



Published in final edited form as:

Psychol Addict Behav. 2014 June ; 28(2): 559–562. doi:10.1037/a0036086.

Computer-delivered, Home-based, Attentional Retraining Reduces Drinking Behavior in Heavy Drinkers

John E. McGeary, Ph.D.,

Providence Veterans Affairs Medical Center; Division of Behavioral Genetics, Rhode Island Hospital; and Department of Psychiatry and Human Behavior, Brown University

Sydney P. Meadows, B.A.,

Binghamton University

Nader Amir, Ph.D., and

Joint Doctoral Program, San Diego State University/University of California

Brandon E. Gibb, Ph.D.

Binghamton University

Abstract

In order to examine the impact of a computer-delivered, home-based, alcohol-specific attention modification program (AMP), 41 heavy drinking college students were randomly assigned to AMP or an attention control condition (ACC). Participants selected ten alcohol-related words most relevant to their own drinking experience as well as ten neutral words not related to alcohol. These personalized stimuli were used in an attention retaining program based upon the probe detection paradigm twice weekly for four weeks. Participants in the AMP condition reported decreased drinking whereas those in the ACC condition reported no change in their drinking. These preliminary data suggest that a computer-delivered, home-delivered, attention-retraining for alcohol treatment may be an inexpensive and efficacious adjunct to standard alcohol treatments.

Keywords

Attentional Retraining; Drinking Behavior

Introduction

The 12 month prevalence of alcohol use disorders has been estimated at 10.8% in a nationally representative sample (Agrawal et al., 2011) and cause an estimated 79,000 deaths annually (Bouchery et al., 2011). Furthermore, with estimated annual economic costs of \$223.5 billion dollars (Bouchery et al., 2011), AUDs constitute a major public health problem and efficacious treatments have the potential to reduce many of these direct and indirect consequences. Although treatments for AUDs have substantially improved in recent decades, only a third of those who receive treatment remain abstinent over one year (Miller,

Walters, & Bennett, 2001), demonstrating a clear need for continued improvement. Focusing treatments on the specific mechanisms that maintain AUDs may help to advance current treatments. Attentional biases for alcohol-related cues offer one promising mechanism of change.

There is a well-supported association between alcohol use and attentional bias towards alcohol-relevant cues. For instance, heavy drinkers show a stronger attentional bias for alcohol-related pictures than non-alcohol related pictures when these pictures are presented for longer durations of 500 and 2000ms (Field, Mogg, & Zettler, 2004). This bias has also been demonstrated in clinical alcoholic populations using the Stroop Task (Johnsen, Laberg, Cox, Vaksdal, & Hugdahl, 1994). Furthermore, there is preliminary evidence that attentional biases may influence treatment outcome for substance use disorders. Specifically, in abstinent inpatient heroin users, pre-treatment attentional biases for drug-related stimuli predicted relapse (Marrisen, et al., 2006). This has also been demonstrated in patients diagnosed with alcohol dependence, where increases in attentional bias for alcohol-related words between intake and discharge predicted relapse following discharge (Cox, Hogan, Kristian, & Race, 2002). This suggests that attentional bias for substance-relevant cues may be an important mechanism leading to substance use disorder, and that efforts to directly target the reduction of this bias could reduce substance use.

Computer-based methods of attentional biases modification have shown promise in several forms of psychopathology. Specifically, at least 4 randomized controlled trials showed significantly larger improvement of symptoms in the ABM when compared to the ACC that were maintained at follow-up (Amir et al. 2009, Amir et al. 2009, Heren et al. 2012, Schmidt et al. 2009). However, at least four recent attempts to replicate the above findings have failed to find improvements in anxiety following ABM when compared to the ACC (Carlbring, et al., 2012, Boettcher et al., 2012, Bunnell et al., 2013). Although a number of factors could account for these discrepant results (e.g., method of delivery: in lab delivery vs., internet delivery, etc.), the most parsimonious explanation may be that in these latter studies, the active dose of the mechanism of change for attention training (i.e., change in attention bias) was similar in both groups.

Although research is more limited for the role of attention training in alcohol use disorders, there is some evidence that it may be an important tool for reducing attentional biases and actual alcohol consumption. For example, with just a single attention training session, Shoenmakers, Wiers, Jones, Bruce, & Jansen (2007) were able to reduce alcohol-related attentional biases in undergraduate heavy drinkers.

