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A Negative Attentional Bias for Positive Recovery-Related Words as a Predictor of Treatment Success Among Individuals with an Alcohol Use Disorder

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Abstract

Introduction: This study assessed relationships between clients' attentional bias (AB) for different types of stimuli and their treatment outcomes. Alcohol AB during detoxification has previously been shown to predict relapse, but further research was needed to clarify this relationship. The current study determined whether AB for recovery-related words would also predict treatment outcome.

Methods*:* Participants were 45 clients undergoing alcohol detoxification, and a control group of 36 staff members. They rated words for personal relevance in four categories (alcohol-related, neutral, positive change-related, and negative change-related). Participants completed an individualized Stroop task containing their chosen words. They were also assessed on readiness-to-change, difficulties with emotion regulation, drinking problems, anxiety, and depression. Clients were interviewed at a three-month follow-up to determine their treatment outcome.

Results: As predicted, questionnaire measures did not predict clients' treatment outcome ($p > .05$). A logistic regression model indicated that the best predictor of treatment outcome was AB for positive change-related words ($p = .048$), with successful individuals having less AB for these words than for the other word categories. Although this finding was unexpected, it was supported by significant relationships between positive change-related interference scores and continuous measures of drinking at follow-up [i.e. number of units drunk ($p = .039$) and number of drinking days ($p = .018$)].

Conclusions: The results suggest that positive change-related words are a better predictor of treatment outcome than are either alcohol-related words or negative change-related words.

Keywords: Alcohol, attentional bias, treatment outcome, Stroop test, recovery

1. Introduction

Health problems arising from alcohol misuse cost the UK National Health Service an estimated £3.5 billion annually (National Treatment Agency for Substance Misuse, 2013). Providing treatment at detoxification units is a cost-effective way of reducing the financial impact (Raistrick, Heather, & Godfrey, 2006). Despite continuous improvements in treatment services, the rate of relapse post-detoxification remains between 60-90% (Aguiar, Neto, Lambaz, Chick, & Ferrinho, 2012; Becker, 2008; Raistrick, 2006; Spada, Nuamah, Luty, & Nikcevic, 2008).

It is important to understand why these high rates of relapse after detoxification occur. It has been suggested that attentional bias (AB) for alcohol-related stimuli is a primary feature of alcohol dependency; it promotes craving and helps maintain the addiction (Field & Cox, 2008). AB is an automatic focus of attention on personally salient stimuli (Fadardi & Cox, 2008; Williams, Mathews, & MacLeod, 1996). According to Klinger and Cox's (2011) theory of current concerns, drinking alcohol has become a major goal in the life of alcohol-dependent individuals. Being committed to achieving this major goal causes a *current concern* to develop. It is a latent, unconscious brain process, which allows alcohol to gain priority in the cognitive system to facilitate the goal of procuring and imbibing alcohol. As a result, the individual has automatic distractions for alcohol-related stimuli.

The most widely used measure of AB is the alcohol-Stroop test (Cox, Fadardi, & Pothos, 2006; Field & Cox, 2008). Typically, neutral and alcohol-related words are presented on a computer screen in various colors, and participants are required to respond as quickly and accurately to the color of the words while ignoring their meaning. Stroop interference, which is a measure of AB, is calculated by subtracting mean reaction times to the neutral words from mean reaction times to the alcohol words (Cox, Fadardi, Intrilligator, & Klinger, 2014).

A large body of evidence shows that heavy drinkers have an AB for alcohol-related words on the alcohol-Stroop test (Cox, Blount, & Rozak, 2000; Cox et al., 2006; Cox, Yeates, & Regan, 1999). Individuals' degree of AB is proportional to the amount of alcohol that they habitually consume, with dependent drinkers showing the greatest AB (Fadardi & Cox, 2009; Field & Cox, 2008; Stormark, Laberg, Nordby, & Hugdahl, 2000). This is likely because dependent drinkers have the greatest concern for drinking alcohol, which gains priority in their cognitive system.

