RUNNING HEAD: Responsible drinking messages

The effects of responsible drinking messages on attentional allocation and drinking behaviour

Antony C. Moss1, Ian P. Albery1, Kyle R. Dyer2, Daniel Frings1, Karis Humphreys1, Thomas Inkelaar1, Emily Harding1, Abbie Speller1

1Department of Psychology, School of Applied Science, London South Bank University, 103 Borough Road, London, SE1 0AA, United Kingdom;

2Institute of Psychiatry, King's College London, Addictions Sciences Building, 4 Windsor Walk, Denmark Hill, London, SE5 8AF, United Kingdom.

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Correspondence concerning this manuscript should be addressed to: Antony C. Moss, Tel. 0207 815 5777, Email: mossac@lsbu.ac.uk.

**Abstract**

Aims: Four experiments were conducted to assess the acute impact of context and exposure to responsible drinking messages (RDM) on attentional allocation and drinking behaviour of younger drinkers and to explore the utility of lab-based methods for the evaluation of such materials.

Methods: A simulated bar environment was used to examine the impact of context, RDM posters, and brief online responsible drinking advice on actual drinking behaviour. Experiments one (n = 50) and two (n = 35) comprised female non-problem drinkers, while Experiments three (n=80) and 4 (n = 60) included a mixed-gender sample of non-problem drinkers, recruited fro m an undergraduate student cohort. The Alcohol Use Disorders Identification Test (AUDIT) was used to assess drinking patterns. Alcohol intake was assessed through the use of a taste preference task.

Results: Drinking in a simulated bar was significantly greater than in a laboratory setting in the first two studies, but not the third. There was a significant increase in alcohol consumption as a result of being exposed to RDM posters. Provision of brief online RDM reduced the negative impact of these posters somewhat; however the lowest drinking rates were associated with being exposed to neither posters nor brief advice. Data from the final experiment demonstrated a low level of visual engagement with RDMs, and that exposure to posters was associated with increased drinking.

Conclusions: Poster materials promoting responsible drinking were associated with increased consumption amongst undergraduate students, suggesting that poster campaigns to reduce alcohol harms may be having the opposite effect to that intended. Findings suggest that further research is required to refine appropriate methodologies for assessing drinking behaviour in simulated drinking environments, to ensure that future public health campaigns of this kind are having their intended effect.

Keywords: responsible drinking messages; attention; alcohol; eyetracking; simulated bar; student drinkers

The effects of responsible drinking messages on attentional allocation and drinking behaviour

 Public health campaigns which aim to educate individuals regarding the potential harms of alcohol and how to drink in a responsible manner are one of the first lines of defence against alcohol-related harms (Marlatt & Witkiewitz, 2010). Fear based campaigns designed to manipulate the threat experienced when an individual considers taking action have been questioned (Ruiter, Abraham & Kok, 2001). Work has shown that the presentation of fear evoking information whilst creating increased accessibility of harm-related thoughts (e.g. Jessop, Albery, Rutter & Garrod, 2008) will also result in increased intentions to drink (Jessop & Wade, 2008) and smoke (Hansen , Winzeler & Topolinski, 2010) as well as increasing pre-existing smoking cravings (Arndt et al, 2013). Whilst this effect has been shown in the context of fear-related information, little evidence has accrued for the operation of this type of effect in messages framed to engender responsible behaviour. Responsible drinking messages (RDM) are commonly conveyed as a subcomponent of industry marketing materials (e.g. ‘Drink Responsibly’ messages printed on posters) as well as more directly through public health media campaigns. Evaluations of RDM campaigns suggest that they are effective in improving knowledge of the principles of responsible drinking behaviour (Kalsher, *et al*., 1993), that they may be effective in improving drinkers’ knowledge about the effects of alcohol (Fenaughty & MacKinnon, 2011), and may lead to greater intentions to drink responsibly (York *et al*., 2011). However, no research to date has explored whether such changes in knowledge, belief or intention actually achieve their aim of making prospective drinking behaviour ‘more responsible’. One review concluded that there is little evidence for the effectiveness of media-based responsible drinking campaigns in terms of changing drinking behaviour (Anderson *et al*, 2009; Wakefield *et al*., 2010). Our own research demonstrates that the association between knowledge of responsible drinking, the harmful consequences of alcohol misuse, and actual drinking behaviour is complex. We reported high rates of harmful/hazardous drinking amongst medical students, despite this cohort demonstrating a high level of knowledge of alcohol-related harms and responsible drinking guidelines (Moss *et al*., 2009).

 Schilling and McAlister (1990) discussed some of the difficulties involved in evaluating media-based public health campaigns, noting that attempts to discern whether individual-level changes in drinking are due to a direct effect of a campaign, or multiple other factors, is fraught with methodological difficulties. In particular, lab-based evaluations lack ecological validity and retrospective reports of drinking can be unreliable (although the use of in vivo measures using mobile phone technology may offer a more reliable means of assessment in drinking contexts, see Monk & Heim, 2014). It has been argued that the effects of being in an alcohol-related context for priming the operation of related cognitions (e.g. expectancies) is fundamental in explaining differential alcohol consumption patterns seen in “wet” versus “dry” conditions (Lau-Barraco & Dunn, 2009; Roehrich & Goldman , 1995; Wall, McKee & Simpson, 2000). The role of context in the operation of alcohol-related cognitions and drinking behaviour has been highlighted across a number of studies. For instance, in assessing whether an individual’s attentional preference for alcohol-related cues generalised to conditions outside of the laboratory, Schoenmakers and Wiers (2010) demonstrated decreased attentional preference relative to the amount of alcohol consumed in a bar environment but that urges and cravings to drink were maintained as a function of amount consumed. This evidence showed that when a person has started to consume alcohol in a relevant environment, the need to search out alcohol-related cues diminishes but the desire to drink is maintained or exacerbated with increasing intoxication. Other work showed that participants who viewed a panoramic (widescreen) video of a lecture hall or a bar whilst completing consumption-related measures (Monk & Heim, 2013a), and who completed measures in a lecture hall or in a real bar (Monk & Heim, 2013b), showed more positive alcohol expectancies and decreased perceived control in the bar conditions.

