INTRODUCTION

Alcohol use among adolescents and young adults mostly takes place within a social context. The context or environment in which substance use takes place directly affects use, for example, through availability, social norms or through modelling (e.g. Maisto et al., 1999). Previous studies have shown that people demonstrate a remarkable level of adaptation to other people’s drinking behaviour (Bot et al., 2005a; Larsen et al., 2009). Seeing the drinking patterns of peers sets norms one can use as guidelines for ones own drinking pattern; for example, the choice between drinking alcoholic or non-alcoholic beverages, and even the frequency, amount and speed of drinking. During adolescence, opportunities to consume alcohol increase, contributing to the potency of peer influence on individual attitudes and behaviours. Substance use is a prominent part of youth culture and peer interactions (Thombs, 1999). Because of the high prevalence and acceptance of substance use among youth, young people are likely to encounter excessive peer-substance use and undesirable substance use attitudes, which significantly increases the chances that they experience pressure to use more than they want or intended to (Schulenberg et al., 1994; Borsari and Carey, 2001).

Increasing young people’s self-efficacy and skills to control their alcohol consumption and to withstand environmental pressure may help to decrease alcohol use in social drinking situations. The perceived ability to refuse alcohol in specific situations rather than whether or not one drinks has also been termed drinking refusal self-efficacy (Lee and Oei, 1993). Refusal self-efficacy has been shown to play a role in the amount of alcohol consumed (Baldwin et al., 1993). Adolescents with previous drinking experience reported lower drinking refusal self-efficacy compared with adolescents who had no prior experience with alcohol. Similarly, low refusal self-efficacy in social and opportunistic situations for young drinkers has been found to predict alcohol consumption (Young et al., 1991). In light of these findings, a recent Dutch national campaign on adolescent alcohol use aimed explicitly at increasing empowerment and self-efficacy to control alcohol use and to resist environmental influences. However, mass media campaigns seem mostly effective to increase knowledge and attitude change, but hardly seem to affect behaviour (Kleinjan and Engels, 2011). This might be in part because when adolescents are in actual substance use situations, environmental cues can easily take precedence over the effects of exposure to this information (see Verplanken and Wood, 2006). Therefore, it is crucial that interventions that target substance use are implemented within the context of use, e.g. by reminding adolescents of their own alcohol limits, their susceptibility to external—particularly peer and marketing—influences, and their intention to resist this pressure. We therefore created a visual reminder (cue) to the campaign that could be administered in the context of use, to increase the impact of the intervention.

This cue-reminder is a symbol (‘Power button’ Fig. 1) that represents resistance of external pressures, making your own choices and empowerment to guard your own limits. The idea behind the symbol is that one should be aware of and guard one’s own limits, thus to inhibit impulsive responses in risky social drinking situations. It has been found that inhibiting cues, when made salient, impede impulsive behaviours and counteract seducing or appealing cues or pressures present in that specific situation (MacDonald et al., 2000; Dal Cin et al., 2006). Cue-reminders, as a trigger, can increase the salience of a risky social situation and reinforce actions needed to avoid this situation, in particular, when individuals lack the cognitive capacity to reason (MacDonald et al., 2000; Dal Cin et al., 2006). Cue-reminders can thus be used to induce self-enhancing or self-protecting cognitions and actions. However, although promising, very little research has been done on the applicability and effectiveness of using cue-reminders with regard to health behaviours.
To obtain an indication of the possibilities of using a cue-reminder to target adolescent alcohol use, we conducted two experimental studies. The primary aim of these studies was to test the effectiveness of the ‘Power button’ as a cue in social drinking situations, to remind young people of how their environment influences their own alcohol use and how they can control their use. First, we examined the value of the ‘Power button’ as a cue-reminder by testing if the ‘Power button’ could be effectively associated with the message to be aware of environmental influences that affect use and with refusal skills and strategies to control one’s use. We aimed to test whether exposure to the cue-reminder facilitates recall of the prevention message. It was expected that an association can be created between the cue-reminder and the message of empowerment communicated by means of a short film that was developed as part of the campaign.

