



**Graphic imagery is not sufficient for increased attention to  
cigarette warnings:  
The role of text captions**

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**Graphic imagery is not sufficient for increased attention to cigarette warnings:  
The role of text captions**

Brown, K.G., Reidy, J.G., Weighall, A.R. & Arden, M.A.

Department of Psychology, Sociology & Politics, Sheffield Hallam University,  
Sheffield, S10 2BP

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Author for correspondence:

Dr Kyle Brown  
Dep. Experimental Psychology,  
Eleanor Rathbone Building,  
Bedford Street South,  
University of Liverpool  
Liverpool, L69 7ZA,  
UK  
k.g.brown@liverpool.ac.uk  
Tel: +44 151 794 1137  
Mob: +44 7854 778793

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1 **Abstract**

2 **Aims** The present study aims to assess the extent to which attention to UK cigarette warnings  
3 is attributable to the graphic nature of the content. **Design** A visual dot probe task was  
4 utilised, with the warnings serving as critical stimuli that were manipulated for the presence  
5 of graphic versus neutral image content, and the accompanying text caption. This mixed  
6 design yielded image content (graphic v neutrally matched images) and presence (versus  
7 absence) of text caption as within subjects variables and smoking status as a between  
8 participants variable. **Setting** The experiment took place within the laboratories of a UK  
9 university. **Participants** 86 psychology undergraduates (51% Smokers, 69% female),  
10 predominantly of Caucasian ethnicity took part. **Measurements** Reaction times towards  
11 probes replacing graphic images relative to probes replacing neutral images were utilised to  
12 create an index of attentional bias. **Findings** Whilst the graphic image content of the  
13 warnings elicited attentional biases (relative to neutral images) for smokers, this only  
14 occurred when there was an accompanying text caption, highlighting that although graphic  
15 images increase attention to a warning, the text caption is still a necessary requirement.

16 **Conclusions** This study not only highlights that graphic imagery increases attentional capture,  
17 but it highlights the importance of accompanying text. It also represents a direction for future  
18 warning research, which should isolate specific features (such as their graphic nature) in  
19 order to ascertain the best characteristics of a warning.

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23 ***Introduction***

24 Following a request from the Framework Convention on Tobacco Control [1], an increasing  
25 number of countries have implemented policies introducing larger, clearer cigarette warnings.  
26 A review by Fong, Hammond & Hitchman [2] documents the most notable changes to the  
27 warnings, notably the inclusion of colour and often graphic imagery depicting the dangers of  
28 smoking. Moreover, they provide evidence for the efficacy of graphic image based warnings  
29 in different countries (of varying income and literacy rates). Smoking warnings are  
30 potentially an extremely cost effective health intervention, with pack-a-day smokers being  
31 exposed to the warnings over 7000 times a year [3]. With this amount of exposure, even  
32 small increases in warning effectiveness could have a substantial impact, and as such, are  
33 deemed one of the most effective vehicles with which to inform people about the health  
34 consequences of smoking [4].

35  
36 Attention towards cigarette warnings is stressed as important in models of warning  
37 effectiveness [5-6]; being viewed as a logical necessity for the processing of a persuasive  
38 message [5-7]. Thus, without any attention towards the warning, recipients cannot process  
39 its information and eventually conform to the prescribed behaviour. Additionally, at any one  
40 time, numerous environmental stimuli are competing for attention. Warning labels must  
41 therefore effectively cut through the stream of superfluous information that could provide  
42 potential distraction from the message [8]. Cigarette brand labelling is an example of a  
43 potential distraction, with a highly attractive design, using striking colours and distinctive  
44 fonts [9]. Moreover, given its proximity (in time and space) with smoking behaviour, brand  
45 labelling is likely to serve as a smoking related cue, attention to which is hypothesised to  
46 provide a significant contribution to craving and cigarette seeking behaviour [10-12].

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47 Loeber et al [13] explored whether warning labels can capture attention, utilising a visual dot  
48 probe paradigm [14] to assess whether the cigarette packages containing the newer graphic  
49 image based warnings or the older, “text-only” style of warning influenced attentional biases  
50 relative to cigarette packages containing images from the International Affective Picture  
51 System [15]. In the typical visual dot probe task, *two cue stimuli* (e.g. graphic and text only  
52 warnings) are presented equidistant from a central point on a computer screen. In quick  
53 succession, a probe appears in the place of one of the cues, which subjects are required to  
54 respond to. The central premise of this task is that attention to a cue that appears in the same  
55 spatial location as the target is indexed by a faster reaction time to that cue. Faster reaction  
56 times to probes replacing one stimulus category over another indicate attentional priority  
57 given to that stimulus category. Thus, faster responding to probes replacing graphic warnings  
58 relative to text only warnings would indicate increased capture of attention by the former.

