e. all 14 DAQ items) onto a single representation (i.e. the total score). This is quite different from the studies that have been criticised for using *one* single subjective judgement cast onto *one* numerical score (e.g. McCusker & Brown, 1990), or for using *one* analogue scale with a single response to rate desire to drink (e.g. Greeley et al., 1993).

The analysis of the data from the desire subscale *Strong Intentions and Desires* also shows significantly more reactivity in response to alcohol cues than to soft drink cues. This scale represents 'classic' desire items, like "My desire to drink right now seems overwhelming". One would expect this scale to show reactivity because its items relate mostly to the single-item representations used in previous studies.

More interestingly, the subscales *Mild Intentions and Positive Reinforcement* and *Negative Reinforcement* also demonstrate higher reactivity after cue alcohol exposure. The items on those subscales, rather than representing sheer desire to drink, represent cognitions of positive outcome expectancies (Goldman, Christiansen, Brown & Smith, 1991; Leigh, 1989; Leigh & Stacy, 1991). Both positive and negative reinforcement have positive outcomes and therefore increase the frequency of behaviour. Surprisingly, the literature on alcohol outcome expectancies has rarely crossed path with classic cue reactivity theory (e.g. Bradizza, Stasiewicz & Maisto, 1994). This might come as a surprise because Marlatt and Gordon's (1985) well-known theory of the high-risk relapse situation proposes increases in positive outcome expectancies and decreases in self-efficacy when an alcoholic is confronted with a high-risk situation. The high-risk situation is just another label for a time when a person encounters a number of alcohol cues formerly associated with alcohol ingestion.

DAQ factor 4, *Control over Drinking*, was found to have face validity in a alcoholic population only (Love et al., 1998). One would not expect a social drinking population to respond on such a factor after cue exposure. Social drinkers are considered to be in control of their drinking, and for this reason they have no drinking problems. Nevertheless, the result clearly shows that social drinkers' feelings of control can also be influenced by cue manipulations. However, this finding does not mean that a decrease in control feelings will lead to drinking behaviour. Overall the baseline mean score on the *Control* scale was 5.5 and decreased to about 5.2 after alcohol cue exposure. On a 7-point Likert scale this still represents the "more in control" half of the scale.

Unexpectedly, all DAQ factors, i.e. desire aspects, displayed alcohol reactivity. After closer inspection of the experimental design used, this result appears less curious. An effort had been made to ensure that the experimental cues were of great personal relevance for all participants. Therefore, the alcohol cues used were very salient stimuli. Additionally, the within-subjects design used in this experiment is a very powerful design, because each participant's response to the alcohol cues is compared with the same participant's response to the soft drink cues. Therefore the DAQ revealed changes in participants' desire following alcohol cue exposure which a less powerful between-subjects design might not have picked up. However, having established that all DAQ factors respond to alcohol cues, we are yet to find out which

aspect of subjective desire for alcohol is the most cue-responsive and which alcohol cues are the most salient.

The second research question of this experiment was concerned with the influence of the order of cue presentation. According to a experiment by Monti et al. (1987) the effects of order of cue presentation might influence the results because of a lowering of reactivity over the time of the experiment. It was decided to counterbalance the order of cue exposure stimuli (soft-alcohol versus alcohol-soft) in order to investigate if subjective feelings of desire would also be subject to such flattening of responses over time. No order effects were detected in the data. This result encourages designs which favour a counterbalanced order of presentation because it ensures internal validity of the experiment and does not confound drug-salience of the cue with time spent in the laboratory (Carter & Tiffany, 1999b).

The current experiment has demonstrated alcohol cue reactivity on *different* aspects of subjective desire in *social drinkers*. This result emphasises the need to employ multi-dimensional instruments to assess subjective cue responses. The DAQ provides a sensitive measure for investigating the different desire aspects of cue reactivity in social drinkers.

The next research questions should lead us to further explore the different aspects of subjective desires for alcohol, and investigate which aspects of desire to drink are the most cue responsive ones.

3 Experiment Two: Desires for Alcohol and Outcome Expectancies as Measures of Cue Reactivity in Social Drinkers

The previous experiment demonstrated subjective cue reactivity in social drinkers on a multi-dimensional measure of desire for alcohol (DAQ). Two DAQ scales (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*) were described as positive outcome expectancies scales but were found to be very limited with respect to the range of positive outcome expectancies that are usually assesed in alcohol motivation research. The current experiment extended the range of outcome expectancies measured by employing the Alcohol Expectancy Questionnaire (AEQ: Brown, Christiansen & Goldman, 1987) and the Negative Alcohol Expectancy Questionnaire (NAEQ: Jones & McMahon, 1994).

Eighty-eight social drinkers volunteered to participate in a taste preference experiment. During the taste preference assessment exercise, participants were systematically exposed to the sight, smell and taste of either soft or alcoholic drinks. Subjective responses were recorded after exposure using the DAQ, AEQ and NAEQ. Analyses of covariance were conducted on the data, controlling for the effects of *Quantity* of alcohol consumption.

Subjective alcohol cue responses were found for the total DAQ score and two of the four DAQ subscales. The DAQ subscale *Controllability* demonstrated an alcohol cue response but only when testing on the DAQ was preceded by testing on the expectancy questionnaires. There were no significant alcohol cue responses for expectancy as measured by the AEQ or NAEQ. However, measures of positive outcome expectancies were found to be moderately related to desires to consume alcohol.

It was hypothesised that the decrease of perceived control over drinking after alcohol cue exposure and expectancy questionnaires could be due to either (i) the effect of a priming dose of alcohol, or (ii) the effect of cognitive cues associated with alcohol (i.e. expectancy items). Both explanations could have substantial implications in an applied setting.

3.1 Introduction

The first experiment in this thesis, found evidence for alcohol cue reactivity on a multi-dimensional desire measure in social drinkers by employing a within-subject design. The Desire for Alcohol Questionnaire (DAQ) was shown to be a sensitive measure for different desire aspects of cue reactivity that had been identified through previous factor analytic studies in social drinkers (Clark et al., 1996; Love, James and Willner, 1998). Personal relevant alcohol cues elicited responses on all DAQ factors, which represent the various desire aspects. It will be the aim of this chapter to further explore the scales of the DAQ and the different aspects of desire by effectively extending some of the DAQ scales through the use of additional measurement. The theoretical concept behind this idea will be discussed now.

In the previous chapter, the DAQ scales of *Mild Intentions and Positive Reinforcement* and *Negative Reinforcement* were described as comprising items that were essentially positive outcome expectancies which were respectively positively or negatively reinforcing. Those particular DAQ scales, however, are very limited with respect to the range of positive outcome expectancies that are usually used in alcohol motivation research.

Outcome expectancies and desires for alcohol are both representations of the construct of motivation to drink and have both been associated with alcohol consumption decisions and behaviour. The role of outcome expectancies in drinking decisions will be outlined now.

It is claimed that negative outcome expectancies can represent the motivation to restrain from drinking through cognitions about the negative effects of alcohol (Adams & McNeil, 1991). Such negative alcohol outcome expectancies are cognitive structures in the long-term memory that are formed through an individual's direct and indirect experiences with alcohol (Jones & McMahon, 1998). By learning about the negative effects of alcohol, an individual might expect to "get a headache upon drinking" or to "get into debt" when alcohol is consumed. Expecting a negative outcome from alcohol consumption will cause restraint in drinking.

Similarly, learning about the positive outcomes of alcohol consumption gives rise to positive alcohol outcome expectancies. Examples might be "expecting to be more relaxed upon drinking" or "expecting to be more sociable". In contrast to negative

alcohol outcome expectancies, positive outcome expectancies promote the consumption of alcohol. Positive expectancies are seen as determinants of drinking because they are more closely associated with cues in the immediate drinking environment (Stacy, Widaman & Marlatt, 1990). Negative expectancies arising from often delayed negative consequences of drinking on the other hand are determinants of the quantity consumed and the decision to end a drinking session, i.e. the restraint of drinking (Jones & McMahon, 1998).

Research has supported this view by demonstrating that outcome expectancies influence the frequency and quantity of alcohol consumption (Goldman, Brown, Christiansen, 1987). Alcohol outcome expectancies discriminate between heavy and light drinkers (Southwick, Steele, Marlatt & Lindell, 1981) and between problem and non-problem drinkers (Brown, Goldman, & Christiansen, 1985). An association between positive and negative expectancy and consumption was detected in cross-sectional studies (Leigh, 1989; McMahon, Jones & O'Donnell, 1994) and imposing a causal explanation was promoted, but longitudinal studies have strongly suggested that expectancy does indeed predominantly cause consumption (Kidorf, Lang & Pelham, 1990; Sher, Wood, Wood & Raskin, 1996).

Although both negative and positive expectancy types influence drinking decisions (Cox & Klinger, 1990), path analytic studies (Stacy et al., 1990) have "supported the distinction between positive and negative alcohol expectancies as differential, prospective predictors of alcohol use" (p. 926). Recent evidence (Stacy et al., 1990) has shown that positive and negative expectancies are discrete constructs with their own properties, and not a single bipolar construct as originally thought by early expectancy and attitude researchers (e.g. Southwick, Steele, Marlatt & Lindell, 1981).

Alcohol cognitions such as outcome expectancies have attracted most research interest in the last decade (Goldman et al., 1991; Goldman, Del Boca & Darkes, 1999; Jones & McMahon, 1998; Leigh, 1989; Leigh & Stacy, 1991). A social learning model of drug use (Bandura, 1977; Marlatt & Gordon, 1985; Wilson, 1987) has provided a common framework, incorporating cognitive constructs such as outcome expectancies and self-efficacy, within which varying alcohol consumption can be explained. Common frameworks build on fewer assumptions than several different frameworks and are therefore considered a more elegant choice (Jones & McMahon, 1998). This would mean that knowledge about alcohol cognitions could

be extrapolated from one point to another on a continuum of alcohol use that varies from social drinking to alcohol abuse. By using a common framework more knowledge about alcohol cognitions can be gained and by looking at different points of the continuum a more complete picture about the role of alcohol cognitions can be disclosed.

Although social learning theory has provided a common framework within which drinking behaviour can be explained by individuals' outcome expectancies, it has also attracted criticism. These criticisms will be outlined now, so that they can serve as an introduction to explain how the incorporation of elements from other theories might be the way forward in correcting current shortcomings.

Social learning theory's reports about the role of cognitions lack explicit descriptions about the processes by which cognitions influence behaviour (Marlatt & Gordon, 1985; Wilson, 1987). Therefore social learning theory has not been able to provide clear, testable mechanisms by which cognitions influence behaviour. A second criticism of social learning theory is that self-efficacy or outcome expectancies are seen as primary determinants of whether an individuals drinks or not. Self-efficacy and outcome expectancies may be a good predictor of behaviour but they are not the cause of behaviour (Hawkins, 1992). A third difficulty is that reactions to environmental alcohol stimuli are viewed as self-generated (Wilson, 1987) by thoughts or activated by learned expectations, and therefore social learning theory cannot account for the relationships found between cognitions and reactivity to alcohol and drug cues (Bradizza, Stasiewicz & Maisto, 1994). There is little reference in social learning theory to research that showed reactivity to environmental stimuli associated with alcohol consumption.

Reactivity to alcohol and drug cues stands at the centre of conditioning models of drug use and dependence. The classical conditioning model of drug use and relapse, proposes that through classical conditioning, a form of learning, environmental stimuli can acquire the ability to elicit conditioned drug responses which serve to increase the motivation for drug use (Glautier, 1994). Cue exposure and response prevention treatment techniques (e.g. Blakey & Baker, 1980; Glautier & Drummond, 1994b; Rankin, Hodgson, Stockwell, 1983) underlie the Pavlovian principle of extinction and have been applied to the assessment and treatment of alcoholism and other substance use disorders. Classical conditioning approaches have originally failed to incorporate cognitive mechanisms that cannot be neglected in a

contemporary explanation of influences on drug use behaviour. Behaviour-analytic approaches have acknowledged that cognitive events may precede alcohol consumption (Biglan, 1987; Vuchinich & Tucker, 1983) but do not view them as mediators between environmental events and overt behaviour (Vuchinich & Tucker). However, in recent years behaviouristic theories have acknowledged the need to extend their representation of cue reactivity beyond traditional approaches. The introduction to this thesis has already pointed to such developments in cue reactivity theory. Bradizza, Stasiewicz and Maisto (1994, p.15) expressed this view by writing: "Recently, cue exposure research has been broadened to incorporate elements of social learning theory in an attempt to explain how cognitive constructs, such as self-efficacy and positive outcome expectations, mediate between environmental cues and affective, behavioral and physiological reactivity."

From a social learning point of view, this can be turned around and cue reactivity principles can be viewed within a social learning context. Expectancies, earlier described as cognitive structures in long term memory, will have similar properties to any other long term memory structure (Dunn & Goldman, 1996; Weingardt, Stacy & Leigh, 1996) and their accessibility should impact on alcohol consumption decision making (Earleywine, 1995). Cognitive structures in long-term memory can be made more accessible by priming (Glautier & Spencer, 1999). Alcohol cues might be viewed as such priming stimuli that make outcome expectancies more accessible, and therefore impact on consumption decisions.

In the discussion of chapter two of this thesis it was noted that until recently, social learning theory had rarely crossed path with cue reactivity theory. Marlatt and Gordon's (1985) model of the high-risk situation, which proposes the high-risk situation as a threat to the alcoholic's self-control, could simply be seen as a different terminology for a set of alcohol cues associated with consumption (Powell, Gray & Bradley, 1993). Marlatt and Gordon's model predicts that individuals with high positive outcome expectancies for the effects of drug use show greater desire (or craving) for drug use. Those people would also be expected to show greater cue reactivity and are at greater risk for relapse for this reason.

Powell, Gray and Bradley (1993) confirmed those predictions in opiate addicts by showing a significant correlation between craving and positive outcome expectancies. Cooney, Baker, Pomerleau and Josephy (1984) found that salivary

reactivity was correlated with positive outcome expectancies for alcohol, but they did not find urge reactivity to be related to positive outcome expectancies.

In this context, surprisingly few studies of alcohol cue reactivity have employed outcome expectancy as a dependent variable and those that have, have used inappropriately constructed (Cooney, Gillespie, Baker & Kaplan, 1987) or inappropriately limited (Fromme, Katz, D'Amico, 1997) expectancy representations. Cooney et al. have used the Alcohol Effects Questionnaire (Southwick, Steele, Marlatt & Lindell, 1981) as a dependent measure, which represents outcome expectancies as bipolar constructs. Previous studies however, have shown that positive and negative outcome expectancies are discrete constructs (Stacy et al., 1990). Fromme et al. have limited their study to the effects of alcohol on perceived consequences of risk taking. In Experiment One of this thesis, two DAQ scales (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*, Clark et al., 1996), which can be described as limited positive expectancies scales, demonstrated alcohol cue reactivity. The reactivity shown on these limited DAQ expectancy scales in the previous experiment suggests that alcohol outcome expectancies are responsive to cue manipulation.

To gain a better understanding of the extent to which outcome expectancies are alcohol cue reactive, the current experiment takes advantage of the wide ranging items of positive and negative expectancy provided by the Alcohol Expectancy Questionnaire (AEQ: Brown, Christiansen & Goldman, 1987) and Negative Alcohol Expectancy Questionnaire (NAEQ: Jones & McMahon, 1994). The experiment aims to investigate the effect of sight, smell and taste alcohol cues on alcohol outcome expectancies and desires to drink using a between-subjects design.

3.2 Method

3.2.1 Participants

Eighty-eight university students (41 female, 47 male) took part in a 'taste preference experiment' advertised throughout the University of Glasgow for which they were paid £3. Participants were excluded from the experiment if they (i) have ever been treated for, or diagnosed with an alcohol problem; (ii) were under 18 years of age; (iii) had consumed alcohol on the day of the experiment or (iv) were possibly pregnant. Participation was based on voluntary, informed consent. A copy of the consent form is included in the appendix (Appendix A.05).

The participants were, on average, 22.8 years of age (*SD* = 4.2). They reported a mean consumption of 25.2 units of alcohol (*SD* = 20.2) in 3.7 days (*SD* = 1.8) of the week prior to the experiment. Participants stated that they have been drinking at the reported levels for *M* = 3.9 years (*SD* = 3.2). Twenty-eight participants (32%) reported a family history of alcoholism (i.e. a family member of the participant with a drinking problem); 13 participants (15%) said they had an alcoholic parent.

3.2.2 Design

A 2x2 between subjects design was used for the cue exposure experiment, with the between-subjects factors *Drink Cues* (2 levels: soft [S] versus alcoholic [A] drink cues) and *Order* of Questionnaire Presentation (2 levels: desire questionnaire / expectancy questionnaires [DE] versus expectancy questionnaires / desire questionnaire [ED]). Participants were randomly assigned to the four experimental cells resulting from this design: S-DE, S-ED, A-DE, A-ED (see Table 3-1 for a summary of the experimental groups). During the completion of a stooge 'taste preference' questionnaire, participants were exposed to sight, smell and taste stimuli of soft and alcoholic drinks, and were then assessed on the dependent variables, desire to drink alcohol and alcohol outcome expectancies.

Table 3-1. Experimental Cells and Participant Numbers (*n*) in the 2x2 (*Drink Cue* x *Order*) Between-Subjects Design

		Drink Cues	
		Soft Drink Cues (S)	Alcohol Cues (A)
Order of Assessment	desire/ expectancy (DE)	S – DE *n* = 22	A - DE *n* = 22
	expectancy/ desire (ED)	S – ED *n* = 22	A – ED *n* = 22

3.2.3 Cue Exposure Stimuli and Measures

For the cue exposure, participants had a choice of one from three drinks, either canned soft drinks (Coke, Irn Bru, Tango) or alcoholic drinks in small bottles (Miller, Budweiser, Becks), depending on which experimental group they had been placed in. A stooge taste preference questionnaire, applicable to both soft and alcoholic drinks, served two purposes. Firstly, it provided a theme for the experiment so if participants would respond to the anticipated demands in the experimental situation, the taste preference questionnaire would present such demands, but not the desire questionnaire. Secondly, the taste preference questionnaire would ensure that participants' attention would be directed towards the alcohol cues. And thirdly, it presented a structured cue exposure schedule, directing the participants' attention to the drink cues by asking questions about the look, smell and taste of the drink. A copy of the taste preference questionnaire can be found in the appendix (Appendix A.06). The cue exposure was designed to last 10 min.

Subjective cue responses were assessed with the short version of the Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996). The desire scores of the 14 items were arithmetically combined to make up the four DAQ factor scores and one total score:

(1) *Mild Desires and Positive Reinforcement*

(2) *Strong Intentions and Desires to Drink*

(3) *Negative Reinforcement*, and

(4) *Control over Drinking*, and additionally

(5) a total desire score.

The DAQ was introduced in detail in chapter two of this thesis (2.2.2 Stimuli and Measures). A copy of the DAQ is included in the appendix (Appendix A.02).

Alcohol expectancies were assessed using the Negative Alcohol Expectancy Questionnaire (NAEQ: Jones & McMahon, 1994, 1995) and the positive Alcohol Expectancy Questionnaire (AEQ: Brown, Christiansen & Goldman, 1987). A copy of the NAEQ and AEQ and the associated instructions is incorporated in the appendix (Appendix A.07, A.08 and A.09, respectively). Both questionnaires will be introduced in detail in the next section.

An adaptation of the Timeline Follow Back procedure (Sobell & Sobell, 1992) was used to collect information on the previous week's alcohol consumption (quantity and frequency measures). Demographic measures were taken. A copy of Timeline-Follow-Back drinking diary and the demographic questions asked can be found in the appendix (Appendix A.03 and A.04).

