Can problematic alcohol use be trained away?

New behavioural treatments aimed at changing and moderating implicit cognitive processes in alcohol abuse

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In this chapter a general theoretical framework is first outlined in which alcoholism is viewed as the result of a disturbed balance between largely automatic appetitive processes and more controlled regulatory processes that can inhibit the appetitive impulse to use alcohol. Different interventions from this perspective are then introduced, both the more traditional cognitive–behavioural therapies and new interventions directly aimed at changing the automatic appetitive processes involved. We argue that this approach has the potential to generate a new class of behavioural interventions that can be summarised as varieties of ‘training’ or ‘re-training’, and which are fundamentally different from and potentially complementary to currently used interventions, sometimes summarised as ‘pills’ (medication) and ‘talking’ (psychosocial interventions). Our argument is not that ‘training’ will make other interventions superfluous, but that they may develop into a helpful third general class of interventions.

A theoretical framework

Until recently, psychological models of alcoholism and other addictive behaviours were rooted in rational decision theory (cf. Wiers and Stacy, 2006a,b; West, 2006). The underlying idea was that people, addicted or not, weigh the pros and cons of different behavioural options and then make a rational decision. According to this view, as long as the (short-term) expected benefits outweigh the (long-term) expected harm, people will continue their alcohol and drug use. Recently, it has been proposed that implicit or relatively automatic processes may provide essential clues to understanding addiction (Wiers and Stacy, 2006a,b; Wiers et al., 2007a). The central notion is that behaviour is partly governed by relatively automatic processes that often exert their influence outside conscious control. Note, however, that people can become aware of the outcomes of these processes (see Gawronski et al., 2006); the term ‘implicit’ refers to the idea that the underlying processes are triggered and, in some cases, executed outside conscious control.
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control. The growing focus on these processes does not imply that explicit or deliberate processes are unimportant, but rather that implicit processes must be acknowledged if alcoholism or other addictive behaviours are to be understood and treated.

In many recently formulated dual-process models of addictive behaviours, the general picture is that there are [inserted to make grammatical sense] at least two semi-independent systems: a fast associative impulsive system, which includes automatic appraisal of stimuli in terms of their emotional and motivational significance, and a slower reflective system, which includes controlled processes related to conscious deliberations, emotion regulation and expected outcomes (there are many examples in Wiers and Stacy, 2006; for a general framework of impulsive versus reflective processes see Strack and Deutsch, 2004). Different neural structures underlie these processes (Bechara et al., 2006; Berridge, 2001; Yin and Knowlton, 2006). Implicit cognitive processes have been shown to be important in the understanding of various addictive behaviours, with most research on alcohol abuse (see Cox et al., 2002; 2006; Palfai and Ostafin, 2003; Stacy, 1997; Wiers et al., 2002, 2005; for reviews see Cox et al., 2006; Wiers et al., 2006b, 2007a), but other addictions have been investigated as well (see Ames et al., 2006 for a review).

Implicit processes are assessed with implicit or indirect measures. These measures are implicit in the sense that they capture the to-be-measured construct in a way that is relatively beyond the respondents’ intentional control. Hence, instead of asking an alcohol abuser for reasons behind his or her alcohol abuse, the investigator tries to assess implicit cognitive motivational processes by registering fast spontaneous reactions to alcohol-related stimuli. As such, these measures may uniquely capture processes that are important in real-life behaviours, including addictions (De Houwer, 2006). At least three different implicit cognitive processes can be distinguished.

First, attentional processes indicate that alcohol abusers show an attentional bias for alcohol-related stimuli (Cox et al., 2006; Franken, 2003). The most commonly used tasks to assess an attentional bias for alcohol-related stimuli include the alcohol Stroop test (see Cox et al., 2006 for a review) and the visual probe task (e.g. Townsend and Duka, 2001). As discussed later, both tests have recently been adapted as re-training versions, to influence alcohol-related attentional bias. These tests, together with their re-training versions, are explained below.

The second class of implicit cognitive processes includes automatic memory associations and automatic evaluations. The idea is that once an alcohol-related cue is detected by an alcohol-abuser, this automatically triggers alcohol-related associations that are mostly affective in nature. Heavy drinkers have relatively strong associations of positive arousal when they encounter alcohol cues (Houben and Wiers, 2006; De Houwer et al., 2004; Wiers et al., 2002). There is also some evidence for negative alcohol associations (see Wiers et al., 2006b) and for associations representing negative reinforcement (i.e. negative mood is automatically associated with alcohol use in problem drinkers with psychiatric distress; Zack et al., 1999), but the role of these associations in terms of determining drinking is less clear and warrants further research (Wiers et al., 2006b). Automatic or implicit memory associations can be assessed with spontaneous memory tests using paper and pencil (Stacy, 1997; Stacy et al., 2006) and with a variety of reaction-time paradigms, including the often used Implicit Association Test (IAT; Greenwald et al., 1998) and different versions of this test (see Houben et al., 2006 for a review). One way to influence automatic evaluative associations is through evaluative conditioning, as discussed below.

The third class of implicit cognitive processes includes automatic action tendencies. There are
two basic motivational orientations: approach and avoidance. Generally, positive evaluations trigger approach tendencies and negative associations trigger avoidance tendencies. Different reaction-time tests have been developed to assess approach and avoidance tendencies and again variations of these tests have recently been used to influence these automatic action tendencies (Wiers et al., 2007b). These tests, as well as their re-training versions, are briefly introduced later in this chapter.