Next, the effect of the cue in a real-life drinking setting was examined. It was expected that, after having been exposed to an empowerment film on alcohol use with the cue, the presence of the cue within the drinking context would result in less alcohol consumption compared with a condition in which the cue was not present. Testing the cue-reminder in a real-life drinking setting is also especially relevant because cue-reminders were found to increase the salience of a risky situation in contexts in which individuals have been drinking (MacDonald et al., 2000; Dal Cin et al., 2006). A term that is often used to explain the psychological effects of alcohol intoxication is ‘alcohol myopia’. Alcohol myopia can be described as a state in which shallower cognitive processing occurs and attentional capacities are reduced (Steele and Southwick, 1985; Steele and Josephs, 1990). It is hypothesized that when drinking, weak cues for guiding behaviour will not be extensively processed. Because these weaker cues receive less attention, the most salient cues are more likely to guide behaviour when one has been drinking (Hirsh et al., 2011). Because the intervention targets youth who already have experience with drinking and for whom the cue-reminder is hypothesized to inhibit impulsive responses in social drinking situations (cf. MacDonald et al., 2000; Dal Cin et al., 2006), we additionally test if the effect of the presence of the cue-reminder on adolescent alcohol consumption is moderated by their general drinking patterns. Participants who have more excessive drinking patterns in general might be more likely to drink alcohol during the experiment and it is expected that the cue-reminder might be especially effective within the group of individuals with more frequent and intensive drinking patterns.

METHODS AND RESULTS OF STUDY 1

Development of the Power button and film

The ‘Power button’ is the essential part of the intervention and functions as the cue-reminder. The Power button was developed by the Trimbos Institute together with design studio M-CLASS. The Power button was designed as a symbol (pictogram) that represents making your own choices, resistance to external pressures and empowerment to guard your own substance use limits. The design of the Power button resembles the on-off button of a computer and the symbol is accompanied by the text ‘Power on-pressure off’, implying that everyone has the ‘Power’ to withstand peer pressure (e.g. you decide for yourself).

We aimed to create an effective association between the ‘Power button’ and the message of the film to be aware of environmental influences that affect use and strategies to control one’s use. The ultimate goal was that the cue by itself triggers recall of the prevention message communicated and portrayed in the film. The theme of the film was environmental pressure and alcohol use. It focused on social norms, pressure to drink, external influences of commercials and happy hours and refusal skills. Before the development and recording of the film, an expert meeting took place in which several experts in the area of substance use prevention and communication sciences took part. In this expert meeting, the content and pre-limiting conditions for the film were discussed, among which the framing of the message and strategies to prevent possible adverse effects, such as psychological reactance or the cue causing craving. This input was used in the development and editing of the film. Also, no controlling language was used (NOT: should, ought, must, need; BUT: could, can, may, may want to) (Miller et al., 2007) and the eliciting of negative emotions, for example, by obviously stating the negative consequences of the behaviour, were avoided (Brown et al., 1997).

Procedure

In December 2009, we started with Study 1. The aim of Study 1 was to test whether an effective association between the ‘Power button’ and the prevention message could be made by comparing cued memory performance after prior association of the cue with the prevention message to cued memory performance without prior association of the cue with the prevention message (De Houwer et al., 2001 for a review on associative learning). Hence, for Study 1, two versions of the film were made that were exactly similar except that in one version the ‘Power button’ was embedded (experimental condition) and in the other version the ‘Power button’ was not embedded (control condition). Two days after viewing the film, all participants received the same memory test in which a picture of the ‘Power button’ was present as cue-reminder for the message.

Participants were told that they took part in a study on lifestyle in which the effects of informative films on the lifestyle choices of youth was investigated. There were two sessions that took place in an educational room behind the computer.
During the first session, participants viewed three prevention films (i.e. the empowerment film on alcohol use, a film on safe internet use and a film about doing your own financial administration after turning 18). To prevent order-effects, the films were counterbalanced. Directly after the films, adolescents were asked to rate the films on being clear, funny, annoying, appropriate and informative on a 7-point scale ranging from 1 (not at all) to 7 (very).

Respondents were requested to return 2 days later for a follow-up. During the follow-up, the strength of the association between the cue and the prevention message of the film on alcohol use was assessed. Adolescents were asked to report what they remembered about the film by filling out a questionnaire. In both conditions, a picture of the ‘Power button’ was present as a logo on top of the online questionnaire and clearly visible for the participants.

**Participants**
Participants were 92 adolescents between 16 and 22 years (M = 17.5, SD = 1.45). A total of 62% was female. The respondents were recruited at four Regional Educational Centres (ROCs: lower professional training) in the Utrecht region in the Netherlands and were individually randomly assigned to two conditions (n = 46 per condition). A total of 73.2% of respondents indicated that they had consumed alcohol in the past weeks. On average, respondents drank 5.71 alcoholic consumptions per drinking occasion (SD 4.19).