3.2.4 Positive and Negative Alcohol Expectancy Questionnaires

The Negative Alcohol Expectancy Questionnaire (NAEQ) and the positive Alcohol Expectancy Questionnaire (AEQ) are widely used instruments to assess alcohol outcome expectancies. There are 60 items on the NAEQ which are cast onto 3 temporal subscales representing negative expectancies that:

(i) surround the period of consumption; subscale *Same Day* (e.g. " I would become argumentative")

(ii) relate to the following day; subscale *Next Day* (e.g. " I would have a hangover")

(iii) relate to the longer term (months and years) should consumption continue at the current level; subscale *Continued Drinking* (e.g. "If I continue to drink at this level I would damage my liver")

The AEQ features 64 items cast onto 6 subscales that represent the positive effects of drinking:

(i) *Positive Global Changes in Expectancy* (e.g. "Drinking makes the future look brighter")
(ii) *Sexual Enhancement* (e.g. "I feel sexier after I have had a few drinks")
(iii) *Social and Physical Pleasure* (e.g. "Having a few drinks is a nice way to celebrate a special occasion")
(iv) *Increased Social Assertiveness* (e.g. "Drinking gives me more confidence in myself")
(v) *Relaxation and Tension Reduction* (e.g. "Alcohol enables me to sleep more easily")
(vi) *Arousal and Interpersonal Power* "e.g. " I feel powerful when I drink as if I can really influence others to do as I want")

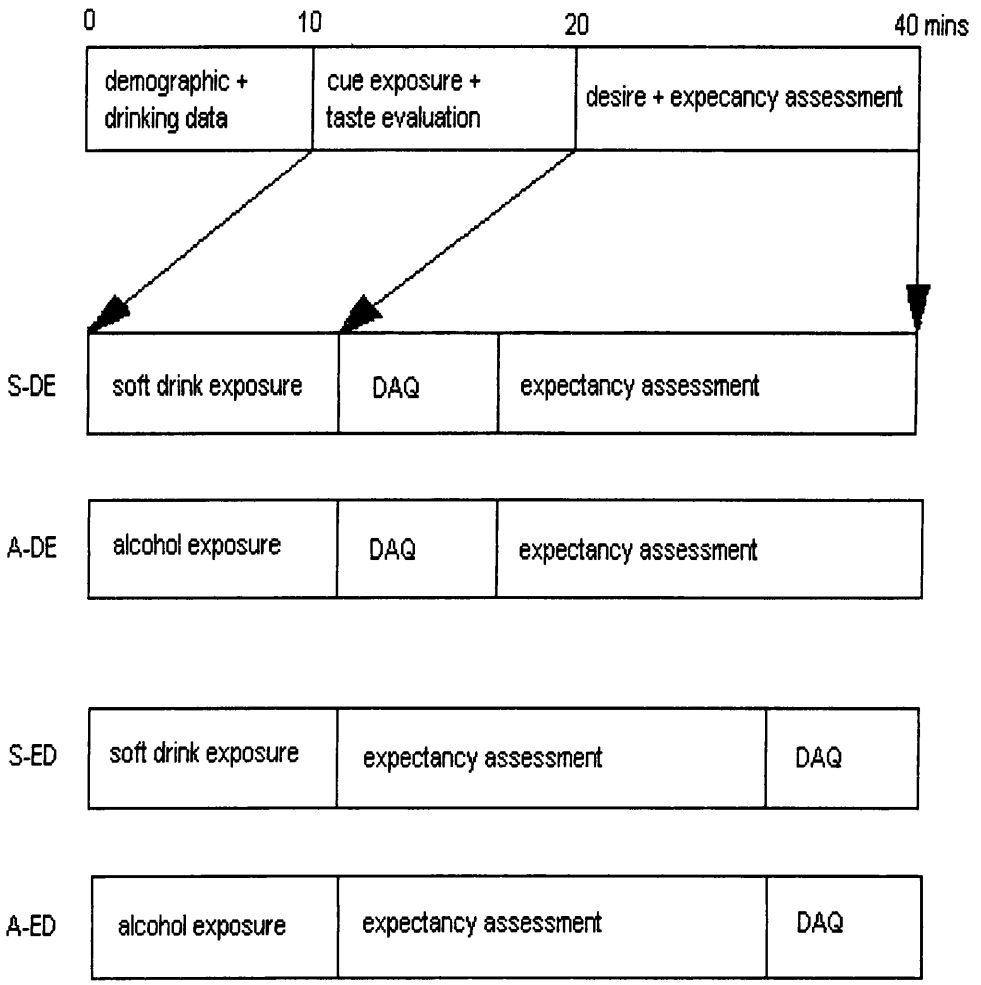
Responses to NAEQ and AEQ items were measured on a 5-point Likert scale ranging from 1 (*highly unlikely*) through 3 (*possible*) to 5 (*highly likely*). There were no reversed items.

3.2.5 Procedure

Before the experiment, participants were informed that the 'taste preference' experiment may or may not involve drinking up to one unit of alcohol (equivalent to 8 g of absolute alcohol). They agreed to take part in the experiment by signing a consent form.

Participants were randomly assigned to one of the four experimental groups (S-DE, S-ED, A-DE, A-ED) and were invited to make a choice of their preferred drink according to group allocation (alcoholic or soft drink). The participants started by completing the drinking diary and demographic questions. Afterwards they were

presented with their chosen drink and asked to open and pour it into the provided glass. It was explained that the taste preference questionnaire would require them to smell and sample the drink, and that smelling and sampling it would help them to answer the questions most appropriately. The questions in the stooge taste preference questionnaire surround the appearance, the smell and the taste of the drink and therefore participants were required to smell and sample the drink repeatedly while completing the questions. Once the taste preference questionnaire was completed, participants were asked to complete the desire and expectancy questionnaires. Half the participants filled in the DAQ first; the other half filled in the expectancy questionnaires first; the order of negative and positive expectancy questionnaires was counterbalanced. There was no time limit set for completing these questionnaires, and participants could consume as little or as much of their drink as they wished (up to one unit of alcohol for alcoholic drinks). A schematic description of the design and procedure used during this experiment can be found in Figure 3-1. On completion of the questionnaires, participants were debriefed and paid their fee.



Design: Cue Exposure Experiment

Figure 3-1. Schematic description of the experimental procedure: Experiment Two

3.3 Results

All participants finished at least half the drink during the 30 minutes of the experiment. More participants in the alcohol group had finished their alcoholic drink (36 participants, 81%) than participants in the soft drink group had finished their soft drink (26 participants, 59%) by the end of the experiment. Table 3-2 states how much drink was left by the end of the experiment by the participants in each experimental group.

Table 3-2. Amount of Drink Left after the Experiment by Experimental Groups

Drink Cues	how much drink left	Order of Assessment			
		desire/expectancy	expectancy/desire	Total	%
soft drink	Nothing	**12**	**14**	**26**	**59**
	1/4	6	4	10	23
	1/2	4	4	8	18
	total	22	22	44	100
alcoholic drink	Nothing	**20**	**16**	**36**	**82**
	1/4	0	3	3	7
	1/2	2	3	5	11
	total	22	22	44	100

2 x 2 analyses of variance (SPSS for Windows 7.0) were carried out with the independent variables Drink *Cues* (alcohol [A] versus soft drink [S] cues) and *Order* of Questionnaire Presentation (DAQ/Expectancy [DE] versus Expectancy/DAQ [ED]). A significance level of $\alpha = .05$ was adopted for all tests. All tests were 2-tailed.

3.3.1 Group Differences in Alcohol Consumption

To test if randomisation had produced groups with similar demographic characteristics and alcohol conditioning history, 2x2 analyses of variance were carried out with *Age*, *Quantity* and *Frequency* of alcohol consumed per the week as dependent variables.

No main effects for *Order* or *Cues*, or an interaction *Order* x *Cues* were found for *Age*, $Fs(1, 83) < 1.1$, $ps > .05$ (for a summary of all ANOVA results, see Table 3-3). Main effects were detected for the *Order* of Questionnaire Presentation on the variables of alcohol consumption, *Quantity* (Q) and *Frequency* (F) of alcohol per week, $Fs(1, 84) = 4.010$ and 5.503, $ps = .048$ and .021, respectively (for a summary of the ANOVA results, see Table 3-4 and Table 3-5.). This means that the participants who received the expectancy questionnaires before the desire questionnaire had been drinking significantly more during more drinking sessions in the week prior to the experiment ($M_Q = 29.4$ units, $SD_Q = 20.3$; $M_F = 4.16$ drinking sessions, $SD_F = 1.46$) than the group who received the desire questionnaire first ($M_Q = 21.0$ units, $SD_Q = 19.3$; $M_F = 3.30$ drinking sessions, $SD_F = 1.96$).

Table 3-3. Tests of Between-Subjects Effects (2x2 [*Order* x *Cues*] ANOVA) for the Dependent Variable *Age*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Drink Cues	0.355	1	0.355	0.020	0.889
Order	0.789	1	0.789	0.044	0.835
Drink Cues x Order	19.452	1	19.452	1.078	0.302
Error	1497.771	83	18.045		
Total	46854	87			

Table 3-4. Tests of Between-Subjects Effects (2x2 [*Order* x *Cues*] ANOVA) for the Dependent Variable *Quantity* of alcohol consumption

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Drink Cues	698.909	1	698.909	1.821	0.181
Order	1538.909	1	1538.909	4.010	**0.048**
Drink Cues x Order	865.636	1	865.636	2.256	0.137
Error	32234	84	383.738		
Total	91342	88			

Table 3-5. Tests of Between-Subjects Effects (2x2 [*Order* x *Cues*] ANOVA) for the Dependent Variable *Frequency* of alcohol consumption

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Drink Cues	6.545	1	6.545	2.195	0.142
Order	16.409	1	16.409	5.503	**0.021**
Drink Cues x Order	0.045	1	0.045	0.015	0.902
Error	250.455	84	2.982		
Total	1496	88			

Alcohol consumption is know to be positively correlated with positive outcome expectancies (Brown, Goldman, Inn & Anderson, 1980; Stacy et al., 1990) and with negative outcome expectancies (Jones & McMahon, 1994; Leigh, 1987). Indirectly, as argued in chapter two, the DAQ also represents alcohol outcome expectancies. Desire for alcohol itself is likely to be related to alcohol consumption; whether desire leads to consumption, or consumption leads to desire. These former findings and assumptions can partly be supported by the correlations between consumption and expectancies/desires in the data from this experiment. For a summary of the correlations see Table 3-6. Therefore *Quantity* of alcohol consumed in the week prior to testing will be entered as a *covariate* into the analyses to control for possible influences from the group differences in drinking behaviour.

Table 3-6. Pearson's Correlations *r* between *Quantity* of Alcohol Consumed in the Week prior to the Experiment and Desire for Alcohol and Outcome Expectancies (*N* = 88)

Dependent Variable	Quantity of Alcohol per week	
	r	*p* (2-tailed)
DAQ Total	.223	**.037**
DAQ 1 *Mild Intentions and Positive Reinforcement*	.324	**.002**
DAQ 2 *Strong Intentions and Desires*	.323	**.002**
DAQ 3 *Negative Reinforcement*	.046	.673
DAQ 4 *Control over Drinking*	-.384	**.001**
NAEQ Total	.384	**.001**
NAEQ *Same Day*	.411	**.001**
NAEQ *Next Day*	.300	**.004**
NAEQ *Future*	.278	**.009**
PAEQ Total	.131	.223
PAEQ *Assertiveness*	-.012	.912
PAEQ *Global*	.155	.149
PAEQ *Pleasure*	.367	**.001**
PAEQ *Power*	-.001	.989
PAEQ *Relaxation*	.162	.132
PAEQ *Sex*	.008	.942

3.3.2 The Relationship between Measures of Desires and Outcome Expectancies

The Pearson's correlations presented in Table 3-7 show that the first three DAQ factors correlate moderately with measures of positive outcome expectancies measured by the AEQ. DAQ factor 1 (*Mild Intentions and Positive Reinforcement*) is primarily related to the AEQ subscale *Social and Physical Pleasure* ($p < .01$). DAQ factor 2 and 3 (*Strong Intentions and Desires* and *Negative Reinforcement*) correlate moderately with *Global Positive Expectancies* ($p < .01$). DAQ factor 4 (*Control over Drinking*) is also related to measures of positive and negative outcome expectancies but only correlate mildly with the expectancy subscales.

Table 3-7. Pearson's Correlation Correlations between DAQ Factors and Measures of Outcome Expectancies (AEQ & NAEQ) (N = 88)

	F1DESIRE	F2DESIRE	F3DESIRE	F4DESIRE
NAEQ Total	0.241*	0.392**	0.228*	-0.295**
NAEQ *Future*	0.214*	0.403**	0.181	-0.175
NAEQ *Same Day*	0.327**	0.346**	0.243*	-0.295**
NAEQ *Next Day*	0.101	0.267**	0.172	-0.298**
PAEQ Total	0.247*	0.381**	0.462**	-0.268*
PAEQ *Assertiveness*	0.220*	0.265*	0.394**	-0.259*
PAEQ *Global*	0.230*	**0.452****	**0.518****	-0.313**
PAEQ *Pleasure*	**0.488****	0.387**	0.299**	-0.214*
PAEQ *Power*	0.110	0.261*	0.415**	-0.120
PAEQ *Relaxation*	0.190	0.246*	0.295**	-0.221*
PAEQ *Sex*	-0.015	0.158	0.219*	-0.066

* $p < .05$; ** $p < .01$ (2-tailed)

3.3.3 Desire for Alcohol

Total desire scores and subscale desire scores for each of the four subscales were computed from the item scores of the DAQ. Those five desire scores represented the dependent variables in the 2x2 analyses of covariance (ANCOVA) that were subsequently carried out.

No main effects for the independent variable *Order* of assessment were found for any desire variables. A main effect for *Drink Cues* was found for the DAQ total score. The total DAQ score of the alcohol group (M = 52.9, SD = 10.2) was significantly higher than the total score from the soft drink group (M = 46.3, SD = 10.5), $F(1, 83) = 7.684$, $p = .007$. The covariate *Quantity* did not have a significant influence on the difference between the total DAQ scores of alcohol and soft drink group, $F(1, 83) = 2.137$, $p = .148$. A summary of the ANCOVA results can be found Table 3-8.

Table 3-8. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Total Score

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	227.156	1	227.156	2.137	0.148
Drink Cues	816.732	1	816.732	7.684	**0.007**
Order	71.701	1	71.701	0.675	0.414
Cues x Order	30.654	1	30.654	0.288	0.593
Error	8822.464	83	106.295		
Total	226620.440	88			

The mean score for factor 1 (*Mild Desires and Positive Reinforcement*) was higher for the alcohol group (M = 5.4, SD = 1.3) than for the soft drink group (M = 4.7, SD = 1.6) but failed to reach significance, $F(1, 83) = 3.931$, $p = .051$, when *Quantity* of alcohol as a covariate was controlled for, $F(1, 83) = 6.106$, $p = .016$. All ANCOVA results for DAQ factor 1 can be found in Table 3-9.

Table 3-9. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ factor 1 *Mild Desires and Positive Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	12.634	1	12.634	6.106	**0.016**
Drink Cues	8.132	1	8.132	3.931	**0.051**
Order	3.423	1	3.423	1.654	0.202
Cues x Order	0.540	1	0.540	0.261	0.611
Error	171.727	83	2.069		
Total	2449.578	88			

A significant main effect for *Drink Cue* was found for factor 2 (*Strong Intentions and Desires*), $F(1, 83) = 6.775$, $p = .011$, indicating that the difference between alcohol (M = 2.1, SD = 1.0) and soft drink group (M = 1.5, SD = .8) was unlikely to have arisen due to sampling error. *Quantity* of alcohol was a significant covariate, $F(1, 83) = 6.548$, $p = .012$. The ANCOVA results for DAQ factor 2 *Strong Intentions and Desires* are summarised in Table 3-10.

Table 3-10. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ factor 2 *Strong Intentions and Desires*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	5.141	1	5.141	6.548	**0.012**
Drink Cues	5.319	1	5.319	6.775	**0.011**
Order	0.255	1	0.255	0.325	0.570
Cues x Order	0.137	1	0.137	0.174	0.678
Error	65.160	83	0.785		
Total	360.875	88			

On factor 3 (*Negative Reinforcement*) the mean for the alcohol group (M = 3.1, SD = 1.1) was also significantly higher than for the soft drink group (M = 2.5, SD = 1.0), $F(1, 83) = 7.001$, $p = .010$. The covariate *Quantity* was not significant, $F(1, 83) = 0.074$, $p = .787$. The ANCOVA results for DAQ factor 3 *Negative Reinforcement* can be found in Table 3-11.

Table 3-11. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ factor 3 *Negative Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	0.083	1	0.083	0.074	0.787
Drink Cues	7.871	1	7.871	7.001	**0.010**
Order	0.140	1	0.140	0.124	0.725
Cues x Order	0.987	1	0.987	0.878	0.352
Error	93.315	83	1.124		
Total	779.250	88			

For a summary of the descriptive statistics for the main effects of the independent variable *Cue* (alcohol versus soft drink cues) on the subjective desire variables (DAQ) see Table 3-12.

Table 3-12. Means (*M*) and Standard Deviations (*SD*) of Desire Scores for Alcohol and Soft Drink Cue Exposure Groups

Dependent Measures	*Drink Cues*	
	Soft Drink Cues *M* (*SD*)	Alcohol Cues *M* (*SD*)
DAQ Total	46.3 (10.5)	52.9 (10.2)
DAQ 1 *Mild Intentions + Positive Reinforcement*	4.7 (1.6)	5.4 (1.3)
DAQ 2 *Strong Intentions and Desires*	1.5 (0.8)	2.1 (1.0)
DAQ 3 *Negative Reinforcement*	2.5 (1.0)	3.1 (1.1)
DAQ 4 *Control over Drinking*	5.8 (1.4)	5.3 (1.2)

An interaction between Drink *Cues* and *Order* of Questionnaire Presentation was found for factor 4 (*Controllability*), $F(1, 83) = 4.605$, $p = .035$, when *Quantity* was controlled for, $F(1, 83) = 15.587$, $p = .001$. A summary of the ANOVA results for DAQ factor 4 is reported in Table 3-13.

Table 3-13. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ factor 4 *Control over Drinking*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	21.937	1	21.937	15.587	**0.001**
Drink Cues	2.683	1	2.683	1.906	0.171
Order	0.073	1	0.073	0.052	0.820
Cues x Order	6.481	1	6.481	4.605	**0.035**
Error	116.813	83	1.407		
Total	2876.500	88			

The interaction is graphically presented in Figure 3-2, showing adjusted means and standard errors for all experimental cells. From Figure 3-2 it is clear, that *Controllability* scores do not differ between alcohol (A-DE: $M_{adjusted} = 5.8$, $SE = .03$) and soft drink exposure (S-DE: $M_{adjusted} = 5.6$, $SE = .03$) when the DAQ is administered immediately after cue exposure. When the expectancy questionnaires are given first, *Controllability* scores for alcohol (A-ED: $M_{adjusted} = 5.3$, $SE = .03$) and soft drink cue exposure (S-ED: $M_{adjusted} = 6.2$, $SE = .03$) differ considerably. Similarly, the soft drink group receiving the desire questionnaire first (S-DE) scored lower than the soft drink group receiving the desire questionnaire after the expectancy questionnaires (S-ED). In the alcohol group, the group receiving the desire questionnaire first scored higher (A-DE) than the other group who received the expectancy questionnaires first (A-ED).

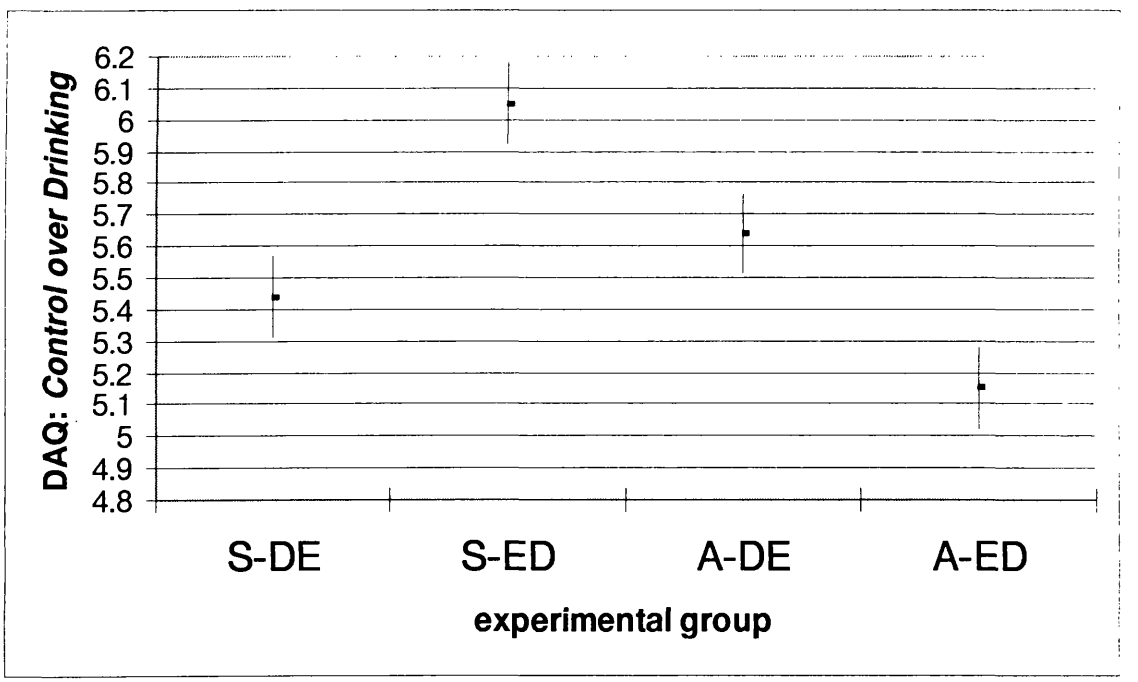


Figure 3-2. Adjusted means and standard errors (*SE*) for the response on the DAQ factor *Controllability* in soft versus alcohol cue condition and desire/expectancy versus expectancy/desire assessment conditions, *Cues* x *Order*: $F(1, 83) = 4.605$, $p = .035$

3.3.4 Negative Alcohol Expectancy

Total negative expectancy scores and the three subscale expectancy scores were computed from the item score delivered by the NAEQ. Those 4 NAEQ factor scores represented the dependent variables in the 2 x 2 analyses of covariance carried out. The mean total score for the soft drink group (M = 101.1, SD = 24.8) was not significantly different from the alcohol group (M = 107.8, SD = 25.7) after the effects of the covariate *Quantity* were accounted for, $F(1,83) = 9.921$, $p = .002$. No main effect for *Order* of Questionnaire Presentation or an interaction of *Order* x *Cue* was detected on the total NAEQ score. A summary of the results can be found in Table 3-14.