The implicit processes sketched out above can be summarised as follows: when a heavy drinker (or alcohol abuser) encounters alcohol-related stimuli, these will grab his or her attention, trigger positive and arousing associations, and trigger approach action tendencies. Wiers et al. (2007a) hypothesised that after repeated alcohol use, all these appetitive processes will get stronger as a result of neural sensitisation (Robinson and Berridge, 2003). Theoretically, one would expect these different processes to be correlated but, thus far, the size of correlations among tests of attentional bias, memory associations and automatic action tendencies has been surprisingly small. One possible explanation is that not all these processes are related to neural sensitisation, or that neural sensitisation is less important in the later stages of addiction (in which habit formation has been proposed as an alternative mechanism) (Everitt and Robbins, 2005). Another possible explanation of this lack of correlation may be measurement error (cf. Cunningham et al., 2001). A third possibility is that in heavy drinkers, these different processes only synchronise after alcohol consumption has initiated. In line with the latter idea, it was found recently attentional bias and approach action tendencies were significantly more correlated in heavy drinkers under the acute influence of alcohol than after a placebo drink (Schoenmakers et al., 2008). Together, these processes will generate an impulse to drink, which will result in drinking – unless the impulse to drink is resisted (see Fig. 15.1). In fact, this ‘impulse’ can include a whole chain of largely automatic behaviours, that call each other in turn, until the act of drinking occurs (i.e. walking to the fridge, fetching a beer, finding the bottle opener, opening the bottle, and so on; cf. Tiffany, 1990).

This capacity to regulate emotional and motivational impulses can be labelled ‘emotion regulation’ or, more specifically, ‘impulse control’ (there are other more indirect – and sometimes more efficient – ways to self-regulate emotional impulses). Impulse control critically depends on the ability and motivation to regulate impulses. Ability to regulate impulses is an aspect of executive functions.

People differ in their executive functions and this is important in relation to the development of alcohol abuse. First, poor executive functions are related to vulnerability for alcohol abuse (e.g. Peterson et al., 1992; Sher, 1991). Second, there is increasing evidence that alcohol abuse, especially during adolescence, disturbs the development of executive functions (see reviews by Dahl and Spear, 2004; Wiers et al., 2007a). Motivation to regulate impulses is an important target in current cognitive–behavioural and motivational interventions. For example, the counselor links the problems that a problem-drinker experiences to the alcohol abuse and, together with the client, makes an explicit analysis of long-term benefits of prolonged alcohol abuse versus stopping (or in milder cases moderating drinking).

Fig. 15.1 shows the theoretical framework discussed (adapted from Wiers et al., 2007a) and includes a number of treatment possibilities from this perspective. The general idea is that when both implicit and explicit cognitive processes influence addictive behaviours, both classes of processes can be targeted in interventions. In the following discussion, interventions that target explicit cognitive processes are introduced first, followed by interventions that target implicit
Figure 15.1 Theoretical framework for targeting implicit and explicit cognitive processes in addictive behaviours (adapted from Wiers et al., 2007a). [REVISED]

Moderation of addictive impulses?
Several dual-process models predict that both more reflective explicit and more impulsive implicit cognitive processes influence behaviour (Fazio and Towles-Schwen, 1999; Kahneman,
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Moreover, an additional assumption of several dual-process models is that the influence of implicit processes on subsequent behaviour are moderated by explicit processes, if motivation and the opportunity to do so are high (Fazio and Towles-Schwen, 1999; Kahneman, 2003; Strack and Deutsch, 2004). Indeed, neurobiological addiction research has shown that the prefrontal cortex and associated areas are not only involved in more reflective decision-making, but also in the moderation of impulses (Bechara, 2005; Kalivas and Volkow, 2005). Dual-process models of addiction specifically predict that the influence of implicit appetitive cognitions on subsequent addictive behaviour might be dependent on moderators such as the level of executive functioning and motivation (e.g. Stacy et al., 2004; Wiers et al., 2007a).

Executive functions

Executive functions can be described as a set of cognitive skills relevant to goal-directed behaviour that involve different abilities such as shifting, updating and inhibition (Miyake et al., 2000). Working-memory capacity has been proposed as a central construct that possibly binds these different, but related, executive functions (Kane and Engle, 2002). The relationship between executive functions and alcohol use has been shown to be bidirectional. Poorer executive functioning can be considered a risk factor for developing addictive behaviours such as drinking alcohol (Peterson et al., 1992; Tapert et al., 2002). Additionally, alcohol abuse has been shown to have negative consequences for the maturation of brain regions (De Bellis et al., 2000), and cause impaired neuropsychological functioning (Brown et al., 2000) and altered processing in executive functioning tasks (Tapert et al., 2004). Prior research has suggested that the influence of implicit automatic processes are indeed moderated by executive control (Feldman-Barrett et al., 2004; Payne, 2005). This has also been proposed more specifically for addictive behaviours (Stacy et al., 2004; Wiers et al., 2007a). However, it should be noted that Fadardi and Cox (2006) showed alcohol attentional bias is not an artefact of poor executive control; the bias still occurs after executive control has been controlled.

Grenard et al. (in press) and Thush et al. (2008) both evaluated the interaction between working-memory capacity and implicit cognitive processes among at-risk young people and found evidence that implicit alcohol-related associations were stronger predictors of alcohol use among those with lower working-memory capacity than among those with higher working-memory capacity. In a related series of studies, Hofmann et al. (in press) showed similar patterns of results for other impulsive behaviours – candy eating, sexual interest and aggression – which were all predicted by the combination of strong associative processes (related to the behaviour of interest) and relatively weak executive control processes.