There are clinical implications of alcohol AB. Cox, Hogan, Kristian, and Race (2002) found that performance on the alcohol-Stroop task during detoxification predicted later relapse. In this study, clients completed an alcohol-Stroop task at the beginning of their detoxification, and again four weeks later prior to their discharge. A four-week, post-treatment follow-up indicated that the individuals who had relapsed had a greater AB for alcohol-related stimuli than successful individuals. Similar findings have also been found in predicting heavy drinkers' alcohol consumption (Cox, Pothos, & Hosier, 2007). Taken together, the results presented here provide support for the use of the alcohol-Stroop task as a predictor of later outcome, although further research is needed to clarify this relationship (Field, Marhe, & Franken, 2014).

Unlike the research described above, which focused on predicting relapse, the present study aimed to identify predictors of treatment success. This is consistent with a shift in the addiction field from a problem-management approach to a more positive recovery-based paradigm (White, 2007).

Miller and C'de Baca (2001) described the process of stopping drinking and moving toward recovery as an enduring transformation of cognitions, affect, and behavior—a process that might not be conscious (White, 2007). Many individuals in treatment may appear to have a conscious intention to change, regardless of whether they actually change. For example,

scores on an explicit measure of change such as the Readiness-to-Change Questionnaire (RCQ; Heather & Honekopp, 2008) can predict short-term reductions in consumption but not longer-term ones (Cox et al., 2007). In addition, because change is an expected outcome of treatment, some individuals may give socially desirable answers on such explicit measures. For these reasons, implicit measures of change might be a better predictor of actual change than self-report measures.

The current study assessed whether AB for change-related words on a Stroop task could serve as an implicit measure of change. It was expected that if individuals do experience a meaningful shift in their motivation for recovery, they would show an AB for change-related words. Consistent with the theory of current concerns (Klinger & Cox, 2011), recovery would have become a major goal for such individuals, thus causing them to react automatically to recovery-related stimuli.

The study aimed to determine whether AB for change-related stimuli could predict treatment success. It was hypothesised that clients who had successful treatment outcomes would have a greater AB for change-related words, and less AB for alcohol-related words, than would clients who relapsed. It was also predicted that clients would have a greater AB for both alcohol-related and change words than would a control group who had not been in treatment. Finally, it was expected that RCQ scores as a self-report measure of motivation for change would not predict treatment outcome.

2. Method

2.1 Participants

There were two groups of participants: (a) an experimental group of clients who had completed their pharmacological regime and were going to be discharged within the next three days and (b) a control group of staff members at the same detoxification unit. Staff members were chosen in an attempt to regulate the control group's exposure to alcohol-

related cues (Cox et al., 2002). Exclusion criteria were that participants could not have had a severe psychotic disorder or neurological impairment, or a history of illicit drug use; staff members could not have had a history of alcohol dependency.

A total of 45 clients and 36 staff members were recruited. The sample size was almost twice as large as that in other similar studies (e.g., Cox et al., 2002), and was determined by the availability of the clinical population. A £10 voucher was provided as an incentive to participate.

2.2 Stimuli

Lists of positive and negative change-related words were compiled from interviews with clients who did not participate in the experimental study. These clients were actively involved in recovery and had maintained a substantial period of sobriety. They were asked to discuss their *change experience* and to list words that reminded them of it. Examples of positive and negative change-related words that these clients provided are, respectively, *hope* and *acceptance* and *death* and *crime*. Lists of alcohol-related and neutral words were compiled from words used in previous studies (e.g. Fadardi & Cox, 2009). Examples of alcohol-related words used are *bar* and *vodka*; examples of neutral words used are *chair* and *door*. Each list comprised 22 words. Participants were asked to select eight words from each of the four lists. All word lists were matched for mean number of syllables per word and word frequency using the Subtlex UK database of word frequencies (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014).

Participants were asked to rate the personal relevance for them of each alcohol-related word on a Likert scale and to identify the eight words that were most personally relevant for them. They were also asked to rate the personal relevance of each of the neutral words, but this time they identified the eight words that were least personally relevant for them. In the same manner, participants in the experimental group rated and identified positive and

negative change-related words that were personally relevant for them. In contrast, participants in the control group rated and identified words that they believed would be most personally relevant for clients undergoing detoxification. This was to avoid staff choosing change words relevant to their own lives.

The words that each participant chose were used in that person's Stroop task. Each word was presented twice in each of four font colors (red, blue, yellow, and green). In order to optimize the Stroop effect (Cox et al., 2006), words in each of the four categories were presented in separate blocks. These blocks were counter-balanced, and the words were randomized within blocks. In total, each participant completed 20 practice trials containing words from all four categories, and 256 experimental trials. Participants completed the experiment on a visual display monitor powered by a laptop, using a serial response PST button box.

