가상현실을 이용한 알코올중독자의 단서노출 치료

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Cue-Exposure Therapy using Virtual Reality for alcohol Addicts

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ABSTRACTS

During abstinence from alcohol, craving is elicited by the cues and contexts previously associated with alcohol, and contributes to relapse. To prevent the craving and relapse experienced by alcoholics, cue-exposure therapy (CET) has been used to extinguish the association between alcohol and alcohol-related cues and contexts. This study applied CET, using a virtual reality (VR) system, to eight members of an Alcoholics Anonymous group, in eight sessions. Cues and contexts most likely to elicit an urge to drink were selected through a preliminary survey in order to compose VR-CET scenarios: a glass, bottle, food, and a bar were judged to be the most tempting for people in alcohol dependence and abstinence. By these cues and contexts, a Japanese style pub and a western bar were composed. Each session was administered for 30 minutes by a psychiatrist and included an introduction, immersion, VR navigation, interviews about feelings, and self-report questionnaires about cravings. The eight sessions consisted of initial and closing sessions, and six cue- and context-focused sessions. As a result, a reduction in cue-elicited craving after VR-CET was reported. A mean score of 15.75 (*SD* = 10.91) on the Alcohol Urge Questionnaire in the first session decreased to 11.57 (*SD* = 6.88) in the final session.

Keyword : Alcohol Craving, Alcohol Addiction, VR, CET

Craving is considered the reason why many drug users and alcoholics fail to exercise restraint even after treatment. One of the explanations about craving is based on Pavlovian conditioning: some contexts or objects (e.g., bottles, glasses, and bars) are repeatedly paired with addictive substances (unconditioned stimuli (US) so that the contexts or objects which become conditioned stimuli (CS) that can elicit the addict's urge (conditioned response: CR) to use, just as an unconditioned response (UR) to addictive substances does. After this conditioning, the addict feels the craving when confronted with the CS. Thus, the cue that evokes cravings is regarded as an activator of addictive behaviors.

Other researchers have offered a different explanation of the cue's effects: they suggest that, rather than eliciting cravings, cues related to drug use elicit automatic behaviors, such as drug use, which have been formed through repeated administration (Tiffany, 1990). For example, if a person used to drop by a grocery store, buy alcohol, and then drink every day, the person would buy alcohol and drink automatically after seeing a favorite alcohol in a shop, even during abstinence. In any event, a cue may contribute to relapse; thus, many

researchers and practitioners have tried cue-exposure therapy (CET) to reduce the urge to use drug and the rate of relapse. CET is used to extinguish the associated responses (CR) through repeated exposure to the cues related to addictive substances, but without the US.

CET has been applied in the treatment of a variety of substance addictions including smoking (Corty & McFall, 1984; Niaura et al., 1999), drinking (Rohsenow et al., 2001; Sitharthan et al., 1997), and drug using (Dawe et al., 1993; Franken et al., 1999). However, the effect of CET has not been consistent. Tiffany and Conklin (2002) supposed that some CET studies failed to prevent relapse because the treatments were done with just one cue so that the extinction of a CR to one cue could not be generalized to the others. That is, the fact that drug administration is paired with many kinds of objects and contexts should have been considered. In addition, extinction in one context (e.g., hospital) does not have an effect in another context (e.g., a site usually used for drug-taking). This explanation is based on the "renewal effect" from animal and human research (Tiffany & Conklin, 2002). Thus, it would be more helpful if the treatment setting was similar to the original conditioned context and had as many related cues as possible.

In terms of the various associations of drug use, previous trials have limitations: most research has been done in a treatment setting, such as a hospital or laboratory, with one or two stimuli. In contrast, VR technology and 3D animation techniques can provide a diverse range of situations and stimuli and a sense of being real (i.e., the feeling of being in a bar rather than in a hospital). This would evoke the craving more effectively than traditionally used methods, such as still photos, and allow the generalization of treatment effects into real life situations. In a previous study (Lee et al., 2004), abstinent smokers in VR-CET composed of various smoking-related cues reported presence (i.e., the sense of being there), and showed a reduced urge to smoke after VR-CET.

Thus, in this study, we investigated whether CET using VR was an effective method to reduce alcohol craving in alcoholics. Before applying this method for alcoholic outpatients, a precise and detailed survey was required to explore which cues were most likely to induce craving and which locations were most likely to elicit an urge to drink. A VR-scenario was then constructed. This survey is elucidated below with the VR-CET study.

METHOD

Preliminary survey and composing cues and scenarios

To investigate what cues and contexts are most likely to elicit cravings, we asked open-ended questions of three groups: alcohol dependence inpatients (Ward group), abstinent people in an Alcoholics Anonymous group (AA group), and light drinkers (normal group).