Finn and Hall (2004) proposed two mechanisms that might be responsible for the moderating influence of executive functioning on the implicit processes–behaviour relationship. First, low activating capacity of working memory makes it difficult to shift attention away from highly activated stimuli to stimuli that are less salient. Second, short-term positive associations with behaviour tend to be highly activated (salient), whereas the long-term negative associations with behaviour are usually weakly activated. Consequently, in high-risk situations (such as being at a party where alcohol is available) an individual needs to be able to switch to less salient goals – such as the intention not to drink large amounts of alcohol, or other information such as the...
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The negative consequences of alcohol (mis)use – and attend to this information, while distracting salient information in the current high-risk situation is automatically activated (e.g. the urge to feel intoxicated or to ‘give in’ to peer pressure). This relationship between executive functioning and behaviour suggests that people who are less able to actively manage less salient but adaptive goals when faced with distracting information are more likely to let their behaviour be guided by distracting salient information that is triggered in the current situation (Stacy et al., 2004; Wiers et al., 2007a).

The clinical implication would be that intervention programs will benefit from behavioural interventions that strengthen frontal inhibitory and executive control. In the development of an addiction especially frontal lobe circuits that are involved in self-regulation and inhibition become damaged, so it makes sense to design interventions in which these functions are specifically trained and strengthened again (Volkow et al., 2004). Indeed, research has shown that executive functions and the associated brain regions are not fixed processes or structures but are characterised by their plasticity and can be modified through feedback and training (Erickson et al., 2007). Although some promising results have been reported with this approach for children with ADHD (attention-deficit hyperactivity disorder) (Klingberg et al., 2005), we do not yet know of applications of this approach to alcohol abuse or other types of addictive behaviours.

On a related note, there is preliminary evidence that a direct stimulation of cortical brain centres involved in the control of appetitive functions through transcranial magnetic stimulation (TMS) may have beneficial effects in reducing craving for cocaine in cocaine-addicted people (Camprodon et al., 2007). Future research has to indicate whether training and/or direct stimulation of executive control functions are effective in restoring executive control in different clinical and non-clinical populations of different ages. Additionally, it has to be investigated in a clinical setting whether these training methods actually have a moderating effect on the influence of implicit cognitive processes on subsequent drinking behaviour.

Motivation

Even if someone has a high level of executive functions, one still needs to be motivated or have a goal in mind to which to apply this executive control (Feldman-Barrett et al., 2004; Klinger and Cox, 2004; Wiers et al., 2007a). Thus the concept of executive functioning does not replace the importance of motivation and goals, just as the concept of motivation does not replace the importance of the capacity to restrain oneself (Towles-Schwen and Fazio, 2006). Indeed, prior research has shown that the influence of implicit processes on behaviour increases when motivation to not act on these salient automatic associations is low (Olson and Fazio, 2004).

The clinical implication would be that interventions can be improved by adding a motivation-enhancement aspect (cf. Cox and Klinger, 2004). In fact, interventions that consist of brief motivational interviewing or feedback (Miller and Rollnick, 2002) have consistently yielded greater support for their efficacy in reducing hazardous drinking in adults compared with educational or information-only interventions (Larimer and Cronce, 2002). However, although brief motivational feedback has been proven to be effective in reducing hazardous drinking in (young) adult populations, this strategy might be less effective in some (at-risk) adolescent populations (for a review see Grenard et al., 2006). This reduced effectiveness in at-risk adolescent
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populations might be explained by the differential response to alcohol in adolescents and (young) adults. During adolescence, it is not so much the negative sedative effects but rather the positive arousal effects of drinking that are experienced (National Institute on Alcohol Abuse and Alcoholism, 2005). Therefore, these adolescents might feel they do not have sufficient reason for changing their drinking behaviour (Thush et al., 2007b). However, although mixed results are found for the effectiveness of brief motivational interventions in this population, these interventions might still be among the most promising approaches, especially in difficult, at-risk, non-treatment-seeking populations (Moyer et al., 2002).

Recently a first study investigated whether a motivational intervention had a moderating influence on the relationship between implicit cognitive processes and subsequent drinking behaviour. Although the motivational interviewing was well received, no such effect was found (Thush et al., in press).

Attentional re-training using modified visual probe tasks

Attentional bias can be directly manipulated by a procedure called attentional re-training. On the one hand, this procedure can be used to assess the causal role of attentional bias in cognitive disorders: for example, MacLeod and colleagues (2002) increased attentional bias for negative words and found an increase in stress reactions in a behavioral test, thus demonstrating the causal role of attentional bias in behaviour. On the other hand, attentional re-training has been studied in a clinically relevant way, to decrease attentional bias in people suffering from cognitive disorders. Evidence for the usefulness of clinical re-training is scarce; only some authors have referred to clinical re-training in anxiety (De Jong et al., 2006; Mathews and MacLeod, 2002). In alcohol use, there are now a small number of papers reporting studies on causality and clinical relevance of attentional re-training in heavy social drinkers.

The type of re-training discussed in this part of the chapter is a modification of an attentional bias measure, the visual probe task. The ‘measurement version’ of this task consists of a number of trials in which an alcohol-related picture and a neutral picture are presented side-by-side on a computer screen for 500 milliseconds. Subsequently, a visual probe (for example, an arrow) replaces one of the pictures. Participants are to classify the arrow as pointing up or down by pressing a response button as quickly as possible. Problem drinkers are overall faster to respond to arrows that replace alcohol-related pictures than to arrows that replace neutral pictures. This finding has been interpreted as attentional bias for alcohol-related stimuli. Their attention is captured by the alcohol picture, therefore it is relatively easy to react to an arrow replacing an alcohol picture (because attention was there already), and relatively difficult to react to an arrow replacing the other picture (because attention has to be switched to the other location). In measurement versions of this test, probes replace pictures from both categories equally often.