 In this paper we report a series of studies undertaken in a bespoke simulated bar environment. This type of environment has been shown to be useful for examining the accessibility and activation of alcohol-related cognitions and alcohol consumption behaviour in a context which provides a degree of experimental control, while more closely approximating actual drinking situations for the participant (Wall *et al*., 2001; Wigmore & Hinson, 1991). Specifically, we explored the effects of context and RDM materials (taken from a national campaign in the UK funded by the Drinkaware Trust to reduce alcohol-related harm) on young drinkers’ alcohol intake. In experiments 1 and 2 we recruited a female-only sample, given the relatively greater risks associated with female binge drinking (Gill & O’May, 2006), to validate our simulation methodology and examine any effects of an RDM poster campaign respectively. In experiment 3, we examined the effects of two different components of an existing RDM in a mixed-gender sample. Finally, an eyetracker was used to determine how participants engaged with health messages presented in RDM and the impact that this had on drinking.

Experiment 1: Validation of a Simulated Bar Environment

**Method**

**Participants**

 Fifty non problem drinking female participants (*M*age=23.8 years, *SD*=4.4, range=18-28) took part in a taste preference task (TPT) in return for course credit. Potentially dependent drinkers scoring higher than 21 on the Alcohol Use Disorders Identification Test (AUDIT, Saunders *et al*., 1993) were excluded from participation. The mean AUDIT score for included participants was 8.53 (*SD* = 3.64, *range*=2-18).

**Design**

 The independent variable in this study was Context (Bar vs. Lab). The dependent variables were total amount of non-alcoholic beer/wine (millilitres) and the total amount of cola (millilitres) consumed during a TPT. Presentation order of beer, wine and cola was counterbalanced across participants. The reason for using non-alcoholic beverages was that study did not require the administration of alcohol, only the perception that the beverages contained alcohol.

**Materials**

**Simulated bar.**A purpose-built laboratory facility was created to resemble a bar-like environment with a 6ft by 5ft bar counter and bar stools, beer taps, and other alcohol-related paraphernalia displayed. Participants taking part in the TPT in the bar condition were sat at the bar counter. Another room in the psychology laboratory was used for the lab context condition. These rooms were of similar size and on the same side of the building, ensuring a near-identical window.

**Taste preference task (TPT).** Participants were provided with two different brands each of non-alcoholic beer, non-alcoholic white wine, and cola. The inclusion of soft drinks in this task provides a means of assessing whether changes in drinking are specific to particular beverage categories. Two hundred millilitres of each beverage were given (a combined total of 1200ml). Beverages were served in plain 330ml drinking glasses. Participants were asked to evaluate each beverage using 5-point Likert scales related to different characteristics of the drinks (e.g. flavour, aroma, etc.), and to indicate which beverage in each pair they preferred. There were a total of 5 rating scales per beverage type, with each Likert scale being specific to the beverage (e.g. for wine, one scale ranged from ‘Dry’ to ‘Sweet’). These ratings were intended to provide credibility to the TPT, such that participants would believe we were interested in their evaluation of these characteristics, rather than volume consumed. Participants were instructed that they should drink as much of each as necessary to make a comparison and provide each rating. The experimenters allowed a maximum of 15 minutes to complete the TPT, though in practice in this and all subsequent studies, participants all finished the task more quickly than this. All participants were led to believe that the beverages were alcoholic. In this and the two subsequent experiments, qualitative data from funnelled debriefing interviews (see Procedure section, below) suggested that participants were not aware that the beverages were in fact non-alcoholic.

**Procedure**

 Participants were randomly allocated to either the bar or lab condition. Random allocation in this and subsequent studies was achieved using a random number generator at the start of the study to produce a random sequence of conditions, to which each participant was assigned on entry to each study. After informed consent was obtained participants were invited to sit at the bar, or at a desk in the lab. Six beverages were then lined up in pairs in front of the participants and they were asked to carry out the TPT. Following the TPT a funnelled debriefing procedure was conducted to ascertain whether the deception had been successful by asking each participant to indicate whether they felt that any aspect of the study differed from how it had been described to them initially (see Bargh & Chartrand, 2000). If suspicions regarding the actual nature of the task were indicated, participants were then asked to elaborate on what they thought the real purpose of the study was. No participants reported awareness of the true study aim.

**Results and Discussion**

 Initial results showed that there was no significant difference in the mean amount of beer (*M*=56.9ml, *SD*=55.8) and wine (*M*=67.8ml, *SD*=57.8) consumed, *t* (49) = 1.3, *p* > .05, and these two variables were combined to create a combined alcohol consumption variable.

**Effects of Drinking Context on Beverage Consumption**

 A one-way between participants multivariate analysis of covariance was conducted on both beer and wine, and soft drink consumption, with Context (Bar vs. Lab) as a between-participants factor and AUDIT scores as a covariate to control for differences in drinking behaviour. There was no significant main effect of Context on the combined drinking variables, *F* (2, 46) = 2.65, *p* > .05, n.s., and AUDIT scores were not significantly related to consumption variables, *F* (2, 46) = 0.25, *p* > .05, n.s. Univariate ANOVAs revealed that the effect of Context had a significant effect on beer and wine consumption, *F* (1, 47) = 4.34, *p* <.05. On average, participants in the bar drank more (*M* = 154.8ml, *SD* = 107.9) than participants in the lab (*M* = 94.6, *SD* = 75.5) (95% CI=1.9 to 114.6). There was no effect of Context on soft drink consumption, *F* (1, 47) = 0.05, *p* > .05, n.s, (bar mean=89.2ml, *SD*=57.6; lab mean=79.8ml, *SD*=83.7; 95% CI=-38.5 to 48.1). Consistent with previous research (e.g. Lau-Barraco & Dunn, 2009; Wall *et al*., 2001;Wigmore & Hinson, 1991), these findings demonstrate that being in a bar context showed increases in drinking, that this drinking was specific to beverages *assumed* to contain alcohol, and that this effect was not influenced by differences in drinking patterns (AUDIT score).