**Outcome measure**
Cued recall
To assess storage of the message, we asked subjects to fill out a list following the sentence ‘Write down everything you can remember about the film on alcohol use’ while having the cue in sight on top of the page (cf. Lang et al., 1999).
Answers were coded for the occurrence of aspects of empowerment (e.g. the importance and ability of making your own choices and decisions with regard to drinking and respecting the choices of others) and refusal skills (e.g. referring to the different ways of withstanding offers of alcoholic drinks) that were key to the film. All answers on the cued recall task were coded separately by two independent judges. Statements regarded both aspects of empowerment and refusal skills. An answer received a score of 0 when none of the above was referred to. Disagreements between the two coders were solved by a third independent and blind coder. The third coder scored only items on which the initial two judges disagreed. The two initial judges were consulted on the final scores. No particular type of disagreement between coders was observed. Differences were never more than 1 point.

**RESULTS**
No differences between the experimental and control group were found in age, sex and self-reported alcohol use, indicating that randomization was effective. Next, we performed an analysis of variance in order to examine whether there were differences in cued recall between the two conditions. Results for cued recall showed that adolescents in the experimental condition referred significantly more to the concepts of empowerment and refusal skills compared with adolescents in the control condition [mean 2.00, SE 0.92 vs mean 1.52, SE = 0.96; F(1, 92) = 5.96, P = 0.017].

**Conclusion**
When comparing cued memory performance after prior association of the cue with the prevention message (experimental condition) to cued memory performance without prior association of the cue with the prevention message (control condition), it was shown that memory performance was better in the experimental condition. It thus seems possible to create an overall association between a symbol (cue-reminder) and information about empowerment, awareness and monitoring of one’s own limits, and refusal skills with regard to alcohol use by means of a short film.

**DESCRIPTION AND RESULTS OF STUDY 2**

**Procedure**
Study 2 was designed to test the effectiveness of the cue-reminder to reduce alcohol consumption in a real-life drinking setting, a bar on the campus. The study was conducted during the autumn of 2010. There were two conditions in Study 2 (cue present vs cue not present). The cue was added to the drinking situation by using double-sided coasters with pictures of the ‘Power button’. These were distributed on all the tables in the bar, including tables with non-participants. In the control condition, the cue was not present. All sessions took place between 4 p.m. and 9 p.m. (cf. Larsen et al., 2009). Participants were invited to take part in a ‘study on the evaluation of informative communication strategies’. This was a cover-up for the real aim of our study, which was to examine the effect of the cue-reminder intervention on alcohol consumption in a naturalistic ad lib drinking setting. The day prior to the session, participants individually watched a series of films online. The same three films as in Study 1 were used. This time, for all participants, the film on alcohol use was the version in which the cue was embedded. After watching the films, participants filled out an online questionnaire containing questions about their alcohol consumption, Internet use, and doing their administration. Also, participants were asked to answer some questions on alcohol-related cognitions and some questions to check whether they had actually watched the films. The next
day, participants were invited in groups to come to the laboratory. Participants were not acquainted to avoid strong peer selection effects. Once there, the experimenter told the participants that the laboratory was double-booked and they had to wait ~45 min in the bar. Participants were each given 6 Euros. They were told that they could use the 6 Euros to order whatever drinks they wanted, but that they had to provide us with the receipt of their purchases. As a check, in 25% of the sessions an observer was present in the bar to also code the drinks that were ordered. Receipts were perfectly congruent with the observations in all cases.

Participants
A total of 121 respondents were recruited on the campus of the Radboud University Nijmegen in the Netherlands and randomly assigned to the two conditions (n = 60 experimental condition; n = 61 control condition). Respondents who indicated they were total abstainers of alcohol were excluded, as well as one group that had their drinks outside because of the good weather and therefore could not see the cue. This left 107 university students (mean 20.9 years, SD 1.77); 63% was female (n = 53 experimental condition; n = 54 control condition). In total, there were 20 groups with on average 5.35 participants (SD 1.56; range 3–8).

Measures
General drinking frequency and quantity (baseline self-report)
To assess general drinking frequency, respondents were asked to report how often they had drunk alcohol in the past 4 weeks. On a 11-point scale, respondents could rate their drinking frequency ranging from 1 (every day) to 11 (no alcohol in the past month). General drinking quantity was assessed by asking respondents to indicate that if they had drunk alcohol in the past 4 weeks, and how many consumptions they drank on a typical occasion.

