The Search for New Ways to Change Implicit Alcohol-Related Cognitions in Heavy Drinkers

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This article summarizes a symposium on new ways to change implicit alcohol-related cognitions, presented at the 2005 Annual Meeting of the Research Society on Alcoholism in Santa Barbara, California, organized by Wiers and Cox. During the past few years, research has demonstrated that implicit cognitions predict unique variance in prospective alcohol use and preliminary results indicate that they also predict treatment outcomes. The central question in this symposium was how implicit cognitions can be changed and how the changes will influence behavior. Field presented data showing that an attentional bias for alcohol can be altered by attentional training: heavy drinkers who were trained not to attend to alcohol stimuli reported less craving and drank less beer than those trained to attend to alcohol stimuli. Schoenmakers used a similar, clinically relevant attentional retraining (AR) procedure; heavy drinkers were trained not to attend to alcohol pictures or received no training. After the training, the AR group attended less to the alcohol pictures than the control group. Fadardi described the Alcohol Attentional Control Training Program (AACTP), which makes alcohol drinkers aware of the automatic, cognitive determinants of their drinking and aims to help them to gain control over these processes. Data were presented to support the effectiveness of the AACTP. Palfai presented data showing that alcohol drinkers can be taught to use implementation intentions to gain control over their drinking, which may be used to automatically activate self-control skills in the presence of alcohol cues. In his discussion, Stacy pointed out the importance of recent cognitive theories that integrate attention and memory processes—theories that can help us better understand the mechanisms involved in AR. Together, the studies presented demonstrate that there are promising new ways in which implicit alcohol-related cognitions and their effects on drinking can be changed. After further refinement, these procedures might be used in clinical interventions that have not previously addressed implicit cognitive processes.

Key Words: Implicit Cognition, Attentional Bias, Dot-Probe, Alcohol-Stroop, IAT, Treatment for Alcohol Abuse, Attentional Retraining, Implicit Associations, AACTP.

INTRODUCTION

During the past decade, research on implicit cognitive processes has become influential in alcohol and addiction research (for a overview, see Wiers and Stacy, 2006). Implicit cognitions have been defined as "introspectively unidentified (or inaccurately identified) traces of past experience that mediate feeling, thought, or action" (Greenwald and Banaji, 1995; see also De Houwer, 2006). Implicit cognition approaches can be roughly divided into 3 lines of research with their own historical roots and background in basic science. The first is the attentional bias (AB) approach, rooted in experimental psychopathology research. In a variety of disorders, it has been demonstrated that disorder-related stimuli automatically draw and capture attention (see for a review Mathews and MacLeod, 2005). On alcohol use, recent reviews have concluded that there is an increase in AB from light to heavy social drinkers to alcohol abusers (Bruce and Jones, 2006; Cox et al., in press). The second line of research concerns the memory bias approach, which is rooted in basic memory research (Stacy, 1997). Stacy et al. (2004) have adapted implicit memory tasks to study alcohol and drug use and have demonstrated that the performance on the tasks predicts alcohol and drug use better than explicit measures. The third line of research has relied on reaction time measures to assess implicit associations, consistent with research rooted in social cognition research (Fazio and Olson, 2003). The best known assessment techniques are the Implicit Association

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Test (IAT, Greenwald et al., 1998) and affective priming (Fazio, 2001). Theoretically, one would expect that the new approaches would at least partially overlap, stimuli related to an individual’s current concerns should readily be retrieved from memory and draw the person’s attention (Cox et al., in press; Franken, 2003). However, it should be noted that there has been surprisingly little research directly comparing the 3 kinds of measures of implicit cognition.

Importantly, in all 3 approaches, there are strong indications that implicit assessment methods add something unique to the prospective prediction of addictive behaviors, beyond the information provided by explicit measures (i.e., questionnaires). For this reason, it may be useful to use implicit tests in conjunction with explicit tests when the current interventions are tested (e.g., Cox et al., 2002; Wiers et al., 2005). Implicit measures may uniquely predict clinically relevant outcomes such as relapse (Cox et al., 2002), and the effects of current interventions on implicit versus explicit cognitions appear to be unrelated (Wiers et al., 2005; cf. Teachman and Woody, 2003). These and other findings (e.g., from neuroscience) have led many theorists to consider addictive behaviors from a dual-process perspective (see many examples in Wiers and Stacy, 2006). From a dual-process perspective, an intervention can be aimed either at more explicit or at more implicit cognitive processes. Most current psychosocial interventions are aimed at changing explicit cognitive processes, making negative (long-term) consequences of continued use more clear, building up motivation for change, teaching strategies to deal with the lures of continued drug use, etc. From a dual-process perspective, one could view such interventions as attempts to influence explicit cognitions, which in turn could moderate the influence of the largely automatic stimulus-driven implicit cognitive system on behavior (Stacy et al., 2004). In addition, researchers in different domains have begun to investigate new ways to directly influence implicit cognitions (for a review, see Wiers et al., 2004). In anxiety research on AB, it has been demonstrated that an AB can be experimentally manipulated either toward or away from the anxiety-provoking stimuli (MacLeod et al., 2002; Mathews and MacLeod, 2002), with corresponding changes in behavior. These findings have directly inspired 3 of the 4 studies presented here (Field; Fadardi and Cox; and Schoenmakers and Wiers), which are, to the best of our knowledge, the first 3 attempts of “attentional retraining” (AR) in the area of alcohol abuse.