Experiment 2: Effect of RDM Posters and Context on Alcohol Consumption

**Method**

 An identical methodology was used as in experiment 1 with a sample comprising 35 non problem drinking females (*M*age=23.2 years, *SD*=3.5, range=18-26). An additional independent variable, Responsible Drinking Posters (RDP), was included in this experiment. Five posters from a UK wide campaign entitled “Why let good times go bad” promoting responsible alcohol consumption were displayed on walls in front of half of the participants in both the bar and lab contexts. Each poster contained a specific message related to responsible drinking behaviour (available at: http://www.drinksinitiatives.eu/details-dynamic.php?id=313). Control posters advertising university academic services were displayed to the other half of participants. All posters were 297 × 420 mm, displayed in portrait orientation at eye-level.

 **Results and Discussion**

 A two-way between-participants ANOVA was conducted on the alcohol consumption data. Replicating the findings from Experiment 1, participants consumed significantly more beer and wine in the bar (*M* = 230.6ml, *SD* = 90.6) than the lab (*M* = 126.5, *SD* = 44.4), *F* (1, 31) = 18.3, *p* < .001 (95% CI=52.1 to 146.9). Further, we found that in conditions where RDPs were displayed, participants drank significantly more (*M* = 210.6, *SD* = 87.3) compared to those who were exposed to the control posters (*M* = 147.6, *SD* = 79.7), *F* (1, 31 = 5.5, *p* < .05, (95% CI = 7.09 to 101.91). The Context × RDP interaction term was not significant, suggesting that both context and RDP had an independent effect on consumption, *F* (1, 31) = 0.006, *p* > .05, n.s. (see Figure 1).

[INSERT FIGURE 1 HERE]

 In essence the presence of RDPs when drinking related to an increase in beer and wine consumption. However, the ‘full’ Drinkaware Trust campaign from which these posters were drawn also included online information about responsible drinking, comprising practical advice on how to avoid alcohol-related harms and an explanation of the messages displayed within each poster. To explore the impact of the full intervention, experiment 3 replicated study 2 with the inclusion of an additional condition during which participants were asked to read the information provided online by the Drinkaware Trust i.e. that which accompanied the posters used.

Experiment 3: Effect of Online Responsible Drinking Advice and Responsible Drinking Posters on Consumption

 In this experiment we examined the effects of providing responsible drinking advice via an online resource before participants were exposed to the posters and the TPT. We tested the hypothesis that providing participants with such information outside of a drinking context would result in the posters acting as a cue for the RDMs and result in reduced beer/ wine consumption. Finally, we explored whether any effects shown previously were evident amongst both male and female drinkers. The inclusion of male participants in the subsequent two studies provided an opportunity to determine whether the effects observed in the previous studies were dependent on gender.

**Method**

 Eighty non problem drinking participants (30 male, 50 female; *Mage*=21.4 years, *SD*=1.5, *range*=18-23) took part in this experiment, with additional website information (http://www.drinkaware.co.uk/campaigns/2010/why-let-good-times-go-bad, retrieved 3rd July 2012) being presented to half of the participants in a separate room to that used for the TPT. To encourage engagement with the content participants were asked to read the information carefully and were informed that they would be asked questions about the information contained within the website afterwards. As in the previous two experiments, the AUDIT questionnaire was used to screen potentially dependent drinkers. The design of this study followed the same format as Experiment 2, with the addition of the brief information as a new independent variable.

**Results and Discussion**

 Initial analysis showed no main effect of drinking context nor any significant interactions involving it and for ease of interpretation a two-way ANOVA has been presented. An analysis by gender was also found to be non-significant and was not included in the analysis. All effects reported here remained when a three-way model, including either gender or context, was used. Replicating results found in experiment 2 the two-way ANOVA showed that participants presented with RDPs drank significantly more (*M* = 111.0, *SD* = 44.6) than those who were not (*M* = 74.6, *SD* = 49.6), *F* (1,76) = 12.7, *p* < .001 (95% CI = 16.1 to 56.9). There was no effect of presenting online information on consumption, *F* (1,76) = 0.76, *p* > .05, n.s. (95% CI = -11.5 to 29.3),but the RDP x Online Information conditions interaction was significant (see Figure 2), *F* (1,76) = 5.67, *p* < .05. Simple effects analysis revealed that when online information was not presented, those presented with RDP showed significant increased consumption, *F*(1, 76)=17.7, *p* < .001 (95% CI = 32.04 to 89.76), replicating experiment 2. This effect was not evident when online information was presented, F(1, 76)=0.70, *p*>.05, n.s. (95% CI = -16.76 to 40.96). When RDPs were presented, participants who had read the online information drank significantly less than those who did not see this information, *F*(1, 76)=5.3, *p* <.05( 95% CI = 4.44 to 62.16). When the RDPs were not displayed, there was no effect of Online Information on consumption, *F*(1,76)=1.1, *p*>.05, n.s. ( 95% CI = -44.36 to 13.36). Finally, a planned comparison between the control group (no RDP, no Online Information) and the group who received the full Drinkaware intervention (RDP and Online Information) showed that while those receiving the full intervention drank on average more (*M* = 94.42ml, *SD* = 35.24) than those in the control condition (*M* = 66.8, *SD* = 59.28), this difference approached but did not reach statistical significance, *F* (1, 76) = 3.63, *p* > .05, n.s. (95% CI = -1.26 to 56.46). These findings replicate previous findings in relation to the effect of RDPs on consumption in a pub context, however it would seem that previous exposure to brief online information related to the poster content eliminates this effect. Importantly, while online advice negated the effects of the posters, the omnibus effect of this intervention did not lead to a decrease in consumption compared to the control group.

