Reward and Cognition: Integrating Reinforcement Sensitivity Theory and Social Cognitive Theory to Predict Drinking Behaviour

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Abstract

Background: Both Reinforcement Sensitivity Theory and Social Cognitive Theory have been applied to understanding drinking behaviour. We propose that theoretical relationships between these models support an integrated approach to understanding alcohol use and misuse. **Objectives:** We aimed to test an integrated model in which the relationships between reward sensitivity and drinking behaviour (alcohol consumption, alcohol-related problems and symptoms of dependence) were mediated by alcohol expectancies and drinking refusal self-efficacy. **Methods:** Online questionnaires assessing the constructs of interest were completed by 443 Australian adults (*M* age = 26.40, *sd* = 1.83) in 2013 and 2014. **Results:** Path analysis revealed both direct and indirect effects and implicated two pathways to drinking behaviour with differential outcomes. Drinking refusal self-efficacy both in social situations and for emotional relief was related to alcohol consumption. Sensitivity to reward was associated with alcohol-related problems, but operated through expectations of increased confidence and personal belief in the ability to limit drinking in social situations. Conversely, sensitivity to punishment operated through negative expectancies and drinking refusal self-efficacy for emotional relief to predict symptoms of dependence. **Conclusions:** Two pathways relating reward sensitivity, alcohol expectancies and drinking refusal self-efficacy may underlie social and dependent drinking, which has implications for development of intervention to limit harmful drinking.

Keywords: alcohol; BIS/BAS; alcohol expectancies; self-efficacy

Heavy alcohol use presents a significant public health concern with consumption causally related to more than 200 health conditions (World Health Organisation, 2014). Both Gray's Reinforcement Sensitivity Theory (RST; 1970, 1982) and Bandura's Social Cognitive Theory (SCT; 1986, 1997) have been applied to better understanding of the initiation and maintenance of problematic drinking, in an effort to inform optimal prevention, early intervention and treatment initiatives. Although each are well-supported, and offer unique contributions to furthering our understanding of drinking behaviour, we propose that theoretical relationships between these models support an integrated approach to understanding drinking behaviour. Specifically we propose that the relationships between variables proposed in RST and drinking behaviours are mediated by variables central to SCT.

Reinforcement Sensitivity Theory (RST)

In Gray's (1970, 1982) original RST the Behavioural Inhibition System (BIS), mediated by serotonergic projections, was proposed to be sensitive to punishment and non-rewarding cues and regulate avoidant behaviour leading to negative emotion, such as anxiety. The Behavioural Approach System (BAS) was proposed to underpin differences in reward sensitivity, and to be associated with impulsivity and positive emotion. Commensurate with its focus on reward, the BAS is thought to be mediated by dopimanergic pathways (Carver & White, 1994). More recent conceptualisations incorporate three biologically-mediated motivational systems: i) the BAS, ii) the Fight, Flight, Freeze System (FFFS), which is involved in threat sensitivity, and iii) the BIS, which detects and resolves conflict between the BAS and the FFFS. In situations that are neither clearly rewarding nor threatening, but contain elements of both, the BIS inhibits ongoing behaviour, arousal is increased, and an assessment of potential risk versus reward is conducted which then drives behavioural

outcomes (Corr, 2002, 2004; McNaughton & Corr, 2004; Smillie, Pickering, & Jackson, 2006).

While this later conceptualisation of RST is theoretically sophisticated, most measures of RST assess the original BIS/BAS components. Consequently, much of the empirical support for the model is based on the two factor approach. Not surprisingly, heavy drinkers consistently record higher scores on measures of reward sensitivity than lighter drinkers (Franken & Muris, 2006; Hamilton, Sinha, & Potenza, 2012; Hundt, Williams, Mendelson, & Nelson-Graym, 2013; Loxton & Dawe, 2001, 2006, 2007). BAS also differentiates individuals with a *DSM IV* diagnosis of alcohol dependence (Johnson, Turner, & Iwata, 2003; Perry, et al., 2013) and those with a family history of alcohol dependence (Yarosh et al., 2014) from controls. The role of BIS in drinking behaviour is less clear, with some researchers observing higher BIS scores among hazardous compared to non-hazardous drinkers (Hamilton et al., 2012), some reporting weak negative relationships between BIS and drinking (Loxton & Dawe, 2001) and others finding no direct relationship (Feil & Hasking, 2008; Hasking, 2006).