The fourth study (Palfai and Ostafin) adopted a different strategy, rather than trying to change the implicit processes that promote drinking alcohol, it investigated whether interventions can be developed that enable hazardous drinkers to automatically activate self-control–related responses in high-risk contexts. Research on the effect of “implementation intentions” on self-control–related responses is presented to exemplify how automatic appetitive responses to alcohol cues can be modified through the use of planning strategies that promote contextually driven self-regulatory processes. These different new approaches to interventions from a dual-process perspective are illustrated in Fig. 1.

**ATTENTIONA BIAS FOR ALCOHOL CUES AND THE MOTIVATION TO DRINK ALCOHOL: ASSESSMENT OF THEIR CAUSAL RELATIONSHIP WITH AN EXPERIMENTAL MANIPULATION**

**Matt Field**

Current models of drug craving emphasize the reciprocal interactions between cognitive variables and subjective drive states. For example, Franken (2003) proposed that, in the experienced alcohol user, alcohol-related cues (e.g., the sight of a bottle of vodka) acquire incentive-motivational properties, which cause these cues to “grab the attention.” The resulting “attentional bias” for alcohol-related cues promotes an increase in subjective craving until eventually craving reaches a threshold level that is sufficient to motivate self-administration. According to Franken, this mechanism could contribute to substance use and abuse across a broad range of substance users (e.g., social drinkers, tobacco smokers, opiate addicts), and it may also explain relapse to drug-taking in drug users who are attempting to remain abstinent. Similarly, according to the “elaborated intrusion” theory of desire (Kavanagh et al., 2005), cognitive elaboration on motivational states (including focusing the attention on drug-related stimuli in the environment) can increase the strength of those motivational states, and this mechanism could contribute to the potentiation of a variety of subjective drive states, including hunger and drug craving.

Consistent with these models, experimental evidence suggests that alcohol abuse is associated with biases in the cognitive processing of alcohol-related stimuli. For example, some studies have used the modified Stroop task to demonstrate that alcohol abusers and heavy social
drinkers are slower to name the color of alcohol-related words than control words (e.g., Sharma et al., 2001; Stor-mark et al., 2000), which suggests that problematic alcohol users find alcohol-related words difficult to ignore, and they “grab the attention.” Other studies have used the visual probe task, in which participants make rapid manual responses to visual probe stimuli, which are presented immediately after the display of a pair of words or pictures. Studies using this task have found that drug users are faster to respond to probes that appear in the location of drug-related pictures rather than control pictures, which suggests that their attention is preferentially allocated to the spatial location of the drug cues. Using this task, several investigators have demonstrated AB for alcohol-related pictures in heavy social drinkers (Field et al., 2004; Townshend and Duka, 2001) and in other drug users, including drug-dependent populations (for a review, see Robbins and Ehrman, 2005). Moreover, ABs for drug-related cues are associated with subjective craving, in different classes of drug users, including social drinkers (Field et al., 2004, 2005).

Although subjective drug craving and AB appear to be associated with each other, the causal relationship between these variables is unclear. Attentional biases may simply be a consequence of the underlying motivational state, but an alternative possibility is that ABs could maintain or potentiate the motivational state, as predicted by Franken (2003) and Kavanagh et al. (2005). As noted by Wiers et al. (2004), the clearest way to test the causal nature of the relationship between cognitive processing biases and motivational states is to experimentally manipulate cognitive biases and then explore the effects of these manipulations on measures of motivational state. As described below, results from a recent study are consistent with the notion that an experimental manipulation of AB for alcohol-related cues can influence the motivation to drink alcohol.

Field and Eastwood (2005) reported an experiment in which a modified visual probe task was used to “train” social drinkers to direct their attention either toward, or away from, the location of alcohol-related cues. Participants (heavy social drinkers who reported regular alcohol consumption at levels above those recommended by the UK Department of Health, N = 40) were randomly allocated to experimental groups, “attend alcohol” or “avoid alcohol.” Participants in the attend alcohol group completed a modified visual probe task in which pairs of alcohol-related and control pictures were presented on a computer screen. In this group, visual probes always replaced the alcohol-related (rather than control) pictures. Because participants were instructed to respond to the probes as rapidly as possible, it was hypothesized that this manipulation would induce an AB for the alcohol pictures. Participants in the avoid alcohol group completed a similar procedure, with the major difference that, in this group, visual probes always replaced control (rather than alcohol related) pictures, which was intended to induce attentional avoidance of the alcohol-related pictures. After attentional training, the effectiveness of the manipulation was confirmed, in that the magnitude of ABs was significantly increased in the attend alcohol group, t(19) = 3.41, p < 0.01, yet significantly reduced in the avoid alcohol group, t(19) = 2.41, p < 0.05, compared with a pretraining baseline. The manipulation also influenced measures of the motivation to drink alcohol in the predicted direction. In the attend alcohol group, subjective alcohol craving increased after attentional training, compared with a pretraining baseline, t(19) = 2.70, p < 0.05, although craving did not decrease in the avoid alcohol group after attentional training, t(18) = 1.16, p > 0.1. Furthermore, after attentional training, participants were given the opportunity to consume up to 250 mL of beer, and the attend alcohol group consumed significantly more beer than the avoid alcohol group, F(1, 37) = 4.64, p < 0.05.