The Ward group was recruited from the department of psychiatry at S Hospital in Seoul and consisted of 49 patients diagnosed with alcohol dependence according to DSM-IV criteria. The AA group consisted of 35 people (from S hospital mentioned above and R Hospital in Seoul). Sixty-three light drinkers were selected using the criteria that, at most, they consumed nine standard glasses of alcohol in a week. The Ward group's mean age was 42.98 years (*SD* = 87.03), and the AA group's was 42.34 years (*SD* = 7.52), and the normal group's was 39.10 years (*SD* = 10.58).

Participants in each group were asked: 1) which places elicited a craving to drink (select all that apply), 2) which objects elicited a craving to drink (select all that apply) and 3) which places or objects were most likely to induce cravings.

The results are shown in Figure 1. The results showed that bars and one's own home were perceived to be the most likely situations to elicit cravings in the Ward group. Bars and amusement quarters were thought to be the most likely situations to elicit cravings in the AA group. Food and bottles were chosen to be the most likely

objects to elicit cravings in both the Ward and AA groups. Furthermore, the Ward and AA group participants answered that places evoked more cravings than objects (Ward = 79.17%; AA = 93.10%; Normal= 95.16%); However, more Ward group participants regarded objects as being highly evocative of craving than the other groups. Based on these results, VR-CET scenarios were constructed for two situations: a Japanese style pub, and a western bar. Both places had some people drinking, side dishes, glasses, some bottles of the participants' favorite alcohol, alcohol advertisement posters, and noise which most real bars have (Figure 2).

Main experiment

Participants: Ten participants from an Alcoholics Anonymous group were recruited for the study and wrote their own fully informed consent statements; however two participants later dropped out. Thus, eight participants each underwent eight sessions of VR-CET for 4 weeks (2 sessions a week). The mean age of the participants was 50.5 years (*SD* = 14), and all had been hospitalized more than once for alcohol treatment. Their average period of abstinence was 58.75 months (*SD* = 98.07), and they used to drink 28 standard glasses (i.e., total amount of alcohol is 316.8 ml) of Soju, a kind of moderate-proof (21%) liquor inexpensive and very popular in Korea, at one time in average.

Measurement and VR instrument: Three scales were used for measuring the level of alcohol craving: the Penn Alcohol Craving Scale (PACS: Flannery et al., 1999), the Alcohol Urge Questionnaire (AUQ: Bohn et al., 1995), and the Obsessive Compulsive Drinking Scale (OCDS: Anton et al., 1995). The PACS is a five-item scale that focuses on the urge that the participant felt to drink during the previous week, using a 7-point scale. The AUQ consists of eight items about dependence on, and preoccupation with, alcohol, and also uses a 7-point scale. The OCDS consists of 14 items that quantify thoughts about alcohol and drinking behavior, and uses a 5-point scale.

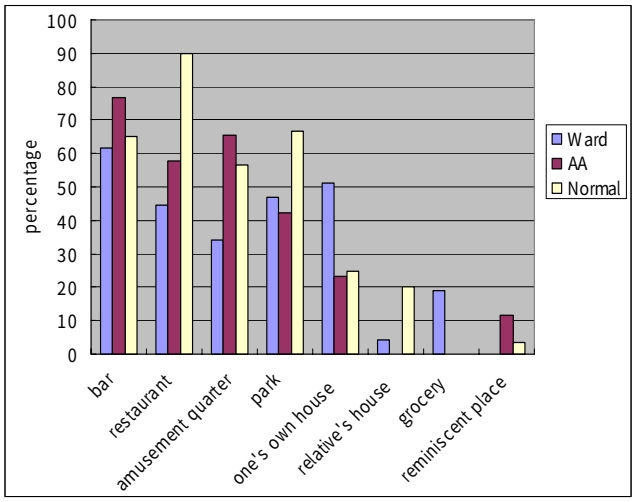
The hardware consisted of a Pentium IV PC, Open GL Accelerator VGA card, a beam projector with a 2.4m × 1.8m screen, and surround speakers.

At the beginning of the VR-scenarios, the entrances of two bars in the middle of a hallway were shown. If a user entered a bar, a bartender and a few people drinking at tables were there. Some people drank alone, and others drank with buddies. On the tables, there were some alcohol bottles, such as beer, Soju, and whiskey with side dishes, and noisy sound was continuing. A poster advertising alcohol was on the wall.

Procedure: The VR-CET was run with all the participants as a group session at R hospital. Before the first VR-CET session, participants were asked for their demographic data, medical history, and a survey of their drinking behavior (e.g., frequency of being fuddled and experience of injury due to alcohol), and asked to report their desire for alcohol on the three scales. After each session, participants again completed the AUQ scale, and at the end of the final session, all three scales were completed again.

