Evaluating the interactive effects of responsible drinking messages and attentional bias on actual drinking behaviours.

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Executive summary

Responsible drinking messages (RDMs) are often used as a key tool to reduce alcohol related harms. Posters are a common form of RDM, displayed in places such as bars, bus stops and toilet cubicles. However, some recent research suggests RDMs may not have the desired effect of reducing levels of consumption.

It is not known how environmental (e.g. the number of alcohol-related cues in a given environment) or individual difference measures (such as prior drinking behaviour and beliefs, or attentional bias towards alcohol related stimuli) influence interactions with RDMs. Nor is it known how these factors affect their efficacy.

This research explored these issues by having participants view RDMs either in a bar-laboratory (i.e. a ‘fake bar’ inside our research facility) or a traditional psychology laboratory cubicle. The key findings of the research are:

1: That posters in general, and RDMs in particular, are poorly attended to in bar environments

2: That attentional biases towards alcohol influence the allocation of visual attention that is consciously controlled and effortful, but not visual attention that is automatic.

Variations at the level of individual drinkers (such as prior drinking history or alcohol expectancies) were also associated with the direction of visual attention towards actual alcoholic drinks.

This research has implications for the optimal placement of RDMs. It also highlights the sensitivity of such messages to changes in content.

Theoretical implications include new questions around the relationship between attentional bias and other forms of attention, and the importance of cue saturation in understanding when attentional bias affects other cognitive and behavioural processes.
Aims and theoretical background

Responsible drinking messages (RDMs) are often used as a key tool to reduce alcohol related harms. Posters are a common form of RDM, displayed in places such as bars, bus stops and toilet cubicles. However, some recent research suggests RDMs may not have the desired effect of reducing levels of consumption. It is not known how environmental (e.g. the number of alcohol-related cues in a given environment) or individual difference measures (such as prior drinking behaviour and beliefs, or attentional bias towards alcohol related stimuli) influence interactions with RDMs. Nor is it known how these factors affect their efficacy.

Responsible Drinking Messages and context

Evaluations of RDM campaigns suggest they improve knowledge around alcohol and responsible drinking behaviour, and may lead to responsible drinking intentions (Kalsher, et al., 1993; Fenaughty & MacKinnon, 2011; York et al., 2012). However, a recent review concluded that there is little evidence for the effectiveness of RDMs in terms of changing drinking behaviour (Wakefield et al., 2010). Research from our laboratory suggests that, in some contexts, viewing RDMs can increase volumes consumed (Moss et al., 2015). Given the prevalence of RDMs and the cost of implementing them (often via national multimedia channels), developing this evidence base is important. One important focus for research is the role of environmental context on how people interact with RDMs and - by extension - how this impacts on their effectiveness in changing drinking behaviour.

Context, and visual / cognitive attention

The role of context in the operation of alcohol-related cognitions has been highlighted previously. For instance, participants who completed questionnaires in a lecture hall or a real bar, showed more positive alcohol expectancies and decreased perceived control in bar conditions (Monk & Heim, 2013). Meta-analysis of similar paradigms confirms this pattern of effects in most, but not all, studies (McKay & Schare, 1999). How such contextual effects may influence attention to RDMs (or how they mitigate or amplify their effects) is, however, unknown. The current study will investigate this question by looking at the effects of two underlying processes: visual and cognitive attention.

How individuals allocate visual attention can be measured using eye movements. Changes in directed attention across the visual field result in a voluntary eye movement (saccade) towards the area being attended to (Findlay & Gilchrist, 2003). Measures for this include:

- Attentional fixations/glances in a given area
- Dwell time (i.e. how long fixations last)
- Initial saccade latency
• Movements between different areas of a visual field (e.g. different components of an image).

Direction of attention is influenced by cognition, behaviour and motivational strategies (Hollands, et al., 2002; Frings et al., 2014). In terms of cognitive processes, attentional biases may be an additional important factor.