In a ‘re-training’ version of this task, in most (e.g. 90 per cent) or all of the trials, probes replace pictures from only one category. Participants are thereby trained to attend to one category and to avoid the other. Hence, in a clinically relevant alcohol re-training, people are trained towards the neutral images and away from the alcohol-related images. This is achieved by letting the probe replace the non-alcohol picture in most (or all) of the trials. In order to investigate the causal role of attentional bias, both training to attend to alcohol (clinically undesirable) and training to avoid alcohol-related pictures can be used to assess effects on craving for alcohol.
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and drinking behaviour.

Field and Eastwood (2005) assessed the causal role of attentional bias in relation to craving and drinking using attention training. They trained one group to attend to alcohol-related pictures and one group away from alcohol-related pictures. Subsequently, participants rated their urge to drink and performed a bogus taste test: they rated the taste of an alcoholic drink after which the researchers measured the amount of alcohol they had consumed. In the post-training tests, the group who had been trained to attend to alcohol pictures showed a stronger attentional bias for alcohol, craved more for drinking alcohol, and drank more alcohol during the taste test than the group who had been trained to avoid the alcohol pictures. Noteworthy was that most of the change took place in the clinically undesirable ‘attend-alcohol’ condition.

Schoenmakers et al. (2007) conducted a study to test the effects of a clinically relevant attentional re-training. They trained one group away from alcohol-related images and compared the results with a no-training control group, who performed an extended visual probe task in which half the probes replaced alcohol pictures and half replaced neutral pictures. Attentional bias decreased in the avoid-alcohol group, but there were no congruent effects on craving and behaviour. In another recent study with an attend-alcohol, an avoid-alcohol and a no-training control group, there were no group differences in drinking behaviour, and craving only increased in the attend-alcohol group for participants who were aware of the experimental contingencies during the training (Field et al., 2007).

Effects of the clinical re-training have only been found with the same stimuli from the re-training within the visual probe task; Schoenmakers and colleagues did not find a significant generalisation towards new stimuli; and Field et al. (2007) even reported an unexpected increase in attentional bias for new stimuli. These findings were disappointing, since problem drinkers should ultimately learn to avoid new alcohol stimuli and not only those exemplars used during the re-training. Generalisation towards other measures of attentional bias (the flicker paradigm, and alcohol Stroop task) has been studied, but not been found (Field et al. [sort out cet al ommas in text] 2007; Schoenmakers et al. 2007). Such an effect would rule out the alternative explanation that re-training effects are merely task-specific learning effects, since the re-training and measurement versions of the visual probe post-test are very similar (but see the discussion in Field et al., 2007). In addition, different measures of attentional bias measure different aspects of attention, such as early engagement or maintenance of attention. Generalisation towards other measures would therefore indicate that re-training affects multiple aspects of the attention system.

Differential effects on craving, behaviour and generalisation in the reported studies suggest that (in heavy drinkers) training to attend alcohol is easier than training to avoid alcohol. Increasing the amount of training sessions has been suggested to increase the power of clinically relevant re-training varieties. Furthermore, the limited findings in clinical re-training have been suggested to be caused by using too few different stimuli, thereby training only relates to specific pictures and not the full alcohol category (Schoenmakers et al., 2007a). However, it should be noted that in one study generalisation was found in an attend-alcohol group but not in an avoid-alcohol group using the same number of stimuli (Field et al., 2007).

Other unaddressed issues in the re-training studies discussed so far are types of drinker and motivation to change. All reported studies have been conducted with heavy social drinkers. The effect on alcoholic patients might differ since their attentional bias differs from that of social drinkers (Noel et al., 2006; Stormarck, 1997). Further, researchers have suggested that motivation
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for someone to change their drinking behaviour plays an important role in the effectiveness of re-training (Wiers et al., 2006a). Participants in the above studies were all unaware of the purpose of the experiments, at least at the time of recruitment, thus motivation did not play a role. Fadardi and Cox (see below) discuss training in which motivation is a key element. Alcoholic patients are generally motivated to change and so might be affected differently by an attentional re-training if the purpose of the training is explained to them. Recently an attentional re-training of the visual probe type was tested in a first clinical trial in 37 alcoholics in treatment, who were randomly assigned to either repeated attentional re-training (AR; with new stimuli in each session and motivational feedback on training results) or to placebo training (Schoenmakers et al., 2008). The training was effective in increasing their ability to disengage from alcohol-related cues, measured 3–4 days after the last training session. This effect was generalised to stimuli that were not used in the training sessions. There were preliminary indications of clinically relevant outcomes: after the intervention, in the clinic with the shortest regular treatment program, AR subjects in the re-training group were discharged sooner than control subjects. And among the few patients who lapsed or relapsed after finishing the intervention, the time to lapse or relapse was longer in the AR re-training condition. Of course, given the limited sample size these results should be regarded as promising preliminary result – with the emphasis on promising.

In summary, studies using attentional re-training with the modified visual task have had effects mainly after increasing attentional bias in social drinkers; they demonstrate that attentional bias has causal effects on craving and drinking. Studies on clinically relevant re-training varieties, however, have shown weak effects in heavy drinkers. However, more promising results have recently been obtained in a first clinical study using a repeated re-training procedure.