[INSERT FIGURE 2 HERE]

Experiment 4: Attentional allocation in RDM posters

 In the previous experiments we displayed posters in an environment where participants were drinking to examine what effect such passive and ‘naturalistic’ exposure might have on consumption. An obvious limitation of this approach is that we were unable to determine 1) whether the posters were being attended to at all, 2) what elements of the posters participants were attending to, and 3) if there was any relationship between attention to different elements of the posters and consumption. To address these limitations in our final study participants were exposed to posters while their eye movements were being monitored and were then asked to complete the TPT. This allowed us to more accurately determine how participants engaged with the posters and to examine whether this more active engagement with the materials would have a different effect on consumption rates. In addition to presenting posters from the Drinkaware campaign, an additional set of posters from a UK health campaign (‘Change4Life’, National Health Service) was also included, allowing us to compare the impact of messages regarding responsible alcohol use and messages which promote healthy behaviour without direct reference to alcohol consumption.

**Method**

**Participants**

 Sixty non problem drinking participants (27 female; 33 male; *Mage*=22.3 years, *SD*=2.2; range=18-25) took part in a TPT in return for course credit. Potentially dependent drinkers were again screened using AUDIT (*M*=10.96, *SD*=5.28), and two participants were subsequently excluded who had scores over 21. A significant difference in AUDIT scores between the two poster conditions (Drinkaware [DA]: *M*=13.1, *SD*=5.3; Change4Life [C4L]: *M*=9.2, *SD*=4.6; Overall: *M*=11.5, *SD*=6.0) was observed, *t* (55) = 3.01, *p* < .01. As a result, AUDIT scores were included as a covariate/predictor in analyses. Analyses of the distribution of drinker types (light vs. heavy, based on AUDIT cut-off scores suggested by Aalto, Alho, Halme, & Seppä, 2009) showed that there was no significant association between drinker type and poster condition, *χ2*(1) = 1.19, *p* < .05, n.s.

**Design**

 The independent variables in this study were Poster Type (DA vs. C4L) and Elaboration Condition (Elaboration vs. No elaboration). The dependent variables were the amount of non-alcoholic beer and wine and orange juice consumed (millilitres) during the TPT. The order in which beverages were presented was randomised across participants, as was the order in which posters were presented.

**Materials**

**Posters and eyetracker.** The two types of poster used in this study were taken from national campaigns in the UK conducted during 2012. The first set of posters was the most recent iteration of those used in the Drinkaware Trust’s *Why let the good times go bad?* campaign. These posters comprised a ‘before and after’ format, with images depicting young people both having a good time, and ostensibly experiencing negative effects of drinking excessively. In addition, each poster also contained a piece of practical advice to encourage responsible drinking (e.g. ‘Alternate alcoholic drinks with soft ones’). An example of this type of poster is shown in figure 3. The second type of poster was taken from the Change4Life campaign (see figure 4) encouraging a range of different health behaviours. These posters are composed of a large illustration and a health message. The Change4Life posters also contain a simple and practical message intended to encourage healthy behaviour (e.g. ‘Try swapping 4 wheels for 2 feet’).

[INSERT FIGURES 3 AND 4 HERE]

 Five posters from one of these campaigns were presented to participants in each condition on a computer monitor while they were seated at an Eyelink-1000 stationary eyetracking device. Each poster was presented for 10 seconds, with a 20 second interval between each presentation. During the interval, participants were asked to note down everything they could remember seeing from each poster. This task was included to try and motivate participants to attend to all aspects of each poster.

**Elaboration task.** Participants in the elaboration condition were asked to spend two minutes verbalising what they thought the key messages were from the posters they had seen. This manipulation was intended to encourage these participants to consider the contents of the posters in greater depth and detail.

**Taste preference task.** As in the previous experiments participants were presented with pairs of beer, wine and orange juice and the experimenter recorded the total volume consumed of each at the end of each session.

**Procedure**

 On arrival in the laboratory participants were briefed on the nature of the study and consent requested. Participants were then asked to sit down at the eyetracker, and calibration checks were performed to ensure that accurate eye movement data was recorded. Calibration checks were carried out in between the presentation of each of the five posters to correct any drift which might occur. Those participants in the elaboration condition were asked to speak for up to two minutes regarding ‘responsible alcohol use’ or ‘healthy living’, depending on the posters they had been exposed to. All participants then completed the TPT and completed the preference ratings for each type of beverage. Finally, a funnelled debriefing was carried out before participants were fully debriefed on the nature and aims of the study.

**Results and Discussion**

**Effects of Poster Type and Elaboration on Consumption in the TPT.**

 A two-way ANOVA was conducted on the consumption data with poster type (DA vs. C4L) and Elaboration Condition (elaboration vs. no elaboration) as between-participants factors and AUDIT score entered as a covariate. Consumption data for each group is shown in table 2.

[TABLE 1 HERE]

 Results showed a significant main effect of poster type on consumption, *F* (1,57) = 12.67, *p* < .01, 95% CI = 8.39 to 132.78). Participants exposed to the DA posters drank significantly more than those exposed to the C4L posters. There was no significant main effect of Elaboration Condition, *F* (1, 57) = 0.004, *p* > .05, n.s., nor a significant Poster Type X Elaboration interaction, *F*(1, 57)=0.12, *p*>.05, ns. Finally, AUDIT scores did not significantly adjust the dependent variable in the model, *F* (1, 57) = 2.81, *p* > .05, n.s.

**Eyetracking Data**

 To allow for an analysis of the areas of each poster type which participants were attending to a number of interest areas were defined for each type of poster. Within each type of poster the same interest areas were defined for each of the five posters, though obviously the interest areas for each poster type differed. Figures 3 and 4 highlight the interest areas which were defined for each type of poster.

