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The impact of menu label design on visual attention, food choice and recognition: An eye tracking study

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Abstract

Nutritional labelling on menus has been found to promote informed food choices and reduce information asymmetry between manufacturers and consumers. However, lack of attention to nutritional labels limits their effectiveness. This study manipulated the way in which nutritional information was provided on menus in aim of enhancing visual attention to the most health relevant information. A between-subject design was implemented with three experimental conditions (*non-directive label; directive label; semi-directive label*). A total of 84 participants chose meals off a starter, main and desert menu whilst their eye movements were tracked using Tobii eye tracking software. Results showed that the menu labels did not significantly differ in their attentional gaining properties however the use of colour and health logos led participants to choose meals containing significantly less calories compared to when nutritional information was presented in black text alone. These findings indicate that nutritional information should be provided in colour or as health logos as this has the largest impact on food choice.

Practical Applications

A factor contributing to the rise in obesity prevalence is the obesogenic environment that we live in. The population has become increasingly reliant on convenience foods and dining out which has led to excess calorie consumption. Menu labelling has been identified as a possible intervention that could be employed by policy makers to guide informed food choices. However, there are calls for further actions and intervention to improve food choice as menu labelling has had mixed effects upon consumer choice and consumption. This study suggests that menu labelling is a viable option when the nutritional information is presented in a visually salient way. The use of colours and health logos attracts consumer’s attention to the most health relevant information which could contribute to efforts in reducing obesity and other illnesses linked to unhealthy consumption.

Keywords: menu labelling; food choice; eye tracking; visual attention; obesity

Introduction

Obesity is a nutrition related disease that has more than doubled in the UK in the past 25 years. Currently 24.8% of adults and 15% of children in the UK are classified as obese; therefore it is considered a significant health problem (National Health Service 2013). Nutrition plays a key role in achieving and maintaining a healthy body weight. However, there has been a concomitant increase in the marketing of unhealthy food, poor dietary choices in the British population, and increased prevalence of obesity and associated chronic illness (Fung *et al.* 2015; Huang *et al.* 2015). Efforts to reduce the continuing prevalence of obesity have steered towards focusing primarily on reducing energy intake and promoting healthier consumption (Valaquez and Pasch 2014).

Factors that influence dietary intake are complex and varied, including taste preferences, beliefs and values about nutrition. Typically, consumers engage in automatic, intuitive decisions regarding food choice that are guided by heuristics (Milosavljevic and Cerf 2008). Health policy and nutritional-related initiatives such as labelling can impact consumers' knowledge of food, health and subsequent food choice (Grunert *et al.* 2010). Research examining the impact of labelling has primarily focused on food packaging, with increased attention in recent years to menu labelling whilst dining out. Meals eaten out of home are predominantly larger in portion size and contain larger quantities of saturated fat compared to traditional home cooked meals (Bassett *et al.* 2007). The presence of nutritional information on packaged foods does not act as a precursor for nutritional awareness when dining out (Grunert, Bolton and Raats 2012). Thus, a need for labelling on menus to increase consumer awareness in restaurant environments was evident, and in 2009 the Food Standards Agency (FSA) developed a voluntary menu labelling scheme for the UK catering industry to promote healthier consumption when dining out (Seiders and Petty 2004). A total of 450 stores, from 21 well-known high street brands, agreed to display calorie information for their food and drink items, with an overall aim to reduce calorie intake such that it was significantly impactful on health at a population level (Morley *et al.* 2013).

Menu labelling

Menu labelling has been reported to significantly impact food choice in a UK obese population such that a reduction in calories selected was observed (Reale and Flint 2016). However, menu labelling research in the UK is sparse. A majority of menu labelling research has been conducted in the USA (e.g., Pulos and Leng 2010) as catering establishments retailing at 20 or more outlets have to provide calorie information on menus as part of the Patient Protection and Affordable Care Act (ACA; Pizam 2011). Angell and Silver (2008) reported that nutritional information presented at the point-of-purchase led to a decrease in calorie intake by 15% in a fast-food outlet. In alignment, Chu, Frongillo, Jones and Kaye (2009) reported similar findings when examining the impact of nutritional values in a cafeteria setting. The average calories purchased significantly decreased from 839 kcal to 667 kcal showing a 20% reduction. Importantly, there were no differences in the total number of entrees sold therefore the reduction in calories were resultant of consumers selecting less energy dense foods. However, in some cases menu labelling has been found to have no impact on food preference (Harnack *et al.* 2008; Finkelstein *et al.* 2011). This has questioned the cost effectiveness of such intervention as extensive time and precision is required to provide accurate nutritional information, especially when the catering industry is continually making changes to the foods on offer (Lazareva 2015).