Fadardi and Cox (2009) used multiple attention training sessions using personalized stimuli and showed that this training resulted in a reduction in attention bias in heavy and hazardous drinking groups, with reduced alcohol consumption in the harmful drinking group. There has been some promise in clinical populations as well, with alcoholic patients who complete attention bias modification being released from treatment earlier and taking a longer time to relapse as compared to patients who do not complete the modification program (Shoenmakers, et al., 2010).

Though the work on modifying attention bias for alcohol has been lab or clinic-based thus far, there is increasing evidence from work in the area of anxiety disorder treatment that such approaches may be successfully implemented using home-based computerized methods (e.g., Amir & Taylor, 2012). The advantages of such an approach over lab or clinic-based implementation include: the ability to increase access to those who are unable to regularly attend in-person intervention meetings, a low-cost adjunct to traditional clinic-based interventions that may improve clinical outcomes, and the convenience of allowing individuals to engage in treatment at a time and location of their choice.

The primary goal of current study was to examine the effectiveness of a computer-delivered, home-based, attentional bias modification in undergraduates reporting heavy drinking. We predicted that those randomized to active attention bias modification training, compared to those allocated to a control condition, would exhibit greater decreases in drinking behavior across the course of treatment.

Materials and Methods

Participants

Participants were 41 male undergraduate students. Subjects provided informed consent and the procedures followed were in accord with the standards of the Committee on Human Experimentation of the institution in which the experiments were done or in accord with the Helsinki Declaration of 1975. All participants received course credit for their participation. The mean age of participants in this study was 18.98 ($SD = 1.05$) and 70.5% were Caucasian. To be included in the study, participants had to score higher than an 8 on the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, & Babor, 1993), reflecting harmful or hazardous alcohol use.

Measures

Participants were recruited based on their scores on the AUDIT. The AUDIT has exhibited good psychometric properties as a screening tool for hazardous drinking in previous research (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998, Piccinelli & Homen, 1997). The scale exhibited good internal consistency ($\alpha = .81$).

Participants' changes in drinking behavior were assessed using an item from Calahan's Drinking Habits Questionnaire (DHQ; Cahalan & Room, 1974): "How often did you have any drink containing alcohol, whether it is wine, beer, whisky, or any other drink during the past week?", which was administered at the initial assessment and then again at the end of treatment. Response options for this question were: "never", "only one day of the weekend", "nearly every day of the weekend", "once a day", "two times a day", and "three or more times a day", which were scored on a scale from 0–6. The DHQ was administered at pre- and post-treatment in the laboratory.

Procedure

The AUDIT was administered as part of a larger screening procedure and individuals scoring above 8 (see Kokotailo et al., 2004 for psychometrics in college students) on the

AUDIT were invited to the laboratory to complete “a research study looking at the link between attention and alcohol use”. Upon arrival to the laboratory, participants were administered the DHQ and then randomly assigned to either the Attention Modification Program (AMP; $n = 19$) or the Attention Control Condition (ACC; $n = 22$). All participants were blind to their condition. The stimuli for the attention training program were 24 alcohol related words paired with 24 neutral words. Each participant selected 10 words from the 24 alcohol related words most related to their personal experiences with drinking, as well as 10 words from the neutral stimuli set that did not relate to alcohol. The most common alcohol-related words chosen were alcohol ($n = 40$), liquor ($n = 39$), vodka ($n = 38$), beer ($n = 37$), shotglass ($n = 36$), and bar ($n = 35$). Following an initial training session in the laboratory, participants were given an USB drive which contained the program and were then asked to complete the training program at home twice a week for 4 weeks, totaling eight training sessions. Following this, participants came back to the laboratory to complete the DHQ again. Compliance with the training was good, with 63% of participants completing all of the training sessions, 27% missing one or two training sessions, and only 10% missing more than two training sessions. The training program utilized a probe detection paradigm (Amir, et al., 2008). Each trial comprised a fixation cross (+) that remained on the screen for 500 ms. Next, two words appeared on the screen for 500 ms, one above the other, and were followed by a probe (either the letter *E* or the letter *F*) that appeared in the position of one of the words and then remained on the screen until the participants responded by pressing a corresponding mouse button (*E* if the letter *E* appeared as the probe and *F* if the letter *F* appeared).