59 Loeber et al. [13] found that light smokers tended to avoid (divert attention away from)  
60 packages with graphic, but not text-only warnings. Heavy and non-smokers showed no  
61 attentional bias in either instance. It was concluded that warnings with a graphic image may  
62 reduce the incentive salience of cigarettes for smokers for whom tobacco consumption is less  
63 habitual. Notably, this study assessed attention towards cigarette packaging (i.e. warnings and  
64 brand labelling) as opposed to focusing on the warnings exclusively. A number of issues  
65 potentially limit the conclusions that can be drawn from this study. Firstly, in the visual dot  
66 probe paradigm, the typical presentation of a stimulus pair is 500ms, whereas Loeber et al.  
67 presented their stimuli for 50ms. Whilst the choice of a 50ms stimulus duration has been  
68 utilised in previous visual dot probe research, it is unlikely that the negative attentional bias  
69 score exhibited for light smokers was due to attentional avoidance with such a rapid stimulus

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70 presentation. Furthermore, the graphic cigarette warnings were not presented with their  
71 accompanying text in this study.

72 In a more direct assessment of attention to cigarette warnings, Munafo, Roberts, Bauld &  
73 Leonards [22] used a naturalistic viewing paradigm to assess whether brand labelling  
74 influences attention to the graphic image based warnings. Participants' eye movements were  
75 monitored whilst cigarette packages with graphic image-based warnings and either normal or  
76 plain brand labelling were presented onscreen for ten seconds. Whilst non-smokers and  
77 weekly smokers examined health warning information more with plain brands, but brands  
78 and warnings equally for the normal style of brands, this effect did not occur for daily  
79 smokers. Moreover, this effect only occurred for the number of saccades and not duration of  
80 individual fixations. It was concluded that plain packaging increases visual attention for the  
81 warnings due to the decrease in salient, sensory driven brand features of the image. Whilst  
82 the study provided an assessment of attention to the graphic image based warnings, there was  
83 no attempt to isolate the influence of the graphic nature of the content from aspects such as  
84 colour and inclusion of any image, both of which have been proposed as potential factors that  
85 increase warning effectiveness [23], and may facilitate attentional capture to the warnings.

86 To date, previous research has also not investigated both the image and text portions of the  
87 graphic cigarette warnings; although a handful of studies have examined attentional processes  
88 towards text and images when presented simultaneously, in the context of advertisements  
89 [16], cartoons with captions [17], diagrams with accompanying text [18-19], subtitling [20]  
90 and a sentence picture verification task [21]. These studies have robustly found that people  
91 typically orient to text before examining images, even when text is superimposed over an  
92 image. Moreover, people rarely alternate between them: they concentrate on one, then the

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93 other. Crucially, this previous research suggests that text may influence attention to the  
94 warnings, suggesting that it is important to examine both text and image together.

95 Whilst the studies from Loeber et al. [13] and Munafo et al. [22] both provide insight into  
96 attentional allocation to cigarette warnings, they do not focus on this potential interaction  
97 between image and text portions of the warnings. Moreover, they circumvent a crucial issue:  
98 Whether the graphic content of the new warnings facilitates attention capture, or whether *any*  
99 image in combination with text warnings results in attention capture. This issue is of  
100 importance given the debate around adverse “boomerang” effects of such stimuli [24], in  
101 which the threatening content of a fear appeal has an adverse effect. It has been assumed that  
102 that we are biologically predisposed to attend to threat [25-27], suggesting that the  
103 introduction of threatening imagery on cigarette packaging is likely to elicit attention towards  
104 and therefore the processing of the new warnings. Previous studies that have examined  
105 attention towards cigarette warnings using self reported measures of attention provide  
106 evidence for this prediction [28-30] but do not provide an objective measure of attentional  
107 processing.