Attentional bias (AB) is the automatic allocation of attention towards motivationally salient stimuli. Research suggests that heavy drinkers have an AB towards alcohol-related stimuli, and that the magnitude of this bias may follow a continuum related to quantity and frequency of use. Among other measures, these ABs have been delineated through longer response times to alcohol-related stimuli in modified Stroop tasks (e.g. when participants are required to name the ink colour of alcohol-related and neutral words whilst ignoring the words themselves: see Sharma, et al., 2001). In non-administration studies, light drinkers do not experience AB to the same extent as heavy drinkers. This demonstrates sensitivity to alcohol stimuli among heavy drinkers. This is thought to be linked to the experience of craving/problematic drinking (Field, et al., 2009). AB is most prominent before and during the early phase of drinking and less influential during sustained drinking (Schoenmakers, et al., 1999; Moss and Albery, 2009).

AB also seems to interact with environmental context. Schoenmakers and Wiers (2010) suggest that when a person has started to consume alcohol, the need to search out alcohol-related cues (a source of AB) diminishes but the desire to drink is maintained or exacerbated. However, whether AB effects persist outside of the laboratory and whether AB magnitude is linked to actual drinking in realistic drinking environments is less clear.

**Actual drinking behaviours**

Existing research in this area has mostly relied upon self-report of previous behaviour, or self-report of future intentions (cf. e.g. Albery, Collins, Moss, Frings and Spada, 2015). Such measures can be prone to under-estimation and/or self-presentation biases. The current research represents a methodological improvement by measuring actual behaviour via a Taste Preference Task (TPT).

In a TPT participants are given a number of realistic alcohol placebos and soft drinks and asked to rate them on a number of dimensions (quality, taste, colour etc.) over a set time period. Participants may drink as much or as little as they wish. As the initial quantities are known, measuring the amount participants leave allows a calculation of consumption. TPTs have been used in alcohol research as a measure of drinking behaviour (e.g. Morrison et al., 2012). Furthermore, participants trained to attend to alcohol cues have shown greater consumption on the taste-testing task than those trained to avoid such cues (Wiers, et al., 2010).
The current study draws on these existing findings to answer a number of research questions. The aims of the study can be split into two strands:

**Strand 1: Responsible Drinking Messages**

This strand aimed to test the effect of responsible drinking messages against a control message in the context of both a laboratory and a bar laboratory. This allowed us to determine whether poster effects were the same in each of these environments, both in terms of attracting visual attention and the subsequent effects on actual drinking behaviour. Specifically we looked at the extent to which RDMs vs. control posters are attended to in each environment, and the link between attention and actual drinking behaviours.

**Strand 2: Cognitive and Visual Attentional Bias**

This strand aimed to test whether cognitive measures of attentional bias (measured using the Alcohol Stroop task) linked with the direction of gaze in bar and lab environments. Specifically, we tested the relationship between Alcohol Stroop scores, visual attention directed to actual drinks, an unrelated task (a wordsearch), and posters within the environment. We also investigated the extent to which these related to individual level characteristics such as AUDIT scores and alcohol expectancies.

**Methods**

**Participants**

One hundred participants were recruited from a university student population, and via subsequent snowball and opportunity sampling. The mean age of the sample was 23.73 years (SD = 6.58). 80% of the sample was female. Usable eyetracking data was obtained from 92 participants. Eight participants’ data were lost due to technical failures.

**Design**

We employed a 2 (Context: Bar laboratory vs. Laboratory) X 2 (Poster: RDM vs. Control) between-subjects design. Participants were randomly allocated to their condition. Participants completed the main phase of the study in either a plain laboratory (featuring an office desk, chair, and desktop PC) or a dedicated bar laboratory. The bar-laboratory is a purpose-built facility that simulates a public house. For example, in addition to authentic pub décor, a 3.6m long bar has been installed and dressed with beer taps, stools, a fruit machine, optics etc.

In both conditions the relative positioning of the participant, the posters and the drinks to be consumed were kept the same. Participants viewed either an RDM
poster or a control poster. This was placed to the upper left of the participant’s vision when seated at the bar/desk.

Materials

Alcohol Audit

The AUDIT is a standard measure of alcohol consumption and alcohol-related harm (Saunders, Aasland, Babor, de la Fuente & Grant, 1993). Scores range from 0 to 40, with scores above 8 (for men, 7 for women) indicating potentially hazardous drinking levels, and a score of 20 or more indicating potential alcohol dependence. In line with other research involving UK undergraduate student populations mean scores observed in the sample were quite high \( M = 11.51, \ SD = 5.51 \).