Attentional control training program

As discussed earlier, one way to study alcohol-related attentional bias is based on interference. The alcohol Stroop test is one of the most widely used measures of alcohol users’ and abusers’ attentional bias for alcohol-related stimuli. The test is a modified version of one of the tasks that Stroop (1935) developed for his doctoral thesis. Stroop used two cards with coloured stimuli, and the participants’ task was to name the colour of each stimulus on each card. The first card comprised coloured squares; they were used to establish a baseline for individual participant’s general performance on colour naming. The second card comprised a series of words naming different colours but each word was printed in a colour that was incongruent with the colour the word referred to, thus the word red might be printed in blue ink. Stroop’s experiment has been widely used for research, although many researchers have changed the baseline stimuli from coloured squares to coloured symbols (like a string of ‘X’s), or to colour congruent words (e.g. the word red is printed in red). The participant’s task on the Stroop test is to ignore the meaning of the stimulus and respond to the actual colour of the stimulus – as quickly and accurately as possible. Participants find it more difficult to respond to colour-incongruent stimuli than to colour-congruent ones; hence, their reaction times to the former are longer than to the latter. On the classic Stroop test, ‘interference’ scores are calculated as the mean reaction time to colour-incongruent stimuli minus the mean reaction time to colour congruent ones; the size of the interference is considered to be an index of general cognitive flexibility and inhibitory control.
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In the alcohol version of the Stroop test, two categories of words are used – alcohol-related and alcohol-unrelated. The two categories are matched on various linguistics dimensions (e.g. frequency of words, number of letters, number of syllables) so that they differ only with respect to their alcohol-relatedness. The words are printed in different colours (usually red, yellow, blue, or green) and the participant must ignore the meaning of the words and respond as quickly and accurately as possible to the colour in which each word appears. Unlike the classic Stroop test, reaction times on an alcohol Stroop are not affected by a conflict between the meaning of the words and the colour in which they appear. Rather, participants’ speed in responding to the font colour of the stimuli might suffer from their distraction by the alcohol-relatedness of the stimuli. Unlike the classic Stroop test, these reaction times are not affected by conflict between the meaning of the words and their colour – the distraction results from the alcohol-relatedness of the stimulus.

Alcohol attentional bias is then calculated as the mean reaction time to alcohol-related words minus the mean reaction time to alcohol-unrelated words. On the alcohol Stroop test, alcohol abusers and other heavy drinkers show greater attentional bias for the alcohol stimuli than social drinkers (for a review see Cox et al., 2006). When a third category of words is included that relates to the individual person’s goals and concerns (apart from their goal of drinking alcohol), alcohol abusers have been found to show greater attentional bias for alcohol-related words than for those related to their personal goals (Cox et al., 2000). This suggests that drinking alcohol is an alcohol abuser’s most compelling goal.

Fadardi and Cox (2006) developed the Alcohol Attention-Control Training Program (AACTP) as a technique to help excessive drinkers overcome their automatic distraction for alcohol-related stimuli, which contributes to their inability to moderate their drinking, especially in high-risk situations (Stasiewicz et al., 1997). The AACTP is designed to neutralise the cognitive processes involved in the automatic chain of drink-related behaviours, by helping excessive drinkers gain more control over their distraction for alcohol-related stimuli. Theoretically, the AACTP was developed to (a) correct the uncontrollability with which excessive drinkers are distracted by alcohol instead of attending to other kinds of stimuli, and (b) increase drinkers’ efficiency and speed in diverting their attention away from alcohol when they want to do so.

The AACTP is based on goal setting, immediate feedback, and monitoring participants’ progresses through progressive levels of difficulty. At the most difficult level, the participant sees on a computer screen pairs of alcohol and non-alcohol containers (bottles or cans), each of which is surrounded by a narrow, coloured outline. The participant’s task is to ignore the alcohol bottle (or can) in each pair and to respond as quickly as possible to the surrounding colour of the non-alcohol bottle (or can). Recently, Fadardi and Cox (2007) evaluated the AACTP with social drinkers, heavy drinkers, and abusive drinkers. Baseline measures were made of each participant’s alcohol consumption and attentional bias for alcohol-related and other concern-related stimuli. They underwent other measures including the Readiness to Change Questionnaire (Heather et al., 1993), the Positive Affect and Negative Affect Schedule (Watson et al., 1988) and the Situational Confidence Questionnaire (Annis and Graham, 1988). At the end of AACTP training, participants were re-administered the tests completed at baseline. The abusive drinkers also received a post-training assessment after 3 months.

The results were as follows:

• First, both the excessive and the abusive drinkers showed a significantly larger attentional bias for alcohol-related stimuli than the social drinkers. The degree of alcohol-related distraction
was positively correlated with the amount of alcohol that participants habitually consumed.

- Second, the excessive drinkers who were trained with the AACTP for two sessions showed a significant reduction in their alcohol-specific distractibility from the pre-training to the post-training assessment. That is, on the post-test their alcohol attentional bias had decreased, but their concern-related attentional bias remained unchanged. These results support the applicability of the AACTP with a non-clinical sample.

- Third, during the initial 1-month waiting period there were no significant reductions in the alcohol abusers’ attentional bias for alcohol-related stimuli, their alcohol consumption, nor any of the other measures (e.g. readiness to change, situational confidence). However, comparing the pre-training to the post-training assessment, alcohol abusers showed a significant reduction in alcohol attentional bias and alcohol consumption, but increases in their readiness to change, situational confidence, and positive affect. All these improvements were maintained at the 3-month follow-up assessment.

