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Short communication

Individualised but not general alcohol Stroop predicts alcohol use

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ABSTRACT

Background: Recently, there have been investigations that have targeted improving the relatively poor validity and reliability of attentional bias measures. These studies have demonstrated that individuals show elevated attentional bias to stimuli associated with their drinking history, although to date, the predictive utility of these measures has yet to be assessed. The current study aimed to investigate the predictive value of an individualised alcohol Stroop task compared to that of an alcohol Stroop task with general alcohol-related words in a sample of non-dependent undergraduate drinkers.
Method: 48 undergraduate social drinkers completed questionnaire measures of alcohol consumption and hazardous drinking which were combined to get an alcohol involvement measure. Participants also completed three blocked format Stroop tasks, a control Stroop (containing soft drink-related words), a general alcohol Stroop (containing a mixture of alcohol-related words) and an individualised Stroop that contained words relating to the participants' favourite alcoholic drink.
Results: Although there was no significant difference in participants' performance across the three different Stroop tasks, only performance on the individualised Stroop was associated with alcohol involvement. Notably, the individualised Stroop predicted variance in drinking after controlling for demographics and general alcohol Stroop performance.
Conclusions: This study indicates that adopting individualised stimuli into attentional bias tasks may increase their predictive validity.

1. Introduction

Incentive-motivational models of addiction (e.g., Field and Cox, 2008; Robinson and Berridge, 2001) argue that addictive processes are characterised by increased attentional bias towards substance-related cues, with the development of attentional bias underlying the progression from social/occasional substance use onto abuse and addiction. Measures such as the modified addiction Stroop task, in which participants state the colour in which a word is written regardless of its semantic content, reliably show attentional bias towards drug-relevant stimuli in drug users compared to controls (e.g., Franken et al., 2000; Munafo et al., 2003). Furthermore, attentional bias exhibited in alcohol Stroop tasks reliably correlates with alcohol use indices (e.g., Field et al., 2007; Johnsen et al., 1994; Murphy and Garavan, 2011; Sharma et al., 2001).

Despite over 15 years of research into the association between performance on the modified addiction Stroop and substance use there has, until recently, been a failure to analyse the reliability of these measures in an effort to improve their predictive value. In their re-analysis of seven different studies Ataya et al. (2012) found the internal reliability of the addiction Stroop task to be poor with only the blocked format having acceptable reliability. One explanation for this is the use of stimuli from a broad category, e.g., different alcoholic drinks which may not necessarily reflect an individuals substance use (Field and Christiansen, 2012; Christiansen and Field, 2013). Indeed, incentive-motivational models of addiction argue that attentional bias is dependent upon conditioning history; therefore it will be only exhibited towards cues consistently associated with rewarding effects, and not towards cues that participants have limited or aversive experiences with. Consistent with this assertion, Fridrici et al. (2013) found that non-dependent social drinkers are slowest to colour name alcohol-related words when they are based upon their personal drinking habits compared to non-specific alcohol-related stimuli. Using a different task, Houben and Wiers (2009) found that performance on a single target "beer" implicit association task (IAT), but not a standard alcohol IAT, predicted alcohol consumption in regular beer drinkers. With regard to alcohol-dependent populations, increased attentional bias on individualised Stroop tasks during treatment is associated with relapse (Cox et al., 2002). Notably, there was no standard Stroop comparison so any conclusions about the efficacy of individualised stimuli in dependent populations are tentative.

Although this research represents some important steps towards investigating individualised stimuli, the predictive value of the individualised Stroop task compared to the standard Stroop is yet to receive thorough testing. Individual differences in

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Table 1
Means (±SD) for age, alcohol use, craving scales and Stroop performance for the sample and males and females separately.

	Sample	Females	Males	*t* (M/F)
Age (years)	21.48 (2.92)	20.97 (1.49)	22.71 (4.78)	−1.94
Past 14 day alcohol consumption (UK units)	45.05 (23.69)	40.64 (23.30)	55.75 (21.84)	−2.34**
AUDIT	12.94 (4.93)	13.29 (5.07)	12.07 (4.63)	0.74
Alcohol involvement	0.00 (1.73)	−1.30 (1.82)	1.32 (1.50)	0.81
Control Stroop RT (s)	79.17 (13.28)	78.71 (13.24)	80.29 (13.81)	−0.38
Errors	2.27 (2.01)	2.03 (2.22)	2.88 (1.29)	−2.10*
Alcohol Stroop RT (s)	79.29 (11.77)	79.20 (11.38)	79.50 (13.14)	−0.23
Errors	2.43 (2.23)	2.20 (2.56)	3.00 (2.48)	−1.45
Individualised alcohol Stroop RT (s)	78.10 (11.02)	76.97 (10.63)	80.86 (11.88)	−1.07
Errors	1.96 (1.92)	2.09 (2.22)	1.64 (0.84)	−0.14