These results demonstrate that (a) AB for alcohol-related cues can be experimentally increased or decreased when manipulated directly, and (b) when AB for alcohol-related cues is experimentally increased, this can increase the motivation to drink alcohol, as assessed by subjective craving and a behavioral measure of alcohol consumption. There are several important theoretical and clinical implications of these results. First, the observed reduction in AB in the avoid alcohol group suggests that heavy social drinkers can exert some control over their AB for alcohol-related cues if trained to do so. The participants were heavy social drinkers recruited primarily from a student population, so it remains to be seen whether the results would generalize to alcohol-dependent populations. However, other studies have demonstrated that, in alcohol-dependent patients, AB for alcohol-related cues is reduced after successful treatment (Townshend and Duka, 2003), which suggests that reduction of ABs could be a realistic treatment goal.

Second, the observed increase in subjective alcohol craving after attentional training in the attend alcohol group appears consistent with Franken’s (2003) model, which predicts that increases in AB for drug-related cues should produce increases in subjective drug craving. Franken (2003) predicts that this bidirectional relationship contributes to an escalation of subjective craving and drug-seeking when drug-related cues are present. When drug users experience craving, this promotes a search of the environment for drug-related cues; yet when these cues are detected and attended to (“attentional bias”), this produces further increases in craving, ultimately increasing the likelihood of drug consumption.

The study reported by Field and Eastwood compared the effects of 2 manipulations with each other: 1 designed to increase AB (attend alcohol group) and 1 designed to reduce it (avoid alcohol group). It is helpful to compare the results reported by Field and Eastwood (2005) with those reported by Schoenmakers and Wiers (this article). The latter investigators used an experimental procedure similar to that described by Field and Eastwood, and they
compared alcohol craving and AB in 2 different experimental groups. In the Schoenmakers and Wiers study, 1 group was trained to direct their attention away from alcohol-related cues (comparable with the avoid alcohol group described by Field and Eastwood, 2005). The other group in the Schoenmakers and Wiers study was not trained to direct their attention toward or away from alcohol-related cues, so that this group can be more appropriately described as a true control group, in contrast to Field and Eastwood’s attend alcohol group, who were trained to direct their attention toward alcohol-related cues. Field and Eastwood reported significant group differences in alcohol craving and beer consumption after attentional training; Schoenmakers and Wiers did not observe differences between their groups on these measures. In both studies, the “avoid alcohol” groups did not report a decrease in the urge to drink alcohol after attentional training (relative to a pretraining baseline), even though the attentional training manipulation produced a significant reduction in AB in both groups. Taken together, these results suggest that a decrease in AB is not sufficient to produce a decrease in craving. If this is the case, it would not be promising for the use of attentional training techniques as a clinical intervention, because a decrease in AB may not be accompanied by a decrease in the urge to drink alcohol. However, it is also important to consider that urges and craving for alcohol produced by alcohol-related stimuli, which presumably result from extensive experience of alcohol consumption and exposure to alcohol-related cues, are probably very difficult to eliminate or reverse. The brief experimental manipulations used in these experiments may have been insufficient to produce a decrease in craving in the avoid alcohol groups (cf. Fadiardi and Cox, this article). Future studies may wish to explore this possibility, perhaps by increasing the number of attentional training trials.

Finally, it is important to consider how the cue-reactivity literature can help to explain the results reported by Field and Eastwood (2005). There are numerous demonstrations that exposure to alcohol-related cues can increase subjective alcohol craving (see Carter and Tiffany, 1999, for a review), and one might question whether attentional training simply involved a greater level of exposure to alcohol cues in the attend alcohol group than the avoid alcohol group—which might explain the observed changes in subjective craving in the attend alcohol group after attentional training. Two important issues arise here. First, attentional training may involve long-lasting changes in the cognitive processing of alcohol-related cues. In the results reported by Field and Eastwood (2005), AB for alcohol cues was increased following attentional training in the attend alcohol group, but the avoid alcohol group actually showed attentional avoidance of the alcohol cues following training. Longer-term studies, using additional measures of the attentional processing of alcohol-related cues, are required to investigate whether attentional training produces long-term rather than transient changes in attentional processing and alcohol craving. Second, the results reported by Field and Eastwood (2005) suggest that cognitive factors contribute to the effects of alcohol cue exposure on subjective alcohol craving. In that study, the attend alcohol and avoid alcohol groups received equal exposure to alcohol-related cues; the critical difference between the groups was that 1 group was encouraged to attend to the alcohol cues, whereas the other group was encouraged to direct their attention away from the cues. Given that only the attend alcohol group reported an increase in subjective craving after attentional training, it appears that mere exposure to alcohol-related cues is not sufficient to produce an increase in alcohol craving. Instead, the alcohol cues must become the focus of attention before they can elicit an increase in craving.

ATTENTIONAL RETRAINING IN HEAVY DRINKERS

Tim Schoenmakers and Reinout W. Wiers

Alcohol abusers and heavy drinkers have an AB for alcohol stimuli (Townshend and Duka, 2001; Wiers et al., 2004). This means that they will selectively attend to these stimuli very rapidly (Stormark et al., 1997) or have a difficulty disengaging from the stimuli (Field et al., 2004). This bias is generally assumed to increase craving and subsequent drinking behavior (e.g., Franken, 2003). In psychopathology, the same assumption is present for AB and emotional vulnerability (Mathews and Macleod, 2005). A number of researchers have investigated this assumed causality and have succeeded in directly changing AB and observing a subsequent change in emotional experience (see Mathews and Macleod; De Jong et al., 2006; MacLeod et al., 2002, for reports on social phobia and general-anxiety disorder). This search for a causal role of AB is now under investigation in alcohol research as well.