Each of the eight sessions took 30 minutes, and each session was divided into three parts: guided and described immersion part for 5 minutes, VR navigation (a psychiatrist led the group of participants along programmed routes) and interview (about their feelings and thoughts) part for 20 minutes, and questionnaire completion part for 5 minutes.

In Session 1, the whole VR environment was shown. In Sessions 2, 3, and 4, each cue-exposure focused on a different craving type; Session 2 focused on person-elicited craving, Session 3 focused on object-elicited craving, and Session 4 focused on situation-elicited craving. These three session types were repeated for Sessions 5, 6, and 7. Finally, Session 8 focused on the prevention of relapse. A detailed description of the contents of each session is shown in Table 1.



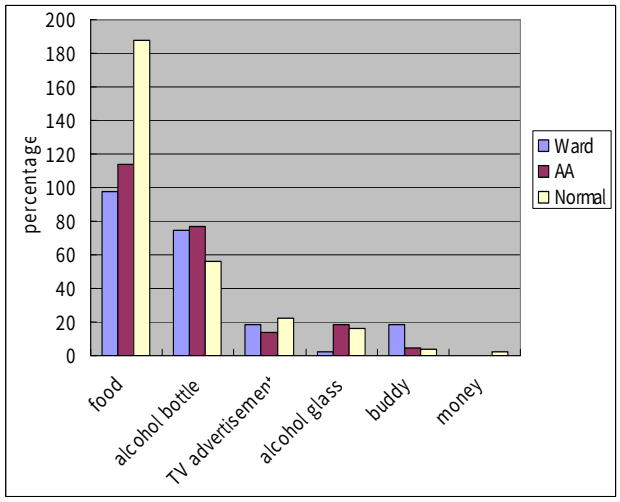


Figure1. Highly inducible places and objects to crave alcohol (selected all that apply)

Figure2. The Japanese style pub and the western bar in VR scenario

Table1. Contents of the CET program sessions

session	*Theme*	*CET program content*
1	**Initial navigation**	The participant was free to navigate during the initial session. 1. Have you navigated VR sufficiently? 2. Tell us about what you felt and thought after the VR. 3. How do you feel and think about the objects and situations in the VR?
2	**Person-elicited craving**	Interview with the participant about the person that elicits craving (open-ended). 1. How do you feel seeing a man drink alcohol alone in the virtual bar? 2. How do you feel seeing a woman drink alcohol alone in the virtual bar? 3. How do you feel seeing people who drink together?
3	**Object-elicited craving**	Interview with the participant about the object that elicits craving (open-ended). 1. What bottle makes you want to drink? 2. What side dish makes you want to drink? 3. What advertisement poster makes you want to drink?
4	**Situation-elicited craving**	Interview with the participant about the situation that elicits craving (open-ended). 1. How strongly do you want to drink when you see someone drink in the western bar? 2. How strongly do you want to drink when you see someone drink in the Japanese bar? 3. If you run out of alcohol, do you want more? How would you drink more?
5	**Person-elicited craving**	Repeat the questions of 2nd session
6	**Object-elicited craving**	Repeat the questions of 3rd session
7	**Situation-elicited craving**	Repeat the questions of 4th session
8	**Final navigation**	The participant was free to navigate during the final session. 1. How do you feel and think now after you've navigated the VR for several sessions? (Compare with the 1st session) 2. How do you feel and think now about the objects and situations that you saw in the VR, and what do they make you feel like doing? 3. If the VR experience happened to you in real life, what would you do?

RESULTS

Findings from the preliminary survey showed that in all groups people craved alcohol when faced with a bar and food, and that alcohol dependents felt the urge to drink more at bars, at home, and in front of their favorite alcohol bottle. In the main experiment, repeated-measures Analysis of Variance (ANOVA) indicated that the mean scores of the responses to the three questionnaires did not change significantly from pretreatment to posttreatment (Table 2).

The mean score on the AUQ decreased between the first and final sessions (Figure 3), although ANOVA revealed that the reduction was not statistically significant.

Participants responded to interview about their feelings and thoughts, depending on the focus of the sessions (Table 3). In person-focused sessions, they reported, for example, “Seeing a woman drink alone, I wanted to join her and drink together.” In object-focused sessions, they reported, for example, “Soju bottle makes me crave more for drinking than a beer bottle.” In situation-focused sessions, they reported, for example, “The Japanese bar makes me crave more for drinking than the western bar because of familiarity.” They also made general comments about the series of sessions, for example, “Audio stimuli made me feel more realistic than visual stimuli” and “The more I was exposed to stimuli, the less tension was produced.” Given the variation in responses, the failure to find a significant change despite a decrease in self-reported craving is understandable. This is discussed in the discussion.