2.3 Materials

A demographics questionnaire was administered. Daily drinking was assessed using the computerised version of the Alcohol Timeline Followback (TLFB; Sobell & Sobell, 1992). Participants retrospectively estimated their alcohol consumption over a three-month period. Participants completed the treatment-specific, revised version of the Readiness to Change Questionnaire (RCQ; Heather & Honekopp, 2008). The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) was used to measure emotional dysregulation; the Short Inventory of Problems (SIP; Kiluk, Dreifuss, Weiss, Morgenstern, & Carroll, 2013) was used to measure problems associated with drinking alcohol; and the Hospital Anxiety and Depression Scale (HADS, Zigmond & Snaith, 1983) was used to determine participants' level of anxiety and depression.

2.4 Procedure

The Bangor University and NHS ethics committees provided approval for the current study. Participants provided informed consent and their contact details. They rated the word lists, completed the questionnaires and then the computerized Stroop task. Participants were instructed to respond as quickly and accurately as possible to the color in which each word was presented by pressing the corresponding color on the button box.

The researcher conducted a follow-up interview with the clients three months later. All questionnaires (except for demographics) were re-administered, and the participant's treatment outcome was determined during this interview using the alcohol TLFB (Sobell & Sobell, 1992). All participants were then debriefed.

2.5 Data Analysis

Four clients were excluded from the analyses involving reaction times. Three of them were color blind, and one had a very high (80%) error rate. Only correctly answered trials (93.66%) were included in the analysis. Trials on which a participant's reaction times were 2.5 standard deviations above or below his or her mean for each of the four word types were also removed. This resulted in a further 2% of the trials being removed. Interference scores were then calculated by subtracting mean reaction times to the neutral words from mean reaction times to the alcohol or change words.

Mann-Whitney U tests were run to determine whether there were differences between the clients and the staff in their interference scores. Non-parametric tests were chosen because the data were not normally distributed, and the score distributions of the two groups were different shapes meaning that data transformations were less effective. Two logistic regressions were conducted to determine whether interference scores and questionnaire scores could predict treatment outcome. Linear regressions were conducted using continuous measures of treatment outcome: average units drunk and percentage of drinking days.

3. Results

Analysis of the demographic characteristics of the staff members (n = 36, 78% females) and the clients (n = 45, 71% males) indicated that there were no significant differences between their age, $t(60.56) = 0.38$, $p = .708$, and their age when they had their first drink, $t(67) = 0.78$, $p = .446$. As expected, clients had drunk significantly more alcohol per day than staff members during the prior three months, $t(40.40) = 15.11$, $p < .001$, and they had significantly ($p < .001$) higher scores than staff members on each of the questionnaires (see Table 1).

[Insert Table 1 here]

Despite the difference in the proportion of males and females in the staff and client groups, gender was unrelated to the interference scores for all three word types ($p > .05$), so was not controlled for in the analyses. Visual inspection indicated that the clients' and staff's distribution of interference scores were similar. The Mann-Whitney U tests showed that alcohol interference scores were not significantly different between clients (Mdn = 1.38) and staff (Mdn = 17.66), $U = 585$, $z = -1.56$, $p = .118$. Positive change interference scores were not significantly different between clients (Mdn = -10.22) and staff (Mdn = 3.95), $U = 684$, $z = -0.55$, $p = .581$. Finally, negative change interference scores were not significantly different between clients (Mdn = -10.95) and staff (Mdn = 14.87), $U = 557$, $z = -1.85$, $p = .065$. On the whole, these results suggest that clients' interference scores were not different from those of the staff. There were, however, differences between clients who did and did not relapse (see Figure 1).