A method to directly change AB in emotional vulnerability research has been developed by MacLeod et al. (2002). In their “attentional retraining,” participants scoring moderate on emotional vulnerability were subjected to an adaptation of the visual probe classification task. In a standard classification task, 2 stimuli (words or pictures) representing 2 categories are presented on a computer monitor. After 500 milliseconds, the stimuli disappear, and a probe consisting of 1 or 2 pixels replaces 1 of the 2 stimuli. By pressing 1 of 2 buttons, participants can differentiate between the probes. A faster response to a probe in place of the stimuli of one category indicates an AB for that category relative to the alternative. In most trials of the MacLeod et al. retraining procedure, the probe replaced threatening words for 1 group and neutral words for the other group. The former group of participants learned to automatically attend to the threatening stimuli (as measured by the probe classification task) and showed more negative reactions to a subsequent stress task than the latter group.
We recently used a similar retraining paradigm for changing AB in male heavy drinking undergraduate students ($M = 40$ Dutch standard drinks per week, which is equivalent to $29$ US 14-g drinks). The retraining was a clinically relevant one; participants in the experimental condition were trained to attend to soft-drink stimuli rather than the alternative category of alcohol stimuli, and the participants thereby learned to avoid the alcohol stimuli. By training drinkers to automatically focus on soft drinks and avoid focusing on alcohol, their attention should focus on the healthier alternative in actual drinking settings. The other half of the participants was randomly assigned to the control group, and they performed the test-only probe classification trials. We were interested in the effect of the retraining on craving and subsequent drinking behavior. Also, we explored whether the retraining generalized to (a) other stimuli that were not used in the training and (b) another measure AB.

In our procedure, participants (all of whom were regular beer drinkers) were first sip-primed with beer to increase the likelihood of finding AB in heavy drinkers (Duka and Townshend, 2004). The participants next performed a visual probe task with alcohol and soft-drink pictures. Immediately thereafter, the retraining started for the experimental group. The training consisted of 576 training trials (with probes always replacing the soft-drink stimuli) and 48 filler trials in which probes replaced both alcohol and soft-drink stimuli. The control group completed 624 trials with the probes replacing each category of pictures on 50% of the trials. Immediately following the training, participants performed a visual probe task, with both the (old) pictures used in the training and the new pictures from the same categories. Thereafter, an adjusted flicker task (Jones et al., 2003) consisting of 4 trials was administered. Craving was measured before and after the manipulation using a 1-item VAS scale. Drinking behavior was measured using an alcohol diary.

Inconsistent with earlier findings (Field et al., 2004; Townshend and Duka, 2001), results indicated no significant AB in the pretest. In the posttest, however, participants in the retraining group had an AB for the soft-drink stimuli, but the controls did not. Thus, the retraining was successful in creating an automatic focus on soft drinks. We found no significant interaction for picture type (old vs new) with group, indicating that the effect did not differ for old versus new pictures. However, given the theoretical importance of generalization and in line with Macleod et al. (2002), we further explored differences for old versus new pictures. This was done by analyzing retraining effects for old and new pictures separately. Here, we found that AB was significant only for old pictures. Therefore, the retraining effect might not have fully generalized.

There was no effect of the retraining on the flicker task, but this task did detect an overall AB for alcohol. Consistent with Field (this article), our retraining did not affect craving or drinking behavior (craving and drinking were increased in his “attend alcohol” group). Our retraining was mainly effective for the old pictures, whereas MacLeod et al. (2002) reported generalization for new stimuli. There are 2 possible reasons for this discrepancy. First, it may be due to a difference in design. Namely, MacLeod et al. trained 1 group to attend to 1 category and the other group to attend to the other category (cf. Field, this article). In contrast, we trained 1 group to attend to a category and the other group simply to complete filler trials. Hence, in MacLeod’s paradigm a larger gap was created between scores of the experimental and control group (see Fig. 2) compared with our design.

Second, it might be that more different picture pairs are needed for generalization of retraining. MacLeod et al. (2002) used 48 different pairs of stimuli and repeated them 12 times in their retraining. We used 12 different pairs of stimuli and repeated these 48 times in our retraining. MacLeod et al. may have trained on all 48 stimuli in the category, whereas our retraining may have increased focus on specific stimuli.

Together, the studies of Macleod et al. (2002), Field (this article), and ours indicate that training to attend to the undesirable response (threat stimuli, alcohol pictures) may be easier than the more clinically relevant retraining away from these stimuli. However, Fadardi and Cox (this article) have decreased the clinically relevant AB (measured by a Stroop task) in multiple training sessions. To serve as a clinical tool, retraining might work better in multiple sessions. If reduction in AB does decrease craving, it might be useful in reducing alcohol abusers’ and other heavy drinkers’ urges to drink and their subsequent drinking behavior. Theoretically, retraining does seem to be a useful means to assess the causal role of AB on craving if AB is increased. But it is in the interest of both theorizing and clinical applications to conduct more research to explore generalization in AR both for new stimuli and for other measures of AB.

![Fig. 2. Differences in design and hypothetical outcomes between the study of Schoenmakers and Wiers (this article) and the study of Field (this article) and MacLeod et al. (2002).](image-url)
ALCOHOL ATTENTION CONTROL TRAINING PROGRAM

Javad S. Fadardi and W. Miles Cox

Basic research within the framework of Cox and Klinger’s (2004) cognitive-motivational model of alcohol use indicates that there are 2 major cognitive-motivational determinants of drinking, (a) alcohol abusers’ motivational structure, which prevents them from focusing on and successfully achieving healthy, adaptive goal pursuits as an alternative to drinking alcohol, and (b) their AB for alcohol-related stimuli, which results from their continuous current concern for consuming alcohol; alcohol AB reflects drinkers’ preoccupation with drinking and their selective distractibility for alcohol-related cues. Alcohol AB and motivational structure are the 2 significant predictors of excessive drinking that remain after a variety of other determinants have been controlled (Fadardi and Cox, in press).