Table 3-14. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable NAEQ total score

Source	Sum of Squares	df	Mean Square	F	p
covariate Quantity	5456.445	1	5456.445	9.921	**0.002**
Drink Cues	405.610	1	405.610	0.737	0.393
Order	1371.418	1	1371.418	2.493	0.118
Cues x Order	240.584	1	240.584	0.437	0.510
Error	45650.328	83	550.004		
Total	1015297	88			

For all three subscales, *Same Day*, *Next Day* and *Continued Drinking*, the effect of the covariate *Quantity* was significant, $F(1, 83) = 5.190$, 4.694 and 12.557, $p = .025$, .033 and .001, respectively, but no main effects or interactions between the independent variables were found. The results of the ANCOVAs can be found in Table 3-15 to Table 3-17.

Although the mean score for the alcohol group on the subscale *Same Day* ($M = 41.3$, $SD = 9.2$) was higher than the mean score of the soft drink group ($M = 37.2$, $SD = 8.0$) this difference failed to reach significance, $F(1, 83) = 3.910$, $p = .051$.

Table 3-15. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable NAEQ *Same Day*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	362.512	1	362.512	5.190	**0.025**
Drink Cues	273.111	1	273.111	3.910	0.051
Order	76.481	1	76.481	1.095	0.298
Cues x Order	11.142	1	11.142	0.160	0.691
Error	5797.715	83	69.852		
Total	142403	88			

Table 3-16. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable NAEQ *Next Day*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	472.786	1	472.786	4.694	**0.033**
Drink Cues	16.031	1	16.031	0.159	0.691
Order	187.355	1	187.355	1.860	0.176
Cues x Order	11.742	1	11.742	0.117	0.734
Error	8359.123	83	100.712		
Total	123190	88			

Table 3-17. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable NAEQ *Continued Drinking*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	1094.575	1	1094.575	12.557	**0.001**
Drink Cues	0.152	1	0.152	0.002	0.967
Order	213.146	1	213.146	2.445	0.122
Cues x Order	76.495	1	76.495	0.878	0.352
Error	7234.789	83	87.166		
Total	83984	88			

The negative expectancy assessment did not show reactivity to alcohol cues. A summary of the descriptive statistics for the alcohol and soft drink cue groups can be found in Table 3-18. The order of assessment had no influences on the responses on the negative alcohol expectancy questionnaire.

Table 3-18. Means (*M*) and Standard Deviations (*SD*) of Negative Expectancy Scores for Alcohol and Soft Drink Cue Exposure Groups

Dependent Measures	***Drink Cues***	
	Soft Drink Cues *M* (*SD*)	Alcohol Cues *M* (*SD*)
NAEQ Total	101.1 (24.8)	107.8 (25.7)
NAEQ *Same Day*	37.2 (8.0)	41.3 (9.2)
NAEQ *Next Day*	35.2 (10.1)	36.8 (10.6)
NAEQ *Continued Drinking*	28.7 (10.1)	29.7 (10.4)

3.3.5 Positive Alcohol Expectancy

A total positive expectancy score and 6 subscale expectancy scores were computed from the AEQ. The resulting 7 positive expectancy scores made the dependent variables in the 2x2 analyses of covariance carried out.

There were no significant main effects or interactions for *Drink Cue* and *Order* of Questionnaire Presentation for the total positive expectancy scores nor each of the 6 AEQ subscales: *Global Positive Change*, *Physical and Social Pleasure*, *Sexual Enhancement*, *Social Assertiveness*, *Relaxation and Tension Reduction*, *Arousal and Interpersonal Power*. The covariate *Quantity* was significant for the subscale *Physical and Social Pleasure*, $F(1, 83) = 9.926$, $p = .002$. The positive correlation ($p = .37$, see Table 3-6) between quantity of alcohol consumption and positive outcome expectancies of physical and social pleasure means that heavier drinkers associate drinking with more positive expectations of pleasure. The covariate *Quantity* was not significant for any other subscales. The ANCOVA results can be found in Table 3-19 to Table 3-25.

Table 3-19. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ Total Score

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	804.612	1	804.612	0.765	0.384
Drink Cues	1795.808	1	1795.808	1.706	0.195
Order	1428.033	1	1428.033	1.357	0.247
Cues x Order	578.340	1	578.340	0.550	0.461
Error	87352.070	83	1052.435		
Total	3254767	88			

Table 3-20. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Social Assertiveness*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	7.832	1	7.832	0.124	0.726
Drink Cues	54.291	1	54.291	0.858	0.357
Order	125.889	1	125.889	1.989	0.162
Cues x Order	77.524	1	77.524	1.225	0.272
Error	5252.259	83	63.280		
Total	104542	88			

Table 3-21. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Global Positive Change*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	159.565	1	159.565	1.195	0.277
Drink Cues	204.366	1	204.366	1.531	0.219
Order	340.205	1	340.205	2.549	0.114
Cues x Order	182.501	1	182.501	1.367	0.246
Error	11078.844	83	133.480		
Total	312681	88			

Table 3-22. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Physical and Social Pleasure*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	180.907	1	180.907	9.926	**0.002**
Drink Cues	28.276	1	28.276	1.552	0.216
Order	16.863	1	16.863	0.925	0.339
Cues x Order	1.036	1	1.036	0.057	0.812
Error	1512.684	83	18.225		
Total	99689	88			

Table 3-23. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Arousal and Interpersonal Power*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	1.659	1	1.659	0.088	0.767
Drink Cues	17.600	1	17.600	0.939	0.335
Order	16.194	1	16.194	0.864	0.355
Cues x Order	1.111	1	1.111	0.059	0.808
Error	1556.432	83	18.752		
Total	35444	88			

Table 3-24. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Relaxation and Tension Reduction*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	55.577	1	55.577	2.014	0.160
Drink Cues	30.893	1	30.893	1.120	0.293
Order	1.146	1	1.146	0.042	0.839
Cues x Order	7.748	1	7.748	0.281	0.598
Error	2290.196	83	27.593		
Total	74157	88			

Table 3-25. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable PAEQ *Sexual Enhancement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	1.176	1	1.176	0.040	0.841
Drink Cues	31.833	1	31.833	1.094	0.299
Order	1.134	1	1.134	0.039	0.844
Cues x Order	9.740	1	9.740	0.335	0.564
Error	2414.278	83	29.088		
Total	25112	88			

3.3.6 Summary of Results

Alcohol cue responses were found for desire as measured by the DAQ total and three of the four DAQ subscales; the difference in scores on the subscale *Mild Intentions and Positive Reinforcement* was only numerical and failed to reach significance. The DAQ subscale *Controllability* also demonstrated an alcohol cue response but only when testing on the DAQ was preceded by testing on the expectancy questionnaires. There were no significant alcohol cue responses for expectancy as measured by the AEQ or NAEQ.

3.4 Discussion

It was the aim of this experiment to further explore subjective cue reactivity in social drinkers by (i) replicating the use of the DAQ as reported in the previous experiment and (ii) by effectively extending the expectancy dimensions of the DAQ through the use of additional outcome expectancy measures.

Within the context of the current experiment, cue manipulation revealed alcohol cue reactivity in social drinkers for desire for alcohol as measured by the DAQ but not for positive or negative alcohol outcome expectations as measured by the AEQ and NAEQ.

These results further support the findings from the previous experiment reported in this thesis that subjective responses can be elicited in social drinkers by alcohol cues of sight, smell and taste as measured by a multi-dimensional representation of desire (the DAQ). It was shown in the current experiment that *different* desire aspects are cue responsive. However, the current experiment adopted a different methodology to the first experiment: responses to alcoholic and soft drink cues were compared between groups who received different cue manipulations instead of responses to different cues by the same participants being compared. Between-subjects designs are much less powerful than within-subject designs because the variability attributable to individual differences is accounted for in within-subjects designs. Further, the cue exposure itself was carried out in a different manner. In the previous experiment, cue exposure was carried out directly by instructions from a tape to look, hold, smell and taste the drink. This experiment however, directed the participants' attention indirectly to the cues of sight, smell and taste by instructing the participants

to assess those drink properties on a questionnaire. The attention participants gave each drink cue is likely to have differed between participants; they might even have spent different amounts of time on each drink cue. This cue exposure schedule is less controlled, but still achieves the goal to point participants' attention to the drink cues in a way that is easier and more time efficient to administer.

Carter and Tiffany (1999b) reported a difference in size of physiological versus subjective (craving) effects in a meta-analysis of cue reactivity studies using addicts; physiological cue effects were found to be small whereas craving effects were relatively large and robust. Since social drinkers have had fewer conditioning experiences than alcoholics, it is reasonable to assume that effect sizes in experiments with social drinkers should be smaller than the ones detected in alcoholic participants' data. Effect sizes in the current experiment were probably further reduced by changes in the experimental design. Despite the use of a between-subjects design, desire responses to alcohol cues were significantly higher than responses to soft drinks.

An interaction between *Order* of Questionnaire Presentation and *Drink Cue* was detected for the DAQ factor feelings of *Controllability over Drinking*. It appears that the cognitions represented by the DAQ factor *Controllability* are also cue reactive but only when the DAQ is completed after expectancy assessment, i.e. group alcohol - expectancy/desire (A-ED). The comparisons between the four experimental groups on the *Controllability* factor indicate that something happened during the time the expectancy questionnaires were filled in, and this caused the interactive effect.

Two things could be held accountable for the difference in feelings of control between alcohol - desire/expectancy (A-DE) and alcohol - expectancy/desire A-ED groups. The significant decrease in feelings of control in the alcohol - expectancy/desire group (A-ED) could have been a result of the alcohol priming dose which was given during the cue exposure phase. For the alcohol group which received the desire and controllability questions *directly* after cue exposure, the time period between the start of drinking and the DAQ questionnaire (10 minutes) was not long enough to drink a large enough amount for the alcohol to take an effect. The alcohol - expectancy/desire (A-ED) group, however, had about 30 minutes from the start of drinking until filling in the DAQ by which time the majority of the participants from this group had at least almost finished their drink (16 participants out of 22; 72%). The suggestion that a priming dose of alcohol influences feelings of

control over drinking is supported by the finding that the ingestion of a priming dose of one unit of alcohol can lead to a decrease of feelings of *Controllability* in social drinkers whereas cue exposure with response prevention did not lead to such a decrease in control (Schulze, in press).

The second explanation for a decrease in feelings of control is that an alcohol cue additional to the sight, smell and taste of alcohol might be generated by the alcohol-related words in the expectancy questionnaires. Participants read through the items while completing the questionnaires and they make a judgement about the likelihood of the occurrence of such an outcome if they went for a drink after the completion of the experiment. The result suggests that the process of reading alcohol-related words and thinking about drinking can act as an alcohol cue in itself, which then impacts on the desire responses measured by the DAQ. If such findings could be confirmed, the implications would be substantial. It could impact on advertising strategies in print and electronic media, and clinical settings might profit from such findings as well, e.g. imaginal exposure approaches in cue exposure treatment could be advocated. Imaginal cue exposure would not only get around ethical considerations, it would also be cost-effective, and could even be developed as a do-it-yourself "homework" programme. Unfortunately, it cannot be determined within this experimental design which of those two factors is responsible for the decrease in *Controllability* in the A-ED group. Ongoing research in our laboratory is currently trying to find some answers to questions related to the impact of cognitive cues.

It was suggested earlier in this chapter that desire responses might be related to the amount of alcohol consumed. A correlation analyses confirmed this assumption for all but one DAQ factor. The linear relationship with amount of alcohol consumed per week could not be confirmed for the DAQ factor *Negative Reinforcement.* This scale had earlier been described as a limited positive expectancy scale. Similarly, although contrary to findings by other researchers (e.g. Brown, Christiansen & Goldman, 1987), scores on only one of the positive expectancy scales (*Social and physical pleasure*) could be shown to be related to quantity of alcohol consumption. The linear relationship between alcohol consumption and negative expectancies (e.g. McMahon et al., 1994) could be confirmed by significant correlations on all negative expectancy scales.

As predicted, the total desire score, which integrates all desire dimensions, was shown to be responsive to cue manipulation. DAQ factor 1 (*Mild Intentions and*

Positive Reinforcement) displayed a non-significant alcohol cue response but factors 2 (*Strong Intentions and Desires*) and 3 (*Negative Reinforcement*) showed a significantly higher response to alcohol cues than to soft drink cues. Factor 2 (*Strong Intentions and Desires*) can be described to feature "classical" desire items, which come closest to the uni-dimensional representations used by other researchers and appear to be alcohol responsive. Factor 1 and 3 (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*) feature items that can be described as positive outcome expectancies. Because scores on those scales were found to be higher after alcohol exposure in experiment one of this thesis it seemed justified to further explore the expectancy dimension in a cue reactivity context. The results on the limited expectancy scales of the DAQ confirm the findings from the first experiment. However, the total scores on AEQ and NAEQ in this experiment were not found to be cue responsive. It appears that Glautier & Tiffany's (1995) call for an in depth analysis of alcohol cognitions applies not only to desire for alcohol but also outcome expectancies. Although no difference in responses to alcohol and soft drink cues were found on the NAEQ total, the subscale representing negative expectancies surrounding the consumption period of the *Same Day* as drinking showed a reactivity to alcohol cues - but this difference was only numerical and missed significance. Reactivity to alcohol cues derives from learning at the time of alcohol consumption. Therefore it is perhaps not surprising that only those *Same Day* expectancies react to the alcohol cue rather than *Next Day* or *Continued Drinking* expectancies.

Increases in negative outcome expectancies as a result of cue exposure might appear surprising, especially since they are co-occurring with increases in desire. One would normally expect that increasing negative expectancies would decrease the likelihood of drinking. Curiously, increasing desire suggests exactly the opposite. However, Jones and McMahon (1998) postulated that negative outcome expectancies, which rise with alcohol consumption, only impact on behaviour once they have reached a threshold. Increasing negative outcome expectancies above this threshold has therefore been one aim of motivationally-based interventions to reduce drinking.

For this reason rises in negative expectancy within a social drinking context are not anomalous and do not necessarily impact on drinking behaviour. Equally, rises in desire for alcohol may not necessarily impact on drinking behaviour. Although this

view has recently been criticised by Goldman, Del Boca and Darkes (1999), there is ample evidence in the alcohol motivation literature to suggest that alcohol cognitions such as negative expectancies can be held and increased *without* behavioural change. For example, the presence of a "Contemplation" stage in between "Pre-contemplation and "Action" stage within DiClemente and Prochaska's (1998) Stages of Change Model or the Readiness for Change Model (Heather, Rollnick & Bell, 1993) suggests cognitive changes without behaviour modification.

The previous experiment showed cue responsivity of two DAQ scales that provided only limited positive expectancy assessment. The results from the in-depth assessment of positive expectancies in this experiment show an insensitivity of positive expectancies (as measured by the AEQ) to cue manipulation although the two DAQ scales (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*) display reactivity once again. The AEQ had been chosen for expectancy measurement because it is the most frequently used expectancy questionnaire. Since the AEQ has not been without criticism (e.g. Leigh, 1989) the question arises if the failure to detect cue reactivity in the current experiment is a construct or questionnaire feature. The fact that the two DAQ subscales, which represent positive expectancies (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*), demonstrate cue reactivity suggests that it might be a failure associated with the questionnaire. There is evidence that suggests that positive rather than negative alcohol-related constructs are more 'reactive' (e.g. Jones & Schulze, in press; Leigh & Stacy, 1998). It appears that more comprehensive assessments of the positive expectancy construct than offered by the AEQ are needed to come to a conclusion about the effect of alcohol cues on positive expectancies.

Cue reactivity was not shown by any positive nor by negative expectancy scales of the AEQ and NAEQ. One other conclusion from the results would be that alcohol outcome expectancies are relatively stable constructs that will not show state-like changes after cue exposure. However, the NAEQ subscale Same Day displayed cue reactivity (but failed to reach significance), as well as the positive expectancy scales on the DAQ. It is yet to be determined if the nature of outcome expectancies justifies state-like changes as a response to alcohol cues.

However, Pearson's correlations between measures of desire and outcome expectancies show that the first three DAQ factors correlate moderately with

measures of positive outcome expectancies. DAQ factor 1 (*Mild Intentions and Positive Reinforcement*) is related to the AEQ subscale *Social and Physical Pleasure* which is not surprising taken into consideration that both subscales are represented by very similar outcome expectancies. DAQ factor 2 and 3 (*Strong Intentions and Desires* and *Negative Reinforcement*) correlate moderately with *Global Positive Expectancies*. As suggested earlier, the DAQ factor 3 (*Negative Reinforcement*) consists of negative reinforcement items that represent positive outcome expectancy. Therefore, a relationship between those variables was also to be expected. The moderate correlation between the DAQ factor *Strong Intentions and Desires* however, presents new information. The moderate correlation emphasises the relationship between positive outcomes of drug use behaviour and subsequent desires and cravings. Although a direction of this relationship cannot be predicted from correlational studies, the results support the hypothesis that positive outcomes of drug use lead to the wish to continue drug use. DAQ factor 4 (*Control over Drinking*) is also related to measures of positive and negative outcome expectancies but does only correlate mildly with any expectancy subscales. This suggests that the DAQ factor *Control over Drinking* measures a concept which does not share as much of its variance with the measures of positive and negative outcome expectancies. Overall, it can be confirmed that desires to drink and outcome expectancies represent related concepts.

The next chapter will discuss why continuing to use the currently available measures for outcome expectancies will probably not provide new insights. The next experiment will instead concentrate the investigation on issues brought up in the beginning of this discussion. It will explore the effects of an alcohol priming dose on desire aspects, as measured by the DAQ, to answer the question raised in this discussion whether an alcohol priming dose can elicit subjective desire responses.

4 Experiment Three: The Effects of Alcohol Priming Doses and Alcohol Cues on Desires to Drink

Experiment Two discovered an interaction on the DAQ factor *Control over Drinking*, which could either be attributed to the effect of an alcohol priming dose or the effect of cognitive alcohol cues provided by the expectancy questionnaires. Research on the concept of loss of control in alcoholics has provided some support for the view that a priming dose of alcohol can elicit a reaction that leads to a decrease, or a loss of control over drinking. The current experiment aims to investigate the effects of alcohol priming doses on the various desire aspects of the DAQ in social drinkers, in particular their effect on feelings of control over drinking.

Sixty-four social drinkers consumed either one or two priming doses of soft or alcoholic drink during a 'taste preference' experiment. Subjective cue reactivity was assessed after consumption using the multi-dimensional DAQ.

The consumption of two drinks (soft or alcoholic) increased expectations about the negative reinforcing effects of alcohol consumption. It is suggested that alcohol-related cognitions (i.e. outcome expectancies) were triggered by a priming context, which the two-drinks condition could have represented.

Alcoholic drinks significantly decreased perceived feelings of control over drinking. This result supports previous research that reported decreased feelings of control after the consumption of 1 unit of alcohol. Therefore, the consumption of an alcohol priming dose might influence subsequent drinking behaviour, even in social drinkers. The design did not allow to differentiate whether such an effect is due to internal or external alcohol cues.

4.1 Introduction

The previous experiment (Experiment Two) was designed to measure alcohol outcome expectancies more extensively (AEQ, NAEQ) after reports of cue responsivity of expectancies measured by two of the factors of the DAQ in Experiment One. The results of Experiment Two show no reactivity by any of the more extensive expectancy scales as a response to alcohol cues. Speculations about reasons for this were related to the issue of concept or questionnaire failure. Since reactivity was again found on the DAQ expectancy scales in Experiment Two, the question emerges why one expectancy questionnaire (DAQ) would detect cue reactivity and another one (AEQ) would not? An important difference between the questionnaires, which could be the reason behind this discrepancy, is their length. The DAQ only comprises 14 items whereas NAEQ and AEQ consist of a combined 124 items. It is not clear for how long cue effects last or for how long they can be detected. It is possible that cue effects had worn off while the participants filled in the questionnaires (AEQ/NAEQ) which take approximately 20 minutes to complete. This argument raises the question whether outcome expectancies as measured by the AEQ/NAEQ represent a trait or a state (Schulze & Jones, 1999a). If desire for alcohol is an immediate result of cue exposure, an attempt to measure such a state with a 20-minute instrument does not seem justified. In contrast, a short 2-minute, 14-item measure is much more likely to capture fast, state-like changes. This raises the question of the appropriateness of the use of the AEQ and NAEQ to measure state-like effects of alcohol cues. AEQ and NAEQ are much more likely to represent the trait 'outcome expectancies' which only change slowly over time when different experiences with alcohol shape the expectations about the effects of alcohol a person holds in their long-term memory. Darkes and Goldman (1999) have shown that expectancies, when measured by the AEQ, change over days and others have demonstrated that changes in expectancies, as measured by the NAEQ, occur in a similar time window. The lack of evidence for much faster changes (i.e. minutes) is consistent with the results of Experiment Two.