One possible explanation for the contrasting evidence is menu label design. Harnack et al. (2008) provided four fast food restaurant menus to participants as part of a between subject design. The calorie information was presented between the food item and price which resulted in just over half of the participant's reporting that they had seen the calorie information (54%). However, Chu et al. (2009) provided nutritional information on larger labels measuring 5 x 3 inches (height and width) and guided participants towards the information using a space divider to ensure the information was read. In similar studies whereby menu labelling had been presented in large text (Cinciripini 1984) and coloured fonts (Milich, Anderson and Mills 1976) a significant impact on food choice has also been reported. This suggests that visual attention to nutritional information plays a key role in consumer use of information and may explain why menu labelling had no impact when provided on a drive-thru menu in Kings County (Finkelstein *et al.* 2011).

The health consciousness of the individual also plays a part in the use of nutritional information. Health conscious consumers tend to act in accord to their internal attitudes, and thus, are more sensitive to behavioural consequences. They will actively search for the nutritional information to guide their choices when menu labelling is present (Gould 1990; Visschers, Hess and Siegrist 2010). Alternatively, less health conscious consumers without nutrient specific goals are unlikely to have their attention drawn towards the most health relevant information. Instead it is likely that they are stimulus driven which is largely determined by attention and the visual saliency of the information within the visual field. Label information salience is determined by characteristics of the label itself against the background of the micro and macro context suggesting that labels need to be presented in a way that will attract consumer's attention towards the most health relevant information (Bialkova and van Trijp 2010).

Nutrition label manipulation

Visual graphics have been reported as a powerful motivator for ordering behaviour (Hanks *et al.* 2012). When used on coloured advertisements they captured participants' attention quicker and for a longer duration of time than black and white advertisements, in an eye tracking study of the yellow pages (Lohse 1997). Similar findings have been reported when consumers were presented with nutritional information on labels that had been made more salient within the visual field (Bialkova and van Trijp 2010). The crucial factors in determining visual attention to labels and the initial phase of searching include shape, contrast (Clement *et al* 2013) and colour, especially when nutritional labels are affected by competing clutter dimensions (Bialkova *et al* 2013). Even though the debate remains regarding how nutritional information should be presented (Feunekes *et al.* 2008), these studies support the notion that colours, font and logos can draw attention to stimuli by separating specific items from one another (Kershaw 2009). Based on these findings, a typology of labelling formats was recently suggested (Hodgkins *et al.* 2012) in relation to the degree to which they allow consumers to draw conclusions about the healthfulness of a product (Grunert and Wills 2007). Three designs were constructed: namely non-directive, semi-directive and directive.

Non-directive labels are currently being used on menus as part of the ACA (Pizam 2011). They provide no information of the products healthiness, other than stating the calorific values of food items on the menu. Semi-directive labels include a partial evaluation of nutritional content through colour. For example, the traffic light labelling system encourages consumers to consider the foods they select based on the evaluation of nutritional content (Borgmeier and Westenhoefer 2009). Finally, directive labels use health logos to guide consumers' attention to the healthiest items in an all or nothing format (van Herpen and van Trijp 2011). Logos reduce cognitive effort thus they are beneficial in promoting healthier consumption to low health conscious people as they are less likely to search for nutritional information to guide their decisions (Russo *et al.* 1986). Health consciousness can be measured using inventories such as the health and nutritional awareness questionnaire which is a validated tool (Kempen *et al.* 2012). However, Hodgkins *et al.* (2012) typology of labelling formats have not been utilised on menus, and whilst previous research (e.g., Bialkova *et al* 2014) demonstrates that they may be effective in improving food choice when purchasing packaged foods, the impact on food choice from a menu is yet to be understood.

Traditional approaches measuring nutritional label used have relied upon self-report methods (Cowburn and Stockley 2005; Higginson *et al* 2002; Kelly *et el* 2009), surveys and questionnaires (Roberto *et al* 2012; Steenhuis *et al* 2010). These processes are limited as two assumptions are made regarding the level of awareness in the processing of nutrition information and the level of introspection in reporting information processing (van Trijp 2009). These limitations have stimulated methodological innovation including approaches based on the visual search methodology (Bialkova and van Trijp 2010; Bialkvoa Grunert and van Trijp 2013) and eye tracking measurements (Graham *et al* 2012).