Follow-up data was provided by 35 of the 41 clients included in the reaction time analysis. These clients were separated into two groups based on their treatment outcome. If individuals had returned to a dependent level of drinking that was similar to their pre-treatment level, they were placed into the *relapsed* category (n = 15). Individuals who had not drunk (n = 14), or were drinking at a non-dependent level (n = 6) were placed into the

successful category (n = 20). This division was used in a previous study that assessed relapse using the alcohol TLFB (Evren, Durkaya, Evren, Dalbudak, & Cetin, 2011), and is consistent with the view that abstinence is not a suitable goal for everyone with an alcohol-use disorder (Subbaraman & Witbrodt, 2014). The two groups did not differ in the number of units of alcohol they had drunk prior to detoxification, $t(33) = 0.01$, $p = .925$. They also did not differ in their explicit ratings of the alcohol-related, $t(33) = 0.52$, $p = .606$, positive change-related, $t(33) = 1.18$, $p = .248$, negative change-related, $t(20.22) = 1.62$, $p = .122$, or the neutral words, $t(33) = 0.11$, $p = .915$.

The mean interference scores for both groups are shown in Figure 1. The group of clients who were *successful* had lower interference scores for alcohol-related and positive change-related words than the individuals who *relapsed*. The effect size for positive change-related words was large ($g = 0.79$); for alcohol words, it was small-to-medium ($g = 0.38$), and for the negative change-related words it was very small ($g = 0.03$). Accordingly, negative change-related words were not included in further analyses.

[Insert Figure 1 here]

A logistic regression analysis was used to determine whether positive change-related and alcohol-related interference scores predicted treatment outcome for the 35 clients. The regression model was statistically significant, $\chi^2(2) = 6.12$, $p = .047$. Based on the non-significant results from the Hosmer and Lemeshow test, $\chi^2(7) = 8.91$, $p = .259$, the model appeared to be a good fit. It explained 21.5% (Nagelkerke R^2) of the variance in the clients' treatment outcome. The model correctly classified 68.6% of the cases, with 85% of the successful outcomes being correctly identified. However, of the two predictor variables, only positive change-related interference scores was significant ($p = .048$).

Negative interference scores for the positive change-related words were associated with treatment success. A one-sample t-test against zero (i.e. no interference) showed that the

successful individuals' negative AB for positive words was significant, $t(19) = -2.45$, $p = .024$. To further explore whether positive change-related words were a significant predictor of treatment outcome, two simple linear regressions were conducted using continuous measures of treatment outcome: average units drunk and percentage of drinking days. Of the 35 clients who were tested, 28 provided this more detailed information about their level of drinking during the follow-up period (see Table 2).

[Insert Table 2 here]

Homoscedasticity and normally distributed residuals were achieved through a log10 transformation for both dependent variables. Positive change interference scores significantly predicted the number of units drunk during the follow-up period, $F(1, 26) = 4.73$, $p = .039$, and the percentage of drinking days, $F(1, 26) = 6.44$, $p = .018$, with higher interference scores associated with more units drunk and a higher percentage of drinking days. Positive change-related interference scores accounted for 15.4% of the variance in the number of units drunk during follow-up and 19.8% of the variance in the percentage of drinking days. All of these relationships yielded a medium effect size (Cohen, 1988).

Finally, a logistic regression analysis was run to determine whether scores on the questionnaires completed during detoxification predicted treatment outcome. As expected, the regression model was not statistically significant $\chi^2(5) = 6.71$, $p = .243$. None of the measures was a significant predictor of outcome: DERS scores ($p = .248$), SIP scores ($p = .101$), HADS anxiety scores ($p = .440$), HADS depression scores ($p = .377$), and RCQ total scores ($p = .859$).

4. Discussion

The current study aimed to determine whether a variant of the emotional Stroop task could predict the treatment outcome of alcohol-dependent individuals undergoing detoxification. The results indicated that positive change-related words were a significant

predictor of treatment outcome, but not in the expected direction. Individuals who relapsed had significantly larger interference scores (i.e., an AB) for the positive change-related words than those who were successful, whereas those who were successful had *negative* interference scores (i.e., a *negative* AB). That is, the successful individuals responded more quickly to the positive change words than to neutral words. AB for positive change-related words also significantly predicted continuous measures of drinking (e.g., number of units drunk and percentage of days drinking) during the follow-up period.

Why did the relapsed individuals show an AB for the positive change-related words and the successful individuals did not? Previous research on Stroop interference in patients with anxiety may provide an explanation. Mathews and Klug (1993) found that patients with an anxiety disorder had an attentional bias for both positive and negative valenced words that were related to their disorder. They suggested this was because the patients viewed both the positive and negative words as aversive regardless of their overt meaning. Similarly, in the current study the positive words might have become aversive for the individuals who were unable to attain recovery, thus causing them to have an attentional bias for these words.