The alcohol-Stroop test (Cox et al., in press) is a robust paradigm for studying AB. On the alcohol-Stroop test, participants respond to stimuli presented in different colors that are either alcohol related (e.g., gin) or neutral (e.g., window). The participant’s task is to name the color of each word as rapidly as possible, while ignoring the word’s meaning. Alcohol interference occurs when participants react more slowly to alcohol-related words than neutral ones. Alcohol interference has been consistently observed among heavy social drinkers (e.g., Stewart et al., 2002) and alcohol abusers (e.g., Stormark et al., 2000), but the degree of interference is proportional to participants’ actual drinking.

Alcohol AB signifies drinkers’ preoccupation with alcohol and lack of confidence in their ability to overcome urges to drink, despite their desire to remain abstinent (McCusker, 2001). In fact, drinkers’ attempts to reduce their drinking increase their AB for alcohol-related stimuli, which in turn intensifies their impulses to drink (e.g., Cox et al., 2002). Such impulses can overshadow the person’s intentions not to drink, leading to a vicious cycle of repeated relapses. According to Robinson and Berridge’s (2001) incentive-sensitization theory, repeated administration of alcohol causes the neural pathways in the midbrain and frontal lobes to become sensitized to alcohol-related stimuli. When a drinker encounters these stimuli, a conditional motivational state in the sensitized brain is triggered, leading the person to crave and search for alcohol and ingest it. This suggests that motivational interventions are incomplete if they fail to address the sensitized attentional system.

It was in this context that the Alcohol Attention Control Training Program (AACTP) was developed. It is a technique for helping excessive drinkers to overcome their automatic distraction for alcohol, which plays an important role in their inability to moderate their drinking, especially in high-risk situations (Stasiewicz et al., 1997). The AACTP is designed to neutralize the cognitive processes involved in the automatic chain of drink-wanting, drink-seeking, and drink-taking behaviors, by helping excessive drinkers gain better control over their attentional distraction for alcohol-related stimuli. The intervention serves 2 important functions. First, it aims to correct the uncontrollability with which excessive drinkers are drawn to alcohol instead of attending to other kinds of stimuli. Second, it aims to reduce the length of time that drinkers need to divert their attention away from alcohol once it has captured their attention.

The AACTP is designed to help drinkers to become aware of the automatic cognitive aspects of their drinking. It helps them gain better control over these processes through a series of systematic, volitional exercises aimed at developing their inhibitory mechanisms responsible for unintentional distraction by alcohol stimuli. The AACTP is based on individualized, hierarchical goal setting and provides trainees with immediate feedback about their performance.

Two of the categories of stimuli used in the training are individually presented on a monitor and comprise single alcoholic or soft-drink bottles, each of which is surrounded by either a colored background or border in 1 of 4 colors—red, yellow, blue, or green. There is a third, more difficult category of stimuli, in which pairs of bottles appear simultaneously on the screen; the participant is instructed to respond to the outline color of each nonalcoholic bottle as quickly as possible, while ignoring the alcohol-related part of the stimulus.

Each session begins with the single stimuli with colored backgrounds (easiest in the series), proceeds with the single stimuli with colored outlines (intermediate difficulty), and continues with the paired stimuli (most difficult). After completing each session, the participant is given in the following graphical feedback: (a) number of errors and mean reaction time to the alcoholic and nonalcoholic stimuli and (b) interpretation of the scores. The goal is to motivate participants to actively take part in the program in a meaningful and goal-directed way. Prior to each session, the participant is encouraged to set a goal for decreasing his or her reaction times to the colored dimension of the nonalcoholic bottles; this procedure leads to systematic reductions in the time limit within which the trainee should make a response. The goal is for each trainee to improve attentional control until his or her own performance plateau has been reached. However, every effort is made to insure that participants always terminate training sessions feeling good about their progress.

In 1 evaluation, detoxified alcohol abusers who received the AACTP showed progressive reductions in their alcohol-specific AB (Fadardi, 2003). The alcohol specificity of the program was established by finding no generalization of the effects of the training to other personally relevant (i.e., concern-related) stimuli.

Another study tested the effectiveness of the AACTP in reducing the alcohol AB of excessive drinking university students (N = 54, 74% female). Participants completed an alcohol consumption questionnaire (males’ mean weekly units of alcohol = 53.79; SD = 32.49; females’ mean weekly...
From the pre- to the posttest, the AR had a significant increase on the Action subscale of RTC alcohol consumption. The preliminary results are promising.

A systematic evaluation of the AACTP with excessive drinkers over these processes through a series of volitional exercises. It helps them gain better control over their drinking behavior, and it helps them gain better control over their drinking.