Observed alcohol consumption
Alcohol consumption was operationalized in two ways. First, we distinguished between having an alcoholic consumption (1) or having no alcohol consumption (0) during the ad lib drinking session. Second, we assessed the total number of alcoholic drinks consumed during the session.

Strategy of analyses
Results were analysed using Mplus version 5.1 (Muthén and Muthén, 1998–2007). Mplus was used because of its possibility to control for cluster effects (cluster analysis: type = complex; cf. Kuntsche and Jordan, 2006). Alcohol use was assessed at the individual level and students participated in groups. The applied statistical procedure corrects the standard errors of the parameter estimates for dependency leading to unbiased estimates. The outcome measures were: (a) alcohol consumption or no alcohol consumption, and (b) number of consumptions. Interaction effect of condition with drinking frequency and quantity were assessed by computing interaction terms and adding these to the equations (drinking frequency and quantity were centred before computing the interaction terms).

RESULTS
No differences between the experimental and control group were found in age, sex, self-reported drinking frequency and quantity and intention to decrease drinking, indicating that randomization was successful. Table 1 shows the reported general drinking frequency and quantity by condition and gender at baseline.

With regard to the real-life drinking situation, Table 2 shows that there are no significant differences between the experimental and control condition in the proportion of respondents that drank alcohol and the average number of alcohol consumptions during the sessions per participant.

We additionally assessed the interactive effects of condition with general drinking frequency and quantity as reported in the baseline questionnaire. There were significant interaction effects between general drinking frequency and condition in relation to both outcome measures (β = −0.24, P = 0.027; R²-change = 0.05 and β = −0.24; P = 0.035; R²-change = 0.05). Interpretation of the first interaction effect as determined by a split half of general drinking frequency showed that within the group of participants who reported more frequent drinking in general, a significantly lower percentage drank alcohol in the bar in the experimental condition (with cue-reminder) compared with the control condition (without cue-reminder). This difference was not observed for the participants who reported lower drinking frequency in general (Fig. 2). Interpretation of the second interaction effect showed that the group of frequent drinkers in general, drank less alcoholic consumptions in the bar in the experimental condition (with cue-reminder) compared with the control condition (without cue-reminder). This difference was less strong for the group that reported less frequent drinking (Fig. 3).

There were no significant interaction effects between general drinking quantity and condition in relation to both outcome measure (β = −0.04; P = 0.80; R²-change = 0.00 and β = −0.06; P = 0.69; R²-change = 0.00).
correlations for the alcohol use outcome measures were 0.069 and 0.155, respectively, indicating that 6.9% of the variance in the occurrence of alcohol use and 15.5% in the amount of alcoholic consumptions in the drinking sessions could be explained by a group effect.

Conclusions

There was no main effect of condition on the drinking outcome variables. However, the presence of the cue within a real-life drinking situation resulted in less alcohol consumption among frequent drinking university students. Results indicate that by implementing the Power button in contexts where substance use takes place, it has the potential to function as a cue-reminder and subsequently affect momentary substance use for frequent drinkers.

GENERAL DISCUSSION

Previous research focusing on health behaviours already showed to some extent that cues can be 'installed'. In the study by Dal Cin et al. (2006), a ‘friendship’ bracelet was used as a cue to remind adolescents of the content of a prevention videotape on sexually transmitted diseases that emphasized the potential harmful consequences of unsafe sex. In this study, participants were instructed to remember these consequences when looking at the bracelet. It was found that condom use at last intercourse was higher among participants in the bracelet condition compared with control conditions. In line with these findings, our results indicate that by implementing the Power button in contexts where alcohol use takes place, it can function as a cue-reminder to inhibit adolescent’s alcohol use.

Results showed that the Power button seems to be mostly effective in preventing alcohol consumption for adolescents who reported highly frequent drinking patterns. An explanation for the interaction effect between condition and baseline drinking frequency could be that in our population (i.e., university students) the frequency of drinking occasions may be greatly influenced by social factors; during college the opportunities to consume alcohol usually stridently increase (Thombs, 1999; Johnston et al., 2000). Students who have ample social opportunities to drink may be more likely to be classified as frequent drinkers in this study. In this group, the presence of the cue-reminder may have affected drinking behaviour by triggering the intention or ability to abstain or hold back from alcohol in yet another drinking situation. In
the control group, where the cue-reminder was not present, no significant differences in alcohol consumption between the groups of high and low frequent drinkers were observed. In contrast to general drinking frequency, no significant interactive effects of condition with general drinking quantity were observed. A possible explanation for the absence of an interaction effect with general drinking quantity might be the limited duration of the session. Because the sessions only lasted for 45 min, the maximum amount of consumptions was two or three (only one individual drank three alcoholic consumptions). Individuals who generally drink more alcoholic consumptions might drink two consumptions in our experiment without having the feeling that they are drinking more than they want, mostly because they are used to drinking much more. The presence of the cue in this experimental situation might therefore not affect high-quantity drinkers.