108 This study builds on previous research by utilising the visual dot probe task to explore  
109 whether the graphic image content of the new warnings can elicit attentional biases relative to  
110 neutrally matched images. To isolate the effect of the image content, neutrally matched  
111 images were created, allowing direct comparison with the graphic images. As with the  
112 graphic image based warnings, these stimuli contained colour and a (neutral) picture, both of  
113 which could influence attentional bias [5, 31]. Thus, whilst differences in attention towards  
114 the newer (graphic image based) and older (text-only) style of warning could be attributed to  
115 the colour or image present on the former, any difference between the graphic image based  
116 warnings and neutral matches can only be attributed to the graphic nature of the content.

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117 Given research highlighting the interaction between images and text on attention, presence of  
118 text caption was also manipulated to assess its effect on attentional biases to the warnings.

119 It was hypothesised that: a) participants will demonstrate an attentional bias towards the  
120 cigarette warnings relative to their neutral counterparts (due to the generic threatening nature  
121 of the images); b) smokers will demonstrate an elevated attentional bias compared to non-  
122 smokers given the warnings represent an increased threat for them; and c) there will be a  
123 difference in attentional bias between warnings with and without text captions.

## 124 ***Method***

### 125 **Participants**

126 A total of 86 participants were sampled from a South Yorkshire University. The majority of  
127 this student sample were of a Caucasian ethnicity (91.86%). 44 were self-reported,  
128 defined as having at least one cigarette a day (17 males and 27 females) and 42 were never-  
129 smokers (10 males and 32 females). The mean age of the sample was 23.90 years (SD= 9.37).

### 130 **Materials**

#### 131 *Warning Images & Matches*

132 Of the 15 warnings currently in circulation on UK packaging, four were excluded because  
133 they contained only a text statement, with no accompanying image. The images were  
134 digitized and converted to an indexed 256-colour palette using Adobe Photoshop (CS4)  
135 software, with image dimensions set to 200 x 160 pixels. Neutral images, matched in terms of  
136 content and visual complexity were selected to serve as appropriate controls (see Figure 1).  
137 This matching procedure has been undertaken in previous visual dot probe research [32-33].

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138 In order to provide a strict experimental control, each neutral image contained the same text  
139 caption as its graphic warning counterpart.

**140 Design & Procedure**

141 The Visual Dot Probe paradigm was programmed in E-Prime (Psychology Software Tools  
142 Inc) and presented on an Intel(R) 1.66 GHz laptop, with a 15 inch monitor and screen refresh  
143 rate of 60 Hz. Participants were sat approximately 45cm away from the screen. Stimuli were  
144 presented at a visual angle of 5.52°. Participants were required to respond to the location of  
145 the probe by pressing either the 'z' or 'm' key for a left or right probe respectively. A probe  
146 location task was used, with a varying inter-trial interval (500ms -1500ms), the latter of  
147 which was implemented to reduce fatigue. Participants were required to complete 12 practice  
148 trials.

149 Each warning was presented four times along with its neutral counterpart. Out of these four  
150 presentations, the warning was presented twice on the left side of the screen and twice on the  
151 right. For each of the two presentations, the probe was presented in a congruent location once  
152 (i.e. on the same side) and an incongruent location once (i.e. on the opposite side). To test the  
153 hypothesis that the text caption played a role in attentional bias, an equal number of trials  
154 were included in which the same images and matches were presented without text. Thus, each  
155 of the 11 warnings was displayed four times with a text caption and four times without,  
156 giving a total of 88 critical trials. The order of presentation for all stimuli were  
157 counterbalanced and randomised.

158 *Insert figure 1 here*

159 For the task, participants were asked to respond as quickly and accurately as possible to target  
160 probes appearing on either the left or right side of the screen whilst ignoring the preceding

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161 images. The 'z' and 'm' keyboard letters were required to respond to targets presented on the  
162 left and right side of the screen respectively.

**163 Data Analysis**

164 Reaction times (ms) from error trials (1.17% of the data) and practice trials were excluded  
165 from the analysis. As in previous research [34-35], participants' anticipatory (< 200ms) and  
166 slow responses (> 2 S.D. of the mean) were also excluded. Together, they accounted for 4.5%  
167 of the data. Parametric assumptions were met. To facilitate understanding of significant  
168 results, a single index of attentional bias was calculated [34], operationalised as the mean  
169 score on incongruent trials minus the mean score on congruent trials [37]. Bias scores were  
170 analysed in a 2x2 mixed ANOVA (Text Caption [Present, Not Present] x Smoking status  
171 [Smoker, Non-Smoker]) to assess whether attentional bias differed between groups. A-priori  
172 one sample t-tests were also conducted to assess whether attentional bias scores were  
173 significant for each group separately. [13]. Analyses were conducted with SPSS version 18.