Alcohol AB was correlated with the amount of alcohol consumed after participants' scores on the PANAS and their classic Stroop interference scores had been partialed out (p = 0.04). A repeated-measures analysis of variance performed on the alcohol and classic Stroop interference scores at Time 1 and Time 2 showed a significant interaction between Time (i.e., pre- vs posttest) and Task (i.e., alcohol- vs concern-related interference), F(1, 45) = 8.26, p = 0.006, η² = 0.16. Three-way and 4-way interactions between Time, Task, Alcohol Consumption (low, medium, and high), and RTC (low, medium, and high) were not significant. Post hoc t tests for dependent samples showed that the only significant change from Time 1 to Time 2 was in alcohol AB, t(53) = 2.23, p = 0.03. In a separate repeated-measures analysis of variance, Time (i.e., Time 1, Time 2) and RTC (3 levels of Precontemplation, Contemplation, and Action) were entered as within-groups variables and Alcohol Consumption (low, medium, and high) as the between-groups variable. The only significant effect was an interaction between Time and RTC, F(2, 102) = 3.62, p = 0.03, η² = 0.07. A post hoc t test for dependent samples showed that the heaviest drinkers (M = 59.80, SD = 20.01) had a significant increase on the Action subscale of RTC from the pre- to the posttest, t(53) = 2.48, p = 0.02, suggesting that their reductions in alcohol-related AB were accompanied by an increase in their motivation to change their drinking.

In conclusion, the AACTP allows drinkers to become aware of the unconscious, automatic cognitive aspects of their drinking behavior, and it helps them gain better control over these processes through a series of volitional exercises. A systematic evaluation of the AACTP with excessive drinkers from the community was recently completed. It measured the effects of the AR on reductions in both alcohol AB and alcohol consumption. The preliminary results are promising.

DEVELOPING STRATEGIES TO CHANGE CONTEXTUALLY ACTIVATED RESPONSES TO ALCOHOL CUES

Tibor P. Palfai and Brian D. Ostafin

For many problem drinkers, limiting alcohol use is a challenge that typifies the struggle of self-control. A number of investigators have found it useful to think about the challenge of self-control as the selection and pursuit of conflicting goals (Fishbach et al., 2003; Karoly, 1999). Limiting one's alcohol use involves the ability to activate cognitive-motivational representations that support a self-control goal in a context in which a competing appetitive goal (e.g., affect regulation) might be highly salient (Palfai, 2004). What makes self-control of alcohol particularly difficult is the fact that goal processes that support drinking might operate quite differently than those that support self-control skills (Metcalf and Mischel, 1999; Tiffany, 1990). Repeated substance use may result in strong memory associations between contextual cues and substance-related information. Consequently, the self-control of alcohol and other substance use is often challenging because the conflict is one between an automatic appetitive response and an effortful inhibitory response.

One of the central challenges for individuals trying to regulate their alcohol use is to activate self-control–related information within a context that supports the conflicting behavior of alcohol consumption. Coping skills will be more effective to the extent that they are automatically activated and sustained in context. How is this achieved? The most straightforward method is to develop automaticity through practice (Shiffrin and Schneider, 1977). Repeated training in which one generates a coping response in the context of high-risk cues is central to many skill-based interventions (e.g., Monti et al., 1989). Central to this approach is the ability to provide extensive practice with a broad range of high-risk cues, so that skills can be better utilized in context.

A second method of increasing the activation of self-regulatory responses to high-risk cues is through the use of planning strategies. Recent social cognition research has provided some promising avenues through the study of implementation intentions (Gollwitzer, 1993). Implementation intentions are planning strategies that prospectively link specific cues to actions in the form “When I encounter x at time y I will do z” (Gollwitzer, 1999). A number of studies have shown that goals are more likely to be realized when participants form specific plans about when, where, and how the goals are to be pursued (e.g., Murgraff et al., 1996; Sheeran and Orbell, 1999). Gollwitzer (1999) suggested that implementation intentions will facilitate goal attainment by increasing the accessibility of means/actions specified in the implementation intentions. Forming an implementation intention to engage in a specific action in the future will make it more likely that the action will come to mind within the specified context. The ability of implementation intentions to increase the accessibility of information has been demonstrated in a variety of ways, including superior recall of action events and speed of action initiation (Gollwitzer, 1993). When speed of response is emphasized, for example, implementation intentions have been shown to facilitate responses to target cues (i.e., a specific number) on a
vigilance task without interfering with response speed to nontarget cues (Webb and Sheeran, 2004). Brandstatter et al. (2001) conducted a number of experiments that explored the question of whether implementation intentions increase the speed of action initiation within relevant contexts, even under high cognitive load. In 1 study, participants completed a vigilance task that involved key pressing in the presence of a number. Half of the sample was asked to make a commitment to respond to a specific number through the use of implementation intentions. Results showed that participants who used implementation intentions were faster than control participants to identify the target, regardless of cognitive load.

This research suggests that implementation intentions may be particularly relevant to drinkers’ efforts to control their alcohol use. When individuals have sufficient cognitive capacity, they may be able to manage or override appetitive responses. However, exposure to substance-related cues frequently requires that the individual retrieve and implement coping skills under conditions that make demands on cognitive resources (Drobes et al., 1994; Sayette and Hufford, 1994), making it more difficult to retrieve and utilize these skills.

The primary goal of this preliminary study was to examine whether implementation intentions can facilitate action responses to alcohol cues by using a categorization task based on the IAT (Greenwald et al., 1998). An alcohol-specific version of the IAT was used (see Palfai and Ostafin, 2003, for details of the IAT procedure). In this task, participants categorize a series of computer-presented words into 1 of 4 categories (2 target and 2 attribute categories) by pressing 1 of 2 response keys as quickly as possible. In this study, the target categories were “alcohol” and a control category “electricity,” and the attribute categories were “approach” and “avoid.” A congruent and incongruent critical block of trials was presented. In the congruent block, alcohol and approach categories were mapped onto the same key, such that the same key was pressed when alcohol-related or approach-related words appeared on the screen. Performance on this task tends to be faster when categories that are associated with each other are mapped onto the same key (e.g., “alcohol” with “approach” for alcohol users) compared with when they are mapped with nonassociated categories (i.e., incongruent trials). Eighty trials were presented in the congruent and incongruent blocks.