For this reason the AEQ and NAEQ will no longer be employed in further experiments reported in this thesis as measures for cue effects. The question whether alcohol cues influence drinking behaviour by impacting on outcome expectancies

cannot be satisfactorily answered from the research reported in this thesis. The currently available expectancy measures, which have been used in the reported research, appear to hinder research progress. Further research that investigates the role of expectancies in cue reactivity awaits the development of measures that can sample short time periods while properly representing the wide range of expectations that individuals appear to hold.

In Experiment Two it was also found that the DAQ desire aspect *Control over Drinking*, unlike the other desire aspects, not only responded to the alcohol cues of sight, smell and taste of alcoholic drinks but also to a priming dose of alcohol and to cues of alcohol related cognitions. However, the design of Experiment Two did not allow the identification of the extent to which the effects of the priming dose were involved in the reported interaction on DAQ factor 4 *Control over Drinking*.

This aspect of the Desire for Alcohol Questionnaire, *Control over Drinking*, is likely to influence both the initiation and the course of a drinking episode. This is important in social drinkers because a decrease in control feelings before or during a drinking episode might lead to harmful behaviours like binge drinking or drinking and driving. The effect of alcohol cues on feelings of control is even more important in alcoholics who are trying to stay abstinent. Their self-control might potentially be threatened by the encounter with alcohol cues. Ludwig, Wikler and Stark (1974) suggest that the behavioural state, which is loss of control, is initiated by craving, and that craving occurs as a conditioned withdrawal response to a priming dose of alcohol. Therefore, the suggestion that a priming dose of alcohol might influence perceived feelings of control over drinking might be of particular interest in the explanation of engagement in harmful drinking related behaviours of social drinkers, and relapse and associated harmful behaviours in alcoholics.

There has been some discussion about the validity of the DAQ factor *Control over Drinking* in the literature. Love, James and Willner (1998) factor-analysed social drinkers' DAQ data and could not confirm *Control over Drinking* as a fourth factor on the DAQ. However, they agreed on the face validity of the factor and its importance in a research context. In a cue reactivity experiment using the DAQ to measure subjective responses to the sight, smell and taste of alcohol, Schulze (1999) showed that social drinkers responded significantly more on the DAQ factor *Control over Drinking* to a priming dose of 1 unit of alcohol and alcohol cues than to soft drink cues. Willner et al. (1998) showed that half a pint of beer (equivalent to 283

ml, or 1 unit of alcohol) significantly increased craving scores in male recreational drinkers on the DAQ factors *Negative Reinforcement* and *Control over Drinking*. These results supports the claim by Love et al. that the factor *Control over Drinking* might have implications, even in social drinkers, and therefore should be retained for research purposes.

The current experiment (Experiment Three) will investigate the claims from Experiment Two closer by looking at the effect of alcoholic drinks and drink cues on desires to drink. The experiment was designed to test the influence of the consumption of one or two alcohol priming doses on desires for alcohol and in particular, feelings of *Control* over drinking.

4.2 Method

4.2.1 Participants

Sixty-four students (35 male, 29 female) participated in the experiment, which had been advertised around the University of Glasgow as a "Taste Preference Experiment". Criteria for participation included (i) legal age for drinking (i.e. 18 years of age or above), (ii) social drinking status (i.e. participants had never been diagnosed with or treated for alcohol-related problems) and (iii) participants were not pregnant or had no reason to believe they might be pregnant. Participants gave their informed consent to take part in the experiment. A copy of the consent form can be found in appendix (Appendix A.10).

The participants were of an average age of 22.0 years (SD = 4.4). They had consumed an average of 19.9 units of alcohol (SD = 13.6) on M = 3.1 (SD = 1.7) drinking days during the week prior to the experiment. Participants reported that they have been drinking at this level for M = 3.6 years (SD = 3.2). Six participants (9.4 %) stated that at least one of their parents was alcohol-dependent; 21 participants (33%) reported that a family member was an alcoholic. Participants were paid a small fee for participation.

4.2.2 Design

A 2x2 between-subjects design was used for the cue exposure experiment, with the between-subjects factors drink *Cues* (2 levels: soft [S] versus alcoholic drink cues [A]) and *Number* of priming drinks (2 levels: 1 drink [1] versus 2 drinks [2]). Participants were randomly assigned to the four experimental cells resulting from this design: S-1, S-2, A-1, A-2 (see Table 4-1). While participants completed a stooge 'taste preference' questionnaire, they were systematically exposed to alcohol or soft drink cues and were then assessed on the dependent variables, desires to drink alcohol as measured by the DAQ.

Table 4-1. Experimental Cells and Participant Numbers (*n*) in the 2x2 (*Cues* x *Number*) Between-Subjects Design (*N* = 64)

		Number of Priming Drinks	
		one drink (1)	two drinks (2)
Drink Cues	soft drink cues (S)	S – 1 *n* = 16	S – 2 *n* = 16
	alcohol cues (A)	A – 1 *n* = 16	A – 2 *n* = 16

4.2.3 Cue Exposure Stimuli and Measures

For the cue exposure, participants received either one or two bottled alcoholic drinks (Miller: 1 bottle = 330ml, 4.7%; Becks: 1 bottle = 275ml, 5%), or one or two canned soft drinks (Coke, Irn Bru; 1 can = 330 ml) depending on which experimental group they had been placed in (S-1, S-2, A-1, A-2).

Participants filled in the stooge taste preference questionnaire, applicable to both soft and alcoholic drinks, which directed their attention systematically to the drink cues by asking questions about the look, smell and taste of the drink. The procedure is explained in more detail in the Method section of the previous chapter. A copy of

the taste preference questionnaire can be found in the appendix (Appendix A.06). One taste preference questionnaire was completed for each drink, i.e. the groups receiving two drinks (S-2 and A-2) filled in two taste preference questionnaires (cue exposure phase for those participants lasted 20 min), in contrast to the groups receiving only one drink (S-1 and A-1) who filled in the taste preference questionnaire just once (cue exposure lasted 10 minutes).

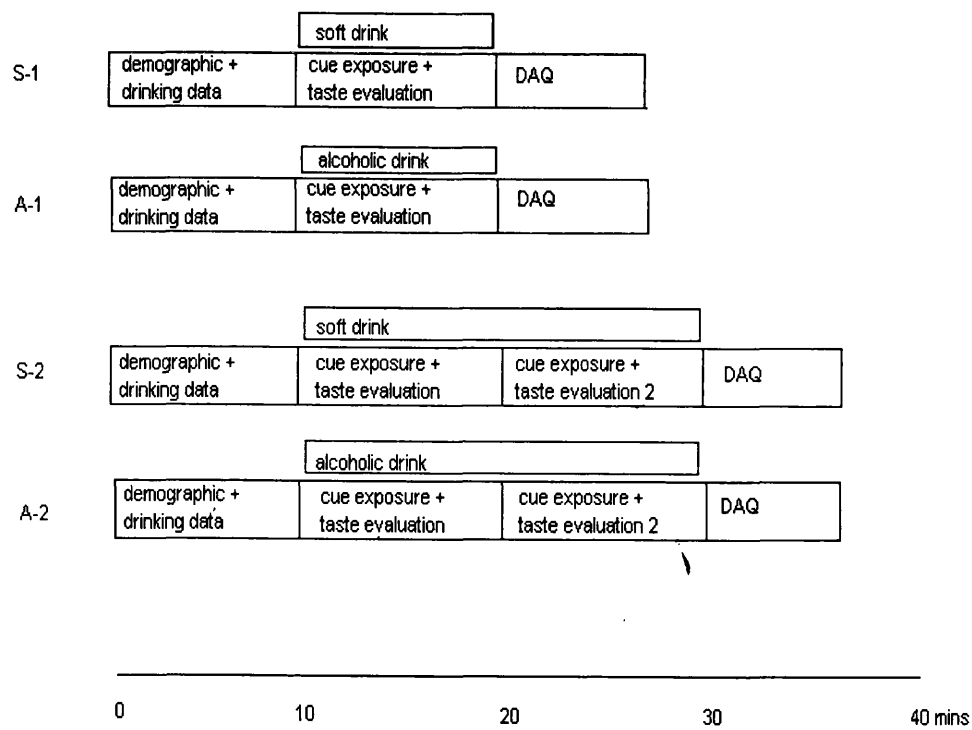
Subjective cue responses were assessed with the short version of the Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996). The desire scores of the 14 items were arithmetically combined to make up the four DAQ factor scores, (1) *Mild Desires and Positive Reinforcement*; (2) *Strong Intentions and Desires to Drink*; (3) *Negative Reinforcement* and (4) *Control over Drinking*, and additionally (5) a total desire sum score. For more details on the DAQ, see chapter two of this thesis (2.2.2 Stimuli and Measures). A copy of the DAQ can be found in the appendix (Appendix A.02).

An adaptation of the Timeline Follow Back procedure (Sobell & Sobell, 1992) was used to collect information on the previous week's alcohol consumption (quantity and frequency measures). Demographic measures were taken. A copy of the drinking diary and the demographic questions used in the experiment can be found in the appendix (Appendix A.03).

4.2.4 Procedure

Before the experiment, participants gave informed consent to taking part in the 'taste preference experiment' which they were told "may or may not involve drinking up to two units of alcohol". Participants were randomly assigned to one of the four experimental groups (S-1, S-2, A-1, A-2). The participants started by completing the drinking diary and demographic questions. Then they were presented with their drink(s) and asked to open, smell and sample the drink(s). It was explained that smelling and sampling the drink(s) would help them to answer the questions in the taste preference questionnaire most appropriately. It was explained to them that taste ratings for the two drinks would be compared. The questions in the stooge taste preference questionnaire surround the appearance, the smell and the taste of the drink and therefore participants were required to smell and sample the drink repeatedly

while completing the questions. Participants were encouraged to sample the drink frequently during the completion of the taste preference questionnaire(s). One taste preference questionnaire was completed for each drink. Participants were required to finish each drink and the associated taste preference questionnaire within 10 minutes. Once participants had completed the taste preference questionnaire(s) they were asked to complete the desire questionnaire (DAQ). There was no time limit set for completing the questionnaire. On completion of the questionnaires, participants were debriefed and paid their fee. A schematic description of the design and procedure used in this experiment can be seen in Figure 4-1.



Design: Cue Exposure Experiment Three

Figure 4-1. Schematic description of the experimental procedure: Experiment Three

4.3 Results

SPSS for Windows 7.0 was used to carry out 2 x 2 analyses of variance with the independent variables *Cues* (alcohol [A] versus soft drink [S] cues) and *Number* of drinks (1 drink [1] versus 2 drinks [2]). A significance level of $\alpha = .05$ was adopted for all tests. All tests were 2-tailed.

4.3.1 Group Differences in Alcohol Consumption

2x2 (*Cues* x *Number*) analyses of variance were carried out to test if randomisation had produced groups with similar demographic characteristics and alcohol conditioning history. *Age*, *Quantity* and *Frequency* of alcohol consumption were the dependent variables.

No main effects for *Cues* or *Number*, or an interaction *Cues* x *Number* were found for *Age*, Fs(1, 60) < 2, ps > .05. A main effect was detected for the *Number* of drinks on the variable *Frequency* of alcohol consumption, $F(1, 60) = 5.012$, $p = .029$. It was also found that the participants who received alcoholic drinks had been drinking slightly more in the week prior to the experiment (M = 22.0 units of alcohol; SD = 13.7) than the participants in the soft drink group (M = 16.0 units of alcohol; SD = 13.0), but this difference failed to reach significance, $F(1, 60) = 3.077$, $p = .085$.

In Experiment Two of this thesis it was shown that desire for alcohol is related to alcohol consumption. This finding is supported by the data from the current experiment; the correlations between consumption and DAQ desire factors are shown in Table 4-2. As a result, *Quantity* of alcohol consumed per week will again be entered as a *covariate* into the analyses to control for possible influences from the group differences in drinking behaviour.

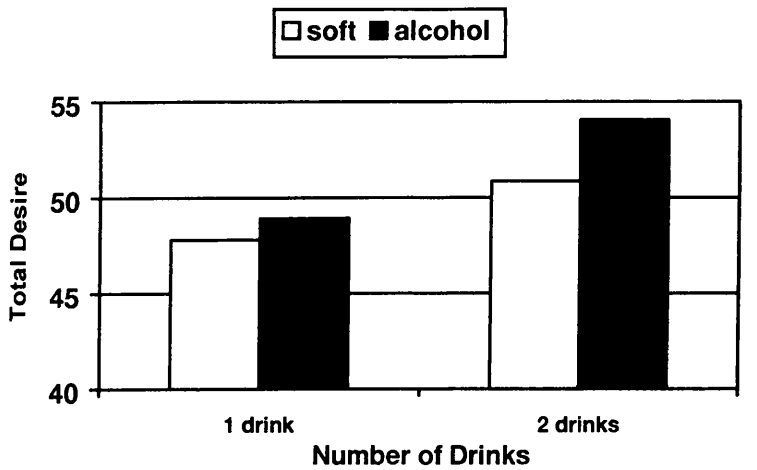
Table 4-2. Pearson's Correlations *r* between *Quantity* of Alcohol Consumed in the Week prior to the Experiment and Desires for Alcohol (N = 64)

Dependent Variable	Quantity of Alcohol per week	
	r	*p* (2-tailed)
DAQ Total Score	0.25	**0.05**
DAQ 1 *Mild Intentions + Positive Reinforcement*	0.23	**0.07**
DAQ 2 *Strong Intentions and Desires*	0.15	0.25
DAQ 3 *Negative Reinforcement*	0.27	**0.03**
DAQ 4 *Control over Drinking*	-0.17	0.17

4.3.2 Desire for Alcohol

Five DAQ desire scores (four factors and one total score) represented the dependent variables in the 2x2 (*Cues* x *Number*) analyses of covariance (ANCOVA) which was conducted on the data.

No main or interactive effects for *Cues* or *Number* were found for the DAQ total score (see Figure 4-2). The covariate *Quantity* was not a significant influence on the total DAQ scores, $F(1, 59) = 3.059$, $p = .086$ (see Table 4-3 for all ANCOVA results).



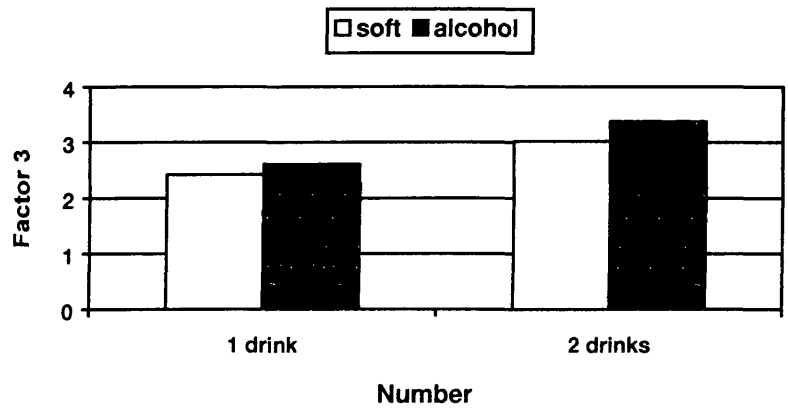
Cues: $F(1, 59) = 0.143, p = .706$; *Number*: $F(1, 59) = 1.750, p = .191$;
Cues x *Number*: $F(1, 59) = 0.210, p = .649$

Figure 4-2. The effects of *Cues* x *Number* of drinks on DAQ Total Desire Score ($N = 64$)

Table 4-3. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable Total Desire Score

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Covariate Quantity	369.937	1	369.937	3.059	0.086
Cues	17.337	1	17.337	0.143	0.706
Number	211.662	1	211.662	1.750	0.191
Cues x Number	25.364	1	25.364	0.210	0.649
Error	7136.126	59	120.951		
Total	170577	64			

A significant main effect for *Number* of drinks was found for factor 3 (*Negative Reinforcement*) (see Figure 4-3). Participants receiving one drink had significantly less positive expectancies for negative reinforcement (M = 2.5, SD = 1.0) than participants receiving two drinks (M = 3.2, SD = 1.1), $F(1, 59) = 6.090$, $p = .017$. The covariate *Quantity* was not significant, $F(1, 59) = 3.627$, $p = .062$ (see Table 4-4 for a summary of all ANCOVA results).



Cues: $F(1, 59) = 0.385$, $p = .537$; *Number*: $F(1, 59) = 6.090$, $p = .017$;
Cues x Number: $F(1, 59) = 0.181$, $p = .672$

Figure 4-3. The effects of *Cues* x *Number* of drinks on DAQ 3 *Negative Reinforcement*

Table 4-4. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 3 *Negative Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Covariate Quantity	3.809	1	3.809	3.627	0.062
Cues	0.404	1	0.404	0.385	0.537
Number	6.396	1	6.396	6.090	**0.017**
Cues x Number	0.190	1	0.190	0.181	0.672
Error	61.960	59	1.050		
Total	596.313	64			

A main effect for *Cues* was found for factor 4 (*Control over Drinking*), $F(1, 59) = 5.961$, $p = .018$ (see Figure 4-4). The group receiving a non-alcoholic priming dose (soft drink) had a higher mean score for feelings of control over drinking ($M = 6.3$, $SD = 1.0$) than the group which received an alcoholic priming dose ($M = 5.6$, $SD = 1.2$). The covariate *Quantity* had no significant effect, $F(1, 59) = 0.678$, $p = .414$. All results from the conducted ANCOVA for the factor *Control over Drinking* can be found in Table 4-5.

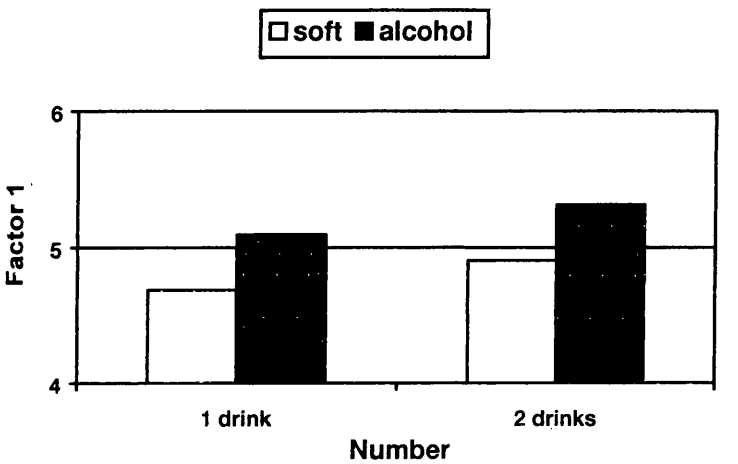
Cues: $F(1, 59) = 5.961$, $p = .018$; *Number*: $F(1, 59) = 0.001$, $p = .984$;
Cues x Number: $F(1, 59) = 0.119$, $p = .732$

Figure 4-4. The effects of *Cues* x *Number* of drinks on DAQ 4 *Control over Drinking*

Table 4-5. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 4 *Control over Drinking*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Covariate Quantity	0.879	1	0.879	0.678	0.414
Cues	7.728	1	7.728	5.961	**0.018**
Number	0.001	1	0.001	0.001	0.984
Cues x Number	0.154	1	0.154	0.119	0.732
Error	76.481	59	1.296		
Total	2337.25	64			

No other main or interactive effects for *Cues*, *Number* or *Cues* x *Number* were found for the other desire factors *Mild Intentions and Positive Reinforcement* and *Strong Intentions and Desires*. Results for all desire scores are graphically represented in Figures 4-1 to 4-5, and summaries of all results from ANCOVAs can be found in Tables 4-3 to 4-7.

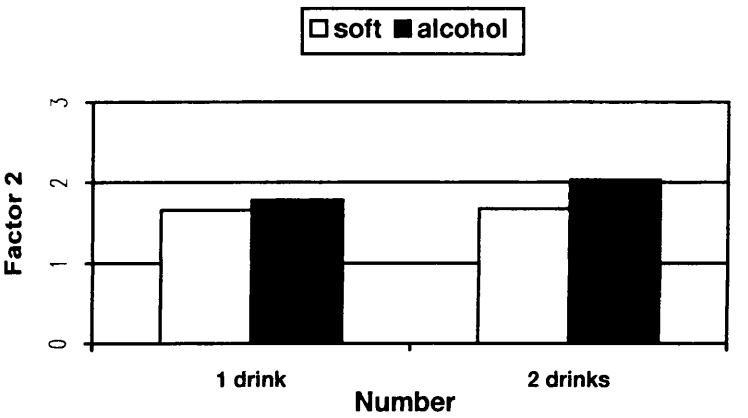


Cues: $F(1, 59) = 0.479, p = .492$; *Number*: $F(1, 59) = 0.183, p = .671$;
Cues x Number: $F(1, 59) = 0.006, p = .941$

Figure 4-5. The effects of *Cues* x *Number* of drinks on DAQ 1 *Mild Intentions and Positive Reinforcement*

Table 4-6. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 1 *Mild Intentions and Positive Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	5.6877	1	5.688	2.433	0.124
Cues	1.1196	1	1.120	0.479	0.492
Number	0.4269	1	0.427	0.183	0.671
Cues x Number	0.0129	1	0.013	0.006	0.941
Error	137.9061	59	2.337		
Total	17470	64			



Cues: $F(1, 59) = 0.540, p = .466$; *Number*: $F(1, 59) = 0.195, p = .660$;
Cues x Number: $F(1, 59) = 0.261, p = .611$

Figure 4-6. The effects of *Cues* x *Number* of drinks on DAQ 2 *Strong Intentions and Desires*

Table 4-7. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 2 *Strong Intentions and Desires*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	0.885	1	0.885	0.878	0.352
Cues	0.543	1	0.543	0.540	0.466
Number	0.196	1	0.196	0.195	0.660
Cues x Number	0.263	1	0.263	0.261	0.611
Error	59.408	59	1.007		
Total	265.688	64			

4.4 Discussion

The current experiment was designed to test the influence of different amounts of alcohol priming doses on the aspects of desire for alcohol as measured by the DAQ. Previous studies have suggested that the ingestion of a priming dose of alcohol decreases perceived feelings of control over drinking in social drinkers (Schulze, in press; Willner et al., 1998). A similar suggestion had emerged in this thesis from the results of Experiment Two but problems with confounding variables within the design of the experiment did not allow a clear conclusion.