Alcohol Stroop

The Alcohol Stroop used in this study consisted of two lists of 40 words. One list contained alcohol-related words, and the other list contained non-alcohol-related words. Each word was presented in a different colour and the participant’s task was to name the colour of each word while ignoring the word’s meaning. Presentation of the lists was counterbalanced between participants. The time taken to identify the colour of the control words is subtracted from the time taken to identify the colour of the alcohol words, resulting in an alcohol stroop score. Higher scores indicate a longer response time for alcohol versus non-alcohol words, and thus a higher level of attentional bias.

Alcohol expectancies

Alcohol expectancies were measured using the alcohol expectancy questionnaire (AEQ, Brown, Christiansen & Goldman, 1987). This consists of 120 items measuring positive expectancies around the effects alcohol consumption in the following domains: changes in experience, sexual enhancement, social and physical pleasure, assertiveness, relaxation/tension reduction and arousal/interpersonal power. In the current study reliability of this scale was good (Cronbach’s \( \alpha \) = 0.93).

Wordsearch

A wordsearch was created consisting of a 20X20 grid filled with letters. The target words were Axe, Shoe, Broad, Bless, Rope, Pile, Zebra, Rice, Shift, Quiet, Zombie, Fans, Flower, Rode and Loom. Participants were given 15 minutes to complete the wordsearch, but were told they could proceed to the taste-preference phase of the study by indicating to the experimenter they were finished at any point. Time spent working on the wordsearch (and scores) was recorded.
Posters

Two posters were created. Both posters were based on the ‘Keep Calm and Carry On’ motif commonly used in World War II propaganda, variations of which are now a common social meme in the UK.

In the RDM condition, the text read Keep Calm and Drink Responsibly.

In the control condition, the text read Keep Calm and Exercise Regularly.

This ensured the posters were matched on number and length of words and ensured no additional primes were present in the poster. Both posters can be seen in the appendix.

TPT

The participants were given 3 bottles of non-alcoholic beer, with the labels concealed. They were then given 10 minutes to drink as much or as little of the drinks as they liked, rating them on attributes such as taste, smell, quality and expense. Participants could move on from this phase the study by calling investigators at any time. At the end of the study, the investigator measured the remaining fluid and calculated total consumption.

Eye-tracking measures

Measures of visual attention were collected using a Diakablis monocular eye tracker driven by D-Lab software (D-Lab, V3). Areas of interests (AOIs) were defined around the drinking area, the poster, and the word search task. This was recorded from the moment participants entered the bar or lab to the point they finished the taste preference task. During this time the direction of participants’ visual attention was recorded. On the basis of this recording a number of indexes are calculated. For the sake of clarity in the current report, the three most relevant indices are included here:

Number of glances

The number of times someone visual attention entered and made a fixation (i.e. their attention rested) within an area of interest.

Number of longer glances

The number of times someone’s visual attention entered an area of interest and remained there for more than 2 seconds.
**Total glance duration**

The total length of time people spent attending to each area of interest.

As session length varied between conditions (see below), each value for the duration and number of glance variables was divided by the participant’s total session time. However, as the resultant figures are difficult to interpret, unadjusted means are reported for clarity in all subsequent analyses.

Together these measures allow insights to be drawn as to what extent an individual is attending to each area of interest defined.

After data was collected software was used to eliminate blinks and fly-through (situations where a participant’s gaze entered the area of interest and swept through the area without making a fixation). Pupil detection rates were maximised by manually marking the pupil where this data was missing from the given frame. Areas of interest were checked for each participant individually. An automated calculation of each of the indices was then generated by the software.

**Procedure**

Upon arrival in the psychology laboratory, participants were taken to a plain laboratory. They then gave informed consent and completed the Alcohol Stroop, the AEQ and the AUDIT.

Following this, they were escorted (with their eyes closed) to either the bar laboratory (bar condition) or a second plain laboratory room (lab condition). Participants were then seated at the bar (behind a desk) still with their eyes closed. The eye tracking headset was then placed on their head. They were then asked to look down at the desk and undertake a calibration procedure for the eye tracking software. They were then told they could look up.

In both context conditions, a set of bottles and glasses for the TPT were positioned on the desk to the participants left. To the upper right of the visual field (assuming they were looking straight ahead) the RDM or control poster was displayed. The wordsearch was placed on the desk in front of the participant turned face down. Participants completed this, and then the TPT. During this entire period, visual measures were taken via the eye-tracking device. Once the TPT was completed, recording stopped.

After this a funnelled debriefing procedure (Bargh & Chartrand, 200) was followed. Specifically, participants were asked: “How did you find the study?”, “What did you think the study was about?”, “Did you notice anything odd or unusual about the study?”, and “Did you notice anything odd about the drinks you asked to rate?”. 

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No participants were excluded on the basis of any explicitly stated awareness of the hypotheses of the study or placebo use. Finally, an experimental debriefing was given to participants who were then paid for their time, thanked again, and escorted from the laboratory.

**Results**

These results represent our initial analysis of this work, and may differ slightly in strategy and detail in subsequent publications.

**Session time**

On average the wordsearch and drinking phases took a total of 590.53 seconds. ANOVA revealed that the sessions took less time in the bar lab ($M = 549.47, SD = 80.41$) than it did in the lab ($M = 626.56, SD = 150.69$). $F(1, 88) = 9.53, p = .003, \eta^2 = .10$. There was no significant main effect of poster type. There was a significant interaction $F(1,88) = 4.50, p = .037, \eta^2 = .04$. Simple effects analysis revealed a simple effect of context when the control poster was displayed, $F(1, 88) = 13.26, p < .001, \eta^2 = .13$, with the task taking longer in the lab condition ($M = 651.20, SD = 140.90$) than the bar condition ($M = 519.18, SD = 57.67$). No other simple effects were present.

**Strand 1: Responsible Drinking Messages**

**Attention to posters**

To explore the effects of context and lab upon visual attention directed to the posters a series of ANOVAs were undertaken. In each ANOVA, context and poster were included as between participant factors. Means for each index can be seen in Table 1.

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Poster condition</th>
<th>Number of glances</th>
<th>Number of longer glances</th>
<th>Total glance duration (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>Control</td>
<td>16.67 (21.89)</td>
<td>0.83 (2.04)</td>
<td>12.21 (13.61)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>23.72 (20.35)</td>
<td>1.50 (1.5)</td>
<td>16.40 (21.11)</td>
</tr>
<tr>
<td>Bar</td>
<td>Control</td>
<td>23.54 (13.05)</td>
<td>0.96 (2.05)</td>
<td>12.39 (5.86)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>14.00 (18.24)</td>
<td>0.24 (0.44)</td>
<td>5.89 (6.61)</td>
</tr>
</tbody>
</table>

**Number of glances**

Neither context nor poster type had a main effect on number of glances at the poster ($ps > .39$). There was a significant interaction between the two factors, $F(1, 87) = 11.80, p < .001, \eta^2 = .12$. Simple effects analysis revealed that in the bar condition, RDM posters received fewer glances than did control posters, $F(1,86) =$...
8.57, \( p = .004, \eta^2 = .09 \). In the lab condition, the opposite pattern was observed, though this effect was not significant at the \( p < .05 \) level, \( F(1, 87) = 3.59, p = .061, \eta^2 = .04 \). In the control poster condition, fewer glances were directed at the poster in the lab relative to bar condition, \( F(1, 87) = 7.87, p = .006, \eta^2 = .08 \). In the RDM condition, this pattern was reversed with fewer glances being directed at the poster in the bar relative to the lab, \( F(1, 87) = 4.20, p = .043, \eta^2 = .05 \).

**Number of longer glances**

Neither main effect were significant, \( ps > .24 \). There was also no significant interaction (\( F(1, 87) = 2.47, p = .12, \eta^2 = .03 \)). Simple effects analysis revealed a marginal effect of context in the RDM condition, \( F(1, 87) = 3.80, p = .055, \eta^2 = .03 \), with more glances at the RMD poster in the laboratory than in the bar.

**Total glance time**

Neither context nor poster condition had a significant main effect on the total duration of glances, \( ps > .19 \). This was qualified by a significant interaction, \( F(1, 86) = 5.04, p = .027, \eta^2 = .06 \). Simple effects analysis revealed that total glance duration was lower for the RDM message relative to control poster in the bar condition, with marginal significance, \( F(1, 86) = 3.05, p = .084, \eta^2 = .034 \). RDMs were attended to less in the bar condition than in the lab condition, \( F(1, 86) = 6.35, p = .014, \eta^2 = .07 \). No other simple effects were significance, \( ps > .16 \).

*In summary, it appears that RDMs (but not control posters) were visually attended to less in the bar context than in the lab context.*

**Attention to drinks**

The same analysis was conducted for visual attention aimed towards the drinks. Means and standard deviations can be found in Table 2.

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Poster condition</th>
<th>Number of glances</th>
<th>Number of longer glances</th>
<th>Total glance duration (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>Control</td>
<td>71.38 (55.48)</td>
<td>4.79 (4.68)</td>
<td>50.36 (36.66)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>99.95 (74.83)</td>
<td>7.47 (10.29)</td>
<td>74.84 (93.51)</td>
</tr>
<tr>
<td>Bar</td>
<td>Control</td>
<td>62.24 (42.98)</td>
<td>1.90 (2.49)</td>
<td>74.44 (104.39)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>33.77 (33.76)</td>
<td>1.86 (2.66)</td>
<td>32.85 (67.51)</td>
</tr>
</tbody>
</table>

**Number of glances**

There was no main effect of poster condition on the number of glances directed at the drinks. There was a main effect of Context, \( F(1, 88) = 8.77, p = .004, \eta^2 = .09 \). This reflected more glances at the drinks in the lab condition (\( M = 85.95, SD = 66.95 \)).
than in the bar condition \((M = 47.67, \ SD = 40.70)\). The interaction term was also significant \(F(1,88) = 11.55, p = .001\). Simple effects analysis revealed an effect of context in the RDM condition, \(F(1, 88) = 20.67, p < .001, \ \eta^2 = .19\), with more glances being directed at the drinks in the laboratory condition. There are also significant simple effects of poster type in both contexts. In the lab condition, drinks received fewer glances in the control condition than in the RDM poster, \(F(1, 88) = 6.14, p = .015, \ \eta^2 = .07\). In the bar condition this pattern was reversed with drinks receiving a greater number of glances in the control condition, \(F(1, 88) = 5.46, p = .02, \ \eta^2 = .06\).

**Longer glances**

Context had a main effect on number of glances aimed at the drinks, with fewer longer glances being directed at drinks in the bar condition \((M = 1.88, 2.54)\) than in the lab condition \((M = 6.16, \ SD = 8.08)\), \(F(1, 88) = 6.56, p < .010, \ \eta^2 = .07\). The main effect of poster type, and the interaction, did not approach significance, \(ps < .31\).

**Total glance time**

Neither context nor poster condition had a main effect on the total duration of glances, \(ps > .43\). This was qualified by a significant interaction, \(F(1.86) = 5.14, p = .026, \ \eta^2 = .06\). Simple effects analysis revealed that, in the bar condition total glance duration aimed at the drinks was lower in the RDM message condition (relative to the control poster) \(F(1.86) = 4.40, p = .039, \ \eta^2 = .048\). No other simple effects approached significance, \(ps > .11\).

*In summary, in the laboratory condition, people looked at their drinks more. Moreover, in the bar condition, displaying an RDM poster led to people attending to their drinks even less.*

**Attention to wordsearch task**

The same analysis was conducted for visual attention aimed towards the wordsearch. Means and standard deviations can be found in Table 3.

**Table 3: Mean visual attention directed at the wordsearch across condition.**

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Poster condition</th>
<th>Number of glances</th>
<th>Number of longer glances</th>
<th>Total glance duration (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>Control</td>
<td>99.45 (74.09)</td>
<td>17.58 (14.04)</td>
<td>178.28 (106.86)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>139.24 (109.41)</td>
<td>19.48 (11.21)</td>
<td>165.09 (91.70)</td>
</tr>
<tr>
<td>Bar</td>
<td>Control</td>
<td>68.90 (40.12)</td>
<td>19.61 (4.12)</td>
<td>202.22 (56.40)</td>
</tr>
<tr>
<td></td>
<td>RDM</td>
<td>98.18 (78.22)</td>
<td>11.50 (7.51)</td>
<td>175.45 (103.75)</td>
</tr>
</tbody>
</table>
Number of glances

ANOVA revealed a main effect of poster type, $F(1, 88) = 6.05$, $p = 0.016$, $\eta^2 = .06$. More glances were directed to the wordsearch when a control poster was displayed ($M = 85.20$, $SD = 61.96$) than when an RDM was displayed ($M = 120.02$, $SD = 97.30$). No other effects approached significance, $ps > .16$.