 Each of the five posters was displayed for 10 seconds for DA and C4L poster conditions. As interest areas did not cover the entirety of each poster, an independent samples t-test was conducted to see if there was a significant difference in the total amount of time participants spent attending to interest areas across poster type conditions. Results showed that there was no significant difference in overall dwell times in the DA (*M* = 40.31 seconds, *SD* = 4.82) and C4L (*M* = 38.34, *SD* = 7.34) conditions, *t* (56) = 1.22, *p* > .05.

**Initial fixations***.*We first examined initial fixation data which shows the areas of each poster type which were attended to first by participants. As all participants were required to orient attention centrally to the screen prior to each poster being displayed, initial fixations were defined as the first fixation made within 500ms of each poster being displayed. This allowed us to explore which area participants were drawn to immediately after each stimulus was presented. Figures 5 and 6 show the percentage of first fixations for each interest area. The comparable interest areas across each poster type are the areas which contain the key health message (in the DA posters, the RDM message; in the C4L posters, the healthy behaviour message). It is evident from this data that substantially more initial fixations were towards the key message in the C4L posters (48%), compared with just 3% in the DA poster condition. Also of interest is that within the DA poster condition, 69% of initial fixations were towards the positive imagery within the posters.

[INSERT FIGURES 5 AND 6 HERE]

**Overall time spent looking at the health message in each poster condition.** While initial the fixation data would suggest that the health message in the C4L posters is more attention grabbing than in the DA posters, of arguably greater importance is the total amount of time spent attending to the health message during the 10 seconds that each poster was displayed. For each participant the total amount of time spent attending to the health message across all 5 posters was calculated and an independent samples t-test carried out to compare poster type differences in these times. Results showed that participants in the C4L condition spent significantly more time (*M* = 14.82 seconds, *SD* = 5.81) attending to the health message compared to those in the DA condition (*M* = 7.99, *SD* = 5.64), *t* (56) = 4.55, *p* < .001). This translates as participants spending on average 2.96 seconds out of a possible 10 seconds attending to the health message in each C4L poster, and 1.6 seconds attending to the responsible drinking message in the DA posters.

**Time spent attending to each interest area by poster type.** For each poster type a one-way repeated measures ANOVA was conducted using interest area location as a within participants factor and total dwell time as the dependent variable. For the DA posters the interest areas were the responsible drinking message (RDM), positive imagery, negative imagery and the Drinkaware URL. For the C4L posters the interest areas were the health message, the illustration, further information link and the C4L logo. Results showed significant main effects for interest area type for both the DA posters, *F* (3, 78) = 40.79, *p* < .001, and the C4L posters, *F* (3, 90) = 137.36, *p* < .001. Post hoc comparisons demonstrated that in the DA condition participants spent significantly longer attending to the positive and negative imagery than to the RDM (*p*s < .01), and significantly longer looking at the RDM than the Drinkaware URL (*p* < .001). There was no significant difference in the time spent attending to the positive and negative regions (*p* > .05). In the C4L condition, dwell time for the health message was significantly longer than for the further information and logo interest areas (*p*s < .001), and participants spent significantly longer attending to the illustration than the health message (*p* < .05).

[TABLE 2 HERE]

 These findings confirm our findings in the previous two studies that exposure to RDM posters is associated with increased consumption in the TPT. This study extends these findings by showing the effect persists even when participants are required to actively attend to the posters as a task requirement. The finding that elaborating on the messages within the posters did not have an effect on consumption may represent a ceiling effect (i.e. all participants were engaging in a degree of elaboration of the message, irrespective of whether they were asked to do so) or an inadequacy of the elaboration manipulation used here to produce any additional effects on consumption than seemed to be caused by exposure to the posters during the eyetracker task.

 Eye movements data revealed some important differences in the attention paid to the content within each type of poster. Firstly, it was clear that initial orientation towards the health message was substantially lower in the DA condition compared to the C4L condition – a simple observation of each poster type would lead one to conclude that this is due to the difference in relative prominence of these messages across each type of poster. Beyond these initial fixations, participants in the DA conditions still spent approximately 50% less time attending to the health message compared with the C4L condition. These findings suggest that the design and layout of the DA posters led to the key health message being less salient to participants.

**General Discussion**

 One of our first objectives was to assess the utility of a simulated bar environment for the observation and measurement of drinking behaviour, using a taste preference task. Experiments 1 and 2 suggested that this environmental manipulation was associated with increased drinking, consistent with our expectations, but this finding was not replicated in experiment 3. This inconsistency in context effects on drinking is indeed consistent with previous research, where equivocal outcomes have been observed (e.g. Fromme & Dunn, 1992; Lau-Barraco & Dunn, 2009). This suggests that further research is required to explore factors which might moderate the effects of context priming on drinking behaviour. Such factors, which were not controlled for or assessed either in our own or previous studies, could include time of day, urges to drink alcohol, and differences in individual drinking patterns (e.g. whether participants tend to drink predominantly in bar environments or elsewhere).