In the current experiment, one or two priming doses of alcohol or soft drink (*Number* x *Cues* between-subjects design) were given *before* the participants filled in the desire questionnaire (DAQ). A main effect for the type of *Cues* (soft versus alcohol drink cues) was found on the DAQ factor *Control over Drinking*. Participants in the alcohol group had significantly lower feelings of control over drinking than the participants in the soft drink group. This result supports the assumptions made in chapter three about the effects of an alcohol priming dose on control feelings: consumption of alcohol leads to decreased control feelings over drinking in social drinkers.

The loss of control in alcoholics has been a popular concept for several decades. It is the central concept in Jellinek's "one drink, one drunk" view within a disease model of alcoholism (Jellinek, 1952). Jellinek (1952) states that loss of control in alcoholics means that the consumption of any alcohol will initiate a chain reaction, which is experienced by the alcoholic as a physical demand for a drink. Hodgson, Rankin and Stockwell (1979) reviewed studies on the loss of control in alcoholics after they had consumed a priming dose of alcohol and concluded that loss of control is *not* an inevitable consequence, even for severely dependent alcoholics. They suggest speaking of relative loss of control or increased probability of alcohol consumption. They also point to the fact that desire to drink and loss of control might be independent of each other. Therefore, craving or desires for alcohol can occur in alcoholics without the loss of control and drinking as inevitable consequences. The same should apply to social drinkers.

Throughout this thesis, the DAQ factor *Control over Drinking* has been and will be referred to as 'feelings of control over drinking' or 'perceived controllability' which

accounts for Hodgson et al.'s (1979) point of the relativity of control over drinking, as well as for the subjective nature of those feelings. It is self-evident that a decrease in feelings of control over drinking in social drinkers does not necessarily cause a loss of control as described by Jellinek (1952) for alcoholics.

Nevertheless, as mentioned before, a change in subjective feelings of desire or control does not lead to a change in drinking behaviour. By how much decreased feelings of control affect the actual drinking behaviour in social drinkers is another question, which will need to be answered by other future research. However, the data from the experiments reported in this thesis have indicated a positive relationship between quantity measures of alcohol consumption and the DAQ desire aspects.

The alcohol priming dose had no effects on other aspects of desire. This means that the responsivity of all DAQ scales to alcohol cues, which had been shown before in Experiment One and Two could not be replicated within the context of this experiment. Reasons for not detecting cue reactivity in the current experiment on DAQ scales other than Factor 4 (*Controllability*) could be various, and are related to the experimental design and procedure of the experiment. The following two factors may have been relevant in the current experiment:

(i) In the experimental design of the current study, no specific attention was paid to the selection of personal relevant alcohol stimuli for cue exposure. The participants could not choose their cue exposure drink(s) in the current experiment whereas personal relevant cues were used in Experiment One and Two by asking participants to choose their preferred drink. As discussed in chapter two, personal relevance of stimuli is particularly important when measuring conditioned responses, in other words, the assessed measure can also be described as the degree of experience and familiarity with certain alcohol stimuli. It is clear that unfamiliar stimuli cannot elicit conditioned responses.

(ii) The participants were required to consume one or two drinks within a probably unnaturally short period of time whereas in the previous experiment, participants could sample and consume the drink at their leisure, and during Experiment One they only sipped the drinks twice. It is possible that by forcing people to consume a drink within 10 minutes, the opposite effect was achieved. Participants could have experienced aversive effects from drinking one or two alcoholic or soft drinks, i.e. 330ml or 660ml of fluid within 10 or 20 minutes, respectively. Participants might

feel "full" or "bloated". Such aversive feelings towards drinking would not produce increases in desires to drink due to cue exposure. In contrast, it could also be possible that there was no need for the social drinkers in this study to exhibit desires for another drink at the time of the experiment because they had already consumed one or two drinks during the experiment. Another point to consider is the fact that the experiment was carried out during the late afternoon, so that the participants might possibly have had commitments afterwards, which would make continued drinking less likely. In social drinkers, desires to drink are more likely to be suppressed, or at least not acted upon if they interfere with plans or commitments of the person in question.

A main effect for the *Number* of drinks was found on factor 3 (*Negative Reinforcement*). Participants in the experiment had higher positive expectancies for negative reinforcement after two drinks than after one drink irrespective of the type of *Cues* (soft or alcoholic drinks). Expectancies for the outcomes of alcohol consumption are long-term memory structures that are formed through an individual's experiences with the effects of alcohol (Jones & McMahon, 1998). Those memory structures representing expectations about the consequences of consumption can be made more accessible by priming (Jones & Schulze, in press). Exposing participants to different alcohol cues can create a priming context: a bar setting, the sight and smell of a drink, a prime sip or alcohol related cognitions. It could be possible that positive outcome expectancies were triggered in participants when they were asked to rate their preference for the drink they were given during the cue exposure. The questions in the taste preference questionnaire were applicable to both soft and alcoholic drinks, so it would be possible that those questions triggered alcohol-related cognitions. Participants in the soft drink group were aware of the fact that they are "control participants in an alcohol taste preference experiment". Participants who received two drinks during the cue exposure, spent twice the time (20 minutes) filling in two taste preference questionnaire whereas participants in the one-drink-group spent only 10 minutes filling in one questionnaire. These additional 10 minutes attending to smell and taste cues of a drink might have triggered drinking related cognitions so that when participants encountered the alcohol desire questions on the DAQ, they reported more positive expectancies towards drinking. Experiment Two also pointed to the possible importance of cognitive stimuli triggering desire responses.

So far several factors which influence responses to alcohol cues have been found. A main factor appears to be the personal relevance of alcohol cues. According to classical conditioning theory, it is not surprising that stimuli which a person has not encountered before or only had little experience with, did not elicit conditioned responses, or only evoked small responses which were hardly detectable, let alone statistically significant. A point emerging from this experiment is that there are difficulties with testing the effects of alcohol priming doses in experiments as, due to constraints on time resources in experiments, participants need to consume the drink(s) within a short period of time. Again, confounding factors in the design of the experiment (e.g. varying exposure times or time constraints) make it difficult to reach a clear conclusion about the results. No conclusions about the impact of pharmacological effects of alcohol, i.e. the priming dose alone without the cues of sight and smell can be reached yet. This aspect is of relevance in relapse prevention since recent schools of thought in alcohol treatment emphasise the importance of preventing heavy, harmful levels of drinking rather than complete abstinence (e.g. Drummond & Glautier, 1994). If an alcoholic relapses and consumes alcohol, how does the consumed alcohol influence the desire for more drink and how much control over drinking can be resumed after one or two drinks? Those questions are of great importance in harm prevention in alcoholics but also have implications on the course of a drinking episode in social drinkers.

5 Experiment Four: The Effects of a Concealed Priming Dose of Alcohol on Desires to Drink

The last experiment demonstrated that an alcohol priming dose could affect certain aspects of desires to drink, as measured by the DAQ. Previous research has supported the notion that an alcohol priming dose can lead to an increased likelihood for drinking, even in social drinkers. However, it is still unclear if interoceptive, pharmacological alcohol cues affect the desire to drink, or if exteroceptive cues play a more important role in the motivation to drink. Experiment Four was designed to investigate if a small, concealed priming dose of alcohol and the sight, smell and taste have differential effects on social drinkers' desire for alcohol.

Sixty volunteer social drinkers participated in the experiment, which consisted of two phases. A priming phase (alcohol versus non-alcoholic priming dose) was followed by an exposure phase (alcohol versus soft drink cues). Desire for alcohol was measured by the multi-dimensional DAQ after the exposure phase.

No effect of the concealed alcohol priming dose could be detected. A significant effect of alcohol exposure stimuli was only detected for the DAQ factor *Mild Intentions and Positive Reinforcement* and the total DAQ score. No interactive effects between interoceptive and exteroceptive cues were found.

Failure to detect cue reactivity on other desire aspects was probably due to methodological differences between the current and previous experiments. However, the results point to the fact that knowledge of consumption exerts an important influence on subjective feelings of desire to drink. Experiment Two has also indicated the importance of cognitive stimuli associated with alcohol consumption. Such suggestions are supported by research from other areas in the alcohol field.

5.1 Introduction

Experiment Three demonstrated that a priming dose of alcohol is able to change certain aspects of desire to drink as measured by the DAQ. Social drinkers felt less in control over their drinking after they had consumed some alcohol. This result from the previous experiment suggests that the course of a drinking episode might be influenced by the consumption of a priming dose of alcohol. The priming dose did not significantly influence any other aspects of desire in the previous experiment. Experiments One and Two demonstrated the responsivity of other DAQ scales to the cues of sight, smell and taste. However, during the cue exposure of Experiment Three participants were not only exposed to the priming drink stimulus but also to the cues of sight, smell and taste of the drinks. Therefore, Experiment Three does not allow conclusions about the extent to which the pharmacological effects of alcohol contributed to the decreases in control feelings in the last experiment.

Nevertheless, the suggestion that a priming dose of alcohol increases the likelihood for continued drinking in social drinkers is supported in the literature. In a choice-task experiment, Duka, Tasker and Stephens (1998) found that participants, who had chosen and consumed an alcoholic drink rather than a placebo drink consumed significantly more drinks and were therefore much more likely to continue drinking after sampling a small dose of alcohol. The experiment also measured subjective feelings by self-assessment Likert bipolar visual analogue scales, and reported increases in feelings of 'alert', 'attentive', 'clear-headed', 'quick-witted' and 'content' after a priming dose of alcohol but desire for alcohol was not assessed. It was not reported if the participants consciously preferred alcohol to placebo. Similar results had been reported by de Wit and Chutuape (1993) who showed that participants were more likely to chose alcohol over placebo after they had consumed a priming drink of alcohol. In alcoholics, an increased likelihood of continued drinking through priming is associated with relapse (Ludwig, Wikler & Stark, 1974). Experiments with alcoholics have shown that an alcoholic priming dose would increase the number of drinks accepted compared to a non-alcoholic priming dose and would also increase the rate of drinking (e.g. Hodgson, Rankin & Stockwell, 1979; Stockwell, Hodgson, Rankin & Taylor, 1982).

Cue reactivity experiments have studied responses to various types of alcohol cues in order to partial out the most salient cues. As mentioned above, a priming dose of alcohol primed drinking and craving for alcohol in experiments with social drinkers and alcoholics. However, other experiments have shown that alcoholics' cravings were stronger affected by expectations of alcohol (i.e. the knowledge that alcohol is being consumed) than by the actual consumption of a priming dose (Laberg, 1986).

The cues of sight, smell and taste of alcoholic drinks, i.e. stimuli which always precede drug effects, were shown to be capable of eliciting strong subjective responses in social drinkers (Greeley et al., 1993; Kaplan et al. 1985; Monti et al., 1987) but it was found that social drinkers were more influenced by context than by the cues of sight and smell of alcohol (Jansma et al., 1997).

From the studies cited, and the evidence reported in this thesis it remains unclear how interoceptive cues, i.e. the pharmacological effects of the drug itself, affect the desire to drink, and if desire to drink might be a mechanism by which alcohol cues increase the likelihood for drinking after the consumption of a priming dose. Further, it remains unclear if interoceptive drug cues interact with exteroceptive cues to increase drug desire. The comparison between the responses to intero- and exteroceptive cues might reveal interesting facts about the salience of such cues and their role in the motivation to consume alcohol.

The question if a small priming dose itself can act as an alcohol cue to increase the desire for alcohol and can this way influence drug seeking behaviour is of particular importance for the course of a drinking episode once drinking has started. Pharmacological priming doses resemble the early effects of a drug which signal the later, larger effects (Siegel, 1999). Early theories and research have suggested that drinking small doses of alcohol has a strong effect on subjective feelings, in alcoholics, which could increase the likelihood for relapse. Jellinek's (1952) disease model of alcoholism and its central concept of loss of control was influential for research and treatment. The model predicts of a total loss of control after a chain reaction has been triggered by a priming dose of alcohol. The resulting conclusion of total abstinence as a treatment goal still features strongly in various treatment programmes (e.g. AA). The reported experiment aims to answer the question if a small priming dose of alcohol (i.e. interoceptive cues) and the sight, smell and taste (i.e. exteroceptive cues) have different effects in social drinkers on the desire for alcohol aspects measured by the DAQ.

5.2 Method

5.2.1 Participants

Sixty social drinkers (29 male, 31 female) were recruited for the experiment by advertising through posters in the University of Glasgow. Exclusion criteria for the experiment were (i) having ever been treated for, or diagnosed with, and alcohol problem;(ii) being under 18 years of age; (iii) having consumed any alcohol on the day of the experiment and (iv) possibly being pregnant.

Participation in the study was on a voluntary basis and participants gave their informed consent prior to the experiment. The appendix includes a copy of the consent form (Appendix A.11). Four pounds were paid for participation. The participants were predominantly students of the University of Glasgow, with a mean age of 21.8 years (SD = 2.8). They had consumed an average of 22.8 units of alcohol (SD = 18.5) during M = 3.2 drinking occasions (SD = 1.5) the week before the experiment. The participants started drinking at the current levels M = 3.1 years ago (SD = 2.6). Nineteen participants (32%) participants reported that a family member had a drinking problem; four participants (7%) had an alcoholic parent.

5.2.2 Design

The experiment was carried out using a 2x2 between-subjects design, with *Priming* dose (2 levels: no alcohol, one unit alcohol) and type of *Cues* (2 levels: soft drink, alcoholic drink) as independent factors. The cue exposure phase followed the priming phase. The dependent variables were the desire responses on the Desire for Alcohol Questionnaire (DAQ) which were assessed after the cue exposure. Participants were randomly placed in one of the four experimental groups (see Table 5-1).

Table 5-1. Experimental Cells and Participant Numbers (*n*) in the 2x2 (*Priming* x *Cues*) Between-Subjects Design (N = 60)

		Drink Cues	
		soft drink cues (S)	alcohol cues (A)
Priming	no alcohol (S)	S-S *n* = 15	S-A *n* = 15
	alcohol (A)	A-S *n* = 15	A-S *n* = 15

5.2.3 *Stimuli: Priming Dose*

In the first part of the experiment, participants received a fruit drink for consumption. Half the participants' (the non-alcoholic priming group) fruit drink contained no alcohol and consisted of 40 ml lime juice diluted with equal amounts of a Five Alive (tropical fruit juice) and Lilt (tropical flavoured lemonade) to a volume of half a pint (283ml). The other group's drink (alcohol priming group) consisted of a priming dose of one unit of alcohol in the same fruit drink mixture (1 unit – 8g of absolute alcohol; 1 unit equals one standard drink, i.e. one glass of wine or one shot of spirits). Participants were misleadingly but plausibly told that "the strong flavoured drink would provide the same background taste for every participant". Participants received no feedback about the ingredients of the strongly flavoured fruit drink mixture.

5.2.4 *Stimuli: Cue Exposure*

Participants were given a choice of one out of three drinks for the cue exposure, and were asked to name their preferred drink out of those choices. The soft drink cue exposure group could chose from a list of three canned carbonated soft drinks (Coke,

Irn Bru and Orange Tango). Participants in the alcohol cue exposure group could chose between three bottled alcoholic lagers (Budweiser, Becks and Miller).
Cue exposure was embedded in a stooge evaluation task which asked the participants to attend to the sensory properties of the drink and then find adjectives describing the packaging, the look, the small and the taste of the drink. Participants were automatically led through the cue exposure stages by asking them to "evaluate the sensory properties of the drink". The procedure ensured that participants were attending to the drink cues.

5.2.5 *Measures*

A stooge questionnaire to "evaluate the sensory properties of the drink" was designed to take participants systematically through the important stages (sight, smell, taste, consumption) of cue exposure. The questionnaire asked participants to find five adjectives describing the packaging, five adjectives describing the look of the drink, five for the smell and five adjectives for the taste of the drink. This procedure ensured participants' attention to the drink cues in question, as well it distracted from the real purpose of the experiment so that it is less likely that participants' responses reflect social norms or anticipated experimental demands. A copy of the questionnaire can be found in the appendix (Appendix A.12).
Desire for alcohol was measured with the short, 14-item version of the Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996). More information regarding the DAQ can be found in chapter two of this thesis (2.2.2 Stimuli and Measures). A copy of the DAQ is included in the appendix (Appendix A.02).
Participants also completed an adaptation of the Time-Line-Follow-Back drinking diary (Sobell & Sobell, 1992) which provided frequency and quantity measures to assess previous week's alcohol consumption. Demographic information was also collected. Copies of the drinking diary and the demographic questions asked can be found in the appendix (Appendix A.03 and A.04).

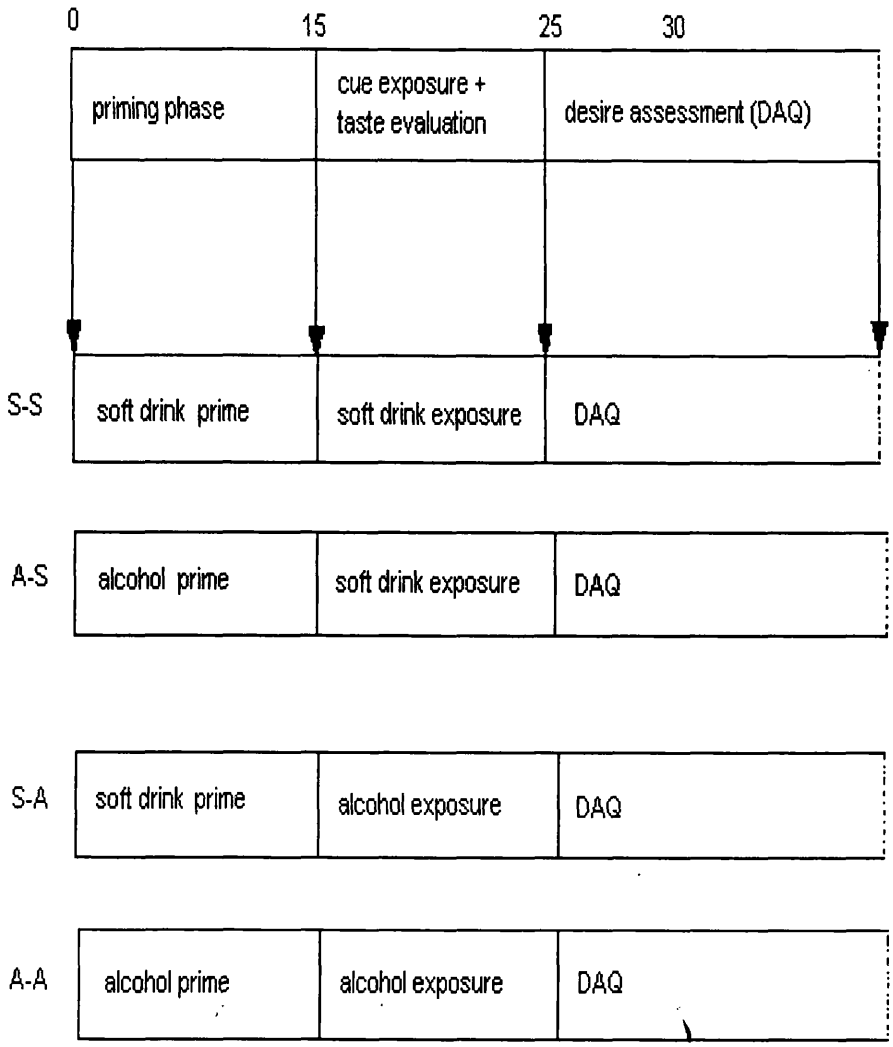
5.2.6 Procedures

The experiment had been advertised around the University of Glasgow as an experiment to "evaluate the sensory properties of alcoholic and soft drinks". At arrival, participants were randomly placed in one of the four experimental groups (S-S, S-A, A-A, A-S). Participants were seated in a small experimental laboratory and the purpose and the schedule of the experiment were explained to them before informed consent was sought. For ethical and safety reasons, it was particularly pointed out to the participants that the experiment might or might not involve drinking some alcohol but no more than one unit.

Participants were invited to make their drink choice for the cue exposure (out of three soft drinks or three alcoholic drinks, according to group assignment). They were then asked to complete the drinking diary and the demographic questions during which time they received the strongly flavoured fruit juice for consumption. It was explained to the participants that "the strong flavoured fruit drink would ensure that all participants start the subsequent drink evaluations with the same background taste". Participants were given 15 minutes to complete this phase and to finish the consumption of the fruit drink.