In both the AMP and ACC conditions participants saw a total of 360 trials per training session. These trials comprised 10 words x 3 (trials type, alcohol - neutral, neutral - alcohol, or neutral-neutral) x 2 (Probe position; top or bottom) x 2 (probe type: E or F) x 3 repetitions for a total of 360 trails per training session. In the AMP condition on trials with one neutral word and one alcohol word, the probe always followed the neutral word. The ACC sessions were identical to those in the AMP, except that in the trials with one of each word type, the probe followed the neutral and alcohol words with equal frequency.

Results

An ANCOVA was used to determine whether group assignment (AMP vs. ACC) predicted residual change in drinking over the course of treatment. In this analysis, the independent variable was group and the dependent variable was post-treatment level of drinking, with pre-treatment level of drinking entered as the covariate. As hypothesize, group assignment (AMP vs. ACC) predicted residual change in drinking over the course of treatment, $F(1, 38) = 5.28, p = .03, \eta_p^2 = .12$. To determine whether this group difference was, as predicted, driven by greater reductions in drinking among our AMP group, we examined within group changes in drinking from pretreatment to post-treatment in our two treatment groups separately. As predicted, participants in the AMP group exhibited a significant decrease in drinking across the course of treatment, $F(1, 21) = 10.81, p = .004, \eta_p^2 = .34$. In contrast, participants in the ACC group exhibited no significant change in drinking across the course of treatment, $F(1, 18) = 1.28, p = .27, \eta_p^2 = .06$.

Discussion

The goal of the current study was to examine the effectiveness of a computer-delivered, home-based, attention bias modification treatment in reducing attention biases and alcohol consumption in heavy drinkers. We found AMP was associated with reductions in drinking behavior across the course of treatment. These findings add to a growing body of research suggesting that attention training using alcohol related stimuli may help curb drinking behaviors.

The study had a number of strengths, including the use of a computer-based, home-delivered intervention, multiple training sessions over a month to maximize treatment effects, and the use of ideographically-chosen training stimuli to best match each participants' drinking cues. However, it is important to note some potential limitations as they may provide future areas of research. First, our population consisted of heavy drinking undergraduates, so it is not clear if these findings would generalize to a clinical population. Future research using participants with diagnosed alcohol use disorders is needed to confirm the usefulness of the AMP in a more clinical setting. Second, we did not determine whether attentional biases changed over the course of the treatment. Therefore, although our results are consistent with the hypothesis that the attention modification program reduced participants' attentional biases, which then lead to reductions in drinking, future research is needed to formally test this hypothesis. Finally, our assessment of drinking relied on a single item and future research should utilize more standardized measures of drinking (e.g., the Timeline Followback), which would also allow for a more nuanced assessment of alcohol use including binge drinking episodes.

In conclusion, the current study adds to a growing body of research that demonstrates not only the importance of attentional biases as driving factors in alcohol use disorders, but the possibility of changing these biases in order to reduce actual drinking behaviors. To our knowledge, this study represents the first to test a transportable attention modification treatment program for alcohol-related concerns. Future research is needed to determine the effectiveness of this form of attention modification in clinical populations. Furthermore, the use of more finely tuned assessments of attentional allocation may help to determine the specific components of attention that must be targeted to maximize treatment gains.

Acknowledgments

This project was supported by grants from the National Institutes of Health R34 MH073004-01, R34 MH077129-01 awarded to Dr. Amir, and R01 HD057066 and R01 MH098060 awarded to Dr. Gibb.

This project was supported by grants from the National Institutes of Health MH087623-04 R34 MH073004-01 awarded to Dr. Amir, and R01 HD057066 and R01 MH098060 awarded to Dr. Gibb. Dr. Amir has financial interest in Cognitive Re-training Technologies Incorporated, which has licensed elements of the technology described in this study for commercial purposes.

References

- Agrawal A, Heath AC, Lynskey MT. DSM-IV to DSM-5: the impact of proposed revisions on diagnosis of alcohol use disorders. *Addiction*. 2011; 106(11):1935–43. Epub 2011 Aug 18. 10.1111/j.1360-0443.2011.03517.x [PubMed: 21631621]