**174 Results**

175 Results of the analysis revealed no general difference in attentional bias scores between  
176 conditions with and without text captions  $F(1, 84) = .558, p = .457, \eta_p^2 = .007$ . There was a  
177 significant main effect of smoking status,  $F(1, 84) = 4.377, p = .039, \eta_p^2 = .050$ , but this was  
178 subsumed within the interaction between presence of text caption and smoking status,  $F(1,$   
179  $84) = 10.841, p = .001, \eta_p^2 = .114$ . Follow up testing of this interaction revealed that Smokers  
180 ( $M = 10.20 \pm 2.56$ ) exhibited a significantly larger attentional biases towards warnings with  
181 graphic image content when accompanied by a text caption than Non-Smokers ( $M = -4.19 \pm$   
182  $2.62$ ):  $t(84) = 3.924, p < .001, d = 0.85$  (see figure 2).

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183 Moreover, bias scores only significantly differed from zero in the case of Smokers  $t(43) =$   
184  $3.950, p < .001$ . These findings refute the initial hypothesis of a general attentional bias for  
185 all participants, but an attentional bias in the smoker group provides support for the second  
186 hypothesis.

187 *Insert figure 2 here*

188 For trials in which the images did not have a text caption, there were no differences in terms  
189 of smoking status,  $t(84) = -.521, p = .604$ . Furthermore, both bias scores did not significantly  
190 differ from zero for both smokers ( $M = .08 \pm 2.83$ ),  $t(43) = .029, p = .977$  and non-smokers  
191 ( $M = 2.19 \pm 2.89$ ),  $t(41) = .745, p = .461$ . As smokers only demonstrated an attentional bias  
192 when text captions were present, this supports the second and third hypotheses, which  
193 delineates a distinction in biases as a result of smoking status and text caption.

## 194 ***Discussion***

195 This study assessed whether warnings with graphic image content can elicit greater  
196 attentional bias in comparison to neutrally matched counterparts and whether biases differed  
197 as a result of smoking status. Only smokers exhibited an attentional bias towards warnings  
198 with graphic image content, corroborating previous cigarette warning research that has  
199 demonstrated smokers' increased attention to these warnings in self report [29, 38] designs.  
200 This bias however, is likely to be driven by the presence of the text caption, given that only a  
201 negligible bias was observed in the absence of text. This study expands upon previous  
202 research, through its manipulation and examination of graphic content and textual aspects of  
203 warning design.

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204 Smokers' increased attentional vigilance for these warnings is likely a result of the  
205 threatening nature of the stimuli [39] that is particularly salient for this group. However,  
206 attentional biases were only demonstrated for warnings when they included a text caption,  
207 that is, presence of text facilitated responses to congruent probes when the text information  
208 was consistent with the image (i.e. on the cigarette warnings and not the matches). This is  
209 consistent with research arguing that when text and graphic serve a unified instructional goal,  
210 processing is faster [40] and relatively effortless [42]. Attentional bias to the warnings may  
211 therefore *only* occur in the presence of the text caption.

**212 *Limitations and future directions***

213 This study has provided evidence for the role of graphic image content in the ability of  
214 cigarette warnings to capture Smokers' attention, most likely because the threat is salient for  
215 this population. It also provides substantial evidence for the central role of the text caption in  
216 attentional biases to the warnings.

217 It is of worth to note that the non-representative nature of the sample somewhat hinders the  
218 generalisability of results. Moreover, unlike previous research, this study did not attend to the  
219 heterogeneity of responding in different smoking categories (such as the differences in  
220 attentional bias exhibited between daily and weekly smokers [22]). With regards to the latter  
221 concern, a distinction between these groupings was not feasible, given that individuals were  
222 required to smoke daily in order to be categorised as a smoker. Moreover, as this grouping  
223 criterion somewhat differs from that established in other studies [13], creating a similar  
224 distinction without any a priori hypotheses may have easily lead to incorrect conclusions  
225 about attention towards the warnings, especially given that there was a significant effect  
226 resulting from smoking status in spite of such distinctions. Another noteworthy concern is

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227 that one could attentional biases towards the warnings may be attributable to familiarity of  
228 the graphic image based warnings relative to the neutral matches. This is unlikely however,  
229 given familiarity effects would also yield attentional biases for the graphic image based  
230 warnings (relative to their neutral counterparts) when not accompanied by a text caption.