 A consistent finding across experiments 2-4 was that exposure to posters containing RDMs led to increased consumption during the TPT. This so-called boomerang effect has been observed previously, whereby drinkers who are exposed to alcohol health warnings actually report fewer perceived risks from alcohol than those who have not been exposed (Jessop & Wade, 2008; Snyder & Blood, 1992). While the evidence for this effect is equivocal (MacKinnon & Lapin, 1998), reviews in the field of health intervention research demonstrate that the same effect is observed in other areas of health behaviour. Ringold (2002) suggested that one reason for this counterintuitive effect is that instead of acting as cues to discourage health risk behaviours, warnings serve to make the target behaviour salient, thereby increasing the likelihood of subsequent enactment of the behaviour. Another area of work, articulated as the terror management health model (Goldenberg & Arndt, 2008), has focused on the importance of individuals’ efforts to control their awareness of their own mortality in health-related decision-making and the adoption of health behaviour in response to threat related warnings. Studies have shown that one mechanism to remove the threat experienced as a result of a person’s interaction with a health communication is to bolster either one’s generic self-esteem or that associated specifically with the behaviour in question (see Cooper, Goldenberg & Arndt, 2011; Taubman Ben-Ari, Florian & Mikulincer, 2000). In a series of studies this effect has resulted in those who need to defend their self-esteem as increasing their risky behaviour because the adoption of such behaviour serves to reinforce or bolster the threatened self-esteem (see Arndt et al, 2013; Jessop et al, 2008). For example, Hansen, Winzeler and Topolinski (2010) identified that the graphic health warnings common on cigarette packets resulted in smokers who attributed a proportion of their self-worth as being linked to being a smoker resulted in increased intentions to smoke. In the present study it may well be that the framing of the DA message whilst being responsibility-based nevertheless acted as a threatening cue such that drinkers ‘needed’ to respond by drinking more or even attending away from the threatening cue to reinforce the challenged concept of the drinker for the ‘self’.

 The RDM posters used in this study were those used as part of a national campaign aimed at young people across the UK. As a consequence of the time frame in which this research was conducted, the posters used in study 4 were a newer iteration to those used in experiments 2 and 3, albeit all were part of a single campaign which utilised the same health messages. Given that the boomerang effect we observed persisted across both generations of these posters, one might reasonably conclude that the mere presentation of an RDM is sufficient to prime drinking motives. Indeed, this effect was observed irrespective of whether participants were required to directly attend to the RDM posters (experiment 4) or not (experiments 2 and 3).

 The eyetracking data recorded in our final study provides an opportunity to explore in more detail possible reasons why exposure to the RDM posters was associated with increased consumption. The conclusion that exposure to messages regarding responsible alcohol use necessarily primes drinking motives (e.g. Ringold, 2002), and subsequently increases alcohol intake, would require evidence that participants were indeed attending to the part of these posters which contained the RDM itself. However, participants spent a minimal amount of time attending to the specific RDM contained within each poster, instead attending to the positive imagery within these posters. As a result, we are unable to clearly conclude that exposure to an RDM per se will lead to increased drinking. Rather, our data suggest that the attempt to deliver a more complex message within these posters, depicting “before and after” consequences of drinking irresponsibly, may have led to the unintended consequence that participants failed to process the message, and instead focused on the positive imagery within the posters. This finding is consistent with our previous research, whereby an attentional bias towards positive imagery was shown when participants were presented with complex images containing positive, neutral and negative elements together (Moss, Albery & Sharma, 2011). A further reason for suspecting that RDMs do not of necessity prime drinking motives is evident in experiment 3, where prior exposure to more complex responsible drinking message materials online was not associated with increased consumption even after participants were exposed to the RDM posters.

 Our findings raise questions about the optimal means of delivering messages to the public regarding responsible alcohol consumption – and more importantly, raise questions about the sufficiency of evidence available to determine whether any given campaign is effective, ineffective or, indeed, counterproductive. The latter of these questions is in part a consequence of a paucity of methodologies available to researchers to evaluate the impact of any large scale intervention at an individual level. Rather, evaluations (when they are carried out) tend to rely heavily on aggregated metrics related to alcohol consumption and related harms – metrics which fail to provide insight in to individual- and social group-level drinking decisions. The findings we present go some way to showing how a novel methodological approach to evaluating the impacts of an intervention on actual drinking may be able to provide additional – and we stress the word additional rather than alternative – understanding of what works and why (see also Albery, Collins, Moss, Frings & Spada, 2015, and Monk & Heim, 2014, for examples of other methodological developments which are relevant to this area).

 We have shown that these posters lead to immediate increases in drinking speed, but did not explore whether this would lead to increases in drinking quantity over a longer period of consumption. This is a problem previously identified in the context of alcohol advertising research (Meier, 2011). However, given the pharmacological action of alcohol, and the consequences of drinking alcohol more rapidly in terms of the underlying cognitive mechanisms of decision making, it is still a significant public health concern if drinkers are consuming alcohol more rapidly, even if the overall quantity consumed were subsequently shown to remain constant (e.g. Moss & Albery 2009; 2010; Moss et al., 2010). That is, it would be preferable for drinkers to drink at a steadier pace over an extended time period, than to begin a drinking session by consuming a large volume of alcohol in a brief period of time. A further limitation is the degree to which the drinking task involved was artificial. To mitigate this to some degree we utilised a simulated bar environment and took steps to ensure that participants were unaware that the volume they consumed was the key outcome variable. However, further research to examine the impact of such posters in naturalistic drinking settings is required to establish the generalisability of the present findings.

 Our findings must also be tempered by the fact that the contents of the Drinkaware posters aim to encourage responsible drinking behaviours (i.e. eating food, drinking soft drinks, etc.), rather than to reduce alcohol consumption by volume *per se*. In this specific context, it may simply be that participants, in failing to fully attend to the posters and their message, simply responded passively to them as an additional ‘drinking-related cue’, which one would expect to lead to increased intake (see Earp et al., 2013; Moss & Albery, 2009). Whilst intervention work aimed at training individuals to divert attention away from alcohol-related cues has been undertaken the evidence to date is equivocal with some studies showing decreased alcohol consumption (e.g. Fadardi & Cox, 2007; McGeary, Meadows, Amir & Gibb, 2014) and others no effect (e.g. Field et al, 2007; Schoenmakers et al, 2007). To our knowledge little, if any, work has directly manipulated how these attentional processes are used when information or cues are framed towards more responsible drinking especially in situations in which drinking is likely to occur. Clearly further work to develop a theoretical and empirical basis for effective promotion of responsible drinking practices is needed.