Social Cognitive Theory (SCT)

While traditional learning theories argue that an individual learns by behavioural association, social cognitive theorists argue that cognitions mediate the influence of environmental stimuli in determining behaviour (Bandura, 1986, 1997). Specifically, the cognitive outcome expectancies that are formed as a result of the ability to foresee the consequences of actions allow appraisal of potential consequences, and the formation of informed decisions about volitional behaviour. Yet, intention to act and a desired outcome are not sufficient to enact behaviour, rather individuals must possess self-regulatory mechanisms which allow them to exert control over their behaviour. Self-efficacy is the key factor underlying the human agency central to SCT (Bandura, 1989, 1991).

Outcome expectancies and self-efficacy have long been implicated in drinking behaviour (Bandura, 1999). Consistent with operant principles, in community-based samples positive alcohol outcomes expectancies are associated with greater drinking and resultant alcohol-related problems (Jones, Corbin, & Fromme, 2001; Ham & Hope, 2003, Hasking & Oei, 2004, 2008). Conversely negative expectancies are related to lower levels of consumption (Jones et al., 2001; Jones & McMahon, 1992). However the opposite is often observed in clinical samples, and both alcohol expectancies and self-efficacy differentiate samples of social and dependent drinkers (Hasking & Oei, 2002; Oei, Hasking, & Young, 2005). While this could be an artefact of the predominantly cross-sectional, self-report designs used to relate expectancies to drinking behaviour, theoretical models assert the relative importance of expectancies early in a drinking career and the conditioned inability to refuse a drink among clinical samples (Oei & Baldwin, 1994). Further, general self-efficacy and alcohol-specific self-efficacy appear to exert different effects on drinking behaviour, with alcohol-specific self-efficacy being more salient in non-clinical samples and general self-efficacy important in treatment seeking samples (Oei, Hasking, & Phillips, 2007).

Drinking refusal self-efficacy refers to the perceived ability to refuse a drink in a variety of situations (e.g. when upset, when friends are drinking). High drinking refusal self-efficacy is related to less alcohol consumption among community-based drinkers (Hasking & Oei, 2004), and prospectively mediates the relationship between alcohol expectancies and drinking behaviour (Baldwin, Oei, & Young, 1993; Bandura, 1999; Connor, George, Gullo, Kelly, & Young, 2011; Young & Oei, 1993). Not only are expectancies formed prior to considerations about the ability to resist drinking (Christiansen, Smith, Roehling, Goldman, 1989; Miller, Smith, & Goldman, 1990) but expectancies may inform refusal self-efficacy. For example, the outcome expectancy that alcohol use will reduce tension is likely to minimise an individual's belief in their ability to resist drinking when tense.

An integrated approach to understanding drinking behaviour

An individual who responds to cues of reward, according to RST, is driven to seek rewarding environments and situations that stimulate dopaminergic reward pathways (Gray, 1970). Thus an individual with high reward sensitivity is more likely to engage in behaviours that stimulate these dopaminergic pathways, including drinking. However, the individual who seeks out rewarding environments (e.g. pubs), also has a greater opportunity to learn behavioural consequences in this environment[1]. Further, reward sensitive drinkers show a greater tendency to notice and attend to alcohol-related cues (Kambouropoulos & Staiger, 2001). Thus, this individual is likely to have strong outcome expectancies that have been formed over numerous experiences, and lowered self-efficacy for refusing the temptations of reinforcing behaviours. As noted above, the relationship between BIS and drinking is less clear. However, given that BIS is through to underlie anxiety, it is possible that people sensitive to punishment are predisposed to the anxiolytic effects of alcohol, and more likely to drink in the context of expectations of tension reduction (e.g. Booth & Hasking, 2009). Consequently, social cognitive constructs such as expectancies and self-efficacy may mediate the relationship between sensitivity to punishment and drinking behaviour.