On the other hand, the successful individuals might have found the positive words appealing rather than aversive. There has been limited research exploring whether positive words elicit positive affect. However, a meta-analysis of studies of AB for positive emotional stimuli (Pool, Brosch, Delplanque, & Sander, 2016) found that positive words have a greater impact on initial orientation to them (i.e., they are grabbing attention) than on disengagement from them and re-orientation to a new task. Words that are perceived as appetitive (i.e., words that produce positive affect) broaden an individual's attention and facilitate the processing of new stimuli (Fredrickson, 2001). Thus, in the present study whereas the words might have initially captured all participants' attention, the successful individuals may have quickly oriented to the stimuli and experienced positive affect, which in turn facilitated their

ability to quickly name the color in which the word appeared. On the other hand, the participants who relapsed might have perceived the positive words as aversive and struggled to disengage their attention from them (which resulted in an AB). Future research should test this hypothesis by assessing participants' affective reactions to positive words and determining whether this improves or impairs their reaction times to positive-change-related words on the Stroop task.

The individuals who relapsed showed a nonsignificant trend toward greater alcohol AB than the successful individuals, but why was their alcohol AB not stronger? Field et al. (2014) suggested that alcohol AB is greatest in *high-risk* situations in which heavy drinkers are tempted to drink. The treatment unit where this study was conducted was a low-risk environment that did not provide an opportunity to drink. Future research in which the alcohol Stroop is administered in naturalistic settings would likely show that alcohol AB is a stronger predictor of treatment outcome than was found in the current study.

In line with our hypotheses, the RCQ did not predict treatment outcome. The RCQ was developed as a measure of individuals' motivation to change their drinking behavior (Heather & Honekopp, 2008), but studies of its predictive utility have yielded mixed results (Cox et al., 2007; Heather, Rollnick & Bell, 1993). The results of the present study suggest that alcohol-dependent individuals' stated readiness to change is unrelated to their subsequent actual change. Possibly, the participants provided socially desirable answers on the RCQ. In this study, some of the implicit measures predicted treatment outcome better than the RCQ.

AB for negative change-related words did not predict treatment outcome. Both relapsed and successful clients explicitly rated these words as meaningful, yet neither group showed an AB for them. It is clear from participants' responses on the Short Inventory of Problems questionnaire that they had experienced serious and multiple problems resulting

from their drinking, yet they had continued to drink. They might, however, have become desensitized to stimuli related to these negative consequences.

The lack of difference in interference scores between staff members and clients also warrants attention. Staff members showed an AB to alcohol-related stimuli probably because in their day-to-day work with alcohol-dependent patients, they were continually exposed to alcohol-related stimuli, even though they themselves might not have had concerns about drinking alcohol. Research conducted by Albery, Sharma, Noyce, Frings and Moss (2015) identified that individuals who consume low levels of alcohol can show a strong attentional bias towards alcohol-related stimuli if they work in environments where there is high exposure to alcohol-related cues. In Albery et al.'s study the participants worked in pubs, but similar findings may have occurred for our staff members who work in a different high exposure environment. As expected, the staff did not show an AB for the positive change-related words. As Field and Cox (2008) suggested, the ideal control group to use in alcohol AB research has not yet been identified.

A criticism of indirect measures such as the alcohol-Stroop is that it is unclear whether these tasks actually measure attentional bias, or whether they measure other related processes such as cognition and motivation instead (Christiansen, Schoenmakers, & Field, 2015). Future research expanding on the clinical utility of using AB to predict treatment outcome could use more direct measures of AB, such as eye-tracking, to further validate the current findings (Wilcockson & Pothos, 2014).

5. Conclusions

This study points to potential clinical utility of using AB as a predictor of treatment outcome, but the results suggest that positive words may be a better predictor than alcohol-related words. However, before the paradigm can be used in clinical practice, further research is needed to replicate the current findings and better determine why relapsed individuals

showed an AB for positive change-related words and successful individuals showed a *negative* AB for them. Developing valid predictors of successful treatment outcomes is important for refining effective treatments. Predicting treatment outcome using an implicit measure might help overcome the limitations of explicit measures.

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