To summarise, the research showed that (a) excessive drinkers can be trained to gain more control over their attentional bias for alcohol, (b) the reductions in alcohol-attentional bias are accompanied by reductions in alcohol consumption, and (c) these reductions are associated with improvements in a variety of other areas of functioning related to drinking. These results are likely to have an impact on how scientists (theoretically) view the initiation and maintenance of abusive drinking. The results are also likely to have an impact on the actual delivery of service, inasmuch as the AACTP – as a tried-and-tested training program – can be used to improve the effectiveness of treatment for alcohol-related problems.

Changing implicit attitudes through evaluative conditioning

As explained in the introduction, it has been demonstrated that explicit alcohol-related cognitions, as well as implicit associations between alcohol and positive arousal, are important predictors of drinking behaviour (Houben and Wiers, 2006; Wiers et al., 2002). In addition, recent research findings also suggest that implicit associations between alcohol and valence, or implicit attitudes towards alcohol, play a role in drinking behaviour. More specifically, it was demonstrated that participants more easily paired alcohol with positive stimuli than with negative stimuli in the Implicit Association Test as they consumed more alcohol (Houben and Wiers, 2007). Hence, these results suggest that stronger implicit positive attitudes towards alcohol are related to an increase in alcohol consumption (see also De Jong et al., 2007; Payne et al. 2008). Therefore, one intervention strategy for reducing drinking could target implicit attitudes towards alcohol.

Gawronski and Bodenhausen (2006) recently proposed the APE-model (Associative and Propositional processes in Evaluation) that specifies under which conditions changes are expected in implicit attitudes. Specifically, they advocate that a direct change in implicit attitudes can be expected when the associative structure is changed, for instance by introducing new associations through evaluative conditioning. Evaluative conditioning refers to changes in the ‘liking’ of a certain attitude, object or stimulus (the conditioned stimulus, or CS) as a result of repeatedly and consistently pairing that stimulus with other objects or stimuli that have a strong negative or positive affective value (the unconditioned stimuli, or US). Specifically, the underlying idea of evaluative conditioning is that pairings of the CS with a valenced US will
cause the attitude towards the CS to change in the direction of the US that it was paired with. Further, it has also been suggested that attitudes develop through processes akin to evaluative conditioning (De Houwer et al., 2001). Consequently, evaluative conditioning might prove to be a straightforward approach for changing implicit attitudes.

While a lot of research has been devoted to examining whether evaluative conditioning can induce attitudes towards novel attitude objects, it has only recently been used to change existing attitudes. Baccus and colleagues (2004), for instance, were able to enhance implicit self-esteem using an evaluative-conditioning procedure. Baccus et al. repeatedly exposed participants in the experimental group to consistent pairings of self-relevant words (CS; e.g. the participants’ own name) with smiling faces (positive US). In contrast, words that were not self-relevant were always paired with either neutral or frowning faces.

For participants in the control group, self-relevant words and non-self-relevant words were randomly paired with smiling, neutral or frowning faces. Importantly, participants in the experimental group showed elevated levels of implicit self-esteem, as indexed by performance on the IAT, as well as lower levels of aggression relative to participants in the control group.

Another example of using evaluative conditioning to change implicit attitudes is found in a recent study by Olson and Fazio (2006). Participants were exposed to pairings of white people with negative stimuli as well as pairings of black people with positive stimuli, interspersed within a stream of ‘filler’ items. Afterwards, implicit racial attitudes were indexed using an evaluative priming measure. Importantly, Olson and Fazio demonstrated that their evaluative-conditioning procedure reduced prejudice against black people in the conditioning condition relative to a control condition of participants who were not exposed to the critical CS–US pairings.

In light of these promising results, Houben et al. (2008) explored whether an evaluative conditioning paradigm, similar to the procedure used by Olson and Fazio (2006), could be used to change implicit and explicit attitudes towards beer in male students. They also examined whether changes in implicit and/or explicit attitudes towards beer induced by evaluative conditioning would produce corresponding changes in their drinking behaviour. Subjects in the experimental group were exposed to an evaluative conditioning procedure during which beer-related pictures (CS) were consistently paired with negative words and pictures (US). Similar to the Olson and Fazio’s procedure, these critical pairings of beer with negative stimuli were interspersed among a stream of filler items. In contrast, participants in the control group were not exposed to these critical CS–US pairings. Participants in both the experimental group and the control group were told they were performing a vigilance task and were instructed to press a button whenever a pre-specified target was presented. Afterwards, all participants took part in an alleged second study, in which both explicit and implicit attitudes towards beer were measured as well as their drinking behaviour. Results did not yield an effect of the evaluative conditioning procedure with respect to implicit attitudes towards beer, which were assessed using the Affect Misattribution Procedure (AMP; Payne et al., 2005). However, the results did show that students in the experimental group reported significantly less negative explicit attitudes towards beer compared to participants in the control group. Importantly, in a bogus taste test, students in the experimental group drank significantly less beer than those in the control group.

Although results of evaluative conditioning in changing implicit attitudes are less clearcut in alcohol research compared to other areas of research, it seems premature to conclude that such an approach cannot be used to change implicit alcohol-related attitudes. It should be noted
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that Houben et al. (2008) might have been unable to demonstrate changes in implicit attitudes towards beer following an evaluative conditioning procedure due to the implicit measure they used as an index of implicit attitudes towards beer. Specifically, whereas Baccus et al. (2004) as well as Olson and Fazio (2006) used well-validated measures of implicit attitudes (such as affective priming and the IAT) Houben and colleagues used a relatively new implicit measure, that may not be as sensitive to implicit attitudes as other established measures. Currently a replication study is being performed.