After the *Priming* phase, the experimenter returned with the chilled drink for the *Cue* exposure phase. Participants were asked to follow the instructions on the subsequent questionnaires. The stooge drink evaluation questionnaire instructed the participant to evaluate the drink by writing down five adjectives describing packaging, look, smell and taste of the drink. The *Exposure* phase was designed to last about 10 minutes.

The Desire for Alcohol Questionnaire followed after the cue exposure phase, and participants were left to complete the questionnaire at their own pace. A schematic description of the design and procedure used in the experiment can be found in Figure 5-1. Finally, participants were asked about the strongly flavoured priming drink they had received at the beginning of the experiment and what ingredients they thought it contained. Participants were debriefed after the experiment and paid 4 pounds for their participation.



Design: Cue Exposure Experiment

Figure 5-1. Schematic description of design and procedure: Experiment Four

5.3 Results

The data was analysed using the statistical package SSPS 7.0 for Windows. An alpha level of .05 was used for all statistical analyses.

2x2 analyses of variance using the Simple Factorial General Linear Model in SPSS were conducted on the data with *Priming* dose (alcohol priming versus no alcohol priming) and type of drink *Cues* (alcoholic versus soft drink cues) being the two independent between-subjects variables.

5.3.1 Group Differences in Alcohol Consumption

In order to evaluate if randomisation had produced experimental groups with similar demographic characteristics, 2x2 analyses of variance were carried out on the dependent variables of *age* and *quantity* and *frequency* of alcohol consumption.

No significant difference in age or drinking habits between the participants in the different exposure and priming groups could be detected. However, the findings and assumptions from the former experiments in this thesis suggested a relationship between desires for alcohol and consumption measures (e.g. Table 3-6 presents the correlations between desire measures and consumed alcohol quantity). Again, in this experiment the relationship can partly be supported by the correlations between consumption and desires in the data from this experiment (see Table 5-2). Although no group differences in consumption were found in this experiment, it was decided to enter *Quantity* of alcohol consumption as a *covariate* into the analyses. This provides continuity with previous experiments and controls for possible influences from the differences in drinking behaviour between participants on the strength of the correlations reported below.

Table 5-2. Pearson's Correlations *r* between *Quantity* of Alcohol Consumed in the Week prior to the Experiment and Desire for Alcohol (*N* = 60)

Dependent Variable	Quantity of Alcohol per week	
	r	*p* (2-tailed)
DAQ Total Score	0.03	0.82
DAQ 1 *Mild Intentions + Positive Reinforcement*	0.05	0.71
DAQ 2 *Strong Intentions and Desires*	0.06	0.63
DAQ 3 *Negative Reinforcement*	0.13	0.34
DAQ 4 *Control over Drinking*	-0.28	**0.03**

5.3.2 Desire for Alcohol

Aspects of desire for alcohol, as measured by the different factors of the DAQ, represented the dependent variables in the analyses of covariance (ANCOVA).

The exposure to alcohol cues increased the desire for alcohol for certain desire aspects (see figure 1). The main effect for *Cues* for the *total desire score* was significant, $F(1, 55) = 4.515$, $p = .038$. The differences between the mean scores for the alcohol ($M = 52.66$, $SD = 10.04$) and soft drink exposure group ($M = 46.33$, $SD = 12.35$) reached significance. No main effect for *Priming* and no significant interaction *Cues* x *Priming* was found. The covariate *Quantity* had no significant effects on the total desire scores. For a summary of the ANCOVA results see Table 5-3.

Table 5-3. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable Total Desire Score

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	7.734	1	7.734	0.058	0.811
Cues	602.319	1	602.319	4.515	0.038
Priming	0.432	1	0.432	0.003	0.955
Cues x Priming	0.772	1	0.772	0.006	0.940
Error	7337.570	55	133.410		
Total	154930.111	60			

A significant main effect for *Cues* was detected for *Mild Intentions and Positive Reinforcement* (DAQ factor 1), $F(1, 55) = 5.028$, $p = .029$; the covariate *Quantity* had no significant influence (see Table 5-4 for ANCOVA results). Participants in the alcohol group reported higher intentions and expectations of positive reinforcement ($M = 5.41$, $SD = 1.20$) than participants who were exposed to soft drink cues ($M = 4.51$, $SD = 1.80$). There was no significant different between the no-alcohol and alcohol priming groups, and no significant interaction for *Cues* x *Priming*.

Table 5-4. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 1 *Mild Intentions and Positive Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	0.289	1	0.289	0.119	0.731
Cues	12.153	1	12.153	5.028	**0.029**
Priming	0.711	1	0.711	0.294	0.590
Cues x Priming	0.897	1	0.897	0.371	0.545
Error	132.943	55	2.417		
Total	1621.382	60			

The main effect for *Cues* on DAQ factor 2 (*Strong Intentions and Desires*) failed to reach significance, $F(1, 55) = 3.091$, $p = .084$. The alcohol group reported scores of $M = 2.16$ ($SD = 1.05$) on DAQ factor *Strong Intentions and Desires* whereas the soft drink group score averaged around $M = 1.86$ ($SD = 1.03$). No main effect for *Cues* and no interaction for *Cues* x *Priming* was found. The covariate *Quantity* had no significant influence on the scores of this factor. See Table 5-5 for a summary of the ANCOVA results.

Table 5-5. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 2 *Strong Intentions and Desires*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	0.592	1	0.592	0.531	0.469
Cues	3.447	1	3.447	3.091	0.084
Priming	0.069	1	0.069	0.062	0.805
Cues x Priming	1.451	1	1.451	1.302	0.259
Error	61.325	55	1.115		
Total	287.938	60			

No main effects for *Cues* or *Priming* dose and no interactions between *Cue* and *Priming* dose were found on DAQ factors 3 (*Negative Reinforcement*) or 4 (*Control over Drinking*). A summary of the ANCOVA results for DAQ factor 3 and factor 4 can be found in Table 5-6 and Table 5-7.

Table 5-6. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 3 *Negative Reinforcement*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	0.978	1	0.978	0.860	0.358
Cues	0.798	1	0.798	0.702	0.406
Priming	1.012	1	1.012	0.889	0.350
Cues x Priming	0.186	1	0.186	0.164	0.687
Error	62.572	55	1.138		
Total	509.813	60			

Table 5-7. Tests of Between-Subjects Effects (2x2 ANCOVA) for the Dependent Variable DAQ Factor 4 *Control over Drinking*

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
covariate Quantity	10.249	1	10.249	5.642	**0.021**
Cues	0.040	1	0.040	0.022	0.882
Priming	0.273	1	0.273	0.150	0.700
Cues x Priming	3.305	1	3.305	1.819	0.183
Error	99.918	55	1.817		
Total	1960.500	60			

In summary, the main effects of alcohol cues (*Cues*) and the effects of a priming dose of alcohol (*Priming*) are graphically presented in Figure 5-2 and

Figure 5-3, respectively.

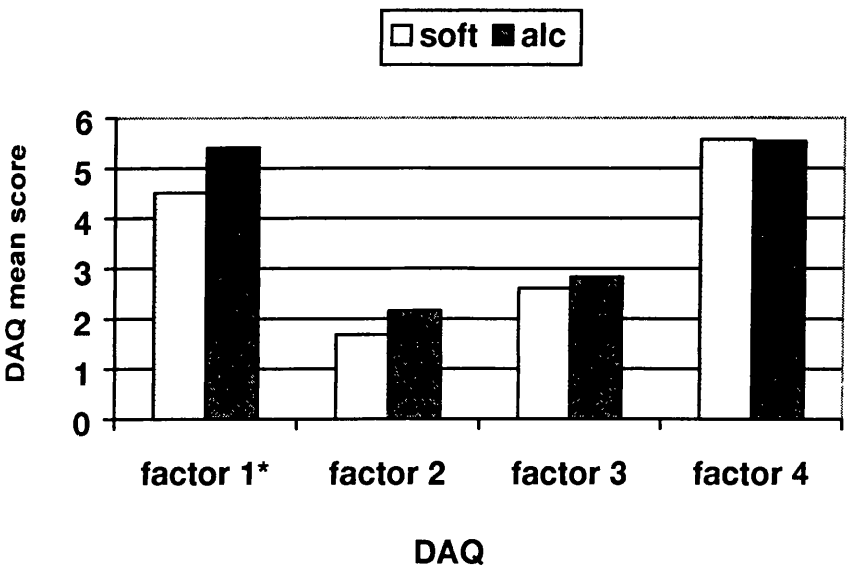


Figure 5-2. The effects of sight, smell and taste of alcohol and soft drinks on the desire aspects of the DAQ (*DAQ 1 *Mild Intentions and Positive Reinforcement*: $F(1, 55) = 5.028$, $p = .029$; factors 2, 3, 4 $p > .05$)

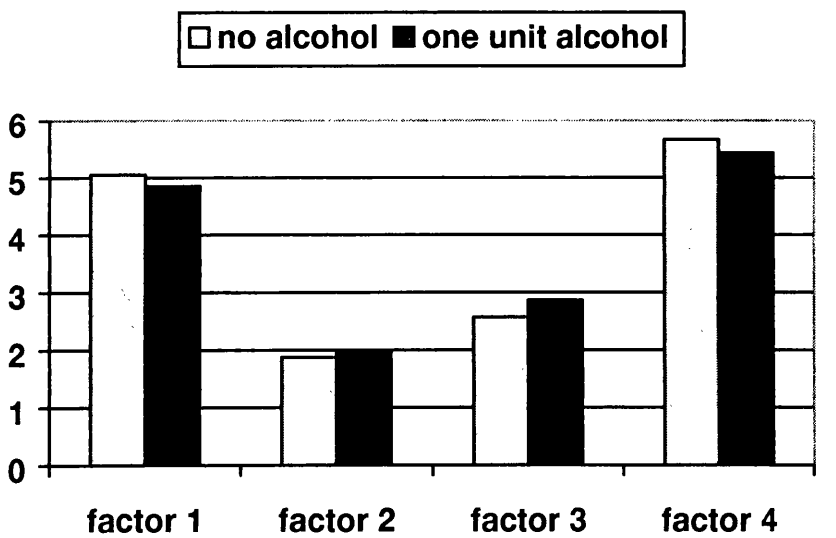


Figure 5-3. The effects of a 1-unit alcohol priming dose on the desire aspects of the DAQ (factors 1, 2, 3, 4: $p > .05$)

5.4 Discussion

The reported study had two aims. Firstly, it investigated if interoceptive (i.e. internal) or exteroceptive (i.e. external) alcohol cues exert a greater influence on social drinkers' subjective cue responses. And secondly, it explored if interoceptive alcohol cues interact with exteroceptive cues to produce subjective cue effects.

The experiment did not show any effects of interoceptive cues on desires to drink alcohol, nor could any interactions between intero- and exteroceptive cue effects be shown. Increased subjective responses after the exposure to exteroceptive alcohol cues (sight, smell, taste) were only found on the desire dimension of DAQ factor 1 *Mild Intentions and Positive Reinforcement* and the total desire score. DAQ factor 2 (*Strong Intentions and Desires*) showed numerical differences in responding to alcohol and soft drink cues which failed to reach significance. Neither interoceptive nor exteroceptive cues nor an interaction of both influenced DAQ factors for expectations of *negative reinforcement* and for feelings of *controllability.*

Such a result for the controllability dimension provides an interesting contrast to the findings from previous experiments. Experiments Two and Three suggested that a priming dose of alcohol influences social drinkers' feelings of controllability over drinking. In both experiments the participants were *aware* of the fact that they were consuming alcohol and they were exposed to the alcohol stimuli at the same time. The current experiment eliminates the knowledge-of-consumption component and dissociates interoceptive and exteroceptive alcohol cues so that a separate analysis of their effects is possible. The fact that neither interoceptive nor exteroceptive alcohol cues alone could alter feelings of controllability, nor could a previous experiment demonstrate cue responsivity on the *controllability* factor without alcohol consumption, suggests that feelings of controllability are strongly influenced by the sheer knowledge that alcohol is being consumed. Such a suggestion for the influence of cognitive factors is supported by experimental evidence cited in the introduction to this chapter, which states that cravings for alcohol are more affected by expectations of alcohol (i.e. the knowledge that alcohol is being consumed) than by the actual consumption of a priming dose (Laberg, 1986). Indeed, this experiment demonstrated that the consumption of a priming dose of alcohol does not seem to influence any alcohol desire aspect as long as the social drinker was not aware of

drinking. In contrast to an alcohol priming dose, alcohol cues of sight, smell and taste could influence desires to drink, as shown in the current and in previous experiments of this thesis. The DAQ factor of *Mild Intentions and Positive Reinforcement* appears to be most responsive to the exteroceptive alcohol cues of sight, smell and taste of alcohol. The current experiment failed to show responses to alcohol cues on any of the other DAQ factors. Directional differences on the total desire score and DAQ factor 2 (*Strong Intentions and Desires*) suggest that changes in the experimental procedures of the current experiment and the use of a different cue exposure schedule, could have contributed to the failure to detect cue responses on other DAQ factors. These methodological points however, do not change the fact that the current experiment points to the importance of *knowledge* of alcohol consumption in subjective responses to alcohol cues. The experiment suggests that cue effects can be elicited in social drinkers by the sheer knowledge of alcohol consumption. Research, which investigated psychomotor or cognitive effects under placebo conditions, supports the claim made that knowledge of consumption has a strong influence. Vogel-Sprott & Fillmore (1999) report that drinkers who expect greater impairment under alcohol also perform poorly under a placebo. Expectations about impairments under alcohol predicted the performance on a psychomotor and cognitive task to a placebo when alcohol was expected.

The preliminary conclusion that cue effects can be elicited in social drinkers by the sheer knowledge of alcohol consumption needs to be supported by further research. Experiment Two had also pointed to the influence of cognitive stimuli on cue responding. Future research should take advantage of sophisticated balanced placebo designs (Marlatt, Demming & Reid, 1973; Marlatt & Rohsenow, 1980), which control for participants' beliefs about the alcohol content of their drink. Such designs allow to separate beliefs about alcohol consumption from the pharmacological effects of alcohol. By employing a balanced placebo design, the influence of cognitive factors, like knowledge of consumption or beliefs about the alcohol content of a drink, could be reliably tested.

6 General Discussion

6.1 Summary of Research Findings

This thesis has focussed on exploring cognitive, motivational responses to alcohol cues in social drinkers. Studies of cue reactivity have usually employed physiological and subjective measures of responses to alcohol stimuli, which were previously associated with drinking. Physiological measures, which are thought of as being objective measures of reactivity, have yielded small effect sizes but their motivational relevance still seems unclear (Carter and Tiffany, 1999a, 1999b). Subjective measures of cue reactivity have also been widely assessed after cue exposure, and the effect sizes were larger than for physiological measures. This thesis argues that by investigating the subjective, cognitive nature of cue responses in social drinkers a wider picture of alcohol motivation can be gained.

Social drinkers represent an ideal population for the investigation of drinking-related issues because they have frequently experienced the effects of alcohol but problems associated with alcohol dependence do not muddy the waters when interpreting the results (Schulze & Jones, 1999a). A central assumption in social learning theory is that of a continuum of alcohol consumption, and that all points on the continuum, which varies from social drinking to alcohol abuse, are influenced by the same learning principles (Maisto, Carey & Bradizza, 1999). By using such a common framework, knowledge about alcohol cognitions could be extrapolated from one point to any other point on a continuum of alcohol use (Jones & McMahon, 1998). Using this method, more knowledge about alcohol cognitions can be gained and a more complete picture about the role of alcohol cognitions can be disclosed.

Previous studies investigating cue reactivity have concentrated on the conditioned responses of drug-dependent participants, and often only assessed social drinkers' responses within a control group design. Studies which have measured social drinkers' cue responses suggested that cue responses play an important part for social drinkers' motivation to consume alcohol (e.g. Greeley et al., 1993; Wallitzer & Sher, 1990).

Subjective responses have been reported to be influenced by drinking-related cues in social drinkers. The concept of cravings and desires has been controversial; although

it was suggested to abandon the term 'craving' from scientific use (WHO, 1955), it has been popular in research and treatment (Wise, 1988). Theories about the nature of cravings have been manifold: some theories suggest that they arise from the reinforcing properties of drugs (e.g. Ludwig, Wikler & Stark, 1974), others explain them in a cognitive context (e.g. Tiffany, 1990). Measurement of subjective cravings or desires has to rely on self-reports. Methodological discussions evolving from meta-analyses and the development of drug craving questionnaires have pointed to the fact that only few cue reactivity studies have accounted for the complexity of craving hypotheses by employing multi-dimensional measures of craving and desire for alcohol (e.g. Carter & Tiffany, 1999b). Carter and Tiffany's call for the use of multi-dimensional, psychometrically adequate self-report measures of cue reactivity has been heeded in the work of this thesis. The reported experiments used a new, multi-dimensional questionnaire to assess desires for alcohol in social drinkers. Before discussing the findings of this research in more detail, a summary of the main work that has been carried out will be given now.

Experiment One, reported the use of the newly developed, multi-dimensional assessment tool, the Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996), to investigate whether social drinkers displayed alcohol cue responses. A cue-exposure experiment was carried out, using a within-subject design, where 86 social drinkers attended to the cues of sight, smell and taste of their favourite soft and alcoholic drink. Those personalised soft and alcoholic drink stimuli were presented in a counterbalanced order. Subjective cue responses were recorded with the 14-item, self-report DAQ.

Mixed 2x2 Analysis of Variance revealed significant responses to the sight, smell and taste of alcohol on all aspects of desire as indicated by the four DAQ factors. Desire scores on three factors increased after alcohol exposure; perceived *Control over Drinking* (factor 4) decreased after looking at, smelling and tasting the alcoholic beverage. No significant effect of counterbalancing the stimulus presentation was detected. Through the novel approach of measuring subjective cue responses, Experiment One could demonstrate that *different aspects* of subjective desire for alcohol are responsive to cue manipulation. It is therefore concluded that multi-dimensional instruments should be employed to assess subjective cue reactivity. Further, it is pointed out that the DAQ factors of *Mild Intentions and Positive*

Reinforcement (factor 1) and *Negative Reinforcement* (factor 3) represent alcohol outcome expectancies rather than sheer desires to drink.

Experiment Two follows by introducing the concept of alcohol outcome expectancies. The DAQ scales, which were described as positive outcome expectancies scales (*Mild Intentions and Positive Reinforcement* and *Negative Reinforcement*), were found to be very limited with respect to the range of positive outcome expectancies that are usually assessed in alcohol motivation research. Therefore, Experiment Two extended the range of outcome expectancies measured by employing two established expectancy questionnaires, the Alcohol Expectancy Questionnaire (AEQ: Brown, Christiansen & Goldman, 1987) and the Negative Alcohol Expectancy Questionnaire (NAEQ: Jones & McMahon, 1994).

Experiment Two was advertised as a 'taste preference experiment' and 88 social drinkers volunteered to participate. During the taste preference assessment exercise, participants were systematically exposed to the sight, smell and taste of either soft or alcoholic drinks. A between-subjects design with two levels (soft/alcoholic drink cues) was used. After taste evaluation (i.e. cue exposure), subjective responses were measured using the DAQ, AEQ and NAEQ. Linear relationships between *Quantity* of alcohol consumption and some DAQ desire aspects were detected and therefore, analyses of covariance were conducted on the data, controlling for the effects of *Quantity* of alcohol consumption.

Significant alcohol cue effects were found for alcohol desires on the DAQ total score and two of the four DAQ subscales. A third DAQ factor, *Mild Intentions and Positive Reinforcement*, displayed a cue response, which failed to reach significance ($p = .051$). The fourth DAQ factor *Controllability* only demonstrated an alcohol cue response when desire measurement was preceded by testing on the expectancy questionnaires. There were no significant alcohol cue responses for expectancy as measured by the AEQ or NAEQ.

The discussion centred on the perceived loss of control over drinking after alcohol cue exposure and expectancy questionnaires. The experimental design led to the conclusion that the decrease in perceived controllability over drinking could be due to either (i) the effect of a priming dose of alcohol, or (ii) the effect of alcohol cognitive cues associated with filling in the expectancy questionnaires (i.e. expectancy items). The failure to detect cue responses on any of the expectancy questionnaires was also discussed. Questionnaire or concept failure were suggested

as reasons for the result. It was concluded that contemporary expectancy measurement tools are unlikely to be successful in assessing short-term changes in alcohol outcome expectancies, and that therefore this line of investigation is unlikely to gain fruitful results.

In Experiment Three the importance of perceived loss of control over drinking was to be studied more extensively. Research on loss of control in alcohol-dependent subjects lent some support for the view that a priming dose of alcohol can elicit a reaction that leads to a decrease, or to loss of control over drinking. Such a view has been advertised by the medical model of alcohol dependence which is known for the statement "one drink, one drunk" (Jellinek, 1952). Though popular, such a view has not been without criticisms since it rules out an aim of moderate drinking as a treatment goal. Previous research has shown, however, that control over drinking can be regained by an alcohol-dependent patient, and moderate drinking can be achieved (Heather, Tebbutt & Greeley, 1993). Therefore, it was decided to investigate the effects of alcohol priming doses on the various desire aspects of the DAQ, and particular interest was reserved for the DAQ factor feelings of control over drinking.