Forty-eight participants (19 women) were recruited from the community and local universities. Inclusion criteria included AUDIT scores of 8+, 21 to 35 years of age, a stated preference for beer, and habitual consumption of at least 5 alcoholic drinks per week. Upon arrival at the lab, participants completed a series of preexperimental procedures (e.g., consent form, pregnancy test for women), the full IAT, and a series of questionnaires. They were then randomly assigned to 1 of 4 conditions in the 2 (Beverage; alcohol/placebo)×2 (Strategy; implementation intention/control) between-groups design.

Following a brief rest period, participants were presented with 2 glasses of either high-alcohol beer (Duvel, 8.5%/volume) or placebo beer (Clausthaler with bitters added). The quantity administered was calculated from a formula based on gender and weight and designed to achieve a BAC of 40 mg%. Participants consumed the beverages over a 10-minute period. Following the beverage administration phase, participants completed breathalyzer tests and measures of mood and urges to drink every 5 minutes. The postconsumption categorization task, based on the modified IAT, began at 18 minutes after beverage administration. Another iteration of the incongruent critical block (80 trials of “alcohol” and “avoid” on 1 key and “electricity” and “approach” on the other key), and participants were reminded of the task and asked to complete it as quickly as possible. Before this second incongruent block, participants in the Control condition were asked to “try to respond to any alcohol word as quickly as possible,” whereas those in the Implementation Intention condition were instructed to say to themselves “next time I see an alcohol word, I will press the left key as quickly as possible.”

Consistent with the Brandstatter et al. (2001) study, we calculated response times to the target (i.e., alcohol category) and nontarget stimuli (the 3 categories separately). Response times in the prebeverage IAT task were used as covariates in each analysis, which was conducted on log-transformed response times. Covariate adjusted mean response times in milliseconds were as follows: Control-Alcohol = 828 milliseconds (SD = 181 milliseconds), Control-Placebo = 772 milliseconds (SD = 167 milliseconds), Implementation-Alcohol = 729 milliseconds (SD = 164 milliseconds), and Implementation Intention-Placebo = 710 milliseconds (SD = 113 milliseconds). The 2 (Beverage)×2 (Strategy) ANCOVA showed that participants in the Implementation Intention condition had faster responses to the alcohol-related words than participants in the Control condition [F(1, 43) = 6.39, p < 0.05]. There was no significant main effect for the Beverage condition [F(1, 43) = 0.25, p = NS] and no Beverage×Strategy interaction [F(1, 43) = 0.01, p = NS], suggesting that the dose of alcohol was not sufficient to cause significant impairments in task performance speed. Implementation intentions had no effect on the nonalcohol words [F(1, 43) = 1.14, p = NS], nor did they interact with beverage type [F(1, 43) = 0.32 p = NS].

Thus, the results of this preliminary study suggest that implementation intentions can increase the speed of emitting a response in the presence of alcohol cues. This improvement was observed only for the alcohol words, suggesting that the results were not due simply to a greater focus on the response key. In contrast to previous studies that have used highly specific targets, the current study examined the effects of a more abstract category (i.e., alcohol) to explore the utility of implementation
intensions. Forming an implementation intention that associated an abstract category with a behavioral response raises the question of whether it is possible to generate implementation intentions that apply to more generalized cues. Utilizing more abstract cues in planning strategies might allow for greater generalizability of coping-skills use across high-risk situations.

Clearly, it will be important to replicate and extend these findings through the use of alternative experimental paradigms and the use of higher doses of alcohol that may reliably interfere with cognitive performance. However, the current study suggests that implementation intentions serve as a useful planning strategy to facilitate the use of coping skills in high-risk contexts. This strategy may be one of many planning techniques that increase the efficiency of self-control strategies through the use of prospectively linking alternative responses to future high-risk contexts. Other strategies such as imagery encoding and mental simulation may also be used to increase the speed of initiation of alternative responses in addiction-related contexts.

COMMENTS

Alan W. Stacy

The studies reported here have applied basic research on implicit cognition, attention, and implementation intentions to the change of addiction-related cognitions. This line of research reflects a growing body of "translation research" in cognitive science, in which the most consistent findings from basic research are applied to important issues in health. Further, the studies each used indirect assessments of cognition, often implicated in either implicit processes or processes that at least are unlikely to involve self-report or introspective bias that can plague or confound typical survey measures of cognition. Each of the studies shows promising findings but also reveals that much more needs to be done in applying basic cognitive research to addiction and other health-related issues. The need for more research is not surprising, because these studies are examples of the beginning of what should become a much larger effort. Although several other research teams have also successfully applied basic cognitive science to this area, this important translation is still only a very small proportion of the research applying cognitive concepts to health behavior. Most cognitive research in this area has applied typical survey assessments, metacognitive judgments, or concepts from other traditions. Inferences based on measures that involve self-perception of one's behavior or extensive reflection may have a number of serious pitfalls, well summarized years ago (e.g., Feldman and Lynch, 1988; Nisbett and Wilson, 1977).