Some limitations of our study should be addressed. In Study 1, only youth from lower professional education institutes were included, whereas Study 2 focused solely on university students. In addition, the time between watching the films and the experimental and control sessions differed between Study 1 (2 days) and Study 2 (one day). Finally, the sessions in Study 2 only lasted 45 min, whereas generally one would spend more time in a bar. Consequently, we do not know the effect of the cue over time and whether the cue would work for high-quantity drinkers if there was the opportunity to drink more. This is an important caveat, since increasing levels of alcohol consumption can lead to less inhibition or self-control and therefore (partly) overrule effects of the cue. Finally, although the ecological validity of the real-life study is high, this does not mean the external validity is as high. In order to generalize the findings to other settings, replication of these results in more elaborate and different designs, and among a larger and more representative population of late adolescents and young adults is necessary.

Other directions for future research include examining whether the cue remains effective in inhibiting alcohol use if participants are in drinking situations with their friends. Even though, in the present study, we observed drinking in a naturalistic drinking setting controlling for the influence of peer drinking, the participants were not acquainted. Adolescent and young adult alcohol consumption is primarily concentrated in contexts with friends and previous studies have shown that adolescent drinking behaviour is sensitive to friends’ drinking (e.g. Bot et al., 2005b; Burk et al., 2012). To generalize research outcomes to real drinking situations, it is important that future studies on the effectiveness of the cue-reminder measure drinking behaviour in a real-life context in friend groups.

A final suggestion for further research includes testing the effectiveness of using cue-reminders when participants have already consumed a certain amount of alcohol. Since the alcohol myopia theory posits that intoxicated individuals no longer have the necessary processing skills to deal with all of the information and impulses in their environment, the cue would have to be very salient and noticeable in a drinking context to attract attention. If powerful cues promoting safe behaviour are prominent, alcohol myopia theory makes the counter-intuitive prediction that alcohol could actually lead to more cautious behaviour (Steele et al., 1985; Steele and Southwick, 1985; Steele and Josephs, 1990). If cues provoking an impulsive choice are more salient than cues inhibiting that choice, alcohol increases impulsivity. This is also what MacDonald et al. (2000) found in their study on the effects of alcohol on intentions to engage in risky behaviour. When strong inhibiting cues were present, intoxicated individual reported more cautious intentions compared with individuals who had not consumed any alcohol.

While the consequences of excessive drinking are clear, effective ways to prevent or intervene in excessive drinking have hardly been established. Mass media campaigns that aim at decreasing excessive drinking levels in adolescents are generally broad and simplistic, a problem worsened by the fact that adolescent and young adult populations are very hard to reach (Treise et al., 1999; Oei and Morawski, 2004). Previous research on determinants of harmful adolescent drinking patterns has largely focused on demographic or individual factors that are very difficult, if not impossible to change. Targeting more modifiable factors in drinking, such as enhancing behavioural control strategies and providing a reminder of these strategies within settings of use, may form a more promising method to address the problem of excessive alcohol use among youth in social drinking situations. To implement the Power button as a cue-reminder, it should thus be implemented in places where youth experiment with or actively use substances. One way to implement the cue-reminder in establishments where youth go out, such as bars, cafes or school parties is by means of existing marketing tools. For example, special coasters with the cue on them could be distributed in cafés that are popular among youth or at school parties. However, to optimize chances of successful implementation in the catering industry, active involvement of the industry (people who own or work in bars, disco’s etc.) is warranted. To ensure that implementation is feasible and realistic, it is important to involve this particular group in the implementation of the cue-reminder.

To conclude, our first study showed that it is possible to create an association between a symbol (the Power button) and information about empowerment, awareness and monitoring of one’s own limits. A second study in a real-life setting even suggested that the cue may have an inhibitory effect on alcohol consumption among young frequent drinkers. Given the detrimental health effects of alcohol, together with the vastness of the target population and the high prevalence of use within social drinking situations, the use of this cue-reminder intervention has the potential to have a significant effect on public health.

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