While we have been able to demonstrate increases in consumption, we are not able, on the basis of either our own or other previous research, to conclusively say how best to deliver messages such that alcohol consumption and related harm would be reduced in a real world setting. Given the personal and social costs associated with alcohol misuse, particularly among young women (Gill & O’May, 2006), and the amount of funding committed to sending out messages regarding responsible alcohol use, it seems vital that efforts are now made to: 1) evaluate existing interventions to identify any which may be having a detrimental impact; 2) evaluate the theoretical efficacy of those interventions currently being developed prior to them being disseminated to the general public, and 3) develop a theoretically driven evidence base on which recommendations for the development of future interventions can be made.

**References**

Aalto, M., Alho, H., Halme, J.T., & Seppä, K. (2009). AUDIT and its abbreviated versions in detecting heavy and binge drinking in a general population survey. *Drug and Alcohol Dependence, 103,* 25-29.

Albery, I.P., Collins, I., Moss, A.C., Frings, D., & Spada, M.M. (2015). Habit predicts in-the-moment alcohol consumption. *Addictive Behaviors*, 41, 78-80.

Anderson, P, Chisholm, D., & Fuhr, D.C. (2009) Eﬀectiveness and cost-eﬀectiveness of policies and programmes to reduce the harm caused by alcohol. *Lancet, 373*, 2234-46.

Anderson, P. (2009). Global alcohol policy and the alcohol industry. *Current Opinion in Psychiatry*, *22*(3), 253-257.

Arndt, J., Vail III, K. E., Cox, C. R., Goldenberg, J. L., Piasecki, T. M., & Gibbons, F. X. (2013). The interactive effect of mortality reminders and tobacco craving on smoking topography. *Health Psychology*, *32*(5), 525-532.

Bargh, J.A., & Chartrand, T.L. (2000) The mind in the middle: A practical guide to priming and automaticity research. In H.T. Reis & C.M. Judd (Eds.). *Handbook of research methods in social and personality psychology* (p.253-285). New York: Cambridge University Press.

Cooper, D. P., Goldenberg, J. L., & Arndt, J. (2011). Empowering the self: Using the terror management health model to promote breast self-examination. *Self and Identity*, *10*(3), 315-325.

Drinksinitiatives.eu. Voluntary initiatives by the EU spirits industry to help reduce alcohol-related harm. http://www.drinksinitiatives.eu/details-dynamic.php?id=313 (retrieved July 3rd 2012).

Earp, B. D., Dill, B., Harris, J. L., Ackerman, J. M., & Bargh, J. A. (2013). No sign of quitting: incidental exposure to “no smoking” signs ironically boosts cigarette‐approach tendencies in smokers. *Journal of Applied Social Psychology*, *43*(10), 2158-2162.

Fadardi, J. S., & Cox, W. M. (2009). Reversing the sequence: reducing alcohol consumption by overcoming alcohol attentional bias. *Drug and alcohol dependence*, *101*(3), 137-145.

Fenaughty, A. M., & MacKinnon, D. P. (1993). Immediate effects of the Arizona alcohol warning poster. *Journal of Public Policy & Marketing*, 69-77.Fromme, K., & Dunn, M.E. (1992). Alcohol expectancies, social and environmental cues as determinants of drinking and perceived reinforcement. *Addictive Behaviors*, *17*, 167-177.

Field, M., Duka, T., Eastwood, B., Child, R., Santarcangelo, M., & Gayton, M. (2007). Experimental manipulation of attentional biases in heavy drinkers: do the effects generalise?  *Psychopharmacology*, *192*(4), 593-608.

Gill, J., & O’May, F. (2006) How ‘sensible’ is the UK Sensible Drinking message? Preliminary findings amongst newly matriculated female university students in Scotland. *Journal of Public Health (Oxf.)*, *29*, 13-16.

Goldenberg, J. L., & Arndt, J. (2008). The implications of death for health: a terror management health model for behavioral health promotion. *Psychological Review*, *115*(4), 1032-1053.

Hansen, J., Winzeler, S., & Topolinski, S. (2010). When the death makes you smoke: A terror management perspective on the effectiveness of cigarette on-pack warnings. *Journal of Experimental Social Psychology*, *46*(1), 226-228.

Jessop, D. C., Albery, I. P., Rutter, J., & Garrod, H. (2008). Understanding the impact of mortality-related health-risk information: A terror management theory perspective. *Personality and Social Psychology Bulletin*, *34*(7), 951-964.

Jessop, D. C., & Wade, J. (2008). Fear appeals and binge drinking: a terror management theory perspective. *British Journal of Health Psychology*, *13*(4), 773-788.

Kalsher, M. J., Clarke, S. W., & Wogalter, M. S. (1993). Communication of alcohol facts and hazards by a warning poster. *Journal of Public Policy & Marketing*, 78-90.

Lau-Barraco, C., & Dunn, M. E. (2009). Environmental context effects on alcohol cognitions and immediate alcohol consumption. *Addiction Research & Theory*, *17*(3), 306-314.

MacKinnon, D. P., & Lapin, A. (1998). Effects of alcohol warnings and advertisements: A test of the boomerang hypothesis. *Psychology and Marketing*, *15*(7), 707-726.

Marlatt, G. A., & Witkiewitz, K. (2010). Update on harm-reduction policy and intervention research. *Annual Review of Clinical Psychology*, *6*, 591-606.

McGeary, J. E., Meadows, S. P., Amir, N., & Gibb, B. E. (2014). Computer-delivered, home-based, attentional retraining reduces drinking behavior in heavy drinkers. *Psychology of Addictive Behaviors*, *28*(2), 559-562.

Meier, P. S. (2011). Alcohol marketing research: the need for a new agenda. *Addiction*, *106*(3), 466-471.

Monk, R. L., & Heim, D. (2013a). Environmental context effects on alcohol-related outcome expectancies, efficacy, and norms: A field study. *Psychology of Addictive Behaviors*, *27*(3), 814-818.

Monk, R. L., & Heim, D. (2013b). Panoramic projection: Affording a wider view on contextual influences on alcohol-related cognitions. *Experimental and clinical psychopharmacology*, *21*(1), 1-7.