The Current Study

We aimed to test the proposition that outcome expectancies and self-efficacy mediate the relationships between sensitivity to punishment, sensitivity to reward and drinking behaviour. Given the ability of these variables to differentiate dependent and non-dependent drinkers it is plausible that the variables differentially relate to particular indices of drinking. Specifically, while sensitivity to reward, positive expectancies and reduced self-efficacy might increase alcohol consumption per se, alcohol expectancies (for example) might be less salient in predicting symptoms of alcohol dependence. As such, we explored whether these

[1] Dopamine is also activated in response to salient events (Franken, et al., 2005), supporting Gray's assertion that individuals highly sensitive to reward are likely to seek out such environments.

relationships differed for alcohol consumption, alcohol-related problems and symptoms of dependence (Figure 1), but did not propose specific hypotheses regarding these differential effects.

Figure 1 about here

Method

Participants

This project was approved by the University Human Research Ethics Committee. A total of 443 participants (83.3% female; mean age = 26.40, *sd* = 1.83) completed anonymous self-report questionnaires assessing the constructs of interest. Of the sample, 77.7% identified as White/Caucasian, and a further 18.5% as Asian. A large proportion were undergraduate students (44%) and a further 29.8% had completed an undergraduate degree. All participants were aged over 18 years (the legal drinking age in Australia, where this study was conducted) and only 4.3% had never consumed alcohol[2].

Materials

Alcohol Use Disorders Identification Test (AUDIT; Degenhardt, Conigrave, Wutzke, & Saunders, 2001). The AUDIT is comprised of ten items and is used to screen for excessive alcohol use and harmful drinking. While a total score gives an indication of global risk, three subscales assess alcohol consumption (3 items), alcohol-related problems (3 items) and symptoms of alcohol dependence (4 items). The AUDIT demonstrates high internal consistency and adequate test-retest reliability with non-clinical and alcohol-dependent

[2] As low reward sensitivity, weak positive expectancies and high levels of refusal self-efficacy may predict abstinence, and we were interested in the continuum of drinking behaviour, these 19 participants were included in analyses.

samples (Reinert & Allen, 2007). Reliability was acceptable in the current sample: Consumption α = .73; Alcohol-related problems α = .69; Dependence α = .71.

Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001). The SPSRQ was developed to assess BIS and BAS through two scales of Sensitivity to Punishment (SP) and Sensitivity to Reward (SR). Respondents indicate whether they engage in each of 24 behaviours (no = 0; yes = 1) assessing each construct (48 items in total; e.g. 'Are you often afraid of new or unexpected situations?' 'Do you sometimes do things for quick gains?'). In the initial psychometric evaluation the two scales were observed to be independent, with acceptable reliability, convergent and discriminant validity (Torrubia et al., 2001). Reliabilities of the two subscales were excellent in the current study: SP α = .80; SR α = .86.

Drinking Expectancy Questionnaire-Revised (DEQ-R; Lee, Oei, Greeley, & Baglioni, 2003). The five DEQ-R subscales (cognitive change, tension reduction, increased confidence, sexual enhancement, and negative expectancies) measure anticipated positive and negative outcomes of alcohol consumption[3]. The test-retest reliability (r =.72-.88) and discriminant validity are well established (Lee et al., 2003). In the current sample reliabilities ranged from α = .67 for Tension Reduction to α = .91 for Increased Confidence.