When visual search methodologies were enforced (Bialkova and van Trijp 2010; Bialkvoa Grunert and van Trijp 2013), attention, as indicated by performance, was better with monochromatic than polychromatic colouring, in particular GDA's. Neuroscience research has demonstrated that this is resultant of the extra brain regions involved in processing colour (Zeki and Marini 1998). However, these findings contradict consumer studies which may be due to the paradigms and measures used. Jones and Richardson (2006) examined the impact of labelling on attention and food choice in a supermarket using eye tracking technology. The use of eye tracking in menu labelling research is sparse; however it is suggested as a useful tool as it is less susceptible to social desirability than participant recall methods (Graham, Orquin and Visschers 2012). It is also well established and widely used in psychology for capturing attention (e.g. Rayner 1998; 2009). The study found that the semi-directive label captured consumers' attention quickly which made it easier for consumers to evaluate the healthfulness of the item compared to the non-directive labelling design.

Similarly, Bialkova *et al.* (2014) reported that label design was found to significantly impact both the number and duration of fixations, such that participants' attention was drawn to the semi-directive labelling system significantly more than the non-directive label. This increased the products likelihood of being selected, providing further evidence that attention is drawn to semi-directive labels. However, both of these studies only compared two of the three label designs. Therefore, it is not surprising that Van Herpen and van Trijp (2011) found contrasting results when comparing all three labelling designs. The semi-directive label impacted food preferences, but its attention gaining properties and abilities to enhance selection beyond the level achieved in the directive labelling condition was not significant. It was the directive labelling system using health logos that enhanced attention resulting in participants making informed food choices. However, 30% of consumers reported that taste preference was the main reason for food choice, and therefore irrespective of health logos, remained a considerable factor in the decision making process as continuously found in the literature (Grunert, Wills and Fernandez-Celemin 2010). These studies provide some indication as to how labelling design impacts attentional capture and food choice, but they are not without limitation. The results represent the impact of nutritional labels on pre-packaged foods and therefore cannot be generalised to a dining out occasion where no time constraint applies (Drichoutis, Lazaridis and Nayga 2006).

Labelling appears to be an effective method of promoting informed food choices. However, despite concerns raised regarding food choice when dining out, there is a lack of research examining the effectiveness of menu labelling and thus, warrants investigation. Research to date has predominantly focused on consumers' comprehension of the information (e.g., Roberto *et al.* 2012) with only a handful of studies examining the effect of nutritional labelling on visual attention and these were limited to pre-packaged foods (Jones and Richardson 2006). A general concern emerging from this line of research is whether consumers notice and use the nutrition information in their final food choice decisions (Bialkova Grunert and van Trijp 2013). It is important to know what attracts consumers attention to nutrition labels and whether these labels have any influence on consumer purchase decisions (Bialkova and van Trijp 2010). It is still unknown how nutritional information on menus is absorbed and retrieved as no research to date has examined what consumers attention is drawn to throughout exposure of menu labelling (i.e., from first fixation during initial exposure, during final food choice and in retrieval). Therefore, the current study examined the impact of menu labelling design on visual attention, food choice and recognition of information.

Based on current evidence relating to the impact of labelling four hypotheses were offered:

1. In line with Jones and Richardson (2006), the semi-directive and directive labelling design were expected to attract participants attention quicker (shortest time to first fixation) than the non-directive label.

2. In line with Bialkova *et al.* (2014), the semi-directive and directive labelling design were expected to draw participant's attention to the information significantly more thus resulting in more frequent observations than the non-directive label (visit count; fixation count; fixation duration).
3. Participants will select food items containing the lowest calorie content in the semi-directive and directive labelling conditions in accordance to previous literature (Van Herpen and Van Trijp 2011).
4. Greater recognition of nutritional information is hypothesised in the directive and semi-directive condition as it will be attended to more, thus will be processed more effectively (and subsequently recognised) than the non-directive condition (Bialkova *et al* 2014).

Methods

Participants

A convenience sample of 84 participants were recruited from Sheffield Hallam University ensuring a small effect size (=.15) and adequate level of power (=.77). The sample included both university staff and students aged 18 years or above (mean = 23.58 ± 5.84) with a mean body mass index (BMI) of 23.94 ± 4.23 $kg{\cdot}m^2$. Participants were excluded from the study if classified as blind or colour blind to prevent invalidating findings.