Past 14 day alcohol consumption (UK units), 1 unit = 8 g alcohol; AUDIT = alcohol use disorders identification test, possible range of scores is from 0 (minimum) to 40 (maximum). Alcohol use = combined *Z* scores of past 14 day alcohol consumption and AUDIT scores.
* $p<.05$.
** $p<.025$.

performance on different Stroop tasks are theoretically important, but if the individualised Stroop task is no more associated with alcohol use in the real world than the general Stroop the value of developing individualised versions would be limited. The current study therefore aims to investigate whether the individualised alcohol Stroop predicts unique variance beyond the general Stroop. Participants completed a control Stroop task (containing soft drink-related words), a general alcohol Stroop (containing a range of alcohol-related words) and an individualised Stroop (containing words relating to participants' favourite beverage). We hypothesised that reaction times for the individualised Stroop will be slower than the general alcohol Stroop. Furthermore, we predicted that although both alcohol Stroop tasks will predict variance in drinking behaviour the individualised Stroop will account for additional variance.

2. Method

2.1. Participants

Forty-eight participants (34 females) aged between 18 and 39 years (21.48 ± 2.92) were recruited from the undergraduate population of the University of Liverpool. Participants were invited to take part if they were fluent in English and drank alcohol on at least one occasion per week. Exclusion criteria included current or past alcohol use disorder and colour blindness.

2.2. Materials

2.2.1. Time line follow back (TLFB; Sobell and Sobell, 1990). The TLFB is a retrospective diary used to assess alcohol consumption; participants estimated the number of alcohol units consumed over the preceding 14 days.

2.2.2. The alcohol use disorders identification test (AUDIT; Saunders et al., 1993). The AUDIT consists of ten fixed response questions regarding alcohol consumption and consequences of drinking. Scores on the AUDIT range between 0 and 40 with scores of 8+ indicating hazardous or harmful use.

2.2.3. Desires for alcohol questionnaire (DAQ; Love et al., 1998). The DAQ is a measure of alcohol craving. The DAQ consists of 14 statements that are responded to on seven point Likert scales. This was included to investigate correlations between DAQ scores and Stroop performance (all coefficients were $p>.1$).

2.2.4. Stroop tasks. Each list was presented on a separate laminated card containing 112 words, consisting of 8 different words, repeated 14 times. Words were presented in a random order in blue, green, red and yellow and there were an equal number of words of each colour on each card. Overall time taken to read the entire list was taken as the dependent variable.

The control Stroop consisted of soft drinks (e.g., Coke/Fanta) and general alcohol Stroop consisted of a mixture of general alcohol related words (e.g., Beer/Vodka). The eight individualised Stroop tasks consisted of Beer (e.g., Carlsberg/Becks; participants = 15), Cider (e.g., Strongbow/Blackthorn; $N=9$), Wine (all words related to red or white, e.g., Sauvignon/Zinfandel; $N=8$), Vodka (e.g., Smirnoff/Absolut; $N=6$), Gin (e.g., Hendricks/Gordon's; $N=5$), Alcopops (e.g., Breezer/Sourz; $N=2$), and Cocktails (e.g., Mojito/Cosmopolitan; $N=3$). Stroop lists were created using informal focus groups of undergraduates concentrating on identifying varieties of drinks popular with undergraduates, although this led to word lists not being fully matched on word length.

2.3. Procedure

Participants were tested at the University of Liverpool. First, participants provided consent before completing the questionnaire battery and informing the experimenter of their preferred drink. They then completed the battery of Stroop tasks (order counterbalanced across participants). The experimenter timed participants with a stopwatch and gave them a "go" prompt to start the Stroop. During the Stroop the experimenter made note of errors using a scoring sheet. As the primary DV was speed of reading participants were told not to correct any incorrect responses and to continue with the Stroop, an identical procedure was used by (Field et al., 2007). Following this they completed a second DAQ, were debriefed and received course credit for their participation.

3. Results

Table 1 summarises demographic and alcohol use characteristics for the sample.

3.1. Comparison of Stroop performance

A three-way repeated measures ANOVA was conducted on Stroop reaction times (control, general alcohol, individualised alcohol). There was no main effect of Stroop type on reaction times ($F(2,94)=0.55$, $p>.1$, $\eta_p^2=.02$). There was also no main effect on number of errors ($p>.1$).

3.2. Predicting alcohol consumption

A hierarchical regression analysis was conducted to investigate the predictive utility of the Stroop tasks. An alcohol involvement variable was used as the dependent variable; this was created by combining *Z*-scores of TLFB and AUDIT scores. We computed Stroop bias scores by subtracting control Stroop times from the general alcohol and the individualised alcohol Stroop. Age and gender were entered in the first step of the regression, followed by general alcohol Stroop bias as step two and individualised Stroop bias as step three. The overall regression model was significant ($R^2=.25$, $\Delta R^2=.18$, $F(4,42)=3.51$, $p<.025$). The first step was significant (R^2 change = .15, *F*-change(2,44) = 3.97, $p<.05$), although