231 Although the present results are promising, future research must ascertain whether smokers  
232 preferentially attend to the warnings over smoking related cues such as brand labelling,  
233 utilising a more generalizable sample. Whilst the relative attention to brands and warnings  
234 has been assessed in previous research [22], only aspects of the cigarette brand were  
235 manipulated in this instance. Therefore, there was no assessment of the effectiveness of  
236 cigarette warning content (i.e. text captions and graphic imagery) on attentional biases. As  
237 such, research should systematically vary components of both the warning and brand to  
238 assess which aspects are responsible for attentional capture. Additionally, further details  
239 regarding phenomenology of attentional biases elicited by the warnings are of utility, such as  
240 the distinction between engagement and maintenance aspects of attention [43]. Together, this  
241 would provide further clarity on the practical significance of attention to the warnings in two  
242 regards. Firstly, it could enable us to ascertain how well this increased attention to graphic  
243 image based warnings translates to increased processing of the warning information and in  
244 turn, behaviour change. Most importantly, given the role of cues (such as brand labelling) in  
245 craving and drug seeking processes [12], preferential attention to the warnings over brand  
246 labelling could potentially limit the effectiveness of brand labelling as a cue to initiate  
247 smoking behaviour.

248

249 The present study provides a significant contribution to the warning literature through its  
250 controlled assessment of whether a specific factor (graphic content) influences attention to

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251 the warnings. This is of particular importance given both the importance of attention for the  
252 processing of a warning [5-6] and that the inclusion of graphic content is the most noticeable  
253 (and documented) addition to the newer style of warnings. Focus on specific factors in this  
254 way represents a benchmark that further research and warning design should adhere to in  
255 order to produce more effective warnings.

For Review Only

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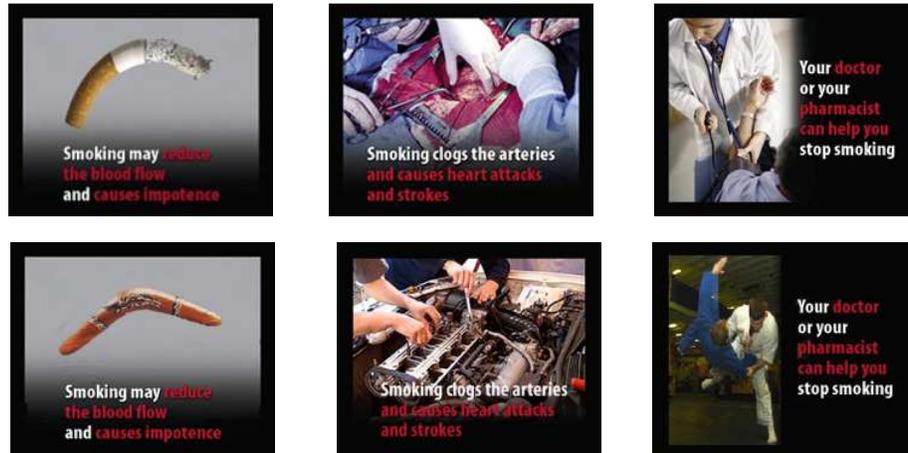


Figure 1: Examples of the new warnings and their neutrally matched counterparts.

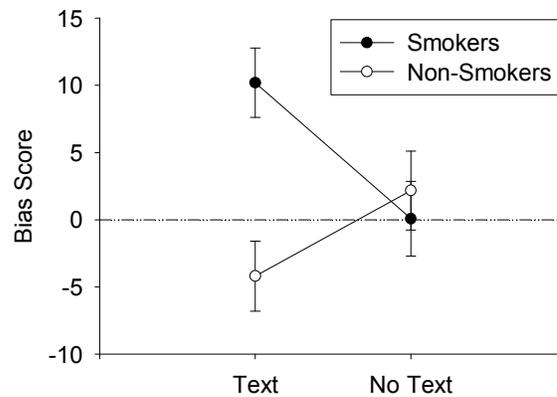


Figure 2: Bias scores representing attention to the graphic warnings by smoking status and presence of text caption and attention to control or matched images with a text caption. Error bars represent standard error.

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