Procedure

Following ethical approval, a pilot study was conducted in 6 participants from Sheffield Hallam University (female = 50%) who were above the age of 18 (21.45 ± 3.43) and had a mean BMI of 22.95 ± 5.72 $kg{\cdot}m^2$. Based on the pilot study, an additional task was added to the eye tracking section of the study. It was determined that short term memory could not be measured validly in the recognition task. Therefore, long term memory would be measured. A maze was added for 120 seconds before the recognition task, to ensure that the time between tasks was controlled.

On entering the eye tracking studio, participants were provided with the information sheet and were offered the opportunity to ask questions about the study, before signing the informed consent form. Initially, participants completed a demographic form and the HNA (Kempen *et al.* 2012). Participants were then seated 65 cm in front of a 24 inch monitor with built in Tobii Studio software (Tobii T60) where they were randomly allocated to an experimental condition, as part of a between-subject design (1= non-directive labelling system; 2= directive labelling system; 3= semi-directive labelling system; see Figures 1-3), to reduce practise effects in line with previous research (van Herpen and van Trijp 2011; Field 2009). At this point the principal investigator left the room allowing participants to complete the eye tracking section of the study alone to prevent distractions and social desirability effects (Lohse and Johnson 1996).

On screen instructions firstly directed participants to fixate on a black dot presented in the centre of a red circle. Participants were asked to follow the dot as it moved around the screen for 10 seconds to calibrate the participant’s eye movement to the eye tracking camera. Green lines were produced once the participant's eye movements were calibrated, indicating that the eye tracking element of the study could begin.

The first element of the eye tracking study required participants to select one food item off the starter, main and desert menu in accordance to the forced choice model. To replicate a natural restaurant setting no time restraint was implemented (Drichoutis *et al.* 2006) and participants were asked to imagine that they were dining out for an evening meal (Brown 2014). Once participants selected their food items, they were directed to solve a maze presented on the screen simply with eye movements. The task was limited to 120 seconds to ensure that time between tasks was controlled. After 120 seconds, regardless of maze completion, the recognition task begun. A previously shown food item from each menu was displayed on the screen for 5 seconds. For each previously shown food item, three calorific values were presented. One of the values was presented previously on the menu and thus was the correct calorific value for that food item. The other two values were fictional but remained within a range of 25% to reduce participant's reliance on guesswork when instructed to select which value they thought was correct (Monroe, Powell and Choudhury 1986). At this point, the eye tracking element of the study was complete and participants were instructed to complete the FCQ (Steptoe *et al.* 1995). The principal investigator then returned to provide a full verbal and written debrief to the participant.

Measures

The Health and Nutritional Awareness Questionnaire (HNA; Kempen et al. 2012) is a reliable measure of health consciousness relevant to two dimensions (Cronbach Alpha: Health awareness $\alpha = 0.86$, nutritional lifestyle behaviours $\alpha = 0.84$). It consists of 21 statements each rated on a 5 point Likert scale from 1-5 (strongly disagree to strongly agree). Scores range from 7- 35 and 14-70 for the health awareness and lifestyle scales respectively.

This measurement was included as there is evidence suggesting that health consciousness determines the effects of internal attitudes and external influences on consumer behaviour (Gould 1990).

The Food Choice Questionnaire (FCQ; Steptoe, Pollard and Wardle 1995) measures the motives that underpin food choice, pertinent to nine dimensions (Cronbach alpha: weight control α = 0.79; mood α = 0.83; convenience α =0.81, health α =0.87; natural content α = 0.84; price α = 0.82; familiarity α = 0.70; ethical concern α = 0.70; sensory appeal α = 0.70). A review of the FCQ suggested that an improved version should include less categories and items, to increase robustness (Fotopoulos *et al.* 2009). Therefore, the categories price, convenience and ethical concern were removed, as they were not relevant to the study. The modified FCQ contained 18 statements, rated on a 4 point Likert scale from 1-4 (not true to very true). Thus overall scores for each scale ranged from 3 to 12.

Menu Design: A starter, main and desert menu included 9 items randomly chosen from a well-known dining out establishment, where nutritional information is readily available. A menu from a sit-down service restaurant was chosen to address previous studies limitations that have predominantly used menus from fast-food outlets (e.g., Angell and Silver 2008). The menu contained three meals of low, medium and high calorie options to ensure there was no tendency towards high or low options. Price was removed in line with previous findings, as it is the most influential factor in the food choice process; therefore its inclusion may have invalidated findings (Roseman, Mathe-Soulek and Higgins 2013). Three designs were used as these are the three main labelling schemes currently used on packaged food in the EU: condition one presented calorie information in black text in accordance to the non-directive labelling design; condition two used health logos as part of the directive labelling design; and condition three employed a colour-coded traffic light labelling system as part of the semi-directive labelling design (Storcksdieck *et al.* 2010). For all experimental conditions the calorific value of meals selected was recorded.