In conclusion, evaluative conditioning appears to be promising for changing implicit attitudes. Future research will have to establish whether, and under what conditions, evaluative conditioning can be successfully used to change implicit attitudes towards alcohol as well as drinking behaviour.

Assessing and changing automatic action tendencies

Different tests have been used in past years to assess relatively automatic action tendencies. First, a variation of the IAT (Greenwald et al., 1998) has been used (Palfai and Ostaﬁın, 2003; Ostaﬁın and Palfai, 2006). In a standard IAT, the attribute categories are ‘positive’ or ‘pleasant’ versus ‘negative’ or ‘unpleasant’. In this motivational variety of the IAT, attribute categories are words related to ‘approach’ versus ‘avoidance’, which are combined with alcohol words or a contrast category (an irrelevant contrast ‘electricity’ in one study, ‘water’ in the other). The extent to which participants were faster at categorising ‘alcohol’ and ‘approach’ together than ‘alcohol’ and ‘avoid’ was related to binge-drinking and to cue-induced craving.

De Houwer developed a different test to assess ‘approach’ versus ‘avoidance’ motivation – the Stimulus Response Compatibility (SRC) task. This task has been successfully applied to alcohol studies (e.g. Field et al., 2005). Subjects have to move a little matchstick figure (manikin) either towards or away from alcohol pictures, using the arrow keys on the keyboard. High-craving social drinkers were found to be faster ‘approaching’ than ‘avoiding’ alcohol pictures. Note that this test is not very implicit, because subjects are instructed in one block of trials to approach the alcohol pictures (move the figure towards the them) and to avoid the other pictures, while in the other block they are instructed to avoid the alcohol pictures (move the figure away from them).

Recently a more indirect approach–avoidance test was developed to assess automatic approach action tendencies for alcohol. In this test, participants react to a feature of the stimulus that is unrelated to the meaning of the stimulus (cf. De Houwer, 2003a,b). Participants reacted to the format of a picture (landscape or portrait, cf. Huijding and De Jong, 2005); their reaction involved an arm-movement that moved a joystick away from or towards their body. The rationale behind joystick tasks is that arm ﬂexion (pulling) generates more positive evaluations than extension (pushing). Following the pioneering work of Solarz in the 1960s, Chen and Bargh (1999) demonstrated that positive stimuli trigger ‘approach’ (pull) movements and negative words trigger ‘avoid’ (push) movements. The novel aspect of the Approach Avoidance Task (AAT; Rinck and Becker, 2007) is that the size of the stimulus on the computer screen changes as a result of the joystick’s movement; it increases upon ‘pull’ and decreases upon ‘push’ movements. This ‘zooming feature’ generates a sensation of ‘approach’ or ‘avoidance’, respectively. Without this feature, subjects may interpret the movements in the opposite way – extending the arm in
response to a picture of a beer can be interpreted as a movement away from the body, or as approaching the beer. The zooming feature unambiguously ties in the pull and push movements with approach and avoidance.

The new feature added was to let the participant react to an irrelevant feature of the picture (it's format) and to investigate whether heavy and light drinkers have different reaction times when approaching or avoiding the alcohol pictures. Note that this is a truly indirect test, because the instruction is to push or pull the joystick depending on the picture's format (i.e. landscape or portrait) and differences in pushing versus pulling can be assessed for different types of pictures (alcohol pictures, soft drinks, general positive and negative pictures). Heavy drinkers were found to be faster when pulling the alcohol pictures when pushing them, while light drinkers show the reverse. In addition, heavy drinkers with a genetic variation assumed to be related to the rewarding effects of alcohol – that is, the presence of a G allele in the μ-opioid receptor (OPRM gene) as described in van den Wildenberg et al. (2007) – showed a particularly strong difference in pulling versus pushing the alcohol pictures (Wiers et al., 2007b). This suggests that heavy drinkers develop strong automatic action tendencies to approach alcohol once they are confronted with stimuli that refer to alcohol. As these implicit action tendencies are related to a genetic variation associated with the rewarding effects of alcohol, these automatic action tendencies may constitute a so-called endophenotype, or biological marker, between a genotype and the distal and heterogeneous phenotype (alcoholism). It should be noted that a recent meta-analysis did not find the same gene to be related to alcoholism (Arias et al., 2006) but a strong appetitive reaction to alcoholism may still be a relevant phenotype in a specific route to alcoholism (early-onset, male alcoholism, cf. Barr et al., 2007; Gianoulakis et al., 1996; Van den Wildenberg et al., 2007).

The next question was whether these action tendencies could be re-trained, in a similar way to that described above for alcohol-related attentional bias. In a second study, these automatic action tendencies were re-trained in an implicit learning paradigm, much like the attention training using the visual probe. After an initial test period, in which pictures of alcohol and soft drinks were pushed and pulled equally often, the task changed into a training version. Half of the participants (push-alcohol condition) now pushed the alcohol pictures in most of the cases (90 per cent) and pulled the soft-drink pictures in most of the cases (90 per cent); the other half pulled the alcohol pictures 90 per cent of the time and pushed the soft-drink pictures half of the time. These results are promising: participants were successfully trained to push alcohol away (outside awareness), as evident from a post-test with the same test. The effect was generalised to new pictures of alcohol and to a different implicit test of alcohol motivation using words, the IAT (Palfai and O斯塔fin, 2003). Hence these generalisation effects were stronger than for attentional re-training with a similar set up, described above. In a subsequent taste test, the heavy drinkers who had been successfully trained to push away the alcohol pictures, drank about half as much as heavy drinkers who were successfully trained to pull the alcohol pictures.