Table2. Mean Scores of Three Questionnaires

Questionnaires	Pretreatment	Posttreatment	*F*
PACS	7.50 ±2.62	11.5 ±5.76	1.436
MUSQ	23.25 ±7.44	24.29 ±8.38	0.286
AUQ	9.44 ±2.23	11.50 ±5.76	2.222

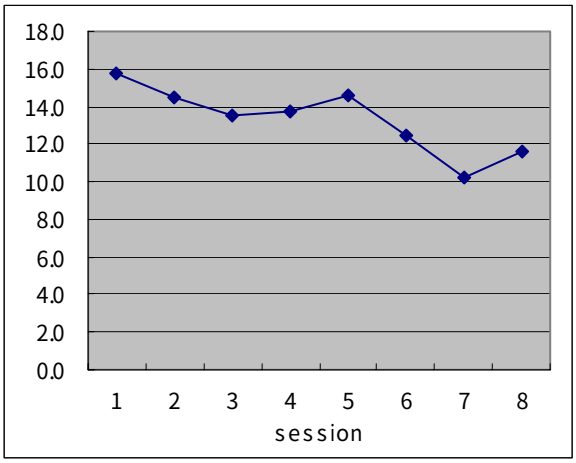


Figure3. The trend of reduced mean scores of AUQ

Table3. Subjective Responses to CET

Session	Interview responses to CET sessions
Person-focused sessions	*-Seeing a woman drink alone, I wanted to join her and drink together.* *-If I drank with a woman, I would drink much more.* *-I have never thought about drinking with a woman.* *-I have never drunk with a woman so that I really want to drink with a woman.*
Object-focused sessions	*-Soju bottle makes me crave more for drinking than a beer bottle.* *-Only a bottle catches my eye in the screen.* *-I salivate as soon as I see a Soju bottle.* *-Western alcohol bottle was not attractive or realistic.*
Situation-focused sessions	*-The Japanese bar makes me crave more for drinking than the western bar because of familiarity.* *-I was evoked even at the hallway, and I wanted to enter other bars.* *-Because of repetition, I want to drink a little bit.* *-The fact that alcoholics are mostly fond of drinking alone was overlooked.*
General comments	*-Audio stimuli made me feel more realistic than visual stimuli.* *-It’s not realistic.* *-The scene, drinking alone, is more attractive.* *-The more I was exposed to the stimuli, the less tension was produced.* *-The possibility of keeping abstinence would be increased.* *-I became curious.*

DISCUSSION

This study surveyed the situations and objects that elicited craving in normal, inpatient, and abstinent people in order to create VR-CET stimuli, and investigated the effectiveness of VR-CET in reducing craving for alcohol in order to prevent relapse. Although the results from self-reported craving scores on the three questionnaires did not show a significant reduction, the participants' urge to drink had decreased slightly when assessed by AUQ immediately after each session. Admittedly, the effect of participant demand characteristics on the experiment should be considered.

As shown in Table 3, VR-CET evokes alcohol cravings in some people. Various stimuli and situations are paired with drinking behavior so that environmental cues in VR-CET can be effective in eliciting cravings, at least in early sessions. This result is consistent with that of previous VR-CET study (Lee et al., 2004) about smoking cessation. However, eight sessions may be too few to desensitize the susceptibility to alcohol-related cues, to extinguish previously associated behavior, and to learn new associations (i.e., that alcohol-related cues no longer bring pleasure). Furthermore, because most people drink in various places and situations, two scenarios may be insufficient to cover the diverse range of situations in which the participants drank.

The clinical histories of the eight participants varied in severity. The duration of abstinence of four of the participants was at most 3 months; however, two participants had remained abstinent for at least 13 years. The latter reported consistently having no urge to drink. Thus, given the small number of participants, it is possible that the latter produced insignificant changes of craving. Nevertheless, we did not analyze, separately, because the small number meant we would be unable to generalize the results. Moreover, four of the participants were newcomers to the AA group, and a bar scene might not have elicited their cravings: they responded that the scene of drinking alone in their home would be more attractive. This response is the same as that of the Ward group in the preliminary survey. Hence, VR-CET might be more effective if adapted to each individual's history and favorite stimuli in individual treatment, rather than in group.

Alcohol and drug craving includes physiological arousal so that self-report of craving is usually inconsistent and is not a good predictor of relapse (Tiffany & Conklin, 2000). Thus, to assess one's craving and the effectiveness of CET more precisely, psychophysiological assessment is needed (Franken, 2003). Future studies will clarify the effectiveness of VR-CET for alcoholics by using psychophysiological measures such as fMRI, EEG, and eye-tracker.

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