Visual Attention: An area of interest (AOI) was created around the nutritional information presented on the menus. The AOI had five measures which were calculated using the Tobii eye tracker software (Tobii TX300): 1) *Time to first fixation* (time from the first menu display until the participant first fixated on the AOI); 2*) Total fixation duration* (total time of all fixations in the AOI); 3) *Fixation count* (the number of times a participant fixated on an AOI) and 4) V*isit count* (the number of times a participant visits an AOI including both saccades and fixations 5) *Percentage of fixations* (the percentage of nutritional information that participants fixated on; Bialkova and van Trijp 2011). The software used a velocity threshold method to define saccades and fixations. When the velocity of the Fovea was higher than 30 visual degrees per second, the eye movement was defined as a saccade. Anything lower was defined as a fixation. The binocular sampling rate was set at 60 Hz and allowed for freedom of head movement in a 41 x 21 cm virtual box (TobiiPro 2015).

Recognition Task: To identify whether learning had taken place following the presentation of nutritional information, a recognition task based on the forced choice model was included (Brown 2014). The crucial feature was that participants were not asked to memorise anything and that under a false pretence, they were presented with calorific values, and thus learning was incidental in nature (Laureati *et al*. 2011). Visual short term memory was not measured as instructions had to be provided immediately before the task thus inhibiting immediate memory capture. Therefore, long term memory was measured following a 120 second task (Baddely and Hitch 1974). The task consisted of completing a maze, rather than popular counting tasks, to prevent numerical values interrupting memory retrieval of the calorific values (Ricker, Cowan and Morey 2010).

Data Analysis

A multivariate analysis of covariance (MANCOVA) was run in SPSS (Version, 21) to determine how menu labelling design impacts visual attention, food choice and recognition, when controlling for health consciousness. Health consciousness was used as a covariate due to individual differences in information processing (Gould 1990) and attentional capture (Visschers *et al.* 2010). All assumptions for the inferential test and the covariate were met following the calculation of descriptive statistics (Table 2). Where a main effect was established, pairwise comparisons were used to follow up significant effects. For all analyses α was set at .05. Internal consistency for the modified FCQ was determined by calculating Cronbach Alpha.

Results

The experimental groups consisted of near to equal sex distribution as shown in Table 1. There was no significant difference for age ($F(2,81) = .06$, $p > .05$, $\eta_p^2 = .01$) or BMI ($F(2,81) = 2.63$, $p > .05$, $\eta_p^2 = .06$).

Visual Attention

The directive labelling (*Condition 2*) design captured participant's visual attention more quickly than the semi-directive (*Condition 3*) and non-directive (*Condition 1*) labelling design. This resulted in participants fixating on the nutritional information in the directive labelling condition for the longest length of time, as shown by the largest fixation duration and count (See Table 2). Participants also returned to the information during the decision making process in the directive labelling condition, but this was more frequent when the information was provided with colours in the semi-directive condition. There was no main effect for time to first fixation ($F(2,81) = .30$, $p > .05$, $\eta_p^2 = .01$), fixation duration ($F(2, 81) = 2.08$, $p > .05$, $\eta_p^2 = .05$), fixation count ($F(2,81) = 2.28$, $p > .05$, $\eta_p^2 = .05$) or visit count ($F(2,81) = 2.31$, $p > .05$, $\eta_p^2 = .05$) for menu labelling design. However, there was a significant difference in the amount of nutrition information that was fixated upon (F(2, 81) = 150.84, $p > .001$, $\eta_p^2 = .79$). Participants in the semi-directive and directive labelling condition fixated upon all the nutritional information, whereas participants in the non-directive conditions fixated on 41.93 ± 4.73% of the nutritional information provided.

When controlling for health consciousness there was also no main effect for time to first fixation ($F(2, 81) = .23$, $p > .05$, $\eta_p^2 = .01$), fixation duration ($F(2,81) = 1.75$, $p > .05$, $\eta_p^2 = .04$), fixation count ($F(2,81) = 1.96$, $p > .05$, $\eta_p^2 = .05$) or visit count ($F(2,81) = 2.54$, $p > .05$, $\eta_p^2 = .06$) for menu labelling design. However, there was a significant difference in the amount of nutrition information that was fixated upon (F(2, 81) = 110.08, $p > .001$, $\eta_p^2 = .81$). Participants in the semi-directive and directive labelling condition fixated upon all the nutritional information, whereas participants in the non-directive conditions fixated on 41.93 ± 4.73% of the nutritional information provided.