- Amir N, Beard C, Burns M, Bomyea J. Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology*. 2009; 118:28–33. [PubMed: 19222311]
- Amir N, Beard C, Taylor CT, Klumpp H, Elias J, Burns M, Chen X. Attention training in individuals with generalized social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*. 2009; 77:961–973. [PubMed: 19803575]
- Amir N, Taylor CT. Combining computerized home-based treatments for generalized anxiety disorder: an attention modification program and cognitive behavioral therapy. *Behavior Therapy*. 2012; 43:546–559. [PubMed: 22697443]
- Amir N, Weber G, Beard C, Bomyea J, Taylor CT. The effect of a single-session attention modification program on response to a public-speaking challenge in socially anxious individuals. *Journal of Abnormal Psychology*. 2008; 117:860–868. [PubMed: 19025232]
- Boettcher J, Berger T, Renneberg B. Internet-based attention training for social anxiety, a randomized controlled trial. *Cognitive Therapy and Research*. 2012; 36(5):522–536.
- Bouchery, EE.; Harwood, HJ.; Sacks, J.J.; Simon, C.J.; Brewer, RD. Economic costs of excessive alcohol consumption in the U.S., 2006. *American Journal of Preventive Medicine*; 2011. p. 516–24. Erratum in: *Am J Prev Med*. 2013 Feb;44(2):198
- Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Archives of Internal Medicine*. 1998; 158:1789–1795. [PubMed: 9738608]
- Cahalan, D.; Room, R. Problem drinking among American men. New Brunswick, NJ: Rutgers Center for Alcohol Studies; 1974.
- Carlbring P, Apelstrand M, Sehlin H, Amir N, Rousseau A, Hofmann SG, Andersson G. Internet-delivered attentional bias modification training in individuals with social phobia – a double blind randomized controlled trial. *BMC Psychiatry*. 2012; 12:66. [PubMed: 22731889]
- Cox WM, Hogan LM, Kristian MR, Race JH. Alcohol attentional bias as a predictor of alcohol abusers' treatment outcome. *Drug and Alcohol Dependence*. 2002; 68:237–243. [PubMed: 12393218]
- Fadardi JS, Cox WM. Reversing the sequence: reducing alcohol consumption by overcoming alcohol attentional bias. *Drug and Alcohol Dependence*. 2009; 101:137–145. [PubMed: 19193499]
- Field M, Mogg K, Zetteler J, Bradley BP. Attentional biases for alcohol cues in heavy and light social drinkers: the roles of initial orienting and maintained attention. *Psychopharmacology (Berl)*. 2004; 176:88–93. [PubMed: 15071718]
- Johnsen BH, Laberg JC, Cox WM, Vaksdal A, Hugdahl K. Alcoholic subjects' attentional bias in the processing of alcohol-related words. *Psychology of Addictive Behaviors*. 1994; 8:111–115.
- Kokotailo PK, Egan J, Gangnon R, Brown D, Mundt M, Fleming M. Validity of the alcohol use disorders identification test in college students. *Alcohol Clin Exp Res*. 2004; 28(6):914–20. [PubMed: 15201634]
- MacLeod C, Mathews A. Anxiety and the allocation of attention to threat. *The Quarterly journal of experimental psychology*. 1988; 40:653–670. [PubMed: 3212208]
- Marissen MA, Franken IH, Waters AJ, Blanken P, van den BW, Hendriks VM. Attentional bias predicts heroin relapse following treatment. *Addiction*. 2006; 101:1306–1312. [PubMed: 16911730]
- Miller WR, Walters ST, Bennett ME. How effective is alcoholism treatment in the United States? *Journal of Studies on Alcohol*. 2001; 62:211–220. [PubMed: 11327187]
- Najmi S, Hindash AC, Amir N. Executive control of attention in individuals with contamination-related obsessive-compulsive symptoms. *Depression and Anxiety*. 2010; 9:807–812. [PubMed: 20821800]
- Piccinelli, M.; Homen, FG. Gender differences in the epidemiology of affective disorders and schizophrenia. Geneva: World Health Organization; 1997.
- Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction*. 1993; 88:791–804. [PubMed: 8329970]

- Schmidt B, Richey J, Buckner J, Timpano K. Attention Training for Generalized Social Anxiety Disorder. *Journal of Abnormal Psychology*. 2009; 118:5–14. [PubMed: 19222309]
- Schoenmakers TM, de Bruin M, Lux IF, Goertz AG, Van Kerkhof DH, Wiers RW. Clinical effectiveness of attentional bias modification training in abstinent alcoholic patients. *Drug and Alcohol Dependence*. 2010; 109:30–36. [PubMed: 20064698]
- Schoenmakers T, Wiers RW, Jones BT, Bruce G, Jansen AT. Attentional re-training decreases attentional bias in heavy drinkers without generalization. *Addiction*. 2007; 102:399–405. [PubMed: 17298647]