The experiment assessed the subjective responses of 64 volunteer social drinkers after consumption of either one or two priming doses of soft or alcoholic drink during another 'taste preference' experiment. Subjective cue reactivity was assessed using the multi-dimensional DAQ. Significant main effects were detected on two DAQ factors: *Negative Reinforcement* and *Control over Drinking*. The consumption of two drinks (soft or alcoholic) increased positive expectations about the negative reinforcing effects of alcohol consumption. It is suggested that alcohol-related cognitions (i.e. out come expectancies) were triggered by a priming context, which the two-drinks condition could have represented. Such an explanation relates to the earlier suggestion about the influence of cognitive stimuli on desires to drink.

Alcoholic drinks significantly decreased perceived feelings of control over drinking. Therefore, a priming dose of alcohol might influence subsequent drinking behaviour by affecting perceived feelings of control over drinking, even in social drinkers. However, it remained unclear whether interoceptive, pharmacological alcohol cues influence the desire to drink, or whether exteroceptive cues play a bigger role in the motivation to drink. The last experiment, Experiment Four, was designed to

investigate if a small, concealed priming dose of alcohol and the sight, smell and taste have differential effects on social drinkers' desire for alcohol.

Experiment Four used a 2x2 between-subjects design to investigate the effects of interoceptive (i.e. pharmacological) and exteroceptive alcohol cues. Sixty volunteer social drinkers participated in the experiment, which consisted of two phases. A priming phase (alcohol versus non-alcoholic priming dose) was followed by an exposure phase (soft drink versus alcohol cues). Desire for alcohol was measured by the multi-dimensional DAQ after the exposure phase.

The concealed alcohol priming dose had no significant effects on desires to drink. A significant effect of exteroceptive alcohol exposure was only detected for the DAQ factor *Mild Intentions and Positive Reinforcement.* However, the results point to the fact that knowledge of consumption exerts an important influence on subjective feelings of desire to drink.

To summarise, the main findings of the presented research are:

- ✧ It was demonstrated that the DAQ as a new, multi-dimensional measure of cue reactivity in social drinkers is responsive to cue manipulation on *different* subjective desire aspects. Alcohol cue exposure increased subjective desires on DAQ factors 1 (*Mild Intentions and Positive Reinforcement*), 2 (*Strong Intentions and Desires*) and 3 (*Negative Reinforcement*), and reduced perceived feelings of control over drinking (DAQ factor 4).
- ✧ Social, non-dependent drinkers showed significantly different subjective responses to alcohol cues when compared with responses to matched, neutral stimuli.
- ✧ The aspects of alcohol desire measured by the DAQ have been found to be linearly related to alcohol consumption measures (i.e. quantity consumed per week) and positive outcome expectancies.
- ✧ Two DAQ aspects represent cue responsive positive outcome expectancies. On more extensive, established alcohol expectancy measures, the responsiveness of expectancies to cue manipulation could not be replicated.
- ✧ The consumption of a priming dose of alcohol changed social drinkers' perceived control over drinking compared with a non-alcoholic priming dose.

- ✧ The amount of alcohol priming dose consumed did not influence desires to drink significantly: there was no difference on DAQ desire aspects between the consumption of one or two priming doses of alcohol.
- ✧ Pharmacological (interoceptive) alcohol cue did not influence desires to drink but exteroceptive alcohol cues of sight, smell and taste did.

The main findings from the experiments reported in this thesis will be discussed now.

6.2 Multi-dimensional Measures of Desire

The currently reported experiments have headed the criticisms by Carter and Tiffany (1999b) and Glautier and Tiffany (1995) about the limitations of the use of uni-dimensional measures for cravings and desires to drink, and responded to their call for acknowledging complex craving hypotheses by using multi-dimensional measurements methods. The reported research used a new, multi-dimensional measure, the Desire for Alcohol Questionnaire, to assess desires to drink after cue exposure. Previous research has shown the DAQ to be superior to a single-item measure of desire to drink (Schulze & Jones, 1999d). The earlier experiment by Schulze and Jones showed that the DAQ was able to detect changes in certain desire aspects after cue exposure whereas the uni-dimensional desire scale recorded no differences in desire after soft and alcohol drink cue exposure. The research in this thesis has extended previous work by investigating the desire responses on the various DAQ factors to different types of alcohol cues. The most basic finding from this research though is that social drinkers did show responses on various *aspects* of desire to drink. The use of multi-dimensional assessment tools seems therefore not only justified but also essential to solving the puzzle that the motivation to drink represents to alcohol researchers.

6.3 Social Drinkers show Subjective Cue Reactivity

This research showed that social drinkers displayed higher desire responses after the exposure to alcohol cues than after soft drink cue exposure. Differences between

social drinkers and a clinical population of alcoholics have been pointed out in the introduction to this thesis. Many researchers have ignored social drinkers as a target group of their research. This thesis has argued that the study of social drinkers' alcohol motivation can provide knowledge of motivational principles that can be applied to clinical populations. The results of the presented experiments support such a view. Conditioned responses to alcohol cues were detected in a social drinking population, just as they had been shown in clinical populations in earlier research. The implications from such a result are clear: social drinkers can no longer be excluded from alcohol studies. Firstly, because they present a population, to which access is easily available, ethical considerations are simpler to handle and medical as well as psychological complications related to alcohol abuse do not complicate the investigation (Schulze & Jones, 1999c). Secondly, such a result suggests that cue responses also affect social drinkers behaviour, and although they are not alcohol-dependent, problems arising from occasional misuse of alcohol have health and economy damaging effects. It has not been the purpose of the currently reported experiments to investigate the relationship between desire responses and actual drinking behaviour but nevertheless, some of the data have suggested that desire responses are positively related to drinking behaviour in social drinkers. However, the question if increased desires to drink leads to alcohol consumption in social drinkers remains unanswered. The answer to this question is of practical importance and future research should aspire to answer it. The point made by Glautier & Remington (1995) that behavioural measures could provide important information in terms of the impact alcohol cues have on drinking behaviour comes to mind when trying to think of possible research designs to answer this question.

6.4 Outcome Expectancies as Measures Of Cue Reactivity?

In Experiment One, two of the DAQ scales, which were found to be cue responsive, were described as measures of positive outcome expectancies. In Experiment Two, more extensive, established measures of outcome expectancies (AEQ and NAEQ) were recruited for assessment but were not found to be cue responsive. As already discussed in chapter three, the discrepancy between the two results probably arises from the difference in measurement. The DAQ is a short measure of 14 items, which

takes about 3 minutes to complete. The AEQ and NAEQ are comprehensive measures of outcome expectancies comprising of 64 and 60 items, respectively, which take about 8 minutes each to fill in. It seems likely that the DAQ is much better suited to assess short-term changes in desires and expectancies than the longer, more extensive expectancy measures. Chapter three pointed out, that it is not apparent if the concept of outcome expectancies justifies state-like, fast changes in response to alcohol stimuli. This statement leads to another line of thought: Maybe desires and outcome expectancies exist on two different levels: as fast changing states and as more permanent traits. Such a concept would explain the discrepancy in results yielded in the research work of this thesis. Positive outcome expectancies, as an aspect of alcohol desire, experienced by social drinkers after alcohol cue encounters would be measured by the DAQ, and the AEQ and NAEQ would measure slow-changing outcome expectancies which are stored in long-term memory. It is very difficult to evaluate if state-like changes occur in outcome expectancies on the basis of the few expectancy items in the DAQ. The AEQ and NAEQ do not seem suitable to assess such fast changes, mainly due to their length. In order to reliably answer the question if alcohol expectancies are cue responsive, research will have to await the development of appropriate new expectancy measures.

6.5 The Effects of a Priming Dose of Alcohol

In Experiment Two, the consumption of a priming dose of alcohol changed social drinkers' perceived control over drinking compared with a non-alcoholic priming dose but only if desire assessment was preceded by expectancy assessment. Two factors could have accounted for such a finding: (i) the consumption of the priming dose of alcohol and / or (ii) the cognitive prime the 124 alcohol-related questions of the AEQ and NAEQ presented. The research reported in this thesis followed up the first explanation since it seemed the most popular and controversial with a view on the literature on relapse following the loss of control through a priming drink. Ongoing research in our laboratory is investigating the second explanation by assessing the effects of cognitive priming stimuli on desire responses. If indeed, cognitive stimuli would affect desire responses in social drinkers, such a result would

have important implications in an applied setting. Imaginal cue exposure treatment approaches could profit from such new findings, and new, cheaper treatment variations could be developed.

In Experiment Three, desire responses were assessed immediately after consumption of one or two drinks (soft or alcoholic drinks). The data showed that after the consumption of an alcoholic priming dose perceived control over drinking was significantly lower than after soft drink consumption. This result supported the earlier mentioned hypothesis that a priming dose of alcohol influences feelings of control over drinking. No effects of the amount of alcoholic priming dose were shown on any of the desire aspects. It appears that alcohol desires in social drinkers are only influenced by the fact that alcohol *is* consumed, not how much of it. This again stresses the importance of cognitive factors. Further, only feelings of control over drinking were shown to be influenced by alcohol consumption but not the other aspects of desire to drink. This finding could be due to the fact that participants had to consume one or two units of drink in a short amount of time, which probably counteracted their desire to drink. It is also possible that social drinkers' desire to consume more alcohol decreased after one or two units of alcohol, especially in the late afternoon when further alcohol consumption would jeopardise their commitments for the rest of the evening.

However, the design of the experiment did not allow the conclusion which kinds of alcohol cues played the most important role in the perceived loss of control. Was it the pharmacological effect of the alcohol priming dose, or was the response due to exteroceptive stimuli of alcohol consumption? Experiment Four was carried out to answer those questions.

A concealed pharmacological priming dose of alcohol was given to half the participants and the rest received plain fruit juice. Cue exposure with soft or alcoholic drink stimuli followed. The results revealed no effects of the hidden alcohol priming dose on any desire aspect but exteroceptive cues of sight, smell and taste influenced the desire to drink alcohol.

The data from the experiment showed that alcohol consumption per se did not increase desire or decrease control over drinking. In social drinkers, a pharmacological priming dose had no effect on desires to drink. Therefore, the findings from Experiments Two and Three have to be evaluated in a new light: cue responses detected in previous experiments were probably due to the participants'

knowledge, beliefs and expectations about drinking alcohol. The exteroceptive alcohol cues of sight, smell and taste normally signal alcohol consumption, and participants in the experiments were even aware of consuming a certain amount of alcohol. Looking at other ongoing alcohol research can support such suggestions. Research that has investigated impairments on psychomotor tasks under alcohol and placebo has discovered similar connections between knowledge of drinking and performance on a task. In a recent review of their work, Vogel-Sprott and Fillmore (1999) report how expectations about impairments on a task under alcohol relate to actual performance, either under alcohol or placebo. Further, previous cue reactivity studies have reported the importance of knowledge of consumption for craving responses in alcoholics (Laberg, 1986). A study by McCusker and Brown (1990) reported that expectations and knowledge of consumption influenced social drinkers' cravings for alcohol.

Although ample support for the importance of expectations and knowledge of consumption comes from other alcohol research areas (e.g. Vogel-Sprott and Fillmore's studies of responding on a psychomotor task), this idea has not received much attention in cue reactivity research itself. This is particularly surprising since recent years saw an increase in interest in the effects of cognitive factors on cue responses, like the effects of negative mood or attention focus (e.g. Bradizza et al., 1999; Hodgins, el-Guebaly & Amstrong, 1995; Stormark et al., 1995).

It appears that knowledge of consumption is an important alcohol cue, able to elicit subjective responses like desires for alcohol and changes in perceived control over drinking. It has to be emphasised that the experiments reported in this thesis cannot present empirical evidence for such a suggestion. The set of results from the four reported experiments and previous research only implies that knowledge of alcohol consumption exerts a strong influence on desires and cravings for alcohol. Future research should investigate the influence of knowledge of consumption by employing sophisticated balanced placebo designs (Marlatt & Rohsenow, 1980).

6.6 Methodological Considerations and their Impact on Research Findings

Some methodological points which are also of great theoretical importance, and which have been introduced at the beginning of this thesis, will be discussed in

retrospective now. In chapter one, the methodology of cue reactivity studies was discussed and it was pointed out that many opportunistic study designs do not allow the conclusion that the observed response is indeed a conditioned response (Robbins & Ehrman, 1992). Robbins and Ehrman suggested that general arousal often gets mislabelled as craving, or that subjects respond to the demands of the situation and report craving because they feel that they are expected to respond in a certain way. The experiments of this thesis cannot fully exclude either of those explanations for the positive result in cue reactivity but steps have been taken to make their occurrence less likely. As for the first possible explanation, the mislabelling of arousal that could be caused by the unusual, unknown experimental setting, the following points can be made: subjects were tested individually in a quiet and comfortable laboratory atmosphere and the agenda for the experiment was explained to them beforehand. They also filled in a drinking diary and the demographic data sheet before the experiment, which allowed time to acclimatise to the unknown laboratory environment. By the time their subjective desire responses on the DAQ were assessed, participants had spent at least 20 minutes in the laboratory and therefore had plenty of time to adjust to the unknown environment. As for point two, the demand characteristics of the experiment, efforts had been taken to disguise the real concern of the experiments. Experiment Two, Three and Four had been advertised as 'taste preference experiments' and it was explained to participants that we were interested in what they thought of the drink in terms of its presentation, taste etc. for marketing research purposes. The gains of this procedure were twofold: the focus on the alcohol cues of sight, smell and taste and the following 'evaluation' of those cues demanded the participants to direct their attention onto the drink cues, and it was therefore ensured that cue exposure was carried out systematically. Secondly, if participants responded to the anticipated demands of the experiment, the shift in experimental focus onto the drinks' evaluation should have placed the experimental demands away from the desire assessment. Nevertheless, it is still possible despite all the efforts that demand characteristics could have accounted for a proportion of the cue reactivity reported in the experiments.

In order to allow inferences about the nature of the response, Robbins and Ehrman (1992) also called to pay more attention to control procedures in cue reactivity experiments. Most experiments use a drink of spring water or lemonade, or even drinking-unrelated stimuli like cedar chips as control stimuli. Experimental

procedures should be the same in experimental and control group – apart from the manipulation of the variable in question. When participants are presented with their preferred alcoholic drink (i.e. choice of preferred drink) in the experimental group, and with spring water in the control condition (i.e. no choice), then it is clearly not the case that only the experimental variable was manipulated. A positive emotional response can be expected in response to the presentation of a *preferred* drink; no response would be expected to a random control stimulus like spring water if participants feel ambivalent towards spring water but if they dislike spring water an emotionally negative response can be expected. It is not surprising that studies using such a design report great differences in desire to drink between experimental and control stimulus. Naturally, a preferred stimulus of any kind will elicit a positive response. However, this research is only interested in such a response if it is attributable to a previous conditioning process in connection with alcohol consumption. In the currently reported experiments, the only variation between experimental and control group consisted of the drink (soft or alcoholic drink) they received. Both kinds of stimuli were chosen by the subject as their preferred (soft or alcoholic) drink, both required the same movements to go through the procedure (open, pour into a glass, hold, smell, sip). Therefore, appropriate control stimuli have been used which allows the conclusion that the observed responses are indeed conditioned responses.

Experiment One discussed the appropriate use of counter-balancing in cue exposure experiments. There has been an argument amongst researchers if counter-balancing is the right method of stimulus presentation, or if its disadvantages overrule the advantages, and a fixed order of presentation would deliver more reliable results (e.g. Carter & Tiffany, 1999; McCusker & Brown, 1991). Experiment One used counter-balancing for stimulus presentation and subsequent evaluation found no effects of counterbalancing on subsequent desire assessment. Therefore, counterbalancing stimulus presentations is suggested in experiments that assess subjective cue responses since it ensures internal validity of the experiment.

The first reported experiment in this thesis used personalised stimuli to elicit craving responses in social drinkers. A within-subject design was used which produced strong effects on all desire aspects measured by the DAQ. The subsequent experiment (Experiment Two) only allowed a choice of one out of three drinks, and therefore personal relevance of the stimuli was not as strong as in the previous

experiment. Nevertheless, desire responses could still be detected on all DAQ scales. Such a result requires a certain degree of generalisation to stimulus properties. Therefore, it can be concluded that possible cue exposure techniques need to account for such stimulus generalisation in order to be effective.

6.7 Future Research and Possible Treatment Implications

The research findings presented in this thesis have answered many of the questions that initiated the research but the over the course of four experiments new questions have been provoked, which future research will need to answer. One of the most important issues brought up in the reported studies is the question about the relationship of cue responses and actual drinking behaviour. Correlational analyses in this thesis suggested a positive relationship of subjective desires and quantity of weekly alcohol consumption. The answer to the question whether desire leads to drinking is of obvious practical importance, and suggestions for possible research designs would follow Glautier and Remington's (1995) remarks about behavioural measures providing the most direct information about the impact of alcohol cues on drinking behaviour. Although Glautier and Tiffany (1995) comment that the complexity of drug-use behaviours will make it unlikely for any single (assessed) behaviour to provide an overall index for drug use behaviour, Carter and Tiffany (1999b) believe that his should not prevent basic research, which can provide information about the impact of alcohol cues on consumption.

The influence of cognitive stimuli like knowledge of consumption or the priming of alcohol-related concepts in memory is another issue brought up by the results of the reported cue reactivity experiments. The data from the experiments implied the importance of knowledge of consumption but reliable conclusions cannot be drawn since the experiments were not designed to test such factors. As suggested earlier, sophisticated balanced placebo designs (Marlatt & Rohsenow, 1980) need to be employed further for assessing the effects of expectations and knowledge of alcohol ingestion. Experiments based on such designs are difficult to carry out since they include deception of participants about the alcohol content of their drinks (Hammersley, Finnigan & Millar, 1992).

The results from the second experiment suggested that the process of reading alcohol-related words and thinking about drinking can act as an alcohol cue in itself, which then impacts on the desire responses measured by the DAQ. This finding that additional alcohol cues might be generated by the alcohol-related words in the expectancy questionnaires could have implications for applied areas of psychology. Advertising strategies in print and electronic media could be influenced by such findings. The impact on treatment strategies in clinical settings might be more profound: e.g. imaginal exposure approaches in cue exposure treatment could be advocated which would not only get around ethical considerations, it would also be cost- and time-effective, and could even be developed as a do-it-yourself "homework" programme. Ongoing research in our laboratory is trying to answers the questions related to the impact of cognitive cues. Our research is in line with other recent research in the field of cue exposure treatment, which has also concentrated on cognitive cues for drinking, especially on negative mood (e.g. Stasiewicz et al., 1997).

The effects of alcohol priming doses on perceived control over drinking and therefore subsequent drinking behaviour have been the cause of much controversial discussion in the field. This controversy is reflected by different treatment aims based on differing opinions of priming dose effects (complete abstinence versus moderate drinking). Future research should also evaluate the effects of cognitive stimuli like the knowledge of consumption in alcohol-dependent patients. New insights of the underlying mechanisms of drug cues might help to adjust ideas about treatment processes and treatment goals. The thesis has presented ideas which contradict the medical model of alcoholism (Jellinek, 1952) but outside of the research setting such a model is still widely accepted by public opinion and treatment approaches are still based its assumptions (Heather & Robertson, 1992).

A new methodology, the multi-dimensional assessment of subjective responses, which was introduced and assessed in the reported experiments could be of clinical use for the evaluation of new pharmacological treatments for drug dependence, or treatment success in general. Recent research efforts have concentrated on the development of 'anti-craving' drugs like naltrexone, acamprosate and research progress will depend on valid, reliable assessment tools. The same demands for the use of multi-dimensional assessment tools to account for the complexity of craving hypotheses that have been placed on cue reactivity studies will apply to research

carried out to develop effective anti-craving drugs. The DAQ might present such a multi-dimensional measure to assess treatment effectiveness of pharmacological or cue exposure based interventions.

Carter and Tiffany (1999b) have suggested some other clinical domains where a cue reactivity procedure could be utilised to an advantage. An assessment procedure to index dependence severity has also previously been suggested by other researchers (e.g. Marlatt, 1995), and its use in treatment planning to identify potential drug cues which might lead to relapse (Carter & Tiffany, 1999b) relates to similar procedures in the treatment of phobic disorders (Oei & Lee, 1993).

Appendix

A.01: Consent Form for Experiment One

Consent Form

Consent

I, ..., agree to participate in this experiment, the general purpose of which has been explained to me by Daniela Schulze. I have been informed that I am free to withdraw my consent to take part in this study at any time without prejudice.

Confidentiality

I understand that any information gathered during this experiment will be treated as confidential. I consent to publication of study results as long as the information about myself is treated anonymously.

The Experiment

The experiment will involve a single session lasting for about one hour. If you smoke, you should take your last cigarette 15 mins before your session. Do not drink any alcohol before the experiment. At the start of the experiment you will be asked to fill in some questionnaires and to give information about your drinking habits. During the experiment your reactions to the sight and smell of different drinks (alcoholic and non-alcoholic) will be measured. You will be asked to fill in 2 more questionnaires. You will be monitored but not recorded via a video camera during the experiment.
You are not allowed to consume the drinks during the experiment but you may take them with you once you have finished the experiment. If you decide to consume the drinks after the experiment you agree to take responsibility for your behaviour and its consequences.
You have received an information sheet with the experimenter's contact e-mail address.

Date:

Participant's Signature:
Experimenter's Signature:

A.02: Desire for Alcohol Questionnaire (DAQ: Clark et al., 1996)

DESIRE FOR ALCOHOL QUESTIONNAIRE

Please read each statement carefully and circle the most appropriate number between 1 (STRONGLY DISAGREE) and 7 (STRONGLY AGREE). The closer your circled number is to one end or the other, the stronger your agreement or disagreement with the statement. It is important that you answer in terms of how you feel **RIGHT NOW.** The word 'Drinks' refers to alcoholic drinks throughout.

	STRONGLY DISAGREE						STRONGLY AGREE
1. I would accept another drink if one were offered to me right now	1	2	3	4	5	6	7
2. It would feel as if the bad things in my life had completely disappeared if I drank more right now	1	2	3	4	5	6	7
3. I could easily limit how much alcohol I would drink if I had another drink right now	1	2	3	4	5	6	7
4. My desire to drink more right now seems overwhelming	1	2	3	4	5	6	7
5. Even major problems in my life would not bother me if I drank more right now . . .	1	2	3	4	5	6	7
6. Drinking more now would make me feel less tense	1	2	3	4	5	6	7
7. Drinking more right now would be satisfying	1	2	3	4	5	6	7
8. I would do almost anything to have another drink right now	1	2	3	4	5	6	7
9. I would consider having another drink right now	1	2	3	4	5	6	7
10. Right now, I want another drink so much I can almost taste it	1	2	3	4	5	6	7
11. Drinking more right now would be pleasant	1	2	3	4	5	6	7
12. I would feel less worried about my daily problems if I drank more right now	1	2	3	4	5	6	7
13. I am going to have another drink as soon as I possibly can	1	2	3	4	5	6	7
14. If I had another drink now, I would be able to stop	1	2	3	4	5	6	7

A.03: Adaptation of the Time-Line-Follow-Back Diary (Sobell & Sobell, 1992)

DRINKING DETAILS

Please indicate in the table below how much alcohol you consumed on each day of the **immediately previous week** by stating **where** you consumed the drink, the **type of the drink** (e.g. lager, wine, vodka), and **how much of that particular drink** you consumed (e.g. 1 pint, 1 glass, 1 pub measure).

e.g. day before yesterday at home red wine 1 glass
pub lager (Budweiser) 2 bottles

	Where consumed?	What type of drink?	How many?	What size of drink?
YESTERDAY				
the day before yesterday				
. . . . .				
. . . . .				
. . . . .				
. . . . .				
. . . . .				

Is that a typical/usual drinking week? YES / NO

Would you normally drink more or less? MORE / LESS

A.04: Demographic Data

In this section we would like to find out a little bit about you.

Your gender?	Female / Male
Your age?	..... years
At what age did you start drinking regularly?	
Age at which you started drinking at the levels indicated above?	
Have you ever had a drink problem?	Yes / No
Have you ever been treated for a drink problem?	Yes / No
To your knowledge, did either your father or your mother have a drinking problem?	Yes / No
Did any of your other relatives have a drinking problem?	Yes / No

A.05: Consent Form for Experiment Two

READ THIS AND SIGN IT IF YOU AGREE TO CONTINUE IN THIS EXPERIMENT

As part of this project you will be asked to taste from a drink in a small bottle or can that you will pour out into a glass.

The drink will either be a soft (non-alcoholic) or an alcoholic drink.
You will be told which and you can be sure there is absolutely no deception.

If you are given an alcoholic drink to taste, the drink will contain no more than one unit of alcohol.

To give you some idea of what one unit represents, it is equivalent to

- ❖ one half pint of regular lager, beer or stout
- ❖ one glass of wine
- ❖ one single measure of spirits

It is important that you agree that

- ✓ you have not drunk any other alcoholic drink today
- ✓ you will take responsibility for your behaviour and the consequences of your behaviour when you leave here
- ✓ in particular you will not drive or operate machinery in the two hours after leaving here
- ✓ the data collected and the analysis carried out can be published (confidentiality and anonymity will be respected)
- ✓ if you are female, you have no reason to believe that you are pregnant or might be pregnant

SIGNATURE..... DATE.....

A.06: Taste Preference Questionnaire

TASTE PREFERENCE QUESTIONNAIRE

Please read each statement carefully and circle the most appropriate number between 1 (STRONGLY DISAGREE) and 7 (STRONGLY AGREE). The closer your circled number is to one end or the other, the stronger your agreement or disagreement with the statement. It is important that you answer in terms of how you feel **RIGHT NOW.**

	STRONGLY DISAGREE						STRONGLY AGREE
1. I am influenced to drink this beverage by its packaging.	1	2	3	4	5	6	7
2. I would not drink this beverage if it went up in price.	1	2	3	4	5	6	7
3. The smell of this beverage would appeal to younger people only. . . .	1	2	3	4	5	6	7
4. I would drink this beverage even if it was not carbonated	1	2	3	4	5	6	7
5. The colour of this beverage adds to its appeal	1	2	3	4	5	6	7
6. This beverage quenches my thirst . .	1	2	3	4	5	6	7
7. This beverage compliments food well.	1	2	3	4	5	6	7
8. This beverage is very fattening . . .	1	2	3	4	5	6	7
9. I only drink this beverage because my friends do	1	2	3	4	5	6	7
10. I am influenced by this beverage's advertising campaign	1	2	3	4	5	6	7
11. I would never drink this beverage in a pub	1	2	3	4	5	6	7
12. The smell of this beverage would mainly appeal to females	1	2	3	4	5	6	7
13. I would never drink more than one glass of this beverage at a time . . .	1	2	3	4	5	6	7
14. This beverage is an acquired taste . .	1	2	3	4	5	6	7

continues...

	STRONGLY DISAGREE						STRONGLY AGREE
15. The bubbles in this beverage get up my nose.	1	2	3	4	5	6	7
16. I would never drink this beverage in a restaurant.	1	2	3	4	5	6	7
17. This beverage is good for my health .	1	2	3	4	5	6	7
18. I only drink this specific brand of beverage	1	2	3	4	5	6	7
19. This beverage can be drunk anywhere	1	2	3	4	5	6	7
20. This beverage has far too much sugar in it.	1	2	3	4	5	6	7
21. This beverage goes well with spicy food	1	2	3	4	5	6	7
22. This beverage tastes sickly when drunk in excess	1	2	3	4	5	6	7
23. This beverage has no distinctive taste.	1	2	3	4	5	6	7
24. I would only drink this beverage if it has been refridgerated first	1	2	3	4	5	6	7
25. The colour of this beverage suits its taste	1	2	3	4	5	6	7
26. This beverage is a good hangover cure.	1	2	3	4	5	6	7
27. This is my favourite beverage of all time	1	2	3	4	5	6	7
28. This beverage is a man's drink . . .	1	2	3	4	5	6	7
29. I would not drink this beverage if it was a dull grey colour	1	2	3	4	5	6	7
30. This is a luxury beverage	1	2	2	4	5	6	7

A.07: Negative Alcohol Expectancy Questionnaire (Jones & McMahon, 1994)

Negative Alcohol Expectancy Questionnaire

John Mc Mahon and Barry Jones

Please read these instructions carefully

Below is a list of things that you might or might not expect to happen to you during or after drinking. Please will you indicate the likelihood of each of these things happening to **you if you were to go for a drink NOW**. Do this by circling the appropriate number on the 1-2-3-4-5 scale. Please be sure to answer every question.

	highly unlikely	unlikely	possible	likely	highly likely
IF I WENT FOR A DRINK NOW...					
1. I would become argumentative . .	1	2	3	4	5
2. I would become aggressive	1	2	3	4	5
3. I would become violent	1	2	3	4	5
4. I would become anxious	1	2	3	4	5
5. I would have an accident	1	2	3	4	5
6. I would become depressed	1	2	3	4	5
7. I would get drunk	1	2	3	4	5
8. I would get into a fight	1	2	3	4	5
9. I would have memory lapses . . .	1	2	3	4	5
10. I would lie about how much I had to drink	1	2	3	4	5
11. I would end up in jail	1	2	3	4	5
12. I would argue with my spouse . . .	1	2	3	4	5
13. I would have difficulty sleeping . .	1	2	3	4	5
14. I would wet the bed	1	2	3	4	5
15. I would become boastful	1	2	3	4	5
16. I would borrow money	1	2	3	4	5
17. I would consider taking other drugs	1	2	3	4	5
18. I would take other drugs	1	2	3	4	5
19. I would lose my driving licence . .	1	2	3	4	5
20. I would drink more than the others in my company	1	2	3	4	5
21. I would have difficulty in stopping drinking	1	2	3	4	5
IF I WENT FOR A DRINK NOW, THEN TOMORROW...					
22. I would miss work	1	2	3	4	5
23. I would have 'the shakes'	1	2	3	4	5
24. I would have 'the sweats'	1	2	3	4	5
25. I would have a hangover	1	2	3	4	5
26. I would feel depressed	1	2	3	4	5
27. I would have low self-esteem . . .	1	2	3	4	5
28. I would crave a drink	1	2	3	4	5
29. I would have difficulty sleeping . .	1	2	3	4	5
30. I would feel generally ill	1	2	3	4	5
31. I would feel frightened	1	2	3	4	5
32. I would feel guilty	1	2	3	4	5
33. I would feel remorseful	1	2	3	4	5
34. I would feel anxious	1	2	3	4	5
35. I would be shy of meeting people . .	1	2	3	4	5
36. I would feel restless	1	2	3	4	5
37. I would be sick	1	2	3	4	5
38. I would be unable to eat	1	2	3	4	5
39. I would go on a binge	1	2	3	4	5
IF I CONTINUED TO DRINK AT MY PRESENT LEVEL,THEN...	1	2	3	4	5
40. I would lose my wife/husband . . .	1	2	3	4	5
41. I would lose my house	1	2	3	4	5
42. I would lose my job	1	2	3	4	5
43. I would have the DTs	1	2	3	4	5
44. I would have convulsions	1	2	3	4	5
45. I would lose my friends	1	2	3	4	5
46. I would get into debt	1	2	3	4	5
47. I would end up in hospital	1	2	3	4	5
48. I would end up sleeping rough . . .	1	2	3	4	5
49. I would consider suicide	1	2	3	4	5
50. I would attempt suicide	1	2	3	4	5
51. I would feel frightened	1	2	3	4	5
52. I would feel depressed	1	2	3	4	5
53. I would feel self-loathing	1	2	3	4	5
54. I would feel self pity	1	2	3	4	5
55. I would lose all respect for myself . .	1	2	3	4	5
56. I would end up in jail	1	2	3	4	5
57. I would damage my liver	1	2	3	4	5
58. I would feel I am going mad . . .	1	2	3	4	5
59. I would choke on my own vomit . .	1	2	3	4	5
60. I would die					

A.08: Alcohol Expectancy Questionnaire (Brown, Christiansen & Goldman, 1987)

Alcohol Expectancy Questionnaire

Brown, Christiansen & Goldman

Please read these instructions carefully

low is a list of things that you might or might not expect to happen to you during or after drinking. Please will you indicate the elihood of each of these things happening to **you if you were to go for a drink NOW**. Do this by circling the appropriate mber on the 1-2-3-4-5 scale. Please be sure to answer every question.

	never				always sometimes
njoy the pleasant, cleansing, tingly taste of some coholic drinks	1	2	3	4	5
eel that social occasions have a certain warmth hen I have been drinking	1	2	3	4	5
hen I am drinking, it is easier to open up and press my feelings	1	2	3	4	5
mes passes quickly when I am drinking	1	2	3	4	5
rinking makes me feel flushed	1	2	3	4	5
eel powerful when I drink, as if I can really fluence others to do as I want	1	2	3	4	5
rinking gives me more confidence in myself	1	2	3	4	5
rinking makes me feel good	1	2	3	4	5
eel more creative after I have been drinking	1	2	3	4	5
njoy having a few drinks to celebrate social casions	1	2	3	4	5
hen I am drinking I feel freer to be myself and to what I want	1	2	3	4	5
an concentrate better on good feelings when I am inking	1	2	3	4	5
lcohol allows me to be more assertive	1	2	3	4	5
hen I feel high from drinking, everything else ems to feel better	1	2	3	4	5
rinking helps me to forget my problems	1	2	3	4	5
ind, that conversing with members of the opposite x is easier after I have had a few drinks	1	2	3	4	5
ind drinking pleasurable because I enjoy being th people who are enjoying themselves	1	2	3	4	5
ike the taste of some alcoholic beverages	1	2	3	4	5
I am feeling restricted in any way, a few drinks ake me feel better	1	2	3	4	5
eel friendlier when I drink	1	2	3	4	5
an discuss or argue a point more forcefully after I ve had a drink or two	1	2	3	4	5
I have a couple of drinks, it is easier to express my elings	1	2	3	4	5
cohol makes me need less attention from others an I usually do	1	2	3	4	5
drink or two makes the humourous side of me me out	1	2	3	4	5
ter a few drinks I feel more self reliant than usual	1	2	3	4	5
ter a few drinks I don't worry so much about iat people think of me	1	2	3	4	5
hen drinking I do not consider myself totally countable or responsible for my behaviour	1	2	3	4	5
cohol enables me to have a better time at parties.	1	2	3	4	5
hen I am drinking the future seems brighter	1	2	3	4	5
eel sexier after I have had a couple of drinks	1	2	3	4	5

	never				always sometimes
31. I drink when I am feeling mad	1	2	3	4	5
32. Drinking alone or with one other person makes me feel calm and serene	1	2	3	4	5
33. After a few drinks I feel brave and capable of fighting	1	2	3	4	5
34. Drinking makes me feel more satisfied with myself	1	2	3	4	5
35. My feelings of isolation and alienation decrease when I drink	1	2	3	4	5
36. Alcohol makes me sleep better	1	2	3	4	5
37. Alcohol makes me more outspoken & opinionated	1	2	3	4	5
38. I am a better lover after a few drinks	1	2	3	4	5
39. When I have muscular tension alcohol helps me relax	1	2	3	4	5
40. Alcohol makes me worry less	1	2	3	4	5
41. When I have had a few drinks I find it easier to talk to people	1	2	3	4	5
42. After a few drinks I am usually in a better mood	1	2	3	4	5
43. Drinking helps me get out of a depressed mood...	1	2	3	4	5
44. After I have had a couple of drinks, I feel a more caring, sharing person	1	2	3	4	5
45. Alcohol decreases my feeling of guilt about not working	1	2	3	4	5
46. I feel more co-ordinated after I drink	1	2	3	4	5
47. Alcohol makes me more interesting	1	2	3	4	5
48. A few drinks make me less shy	1	2	3	4	5
49. If I am tense or anxious, a few drinks make me feel better	1	2	3	4	5
50. Alcohol makes me fall asleep more easily	1	2	3	4	5
51. If I am feeling afraid, alcohol decreases my fears	1	2	3	4	5
52. A few drinks make me more aroused or physiologically excited	1	2	3	4	5
53. When I am in pain, alcohol can act as an anaesthetic	1	2	3	4	5
54. I enjoy having sex more if I have had some alcohol	1	2	3	4	5
55. I am more romantic when I drink	1	2	3	4	5
56. I feel more masculine/feminine after a few drinks	1	2	3	4	5
57. Alcohol makes me feel better physically	1	2	3	4	5
58. When I drink alone or with one other person, it is easy to feel cosy and romantic	1	2	3	4	5
59. I feel more of a happy-go-lucky person when I drink	1	2	3	4	5
60. When I am drinking, get-togethers are more fun	1	2	3	4	5
61. When I have bad feelings alcohol makes me forget them	1	2	3	4	5
62. After a few drinks I am more sexually responsive	1	2	3	4	5
63. If I am cold, a few drinks will give me a sense of warmth	1	2	3	4	5
64. It is easier to act on my feelings after I have had a few drinks	1	2	3	4	5

A.09: Instructions for Filling in the Expectancy Questionnaires

THIS BRIEF NOTE MIGHT BE OF HELP

You are now going to be asked two types of questions about you and alcohol.

It might be useful if the distinction between the two types is made clear.

One set of questions is about what YOU expect to happen to YOU when YOU go for a drink.

For example, do YOU expect to "sing and dance", the question might be. Or would you expect to end up "borrowing money".

THE QUESTION IS ABOUT WHAT MIGHT HAPPEN.

And you will reply that it's likely or possible or unlikely or something.

Another set of questions is about whether things bother you or are important to you not.

For example, does "borrowing money" bother you.
Is "feeling sexy" important to you.

the question is about how you feel about something that might happen.

And you might reply it would bother you a lot or it is very important to you or something. Or you think it is "good" or "bad".

THE IMPORTANT THING TO REMEMBER IS TO BE ALERT TO WHICH OF THESE TWO TYPES OF QUESTION YOU'RE BEING ASKED.

It is easy to get confused and give a daft answer as a result, ok?

You are first asked to answer a heap of "good/bad" questions, then a heap of "likely/unlikely" ones. Please turn over and start.

A10: Consent Form for Experiment Three

READ THIS AND SIGN IT IF YOU AGREE TO CONTINUE IN THIS EXPERIMENT

As part of this project you will be asked to taste from drinks in small bottles.

The drinks will either be soft (non-alcoholic) or alcoholic drinks.
You will be told which and you can be sure there is absolutely no deception.

If you are given alcoholic drinks to taste, the drinks will contain no more than two units of alcohol in total.

To give you some idea of what two units represent, they are equivalent to

- ❖ one pint of regular lager, beer or stout, or
- ❖ two glasses of wine, or
- ❖ a double measure of spirits

It is important that you agree that

- ✓ you have not drunk any other alcoholic drinks today
- ✓ you are not on any prescribed medication
- ✓ you will take responsibility for your behaviour and the consequences of your behaviour when you leave here, in particular you will not drive or operate machinery in the two hours after leaving here
- ✓ the data collected and the analysis carried out can be published (confidentiality and anonymity will be respected)
- ✓ if you are female, you have no reason to believe that you are pregnant or might be pregnant
- ✓ you will receive an information sheet and you will be able to contact the experimenter about the general outcome of the experiment

SIGNATURE.....
DATE.....

A.11: Consent Form for Experiment Four

READ THIS AND SIGN IT IF YOU AGREE TO CONTINUE IN THIS EXPERIMENT

As part of this project you will be asked to consume a strong flavoured fruit drink and then taste, but not consume, another drink, either soft or alcoholic drink.

During the experiment you will not consume more than one unit of alcohol.

To give you some idea of what one unit represent, they are equivalent to

- ❖ Half a pint of regular lager, beer or stout, or
- ❖ one glasses of wine, or
- ❖ a single measure of spirits

It is important that you agree that

- ✓ you have not drunk any other alcoholic drinks today
- ✓ you are not on any prescribed medication
- ✓ you will take responsibility for your behaviour and the consequences of your behaviour when you leave here, in particular you will not drive or operate machinery in the two hours after leaving here
- ✓ the data collected and the analysis carried out can be published (confidentiality and anonymity will be respected)
- ✓ if you are female, you have no reason to believe that you are pregnant or might be pregnant
- ✓ you will receive an information sheet and you will be able to contact the experimenter about the general outcome of the experiment

SIGNATURE.....
DATE.....

A.12: Taste Ratings: Drink Evaluation Table

In the table you will receive instructions what to do next.
Follow those instructions step by step! Finish each step first before you go to the next one.

1. Look at the drink's container. Look at the label, the colours and the shape of the container. Write down 5 adjectives that you would associate with the look of the drink's container!	1. 2. 3. 4. 5.
2. Open the drink and pore some of the drink into the glass!	
3. Hold the drink in your hand and look at the drink! Look at the drink, and write down 5 adjectives that you would associate with the look of that drink!	1. 2. 3. 4. 5.
4. Smell the drink! Smell it again, and write down 5 adjectives that you associate with the smell of the drink!	1. 2. 3. 4. 5.
5. Taste the drink! Sip it again and write down 5 adjectives that you would associate with the taste of the drink!	1. 2. 3. 4. 5.

A.13: Calculation of Factor Scores for the DAQ

Total score: sum of all item scores

The mean scores for the factors are calculated from the following items per factor:

Factor 1: ***Mild Intentions and Positive Reinforcement***

1. I would accept another drink if one were offered to me right now.
7. Drinking more right now would be satisfying.
9. I would consider having another drink right now.
11. Drinking more right now would be pleasant.

Factor 2: ***Strong Intentions and Desires***

4. My desire to drink more right now seems overwhelming.
8. I would do almost anything to have another drink right now.
10. Right now, I want another drink so much I can almost taste it.
13. I am going to have another drink as soon as I possibly can.

Factor 3: ***Negative Reinforcement***

2. It would feel as if the bad things in my life had completely disappeared if I drank more right now.
5. Even major problems in my life would not bother me if I drank more right now.
6. Drinking more now would make me feel less tense.
12. I would feel less worried about my daily problems if I drank more right now.

Factor 4: ***Control over Drinking***

3. I could easily limit how much alcohol I would drink if I had another drink right now.
14. If I had another drink now, I would be able to stop.

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