Food Choice

Participants in the non-directive labelling system chose meals containing the highest mean energy content compared to when a partial evaluation of overall healthiness was provided with semi-directive and directive labels (see Table 2). The MANOVA showed that there was a main effect for content of meals selected based on the menu labelling condition ($F(2,81) = 7.31$, $p < .01$, $\eta_p^2 = .15$). This was also shown in the MANCOVA when controlling for health consciousness ($F(2,81) = 6.95$, $p < .01$, $\eta_p^2 = .15$). Pairwise comparisons identified that the food selected was significantly lower in calories in the directive ($p < .05$) and semi-directive ($p < .05$) conditions in comparison to the non-directive condition.

Recognition

As show in Figure 1, the largest proportion of participants to accurately recognise all three calorific values were those that chose meals in the directive (N=5) and semi-directive condition (N=5). Participants who observed the nutritional information in the non-directive condition recorded the most incorrect answers (N=4; Figure 1). However, in all three conditions the mean accuracy score and time taken was similar (see Table 2), resulting in no main effect for recognition accuracy ($F(2, 81) =.75$, $p > .05$, $\eta_p^2 = .02$) or time taken ($F(2, 81) = 2.13$, $p > .05$, $\eta_p^2 = .05$) for menu labelling design. This was also observed when controlling for health consciousness: recognition accuracy ($F(2, 81) =.66$, $p > .05$, $\eta_p^2 = .02$) and time taken ($F(2, 81) =.73$, $P > .05$, $\eta_p^2 = .02$).

Reason for Food Choice

In all three conditions the most influential factor of food choice was sensory appeal. However, participants were more concerned about their personal health and weight, as well as the food item's natural content, when nutritional information was presented in the directive and semi-directive conditions compared to the non-directive condition. Yet, there was no main effect for food choice based on natural content ($F(2,81) = 1.09$, $p > .05$, $\eta_p^2 = .02$), weight control ($F(2,81) = 1.25$, $p > .05$, $\eta_p^2 = .03$), health concern ($F(2,81) = 1.71$, $p > .05$, $\eta_p^2 = .04$), sensory appeal ($F(2,81) = .85$, $p > .05$, $\eta_p^2 = .02$), mood ($F(2,81) = 1.05$, $p > .05$, $\eta_p^2 = .03$) or familiarity ($F(2,81) = 2.26$, $p > .05$, $\eta_p^2 = .05$) in the three menu labelling conditions. This was also observed when controlling for health consciousness: natural content ($F(2,81) = .75$, $p > .05$, $\eta_p^2 = .02$), weight control ($F(2,81) = 1.25$, $p > .05$, $\eta_p^2 = .03$), health concern ($F(2,81) = 2.27$, $p > .05$, $\eta_p^2 = .05$), sensory appeal ($F(2,81) = .86$, $p > .05$, $\eta_p^2 = .02$), mood ($F(2,81) = .90$, $p > .05$, $\eta_p^2 = .02$) and familiarity ($F(2,81) = 2.35$, $p > .05$, $\eta_p^2 = .06$).

Discussion

Eye tracking technology was used to examine the impact of menu labelling design on attention gaining properties and establish whether and how label design impacts food choice and recognition. Three labelling designs were employed that differed in their ‘directiveness’, referring to the degree to which they allow consumers to draw conclusions about the healthfulness of a food item (Grunert and Wills 2007). This study found that visual attention and recognition of the nutritional information did not significantly vary by label design, however label design did significantly impact food choice.

Visual Attention

When participants were presented with nutritional information on menus, time to first fixation did not significantly vary by menu labelling design in contrast with previous research research (Bialkova *et al* 2014). Therefore, hypothesis 1 was not met. However, the directive and non-directive label, employing a monochromatic colour scheme, showed slightly higher attentional capture than the semi-directive label, which employed a traffic light colour scheme. These findings are in line with previous literature that compared the attentional gaining properties of monochromatic and polychromatic colouring on nutritional labels (Bialkova and van Trijp 2010, Bialkova Grunert and van Trijp 2013) whereby it has been demonstrated that processing colour coded information takes extra time, as more brain regions are involved in processing this information (Zeki and Marini 1998). This outcome contrasts consumer preference for coloured labels (Kelly *et al* 2009). Consumers have been reported to understand and interpret colour more efficiently at high levels of cognitive processing than when provided with monochromatic labels. Therefore, suggesting that colour coding effects may vary by level of information processing (Bialkova and van Trijp 2010).

During the decision making process, participant’s observed less than half of the nutritional information when it was presented in black text. This finding is in line with research that recorded participants self-reported observations of nutritional information on menus (Harnack *et al* 2008). When nutritional information has been provided in a visual salient way and received initial attention, an impact on food choice has been reported (Chu *et al* 2009; Cinciripini 1984; Milich, Anderson and Mills 1976). This finding was replicated in the current study whereby participants in the directive and semi-directive labelling condition who fixated upon significantly more nutritional information provided on the menus had slightly larger fixation durations in comparison to the non-directive label. However, fixation duration was not significantly related to labelling design therefore hypothesis 2 was not met.

Furthermore, nutritional information was viewed slightly less frequently, as indicated by visit and fixation count, when presented in black text compared to the logo and traffic light colour scheme. This difference was not significant and contradicts previous research (Bialkova *et al* 2014; Jones and Richardson 2006). This may be resultant of participant familiarity. Repeated exposure over time has been shown to enhance consumers learning and familiarity to the nutritional information which subsequently affects attention processes with consumers requiring less time to process information they are familiar with. This concept was supported in Bialkova and van Trijp (2011) study that reported a decrease in the fixation count when consumers were familiar with the label format. Therefore, participant's fixation and visit count may not have been significantly different due to prior familiarity with the labels provided as they are currently employed on packaged foods in the UK and on some restaurant menus as part of a voluntary menu labelling scheme (FSA 2009).

Alternatively, no significant differences in attentional data may have been reported due to the subtle changes enforced to the label design, such that the visually manipulated labels were unable to significantly shift participants' attention towards the lowest calorie food items (Wansink, Shimizu and Camps 2012). Label design represents an important opportunity for enhancing visual attention (Graham *et al.* 2012). Hodgkins *et al.* (2012) typology of labels were derived from a consumer sorting task thus using a typology that aims to make a distinction based on processing requirements for attentional gaining properties may explain why no significant differences were found. Furthermore, label design is not the only factor in which can be manipulated. Consumers have been found to exhibit a bias towards items within a certain location on a menu, also known as the sweet spot. This generally tends to be in the centre of the display which increases the likelihood of that item being selected by 60% (Reutskaja *et al.* 2011). The label design therefore may have been competing for visual attention against a predominant location that the participants were observing. With this in mind it is possible that placing the lowest calorie food items in the centre of the menu could enhance visual attention and steer consumers towards informed food choices. However, further study is required before drawing such conclusion.

Food Choice

The current study found that label design significantly impacted food choice in the decision making process. Participants chose menu items containing significantly less calories in the directive and semi-directive labelling condition compared to the non-directive condition, in line with hypothesis three and previous research (Van Herpen and van Trijp, 2011). This may have been a resultant effect of time to first fixation. Even though time to first fixation was not significantly different between conditions, it was slightly quicker in the directive and semi-directive labelling conditions. Evidence suggests that processing of attended information occurs ‘as soon as possible’ (Just and Carpenter, 1980) and acts as a determining factor to elaborate a decision. Therefore, if the attended information is relevant for the intentional decision to be made, then the likelihood of choosing that particular food item increases (Reutskaja *et al* 2011; Bialkova and van Trijp 2011). These food items are known as trigger foods which once exposed to, can set the tone for the entire meal such that exposure to a low calorie appetiser is 8 times more likely to encourage low calorie consumption for the rest of the meal (Hanks *et al.* 2012; Wansink and Love 2014).

A 17-25% reduction was observed in the directive and semi-directive labelling condition in comparison to the non-directive condition, in line with previous menu labelling studies (Chu *et al.* 2009; Liu *et al.* 2012). This reduction equates to a 368 to 528 calorie deficit (semi-directive and directive labelling conditions respectively) which if consumed in excess is equivalent to gaining approximately 8 pounds a year (Cutler, Glaeser and Shapiro 2003). Therefore, menu labelling appears to be a particularly relevant intervention to employ in the UK given that consumers reportedly eat out at least once in every six dining occasions (FSA, 2009).