Multiple-session versions of this training program have been developed and are now compared with respect to their effects. One comparison is of a version in which the participants are made aware of the goal of the training (to push the alcohol pictures away) and the implicit learning version, in which they keep the same instruction (to push landscape pictures away, but to pull portrait pictures) and implicitly learn to push alcohol away.

Another important question is to what extent re-training of action tendencies can be used in a clinical setting and whether it results in positive treatment outcomes. Preliminary results
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from an ongoing first clinical study are promising: after repeated re-training of alcohol action tendencies, patients showed automatic alcohol-avoidance associations (when instructed to push alcohol away and without this instruction), both on new pictures in the test used for the re-training (the AAT) and in a different test using words (the IAT). In addition, craving was reduced in the experimental groups, as compared with the control groups (Wiers et al., 2008).

Train away addiction?

In this chapter, a general theoretical framework was first outlined in which addictive behaviours are viewed as the result of an imbalance between largely implicit or automatic appetitive processes and more controlled regulatory processes. We believe this general perspective may provide a useful new perspective for treatment of alcoholism and other addictions. From this perspective, the essential aim of treatment is to restore the balance between these classes of processes – in other words, to decrease the influence of the largely automatic appetitive processes once they are triggered and to increase the influence of regulatory processes over the impulse to engage in the addictive behaviour. Most conventional psychosocial treatments are aimed at increasing control over impulses, either by increasing motivation to refrain from drinking or by teaching and practising ways to avoid or deal with temptations. There is some disagreement about the extent to which current psychosocial treatments can be called successful (Cutler and Fishbain, 2005), but few clinicians or researchers in this area disagree that there is ample room for improvement.

A large part of this chapter was devoted to new strategies developed over the past few years that aim to directly reduce the influence of appetitive impulses over addictive behaviours. We distinguish between three appetitive subprocesses: attentional bias, memory associations and automatic action tendencies. Each of these sub-processes has been targeted by recent re-training studies, often using variations of the same tests used to measure the process, but changed in such a way that the underlying process is not only assessed but also influenced. In all three areas, initial positive findings have been reported; they can be viewed as a ‘proof of principle’ that these processes can be influenced.

However, these first findings have some limitations, such as generalisation to new stimuli (in the attentional re-training programs using variations of the visual probe test). One interesting aspect of most work presented here is that the effects occur outside the awareness of the majority of participants. We do not know at this moment whether this is important or whether the effects will be larger, equal or smaller in size when participants are made aware of the purpose of the training.

In a clinical setting, it may be more appropriate to inform patients of the goal of the training, as is currently already done in the AACTP. This may increase motivation to change and the feeling that one can positively influence the outcome of treatment. In general, these training procedures have a very positive motivational message: you can actively work on beating your addiction. In this way, interventions aimed at implicit processes may strengthen explicit processes (and vice versa). It should be noted that at present we have little knowledge of stability of these effects or about their clinical usefulness, although first results from the clinically relevant re-training procedures (repeated attentional re-training with the visual probe test, the AACTP, and the repeated action-tendency re-training) are definitive promising.

We believe there are good reasons to further test clinically relevant varieties of different
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re-training procedures. Of course there are many further questions. Issues include application in different addictions, combinations of re-training procedures that target different subprocesses (for example, can evaluative conditioning, attentional re-training and re-training of action tendencies enhance each other?), and combinations with other interventions. Another interesting possibility (that we are presently working on) is whether re-training will work over the internet.

From the present theoretical standpoint, a second class of training procedures can aim to increase the regulatory or control processes, either by behavioural training (as has been done in some externalising problem behaviours in children) or by directly stimulating the relevant brain areas through transcranial magnetic stimulation. These approaches are also in their first stage, but are definitively worth further exploration.

One other general approach should be mentioned: rather than re-training automatic processes that lead to addiction, it may be possible to train and automatise alternative behaviours. In other words, let the automatic processes work in favour of alternative, rather than addictive, behaviours. A very simple and straightforward way of doing this is by forming implementation intentions. Implementation intentions have been found successful aids in many other health behaviours but have rarely been applied to addictive behaviours (Prestwich et al., 2006).

Implementation intentions consist of a specifically described situation, followed by an action plan. For example, if someone realises that they often drink too much after a hard day’s work, they could form the following implementation intention: ‘When I am tired after work, I go jogging. Of course it will help if I already have good sport shoes ready waiting for me, rather than a bottle of Scotch’. This example points to a general idea (not entirely new to the field of treatment, but perhaps helpful if more explicit), whereby in general it is a good strategy to use controlled processes in advance to steer anticipated automatic processes in the right direction. It is easier to decide beforehand not to drink when driving than it is to decide when taking orders. There is even preliminary evidence that some self-regulating processes can be automatised (Palfai, 2006).

Conclusions

To conclude, although it may be beneficial to explore different ways for preventing future automatic processes that lead to renewed addictive behaviours, we believe (given the omnipresence of alcohol-related stimuli) it is also important to directly target those automatic processes.

Therefore, the emerging general perspective is that addictive behaviours can be viewed as an imbalance between relatively automatic appetitive processes and relatively controlled processes that may serve to inhibit or control these impulses. This knowledge may contribute to further research on the treatment of alcoholism and other addictive behaviours, both by providing a new perspective on existing treatments and through development of entirely new treatments.
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References and further reading


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Citation: