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21 **Resumen**

22 El actual etiquetado de las bebidas alcohólicas pasa desapercibido por los consumidores. A
23 ello se le suma que la legislación europea exime a la industria de las bebidas alcohólicas de
24 incluir advertencias sanitarias en sus envases. Este estudio pretende explorar cómo el tamaño,
25 el diseño y el contenido alcohólico de las bebidas influyen en la atención visual prestada al
26 etiquetado de la graduación alcohólica; y cómo el tamaño y el contenido alcohólico influyen
27 en la atención visual prestada hacia una advertencia sanitaria. Usando un diseño
28 experimental, se monitorizaron los movimientos oculares de 64 participantes mientras
29 visualizaban envases de cerveza con diferente graduación (0.4%, 4.6% vs. 15%). Se midió el
30 número de fijaciones hacia el etiquetado de la graduación alcohólica, manipulando su tamaño
31 y el diseño como factores inter-sujetos. En los envases presentados a la mitad de los
32 participantes se incluyó una advertencia sanitaria, manipulando su tamaño como factor inter-
33 sujeto. Los resultados muestran claras evidencias estadísticas de que el número de fijaciones
34 es superior cuando la graduación alcohólica se muestra con un mayor tamaño y mediante un
35 semáforo nutricional. Asimismo, los resultados relevan un mayor número de fijaciones hacia
36 la advertencia sanitaria cuando esta tiene un tamaño mayor y obtiene diferentes niveles de
37 atención visual dependiendo de la graduación alcohólica del envase. En conclusión, el estudio
38 pone de manifiesto que el actual etiquetado de los envases de bebidas alcohólicas es
39 insuficiente para captar la atención de los consumidores y sugiere que, si se persigue lograr
40 un incremento de la atención prestada, el etiquetado debe mostrarse con un mayor tamaño y
41 con un diseño gráfico.

42 **Palabras clave:** Alcohol, Etiquetado, Advertencia, Atención, Eye-tracking

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44

45 Abstract

46 Current alcohol labelling is going unnoticed by consumers. In addition to this, EU legislation
47 does not mandate the inclusion of any health warning label on alcohol packaging from the
48 alcohol industry. This study aims to explore how the size and design of alcohol by volume
49 (ABV) labels, along with the alcohol strength presented on these labels, influence visual
50 attention toward them. We also examine how label size and alcohol strength influence visual
51 attention toward a health warning label on alcohol beverages. Using an experimental human
52 laboratory design, we tracked the eye-movements of 64 participants while they were viewing
53 beer beverages with different ABV (0.4%, 4.6% vs. 15%). We measured the number of
54 fixations toward ABV labelling which varied in size and design (text-only vs traffic light). A
55 health warning label was also included on the beer beverages for half of the participants and
56 its size was manipulated as a between-subject factor. Results showed strong evidence that the
57 number of fixations was higher when the ABV labels were larger and used a traffic light
58 system. Likewise, we found a higher number of fixations toward larger health warning labels
59 and differences in visual attention dependant on the ABV content presented. In conclusion,
60 this study indicates that current alcohol labelling is insufficient to draw the attention of
61 consumers and it suggests that future alcohol labelling must be larger and with a graphic
62 design to attract attention.

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64 **Key words:** Alcohol, Labelling, Health Warning, Attention, Eye-tracking

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68 **Introduction**

69 Alcohol is the third leading cause of morbidity and mortality in the European Union (EU),
70 and Europe is the world's heaviest drinking region (Anderson, Møller, Galea, & World
71 Health Organization, 2012). Despite this, EU legislation requires alcohol by volume (ABV)
72 labels but does not mandate the inclusion of any health warning label (Farke, 2011). In Spain,
73 where this study was conducted, ABV labels are usually small, text-only and at the back of
74 the product, fulfilling the minimum requirement from the current legislation (Parlamento
75 Europeo y del Consejo, 2011), with health warning labels being implemented on a voluntary
76 basis (Farke, 2011). Labels are not easily identified as they often take up only a small
77 proportion of space, they do not usually include graphics nor are they updated regularly
78 (Claire Wilkinson & Room, 2009). On the other hand, in other European countries such as
79 the UK, alcohol companies have pledged to label alcohol beverages with responsible drinking
80 information. However, research has found that consumers pay minimal attention to these
81 voluntary labels (Kersbergen & Field, 2017). Previous research has found that larger alcohol
82 labels have the potential to attract more attention (Farke, 2011; Kersbergen & Field, 2017;
83 Truitt et al., 2002) and increasing their salience through graphic designs, which are often not
84 used in Europe (Celia Wilkinson et al., 2009), might attract and maintain attention, as has
85 previously been shown in food labelling research (Graham, Orquin, & Visschers, 2012). It
86 has been suggested that warnings similar to those used on tobacco products should be placed
87 on alcohol containers (Thomson, Vandenberg, & Fitzgerald, 2012) as they are effective in
88 changing consumer behaviour (Hammond, 2011) and in communicating risk (Noar et al.,
89 2015). Recently, Blackwell, Drax, Attwood, Munafò and Maynard (2018) concluded that unit
90 labelling can be improved for a better understanding of alcohol content and suggested the
91 inclusion of health warning labels alongside unit labelling to improve understanding of
92 alcohol harms and discourage risky drinking behaviours.

93 The present study aims to explore visual attention to a range of ABV labels and a health
94 warning label on alcohol containers. We hypothesise that larger labels (for both ABV and the
95 warning) and the inclusion of graphic design such as a traffic light (for ABV), as compared
96 with text-only information, will increase visual attention. We also hypothesise that visual
97 attention will be greater to higher alcohol strength labels, particularly if they are shown as a
98 traffic light.

99 **Methods**

100 **Design**

101 This was an experimental human laboratory study using eye-tracking to measure visual
102 attention to ABV labelling, with size (small vs. large) and design (text vs. traffic light) as
103 between-subject factors and alcohol strength (0.4%, 4.6% vs. 15%) as a within-subject factor.
104 To measure visual attention to the health warning label, a sub-sample, consisting of half of
105 the participants, also viewed a warning label with size (small vs. large) as a between-subject
106 factor and alcohol strength (0.4%, 4.6% vs. 15%) as a within-subject factor.

107 **Material and measures**

108 **Stimuli.** Four types of ABV labelling stimuli were created to be included on beer bottles as
109 the different combinations of the between-subject factors (design and size): 1) text, small; 2)
110 text, large, 3) traffic light, small and 4) traffic light, large. For text-only stimuli, the ABV
111 information was presented as: 'ALC. 0.4% VOL.', 'ALC. 4.6% VOL.' or 'ALC. 15% VOL'.
112 For traffic light stimuli, three different colours were used in addition to the text: green for
113 0.4%, yellow for 4.6% and red for 15%, also including the words 'bajo' (low), 'medio'
114 (medium) and 'alto' (high) respectively. For half of the participants, beer bottles also
115 included a text-only health warning label: 'El alcohol daña tu cuerpo y tu mente' (Alcohol

116 harms your mind and your body). Two types of health warning labels were created varying in
117 size: 1) small and 2) large. These labels were placed on three different beer bottles and, in
118 turn, they were inserted into three original magazine beer adverts. Thus, a total of 24 original
119 beer bottles were designed to display the combinations of the different stimuli. We present
120 some examples of the stimuli in Figure 1. The Supplementary Material includes more stimuli
121 examples.

122 *INSERT FIGURE 1*

123 **Visual attention.** Participants' eye movements were recorded using a Tobii T120 device,
124 a 17" screen-based eye-tracking device with a sample rate of 120 Hz. Eye movements were
125 measured by two binocular infra-red cameras underneath the computer screen. We used Tobii
126 Studio to extract the number of fixations to labels.

127 **Other measures.** For descriptive purposes, participants also completed the Alcohol Use
128 Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor, Fuente, & Grant, 1993).
129 Using a 10-item scale, we assessed participants' alcohol consumption, drinking behaviour
130 and alcohol-related problems (Cronbach $\alpha=0.63$).

131 **Procedure**

132 Participants were required to be aged 18–30 and be native Spanish speakers. They were
133 recruited from students and staff at the University of Granada (Spain) and members of the
134 public on a voluntary basis. Eligible participants were invited to take part in a study session.
135 On the day of testing, after reading an information sheet, participants provided written
136 informed consent and completed a short demographic questionnaire for age, gender, marital
137 status, and level of education. Using a pre-determined randomised list, participants were
138 assigned to one of four different groups (to determine the label size and design they would

139 view) and to either the health warning label subsample or control. Participants then
140 completed the main eye-tracking phase preceded by a nine-point grid calibration. The eye-
141 tracking phase involved asking participants to view an electronic copy of 'Rolling Stone'
142 magazine. A total of 14 pages were shown individually on the 17" TFT, 1280x1024 pixels
143 screen. Three of the 14 pages consisted of the three magazine adverts where the beer bottles
144 were inserted, one for each ABV (0.4%, 4.6%, and 15%). These were presented randomly
145 through the task. To ensure participants engagement on the eye-tracking phase, they were
146 asked to pay as much attention as possible to the content in the magazine as they would
147 participate in a recall activity afterwards. After finishing the eye-tracking phase, participants
148 took part in a recall task similar to the masked-recall exercise from Thomsen & Fulton (2007)
149 and then completed the AUDIT questionnaire.

150 **Statistical Analysis**

151 For the ABV label, a 2 (size: small vs large) x 2 (design: text vs. traffic light) x 3 (strength:
152 0.4%, 4.6% vs. 15%) mixed-model ANOVA was run for the number of fixations to the label.
153 For the health warning label, a 2 (size: small vs. large) x 3 (strength: 0.4%, 4.6% vs. 15%)
154 mixed-model ANOVA was run for the number of fixations to the label. Recall data were not
155 analysed as it was not part of the study design.

156 **Results**

157 **Participants**

158 A total of 64 participants (52% female; age=21; 100% single; 61% secondary school)
159 completed the experiment. Participants reported a mean AUDIT score of 11.17 (SD=3.48),
160 which indicates alcohol use in excess of low-risk guidelines (Anderson, Cremona, Paton,

161 Turner, & Wallace, 1993; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The
162 subsample of participants who viewed the health warnings consisted of 32 individuals.

163 **Visual attention**

164 Compared to smaller ABV labels, larger labels attracted higher levels of visual attention
165 ($F_{(1,64)}=41.99$, $\eta_p^2=0.41$, $p<.001$). There was also evidence that the use of a traffic light
166 increased the number of fixations ($F_{(1,64)}=10.50$, $\eta_p^2=0.41$, $p=.002$) compared to a text-only
167 design. There was evidence of an interaction between size and design ($F_{(1,64)}=4.67$, $\eta_p^2=0.072$,
168 $p=.035$) such that visual attention was increased when ABV was larger and presented as a
169 traffic light. Finally, there was no clear statistical evidence that the number of fixations
170 differed by the ABV ($F_{(2,64)}=1.81$, $\eta_p^2=0.03$, $p=.17$) or ABV x design ($F_{(2,64)}=0.85$, $\eta_p^2=0.08$,
171 $p=.54$). Results are presented in Table 1.

172 *INSERT TABLE 1 HERE*

173 We observed strong evidence that the size of the health warning label had a positive effect on
174 the number of fixations ($F_{(1,32)}=15.18$, $\eta_p^2=0.34$, $p<.001$). There was also evidence for an
175 effect of ABV ($F_{(2,32)}=7.52$, $\eta_p^2=0.20$, $p=.001$): warnings allocated on the 4.6% ABV alcohol
176 containers obtained the most fixations, followed by 15% and the least for 0.4%.

177 **Discussion**

178 To our knowledge, this is the first study exploring enhanced alcohol labelling in Spain, and
179 one of only a small number worldwide using an objective measure such as eye-tracking. As
180 this study and previous literature have suggested, alcohol labelling in Europe is insufficient as
181 it is often implemented on a voluntary basis by the alcohol industry. Our study shows that in
182 Spain, as in many other European countries where current ABV labelling is small and text-
183 only, these labels attract low levels of attention. Our results show that by increasing the size

184 and using a traffic light system, ABV labelling attracts more attention. This finding is
185 supported by previous literature (Blackwell et al., 2018; Farke, 2011; Graham et al., 2012;
186 Kersbergen & Field, 2017). In Spain, as in most European countries, alcohol beverages do
187 not have to include any warning labels about the risks of alcohol consumption (Farke, 2011);
188 despite their potential to communicate the harms associated with alcohol intake and
189 discourage risky drinking behaviour among consumers (Blackwell et al., 2018). In terms of
190 the inclusion of these warning labels on alcohol packaging, our data suggest they should be
191 displayed large enough to attract attention.

192 Previous literature has shown that low-level stimuli characteristics (i.e., bottom-up factors)
193 have the potential to control attention, largely involuntarily (Wedel & Pieters, 2008). This
194 would explain our results: by increasing the size of our stimuli and including a traffic light
195 design, we changed the low-level stimuli characteristics which, as expected, produced an
196 increase in the attention given to them. However, this cannot explain why the health warning
197 label obtained the highest visual attention level on the 4.6% ABV beverage. This suggests
198 that other factors, related to the consumer (i.e., top-down factors), are also playing an
199 important role. For example, previous literature from the tobacco field found that smokers
200 actively avoid paying attention to health warning labels (Maynard et al., 2014). Further
201 research in this direction is needed.

202 As a preliminary study exploring the impact of alcohol labelling on visual attention, this
203 research has some limitations. First, this study was conducted in Spain, where the systems of
204 using units or standard drinks to display alcohol strength are not used. Therefore, we were not
205 able to examine the impact of these systems on visual attention. Second, we were only able to
206 test for the inclusion of a single health warning label in a sub-sample of the study. Therefore,
207 the results related to this stimulus should be interpreted with caution. Future research should

208 examine a range of different warnings, including pregnancy and other responsibility
209 statements. There are also inherent limitations regarding the age of participants and the
210 alcohol beverage used in this study. These may limit the extent to which our results can be
211 extrapolated to other populations or alcoholic drinks. Finally, although attention is the first
212 step in processing labels, future research should examine how visual attention is related to
213 actual drinking behaviour.

214 Notwithstanding these limitations, our study has important implications. As the first study
215 examining Spanish alcohol labelling, our results suggest that current alcohol labelling (small
216 and text-only) goes relatively unnoticed by consumers. Previous research has shown that the
217 Catalan urban environment encourages alcohol consumption and it is characterised by high
218 alcohol availability, so an improvement in regulation is needed to change the social image of
219 alcohol (Villalbí et al., 2018). This is particularly important given the failures in voluntary
220 agreements from the alcohol industry and the recommendation for further regulation for
221 alcohol labelling (European Union Committee, 2015). In this context, Spain has recently
222 made important efforts to develop a new alcohol labelling regulation (Congreso de los
223 Diputados, 2018). Our study provides guidelines for future alcohol label regulation to design
224 labels which actually attract visual attention by being large and using graphic designs such as
225 a traffic light system.

226 **Declaration of Conflicting Interests**

227 The authors declare that they have no competing interests.

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302

303 *Figure 1.* Stimuli examples. On the left, an original 4,6% ABV beer bottle with small ABV
304 label and only text. In the middle, an original 0,4% ABV beer bottle with a large ABV label
305 and as a traffic light. On the right, an original 15% ABV beer bottle with large ABV label and
306 as a traffic light; and a large health warning label.

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314 Table 1
315 *Number of fixations*

Alcohol By Volume Label	Total (n = 64)	Size		Design		
		Small (n = 32)	Large (n = 32)	Text (n = 32)	Traffic- Light (n = 32)	
.4%	.97 (1.48)	.38 (.61)	1.56 (1.83)	.47 (.72)	1.47 (1.85)	
Alcohol Strength	4.6%	.81 (1.18)	.34 (.55)	1.28 (1.44)	.50 (.80)	1.06 (1.44)
	15%	1.16 (1.39)	.34 (.60)	1.97 (1.49)	.97 (1.40)	1.34 (1.38)
	Total	.98 (1.32)	.35 (.59)	1.60 (1.59)	.67 (.97)	1.29 (1.56)
Health Warning Label	Total (n = 32)	Size				
		Small (n = 16)	Large (n = 16)			
0.4%	1.81 (1.75)	1.38 (1.50)	2.25 (1.91)			
Alcohol Strength	4.6%	3.47 (3.34)	1.63 (1.93)	5.31 (3.48)		
	15%	2.41 (2.56)	1.00 (1.26)	3.81 (2.79)		
	Total	2.56 (2.55)	1.33 (1.56)	3.79 (2.72)		

316 *Note.* Mean number of fixations to alcohol by volume label regarding their size (small vs.
317 large), design (text vs. traffic light) and strength (0.4%, 4.6% and 15%), and mean number of
318 fixations to health warning label regarding their size (small vs. large) and strength (0.4%, 4.6%
319 and 15%). Standard deviations are given in parentheses.