Drinking Refusal Self-Efficacy Questionnaire-Revised (DRSEQ-R; Oei et al, 2005). The DRSEQ-R is comprised of three subscales (social pressure, emotional relief and opportunistic self-efficacy) assessing whether a person believes they can resist drinking in certain situations or moods (e.g., 'When I am at a pub or club', 'When I feel down'). Higher scores indicate a greater belief in the ability to resist drinking. Alpha reliabilities for the DRSEQ-R range from .87 to .94, and test–retest reliabilities range from .84 to .93 (Oei et al.,

[3] The negative expectancies subscale assesses anticipated negative outcomes; all other scales are considered positive expectancies

2005). Reliabilities were excellent in the current sample: Social Pressure α = .91, Emotional Relief α = .96 and Opportunistic α = .90

Procedure

Participants self-selected into the study in response to advertisements posted around a large metropolitan university, community notice boards, and via social media. Advertisements included the study URL, and participants completed the online questionnaire in their own time (30-40 minutes). A Participant Information Sheet was presented prior to the survey, and informed participants of the study aims, participation requirements, voluntary nature of participation and the right to withdraw. To reimburse participants for their time, all were offered the opportunity to enter a raffle to win an Apple IPad Mini, or 2 Gold Class movie tickets. All participants were provided with mental health information and contact details for crisis lines should they wish to further discuss any issues raised in the questionnaire.

Data analysis

AUDIT data were positively skewed, as expected in a non-clinical sample. Mean replacement was utilised to replace less than 1% of data on the AUDIT and less than 3% on the other variables. To partially protect against non-normal data, our mediational hypotheses were tested using Bias-Corrected Bootstrap procedures in AMOS 22 (Efron & Tibshirani, 1993; MacKinnon, Lockwood, & Williams, 2004). Given the correlations between our variables (Table 1), residuals were free to correlate. Model fit was determined by fit indices (CFI, NFI, GFI) greater than .95, a χ^2/df less than 4, and Root Mean Square Error of Approximation (RMSEA) less than .06 (Hu & Bentler, 1999).

Table 1 about here

Results

Participants reported a pattern of drinking consistent with similar Australian samples (*M* audit score = 7.77, *sd* = 5.86; Halim & Hasking, 2012). Scores on the consumption, dependence and alcohol related problems subscales were also consistent with previous reports in young adult samples (Table 1; Lyvers, Hasking, Hani, Rhodes, & Trew, 2010). The majority of the sample (74.58%) reported drinking 4 or fewer standard drinks on a typical drinking occasion; approximately 10% of the sample reported consuming 6 or more drinks on a single occasion at least monthly, somewhat fewer than national figures suggest (AIHW, 2011).

The majority of variables were correlated in the expected direction (Table 1). Neither age (r = .04, p = .46) nor gender [$t(441)$ = 1.76, p = .08], were related to drinking behaviour, and therefore were not included in the models reported[4]. The full model in which all direct and indirect paths between the variables (including all DRSEQ and DEQ subscales) were specified, provided good fit to the data; however, RMSEA and χ^2/df did not meet accepted guidelines for good model fit: $\chi^2(7, N = 443) = 48.183$, $p < .001$, $\chi^2/df = 9.21$, CFI = .98, NFI = .98, GFI = .98, RMSEA = .12. We therefore tested a reduced model in which non-significant paths were removed[5]. The model fit of the reduced model improved, and with the exception of χ^2 (which is sensitive to sample size) all fit statistics met accepted guidelines for good model fit: $\chi^2(29, N = 443) = 85.32$, $p < .001$, $\chi^2/df = 2.94$, CFI = .98, NFI = .96, GFI = .97, RMSEA = .06 (Figure 2).

Figure 2 approximately here

[4] As a check, we did include age and gender in the model and there were no changes to the significance of any pathways or the percentage of variance explained.

[5] All variables remained in the model, but non-significant pathways removed. Where remaining paths did not assist in interpretation of the proposed mediation, variables were excluded from Figure 2.

The final model accounted for 52% of the variance in alcohol consumption, 31% of the variance in alcohol related problems, and 35% of the variance in symptoms of dependence. There were direct effects of sensitivity to reward on both alcohol consumption and alcohol-related problems, and indirect effects on consumption and symptoms of alcohol dependence. There were also significant negative direct effects of sensitivity to punishment on alcohol consumption and symptoms of alcohol dependence, and indirect effects on all indices of drinking (Table 2). As expected, alcohol expectancies were negatively related to drinking refusal self-efficacy, which in turn was negatively related to the drinking measures. Additional significant paths, not depicted in Figure 2, were observed between sensitivity to punishment and expectations of sexual enhancement (β = -.15, 95% CI -.23 to -.08, p = .003), sensitivity to reward and expectations of cognitive enhancement (β = .09, 95% CI .01 to .16, p = .05) and between cognitive enhancement and opportunistic drinking refusal self-efficacy (β = -.04, 95% CI -.15 to -.04, p = .01).

Table 2 approximately here

Discussion

We proposed that the relationship between Gray's (1970, 1982) original conceptualisation of the RST and drinking behaviour could be mediated by elements of Bandura's (1986, 1997) SCT. Specifically, we tested the proposition that relationships between both sensitivity to reward and sensitivity to punishment and drinking behaviour operate indirectly through alcohol expectancies and drinking refusal self-efficacy. Predicted direct effects between reward sensitivity and drinking behaviour were found, as were predicted indirect effects. Evidence of indirect effects demonstrates the utility of integrating these theoretical

frameworks in predicting drinking behaviour and has implications for prevention and treatment.

The final model accounted for a substantial proportion of the variance in drinking behaviour (R^2 = .31 - .52); however, reward sensitivity, alcohol expectancies, and self-efficacy were differentially associated with indices of drinking. Specifically, sensitivity to reward was associated with more alcohol consumption and alcohol-related problems, both directly and indirectly via expectations of increased confidence and lower drinking refusal self-efficacy in social situations. In contrast, sensitivity to punishment was negatively related to less alcohol consumption and dependence; however, positive indirect effects operating via negative expectancies and drinking refusal self-efficacy both in social situations and for emotional relief were observed.

Taken together, the results suggest that changing alcohol expectancies and self-efficacy may interrupt well established pathways between reward sensitivity and drinking behaviour, and that interventions can target individuals according to reward sensitivity. Reduced drinking refusal self-efficacy in both social situations and for emotional relief is related to greater alcohol consumption, suggesting increasing self-efficacy can reduce the amount of alcohol consumed. However, although preliminary, the findings implicate two pathways, mediated by different internal states, in differentially predicting social drinking and symptoms of dependence. Specifically, for people who are sensitive to reward, the social aspects of drinking (expectations of increased confidence, resisting drinking in social situations) appear to be key and interventions might target socially salient cues. In contrast, punishment sensitivity appears to be indirectly linked to symptoms of dependence via a pathway that is characterised by emotion regulation (e.g. negative expectancies, drinking refusal self-efficacy for emotional relief). Similar relationships have previously been noted, with avoidant coping mediating the relationship between BIS and drug and alcohol use

(Hundt et al., 2013). Intervention for individuals high in punishment sensitivity might therefore target improving self-regulatory processes including emotion regulation, coping, and stress reduction (Feil & Hasking, 2008; Lyvers, Hasking, Albrecht, & Thorberg, 2012). Future testing of these proposed pathways and resultant outcomes is warranted.

A number of unexpected findings emerged. First, opportunistic drinking refusal self-efficacy was not related to drinking. Arguably in a non-clinical sample social factors are more salient and opportunities to drink are not necessarily cues to drink. Future testing of whether resistance to drinking when the opportunity presents itself is an important predictor of drinking in clinical samples is warranted. Second, alcohol expectancies were directly related to symptoms of alcohol dependence, contradicting theoretical and empirical accounts that expectancies are less salient to alcohol dependence (Oei & Baldwin, 1994; Oei, Fergusson, & Lee, 1998; Oei & Morawska, 2004). This may be a function of the current community-based sample; however, it does suggest that the relationship between alcohol expectancies and alcohol dependence may be on a continuum and change as drinking behaviours/problems get more severe.

Of particular interest, there was no relationship between sensitivity to punishment and beliefs that alcohol consumption would reduce tension. Given the extensive literature relating anxiety, particularly social anxiety, to drinking through expectations of tension reduction (e.g. Booth & Hasking, 2009; Burke & Stephens, 1999) it may have been expected that punishment sensitivity would operate in a similar manner. One explanation might relate to Gray's original conceptualisation of RST. While BIS is thought to underlie anxiety, within the revised model it is portrayed as incorporating both BIS and threat sensitivity (FFFS). Studies that have assessed FFFS show results consistent with ours, with the relationship between FFFS and drinking mediated by self-regulatory processes, such as avoidant and emotion-focused coping (Ivory & Kambouropoulos, 2012).

Also of interest, while there are direct negative relationships between sensitivity to punishment and drinking outcomes, there are indirect positive effects on alcohol-related problems and symptoms of dependence. This appears to be driven by a negative indirect effect on drinking refusal self-efficacy, through alcohol expectancies. Specifically, sensitivity to punishment per se appears to be protective, but when this lowers the ability to refuse a drink then it ultimately increases drinking behaviour and the associated consequences. This indirect effect may explain the inconsistencies in work relating BIS to alcohol-related outcomes, and suggests more complex relationships than typically assessed. More work is needed to explore how the revised RST can best be measured (Jackson, 2009; Smillie et al., 2006) and to investigate the exact mechanisms by which threat sensitivity relates to drinking and alcohol expectancies.

These unexpected findings might also relate to the cross-sectional self-report nature of the study. Specifically, people who drink less may have fewer opportunities to drink and thus opportunistic self-efficacy would not be a precursor to drinking. This would also explain the inverse relationship between negative outcome expectancies and drinking refusal self-efficacy (i.e. people who consume more alcohol report more negative outcomes). Similarly, social desirability bias may mask associations between reward sensitivity, alcohol expectancies and drinking refusal self-efficacy. Unfortunately our cross-sectional design precludes the ability to draw conclusions regarding the temporal relationships between the variables. Both prospective (i.e. longitudinal) studies and more objective behavioural outcomes measures (e.g. including ecological momentary assessment) would provide further evidence for these arguments. For example, assessing reward sensitivity and the social cognitive variables before a drinking occasion, and subsequently counting the number of alcoholic drinks consumed, would provide prospective data in an ecologically valid context.

Conclusion

The outcomes of the current study highlight the utility of integrating RST and SCT in understanding factors thought to initiate and maintain drinking behaviour. Importantly, differential pathways from reward sensitivity to specific drinking indices were evident. While prospective work testing whether these pathways lead to different drinking outcomes over time is still needed, this research highlights important avenues to explore for the development of optimal prevention, early intervention and treatment efforts.

Glossary

Alcohol expectancies: Beliefs about the anticipated consequences of consuming alcohol

Behavioural Approach System (BAS): Biologically mediated motivational system proposed to underpin individual differences in sensitivity to reward.

Behavioural Inhibition System (BIS): Biologically mediated motivational system proposed to underpin individual differences in sensitivity to punishment and situations of non-reward.

Drinking refusal self-efficacy: An individual's belief in their own ability to resist consuming alcohol in a given situation

Declaration of interest

The authors report no conflicts of interest.

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Table 1. Bivariate correlations between variables of interest

Variable		Mean (sd)	2	3	4	5	6	7	8	9	10	11	12	13
1.	Consumption	4.65 (2.54)	.57***	.56***	-.22***	.25***	.16**	.42***	-.07	.52***	.05	-.63***	-.47***	-.54***
2.	Alcohol-related problems	2.25 (2.93)	-	.67***	-.01	.26***	-.06	.34***	.05	.37***	.40***	-.30***	-.36***	-.43***
3.	Dependence	.96 (1.43)		-	-.07	.19***	-.07	.33***	.06	.39***	.40***	-.31***	-.41***	-.49***
4.	Sensitivity to punishment	13.44 (5.47)			-	.15**	-.16**	.10*	.04	-.08	.14**	.09	-.02	-.10*
5.	Sensitivity to reward	10.34 (4.39)				-	.04	.29***	.12*	.17***	.13**	-.23***	-.24***	-.26***
6.	Sexual enhancement AE	11.19 (2.33)					-	.06	-.24***	.18***	-.39***	-.19***	-.04	-.03
7.	Increased confidence AE	40.12 (8.86)						-	.10*	.30***	.25***	-.44***	-.19***	-.35***
8.	Cognitive enhancement AE	5.75 (1.97)							-	.04	.39***	.00	-.18***	-.10*

9.	Tension reduction AE	8.62 (2.94)	-	.11*	-.50***	-.53***	-.62***	
10.	Negative expectancies	30.49 (9.43)		-	.12*	-.22***	-.27***	
11.	Social pressure DRSE	14.45 (5.57)			-	.52***	.59***	
12.	Opportunistic DRSE	34.59 (6.18)				-	.75***	
13.	Emotional relief DRSE	31.03 (8.42)					-	

AE = alcohol expectancies; DRSE = drinking refusal self-efficacy

* p < .05 ** p < .01 *** p < .001

Table 2. Summary of all standardised indirect effects predicting drinking variables and drinking refusal self-efficacy

Drinking Variables	**Consumption (95% CI)**	**Alcohol-related Problems (95% CI)**	**Dependence (95% CI)**
Sensitivity to punishment	-.01* (-.02 to -.001)	.04** (.020 to .07)	.04** (.02 to .07)
Sensitivity to reward	.06** (.03 to .10)	.02 (-.002 to .05)	.03* (.01 to .06)
Increased confidence	.15** (.11 to .19)	.05** (.03 to .09)	.04** (.02 to .06)
Tension reduction	.23** (.18 to .27)	.06** (.03 to .09)	.14** (.08 to .20)
Negative expectancies	-.05* (-.10 to -.01)	-.04**(-.06 to -.02)	.04** (.02 to .06)
Drinking Refusal Self-Efficacy	**Social Pressure (95% CI)**	**Opportunistic (95% CI)**	**Emotional Relief (95% CI)**
Sensitivity to punishment	-.02** (-.04 to -.01)	-.02** (-.04 to -.01)	-.02** (-.04 to -.01)
Sensitivity to reward	-.09** (-.13 to -.04)	-.01* (-.02 to -.001)	-.03** (-.06 to -.02)

Note: All 95% CIs are bias corrected and estimated from 1,000 bootstrapped resampling draws. * $p < .05$ **$p < .01$

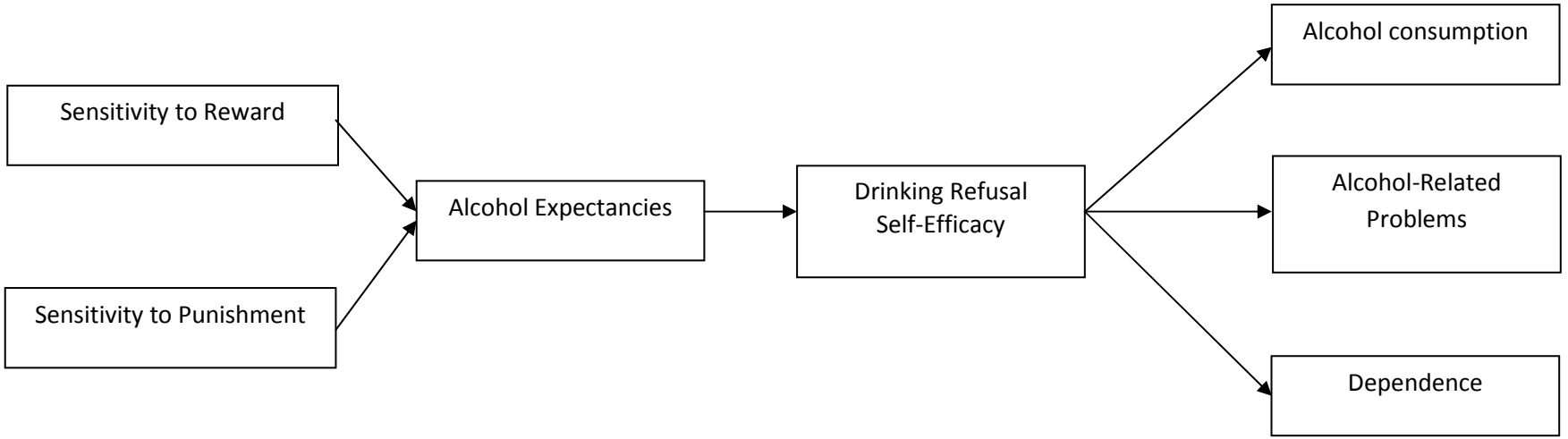

Figure 1. Hypothesised model: Alcohol expectancies and drinking refusal self-efficacy mediate the relationship between reward sensitivity and different indices of drinking behaviour

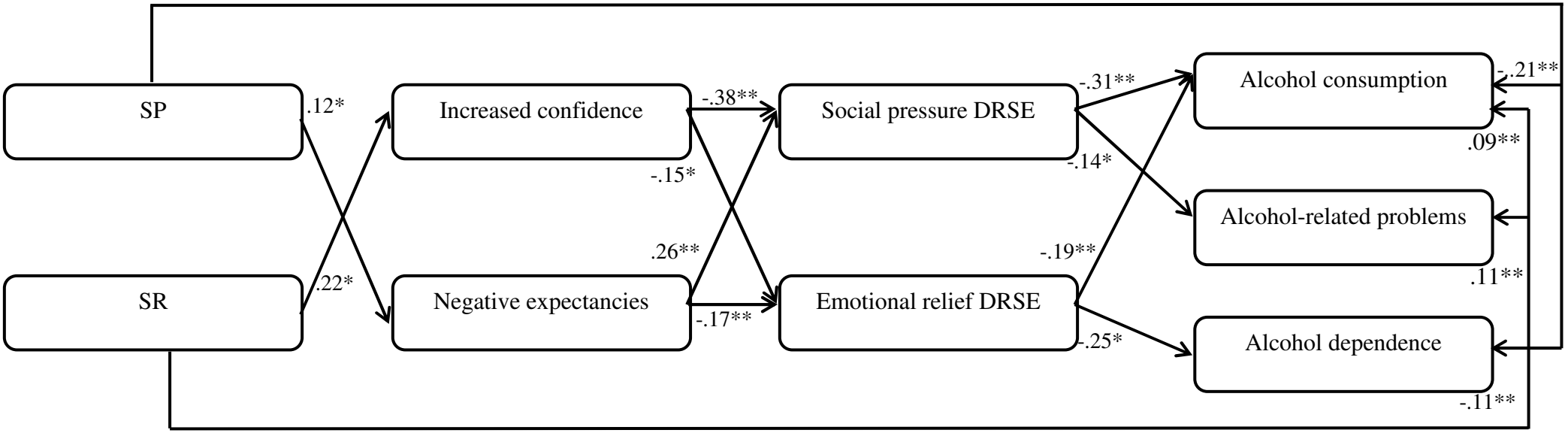

Figure 2. The relationship between sensitivity to punishment (SP), sensitivity to reward (SR) and drinking is mediated by alcohol expectancies and drinking refusal self-efficacy (DRSE). * p < .05 ** p < .01. *Note:* Significant direct paths are also evident between: increased confidence, tension reduction and negative expectancies with each of the three drinking variables (all positively related; all p<. 05). Expectations of cognitive enhancement were also directly related to drinking (all negatively related; all p< .05). To aid interpretation these paths are not illustrated in the Figure.