Number of longer glances

ANOVA revealed no main effects of poster or context, $ps > .15$. A significant interaction was present, $F(1, 88) = 5.57$, $p = .021$, $\eta^2 = 0.06$. Simple effects revealed that the task received fewer long glances in the bar-laboratory condition when the RDM was displayed, relative to when the control poster was displayed $F(1, 88) = 7.23$, $p = .009$, $\eta^2 = 0.08$.

Total glance time

ANOVA revealed a main effect of context, $F(1, 88) = 4.08$, $p = .046$, with greater total glance time being directed at the wordsearch in the bar ($M = 188.52$, $SD = 84.15$) relative to in the lab ($M = 171.54$, $SD = 98.59$). In the bar condition, having an RDM displayed led to fewer glances at the task than having a control poster displayed.

In summary, displaying an RDM led to less attention being directed towards the task. However, in the bar, people directed a greater number of shorter glances (but less overall glance time, and fewer longer glances) to the task. This suggests a pattern of being distracted from the task (attending briefly, shifting attention and returning).

Effects of context and poster type upon consumption.

ANOVA revealed that neither poster condition or context had a significant effect on consumption, $ps > .42$.

In summary, neither context nor poster type affected actual consumption.

Links between attention and consumption

To test for links between actual consumption and attention, zero-order correlations were conducted between TPT consumption and the various visual attention measures (see Table 4). Total consumption was predicted (with one tailed significance) by the number of glances and total length of time spent looking at the posters (collapsed across conditions, $ps = .085$ and $.067$ respectively), the number of glances at the wordsearch ($p = 0.095$) and the number of longer glances at the drinks ($p = 0.097$). Breaking the sample down by poster condition led to no significant correlations between consumption and visual indexes being...
observed ($s > .16$). Similar lack of effects ($ps > .28$) were observed when breaking down the sample by bar condition.

**In summary, the data suggests (but not conclusively) that viewing any poster may be linked to lower consumption. In contrast, glancing at the drinks and attending to the task was linked to greater consumption.**

**Strand 2: Cognitive and Visual Attentional Bias**

**Individual differences in consumption.**

Neither AUDIT, AEQ scores nor alcohol stroop scores predicted actual consumption ($ps > .34$). Between these variables, AUDIT correlated negatively with AEQ scores ($r(n=100) = -.23, p = .019$) and alcohol stroop scores, $r(n=100) = -.29, p = .004$. No other relationships approached significance.

**Individual differences in attentional bias**

Attentional bias was predicted by AUDIT ($r(n = 100) = -.29, p = .004$) with increased attentional bias scores being linked to lower levels of AUDIT scores. Expectancies and levels of consumption were unrelated to individual differences.

**Individual difference and visual attention**

For the AEQ, the only two visual attention indices correlated were number of longer glances at the drinks (positive expectancies being linked to more glances) and, with marginal statistical significance, number of longer glances at the wordsearch ($p = .075$), with higher expectancy scores being linked to fewer longer glances. For AUDIT scores the total number of glances and the number of longer glances aimed at the drinks were both positively correlated with higher AUDIT scores.

**Attentional bias and individual differences**

Neither of the individual difference (AEQ, AUDIT) indices were related to attentional bias.

**Attentional bias and visual attention**

Levels of attentional bias were predicted by the number of longer glances at the drinks, $r (n = 92) = .24, p < .001$. No other measures approached significance ($ps > .22$).
Discussion

Responsible drinking messages (RDMs) are widely used as tools to reduce alcohol related harms, but little evidence has investigated how people interact with them in alcohol-cue laden (e.g. in a bar) vs. non-cue laden contexts, or how such messages affect resultant behaviour. Nor is it well understood how both RDM interaction and visual attention are affected by individual differences such as attentional bias, levels of previous drinking or alcohol expectancies.