Monk, R. L., Heim, D. (2014). A real-time examination of context effects on alcohol cognitions. Alcoholism: Clinical and Experimental Research, 38, 2452-2459.

Moss, A. C., & Albery, I. P. (2009). A dual-process model of the alcohol–behavior link for social drinking. *Psychological Bulletin*, *135*(4), 516-530.

Moss, A. C., & Albery, I. P. (2010). Are alcohol expectancies associations, propositions, or elephants? A reply to Wiers and Stacy (2010). *Psychological Bulletin*, *136*(1), 17-20.

Moss, A. C., Albery, I. P., & Sharma, D. (2011). Development of a repeated measures affective change blindness task. *Behavior research methods*, *43*(3), 826-833.

Moss, A. C., Dyer, K. R., Albery, I. P., Allsop, S., Kypri, K., Erskine, J., & Mackintosh, D. (2010). Alcohol pharmacokinetics, decision making and folk wisdom: A reply to Moxnes and Jensen (2009). *Drug and alcohol dependence*,*109*(1), 1-3.

Moss, A. C., Dyer, K. R., & Albery, I. P. (2009). Knowledge of drinking guidelines does not equal sensible drinking. *The Lancet*, *374*(9697), 1242.

Ringold, D. J. (2002). Boomerang effects in response to public health interventions: some unintended consequences in the alcoholic beverage market.*Journal of Consumer Policy*, *25*(1), 27-63.

Roehrich, L., & Goldman, M. S. (1995). Implicit priming of alcohol expectancy memory processes and subsequent drinking behavior. *Experimental and Clinical Psychopharmacology*, *3*(4), 402-410.

Ruiter, R. A. C., Abraham, C., & Kok, G. (2001). Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology and Health*, *16*, 613-630.

Saunders, J. B., Aasland, O. G., Babor, T. F., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption‐II.*Addiction*, *88*(6), 791-804.

Schilling, R. F., & McAlister, A. L. (1990). Preventing drug use in adolescents through media interventions. *Journal of Consulting and Clinical Psychology*,*58*(4), 416-424.

Schoenmakers, T., Wiers, R. W., Jones, B. T., Bruce, G., & Jansen, A. (2007). Attentional re‐training decreases attentional bias in heavy drinkers without generalization. *Addiction*, *102*(3), 399-405.

Schoenmakers, T. M., & Wiers, R. W. (2009). Craving and attentional bias respond differently to alcohol priming: a field study in the pub. *European Addiction Research*, *16*(1), 9-16.

Snyder, L. B., & Blood, D. J. (1992). Caution: Alcohol advertising and the Surgeon General's alcohol warnings may have adverse effects on young adults. *Journal of Applied Communication Research*, *20*(1), 37-53

Taubman Ben-Ari, O., Florian, V., & Mikulincer, M. (2000). Does a threat appeal moderate reckless driving? A terror management theory perspective.*Accident Analysis & Prevention, 32(1),* 1-10*.*

Wakefield, M. A., Loken, B., & Hornik, R. C. (2010). Use of mass media campaigns to change health behaviour. *The Lancet*, *376*(9748), 1261-1271.

Wall, A. M., McKee, S. A., & Hinson, R. E. (2000). Assessing variation in alcohol outcome expectancies across environmental context: An examination of the situational-specificity hypothesis. *Psychology of Addictive Behaviors*, *14*(4), 367-375.

Wall, A. M., Hinson, R. E., McKee, S. A., & Goldstein, A. (2001). Examining alcohol outcome expectancies in laboratory and naturalistic bar settings: A within-subject experimental analysis. *Psychology of Addictive Behaviors*, *15*(3), 219-226.

Wigmore, S.W., & Hinson, R. E. (1991). The influence of setting on consumption in the balanced placebo design. *British journal of addiction*, *86*(2), 205-215

Wilde, G. J. (1993). Effects of mass media communications on health and safety habits: an overview of issues and evidence. *Addiction*, *88*(7), 983-996

York, V. K., Brannon, L. A., & Miller, M. M. (2012). Increasing the Effectiveness of Messages Promoting Responsible Undergraduate Drinking: Tailoring to Personality and Matching to Context. *Health communication*, *27*(3), 302-309.

**Conflicts of Interest Statement**

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Table 1

*Mean consumption in millilitres (standard deviations in parentheses) by poster type and elaboration condition*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Responsible Drinking Poster | Control Poster | Total |
| No elaboration(no verbalisation) | 153 (86) | 83 (94) | 116 (96) |
| Elaboration (verbalisation) | 154 (103) | 69 (35) | 109 (85) |
| Total | 154 (93) | 76 (69) |  |

Table 2

*Mean total dwell times (in seconds) for each interest area in the responsible drinking (Drinkaware) and control (Change4Life) posters*

|  |  |  |  |
| --- | --- | --- | --- |
| Poster | Interest Area | M | SD |
| Responsible drinking | Responsible drinking message  | 7.99 | 5.64 |
| Positive imagery | 16.17 | 6.65 |
| Negative imagery | 17.58 | 5.89 |
| Drinkaware URL | 2.19 | 1.58 |
| Control | Health message | 14.82 | 5.81 |
| Illustration | 19.92 | 6.18 |
| Further info link | 2.12 | 1.75 |
| Change4Life logo | 1.78 | 1.48 |

Figure Captions

Figure 1. Interaction graph showing the effects of drinking context and RDPs on consumption (error bars show ±1SE).

Figure 2. Interaction graph showing the effects of RDP and Online Information on consumption (error bars show ±1SE).

Figure 3. Interest area locations for the DA posters.

Figure 4. Interest area locations for the C4L posters.

Figure 5. Proportion of initial fixations by each interest area in the DA poster condition.

Figure 6. Proportion of initial fixations by each interest area in the C4L poster condition.