Beyond these general observations, this commentary focuses on 2 specific issues. Both involve a recommendation for some integration in future research with more general theories of cognition. The first recommendation for future research is that several general theories from cognitive science should be considered for application to changing addiction-related AB. Examples of these theories are provided by Logan and Cowan. Logan (2002) provided a general theory of cognition that integrates memory and attention under the same general cognitive system. In this theory, attention and memory are seen as different manifestations of the same process, 2 sides of the same coin. Thus, attention and memory correspond to different ways of testing a single process. To Cowan (1988), attention effects such as selective attention and, by implication, AB, cannot occur without some system for coding perceptions. If perceptions are coded, the codes must come from somewhere. His theory postulates that a fast-acting memory process applies these codes to direct attention. For example, it is possible that automatic semantic or associative priming, known to operate very rapidly, may activate drug-related associations that steer further processing (Stacy et al., 2004). Although a type of "memory bias" has been postulated in one useful theory that integrates attention and memory (Franken, 2003), the bias in that theory occurs after attentional effects. The alternative, fast-acting memory bias should at least be investigated as a reasonable alternative in future research. Addiction theory might also attempt a possible integration of theories of memory and attention under a single process or at least consider the full range of possible memory processes that could be involved in attention effects.

The other specific comment focuses on associations, broadly conceived. Future research on both AB and implementation intentions might consider what associations apply to the paradigms and findings. For example, can an AB for drug stimuli be characterized as an S–R association, in which the individual has incrementally acquired a motor habit of looking toward a stimulus? This would constitute a different type of association than, for example, associations involved in either semantic or affective priming. Different types of associations in memory are linked to divergent neural substrates, having implications for acquisition, activation, and behavior (e.g., Gabrieli, 1998; Packard and Knowlton, 2002).

Associations are also applicable to the important topic of implementation intentions. Such intentions, by definition, involve a triggering situation or cue, to which the intention is relevant. Palfai and Ostafin note the importance of associations in fostering drug use, as well as in interventions on coping responses. In their study, the use of a test of associations, the IAT, underscores the relevance of associations to implementation intentions. It would be interesting and potentially useful to know more about the type of associations that underlie implementation intentions. Clearly, some linkage is needed between cues and the plans for action, but it is not entirely clear whether this linkage is best construed as an if-then rule, an S–R association, or other kinds of associations in memory. Further, the finding that abstract concepts (e.g., alcohol) yielded promising results on the IAT suggests that conceptually based asso-
cognitive memories are relevant. If so, then a variety of general theories of associative memory could be applied to implementation intentions.

**GENERAL DISCUSSION**

*W. Miles Cox and Reinout W. Wiers*

As stated at the beginning of this article, implicit cognitive processes in addictive behaviors have become an important topic of research. It has been clearly shown that people who use addictive substances have implicit cognitive biases for addiction-related information. The biases have been demonstrated as (a) attentional focus on addiction-related stimuli, of which the person may be unaware; (b) selective retrieval of addiction-related information or associations from memory; and (c) selective reactions to stimuli that reflect the person’s attitudes about, or affective appraisal of, the substance that he or she uses. The cognitive biases have also been shown to be proportional to the amount of the substance use. For example, alcohol abusers have greater AB for alcohol-related stimulus than heavy drinkers, who in turn have greater bias than light drinkers (Cox et al., in press). The reason for the current focus on implicit cognitive processes, as the symposium presentations described, is that cognitive biases for addiction-related information are not simply a byproduct of a person’s use of an addictive substance; instead, the implicit processes fuel the motivation to use the substance and can eventuate in actual use of it.

The symposium addressed an important issue, i.e., given the documented relationships between substance use and substance-related implicit cognitive processes, how can we utilize this information to help people change their unwanted patterns of use? Several promising techniques for doing so were described. Matt Field and Tim Schoenmakers described research from their respective laboratories, which used a visual probe task to train heavy drinkers either to attend to alcohol-related stimuli or to avoid doing so. Matt Field presented evidence to show that both types of attentional training were effective in changing the drinkers’ attentional focus; the results were partially replicated in the study that Tim Schoenmakers presented. Additionally, Matt Field’s study showed that increases in alcohol-related AB were accompanied by increases in both the subjective craving for alcohol and the amount of alcohol consumed in an experimental alcohol taste test. Javad Fadardi described a different kind of AR technique. It used a Stroop-like paradigm (Cox et al., in press) in which pictures of alcoholic beverage bottles were presented with colored surrounds. Participants were taught to respond to the colors as rapidly as possible while ignoring the bottles. Doing so resulted in a decrease in the drinkers’ AB for alcohol-related stimuli and an increase in the heaviest drinkers’ motivation to change their drinking. In a study that complements Field’s, Schoenmakers and Wiers’s, and Fadardi and Cox’s AR work, Tibor Palfai and Brian Ostafin taught excessive drinkers to use an implementation intention (“to respond as rapidly as possible when I see an alcohol word”) to reduce their reaction times to alcohol-related words. These promising results suggest that a similar technique could be used in real-world settings to teach excessive drinkers to increase the speed of a behavioral response in the presence of alcohol cues.

These initial studies on the retraining of addiction-related implicit cognitive processes are quite promising; they point to exciting possibilities for future developments. Yet, as discussant Alan Stacy pointed out, much additional work needs to be carried out to apply basic cognitive paradigms to addiction-related issues. First of all, the cognitive retraining paradigms (or adaptations of them) need to be tested in clinical settings to determine whether they are effective in helping excessive drinkers and other substance users to change their behavior. Second, Alan Stacy recommended additional theoretical work, in which researchers test (a) the applicability of general theories from cognitive science to changing unwanted addictive behaviors and (b) more precisely the nature of the associations underlying implicit cognitive processes in addictive behaviors.

**REFERENCES**