The current study placed participants in either a bar-laboratory or traditional lab, and had them complete both an unrelated task and also a taste-preference-task. These were completed in the presence of either an RDM poster or a control. The questions addressed by the study were split into two strands – one strand addressing the effects of context on RDMs and associated outcomes, and the second strand focusing on the links between visual attention, attentional bias and individual differences.

We summarise and discuss findings associated with each of these strands in turn, before addressing their broader significance.

Strand 1: Responsible Drinking Messages

The aim of this strand was to investigate the effects of context (being in a bar or a lab) on visual attention to RDM posters of visual attention. The findings show that RDMs (but not control posters) were visually attended to less in the bar context than the lab context. In essence, in the bar (relative to the lab) people made fewer glances and for shorter periods of time towards an RDM. This finding could be interpreted in terms of a dynamic interaction between conflictual behavioural cue-types. In the bar condition / RDM condition drinkers were in an environment saturated with drinking-related facilitative cues (i.e. the bar landscape and the drinks for the TPT) except for one particularly salient inhibitory cue (i.e. the RDM exposure). In this context it may be that drinkers attempted to avoid (attend away from) any perceptual information that conflicted with thought and behaviours expected in the bar context (i.e. drinking), which were saturating their current experience.

These findings could also reflect difficulty disengaging from alcohol cues. Drinkers may have found it difficult to disengage from such stimuli under conditions of alcohol cue saturation (i.e. when the number of cues in the environment became so great that they no longer attempted to distinguish effectively between them). Under such circumstances, we argue, there may well be no cognitive resource for the required processing of the inhibitory cues to be undertaken and, as such, they are engaged with less.

An alternative (but related) explanation to these findings is that, under conditions when inhibitory and facilitative cues require conflict resolution to guide behavioural choice, certain cues may be processed as more threat-related. This threat-
relatedness is more likely when cues that are present in a context such as a bar generate a behavioural goal (e.g. drinking alcohol) that is the opposite of that espoused by any inhibitory cues (e.g. RDMs). In the current study, it may be that the threat experience embodied by the RDM needed to be avoided to a) remove the negative arousal created by the threat exposure and b) provide the basis for the one’s goal/motivation to behave in line with one’s predominant current experience. As such, it is likely that one’s attention is likely to be less attuned to the RDM and more so to goal-related cues (i.e. towards the alcohol itself).

We have already noted that this is consistent with the attentional allocation for the RDM/control posters in bar vs. lab conditions, to the extent that people pay less attention to RDMs in the bar. However, people also looked at the drinks less in the bar condition than the lab condition. More specifically, the lowest amount of visual attention being directed towards the drink in the bar condition was when an RDM poster was displayed. Given that a similar result was shown for the poster condition, it seems likely that the RDM per se cannot be responsible for this. It is, however, possible that under bar conditions both the drinks and the RDM are two of many alcohol-related cues available for processing. In other words, participants’ attentional resources are saturated by the sheer multitude of alcohol-related cues resulting in a decrease in the saliency of any specific stimuli.

Another finding in this strand was that displaying an RDM led to less attention being paid to an unrelated task (in this case, a wordsearch task). Specifically, a pattern of a greater number of total glances combined with lower overall glance time suggests that participants were experiencing some form of attentional conflict between a specific, and consciously experienced, task and dissociated cues in the current environment. In terms of attentional processing, previous work has detailed a pattern of responding in social (and dependent) drinkers characterised by a deficit in the ability to disengage from concern-related stimuli to the extent that any unrelated task may be affected.

In our study, the magnitude and complexity of the alcohol-related cues available for processing appears to result in a depletion of an individual’s attentional resources allocated for the completion of the wordsearch. The alcohol-related cues distract current cognitive activity to the extent that attention to an unrelated task is more sporadic in nature.

**Applied implications**

From an applied perspective, these findings suggest that RDMs will be attended to more by drinkers when they are placed in relatively simple contexts (or at least those containing fewer alcohol cues), than when they are placed in complex alcohol cue-laden environments. For instance, toilet cubicles or bus shelters may be a better place to display RDM posters than bars. This finding is also likely to generalise to other forms of public health messages such as the use of “know your limits” responsible gambling posters (often displayed on the side of gambling and fixed odds betting machines within gambling locales).
In the current study, we observed no effects of RDM posters or context upon consumption in a taste preference task. This is in contrast with some of our own previous work (Moss et al., 2015). Differences between the current experiment and that work primarily revolve around the content of the poster. In Moss et al. (2015), the poster was visually complex, containing images of people, numerous colours, and a message from which the goal of responsible drinking needed to be inferred. The current study aimed to disentangle these effects by presenting a simpler poster, where only the text was manipulated and the message to drink responsibly was clear.

The lack of substantive effects in this case may suggest that the effects of responsible drinking messages on actual behaviour are highly dependent on the content of the message themselves. From an applied perspective, this suggests that pilot work testing the efficacy of messages, and the direction of their effect, should be undertaken prior to them being distributed.

The lack of contextual effects in this study relative to others is puzzling. Previous literature on the effects of context on, for example, expectancies has shown a mixed picture - with alcohol cues sometimes leading to more positive expectancies and sometimes leading to no difference. The current work adds to this body of research and raises questions around how, when and for whom alcohol cues affect expectancies and behaviour. Further work is needed in this area before strong conclusions can be drawn.

Strand 2: Cognitive and Visual Attentional Bias

The second strand of this research aimed to address theoretical questions about the extent to which attentional bias (measured here using the alcohol Stroop) affects visual attention and alcohol consumption. We also wanted to examine how habitual drinking behaviours, AUDIT scores, and alcohol expectancies influence these effects.

In terms of the links between attentional bias and visual attention, an interesting pattern of findings was observed. Namely, greater levels of attentional bias were linked to an increased number of longer glances being directed towards the drinks. However, there was no relationship between shorter glances and drinks. As longer glances are more likely to reflect a more conscious processing system (maintenance of attention) and shorter glances a more automated mode (initial attentional orientation), it appears that attentional biases may reflect a more conscious processing of relevant cues (see Field, Munafo and Franken, 2009; Noel et al, 2006; Field et al, 2004).

In terms of individual differences and behaviour, neither AUDIT, AEQ scores or alcohol Stroop scores predicted actual consumption. This effect is not in line with the limited amount of previous research conducted in this area, which generally shows higher scores of these dimensions linked to high levels of actual consumption (e.g. Albery et al, 2015). One important difference between this study and previous
work was that AUDIT, AEQ and the alcohol Stroop were completed prior to the context manipulation in a separate allocated room. If one accepts that the operation of alcohol expectancies and attentional biases is likely to be important under relevant contextual conditions (e.g. Monk & Heim, 2013; Moss & Albery, 2009; Schoenmakers et al., 1999), and possibly only of importance prior to the enactment of drinking behaviour (Schoenmakers & Wiers, 2010), then a relationship between be these measures and consumption may not be expected. Further work is required to test the role of, for example, attentional biases in both the initiation of a drinking episode and more sustained consumption after initial consumption within an episode.

**Summary**

In summary, this project represents both theoretical and practical progress. Theoretically, it suggests that the effects of RDMs may be particularly sensitive to both content and context. It also suggests that the effects of context upon expectancy are complex, and that work needs to be undertaken to find relevant moderators and mediators of the context-expectancy link observed in some, but not all, of the previous literature.

Of interest from a cognitive perspective is the link between attentional bias and visual attention towards drinks. This raises a number of interesting new questions for the field. In particular, the observance of a disassociation between relatively short allocation of visual attention and longer, possibly more reflective, glances, suggests that the link between cognitive forms of attentional bias the visual system are present, but complex. However, more research is needed in this area before strong conclusions can be drawn.

From an applied perspective these findings suggest that the placement of RDMs is critical to the amount of attention they receive. Simple, less cue laden, environments may well provide a more effective location for such messages.


APPENDIX

Posters for RDM (left) and control (right) conditions

KEEP CALM AND DRINK RESPONSIBLY

KEEP CALM AND EXERCISE REGULARLY
### Table 4: Zero order correlations (full sample).

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<td>Drinks (all glances)</td>
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<td>Drinks (longer glances)</td>
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<td>.15</td>
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<td>Drinks (total glance time)</td>
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<td>Poster (all of glances)</td>
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<td>Poster (longer glances)</td>
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**Notes:** *** = p <.001; † = p <.10