Menu label design did not significantly impact motives for food choice; however the current study indicated that participants became slightly more concerned about their weight and health when nutritional information was presented with health logos and colours. Consumers appear to have low awareness of the high calorific content of meals when dining out (Berman and Lavizzo-Mourey 2008). The level of comprehension required to understand nutritional information is easily reduced when attentional capturing properties are enhanced. This has been found to have the largest impact on positive lifestyle changes such as a clearer association between consumption and health (Fogg 2009). However, in accordance to previous studies (e.g., Grunert *et al.* 2010), sensory appeal remained to be the most influential factor in the decision making process. This finding may appear to be concerning given that menu labelling aims to encourage informed food choices. However, menu labelling must be done in a way to prevent negative perceptions of taste. Low calorie foods are often associated with low sensory appeal (Wansink and Hanks 2013) which can lead to compensatory behaviours, such as overeating (Chandon and Wansink 2007). With this in mind it has been suggested that priming and expectation building is required before presenting low calorie foods to enhance consumer taste expectations (Wansink and Love 2014). However, the current study indicates that this may not be needed, as directive and semi-directive labels were found to maintain perceived sensory appeal which could subsequently reduce compensatory behaviours.

Recognition

The outcome of the recognition task appears to be closely related to the visual attention data. There was no significant difference in the accuracy of the recognition task which opposes hypothesis 4. Eye movements are associated with information processing (Rayner and Castelhano 2008) and the deeper the information is processed the easier it is to be retrieved. However, attentional capture does not imply that comprehension will be improved. Instead, recognition relies on memory and further processing of nutritional information, rather than being a pure measure of attention which may explain why no differences were found between labelling conditions (Bialkova and van Trijp 2010). Furthermore, when the number of alternatives increases consumers often become more selective in the information they encode through heuristics strategies (Payne, Bettman and Johnson 1993). Therefore, deep encoding may not always be possible as the brains information capacity is limited.

Implications

The implications of the current study are that menu labelling can improve consumer food choice when dining out, and thus should be considered by policy makers. There are calls for further actions and intervention to improve food choice and this study suggests that menu labelling is a viable option that can be enforced. Enforcement of menu labelling could contribute to efforts in reducing obesity and other illnesses linked to overconsumption of high energy dense foods (Bezerra *et al.* 2012). More specifically, when nutritional information is displayed as health logos or in accordance to the traffic light system, it appears to capture visual attention and encourage consumers to spend a longer duration processing the nutritional information. Repeated exposure to menu labelling may lead to an improved awareness of calorie content when dining out (Bettman 1979) which could consequently enhance informed daily food choices. Restaurants may consider providing lower calorie options to meet the consumer demand as these foods are generally more profitable (Wansink and Chandon 2014).

Limitations and Future Research

This study makes an important contribution to the menu labelling literature; however, it is not without limitations. First, the study was conducted in an eye tracking laboratory thus hypothetical choices were observed rather than actual food choices. This increases the likelihood of social desirability biases and does not allow conclusions to be drawn on energy consumption (Morley *et al.* 2013). Second, food choices were based on the forced choice task which mandated participants to choose a starter, main and desert item, whereas in reality they may have chosen a different amount (Brown 2014). Third, participants chose food items after completing the HNA and the menu items were presented in a fixed order which may have created a priming or order effect (Dayan and Bar-Hillel 2011). Furthermore, the current sample were relatively young which reduces the generalisability of the findings given that nutritional label use is influenced by demographic factors such as gender, age, education level and income (Sarink *et al* 2016). A larger sample may have increased the statistical power ensuring the study was not exploratory in nature. Having said this, the current study's findings were similar to previous research conducted in a natural setting, implying that environmental and social influences may not impact food choice to the extent that attentional capture does (Chu *et al.* 2009). Irrespective, future research should test the impact of menu labelling in a real life setting to accurately examine consumer visual attention to menu labelling and its subsequent effect on food choice and consumption.

Conclusion

The current study is a useful addition to consumer psychology and menu labelling research examining the impact of menu label design on visual attention, food choice and recognition by using eye tracking technology. The findings suggest that presenting nutritional information in health logos or colour captures and maintains visual attention such that it has a significant impact on food choice. Consumers became more concerned about their health and weight management which reduced the calorie content of food selected. The UK should therefore consider implementing menu labelling nationwide to enhance informed food choices and reduce the prevalence of obesity and associated ill health.

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Table 1 Participants' demographic information for each experimental condition (mean and standard deviation)

	Non-Directive (Condition 1) N=28	**Directive (Condition 2) N=28**	**Semi-Directive (Condition 3) N=28**
Number of males	N= 15	N= 14	N= 14
Number of females	N= 13	N= 14	N= 14
Age (years)	23.29 ± 4.44	23.68 ± 6.86	23.79 ± 6.16
BMI (kg·m^2)	25.34 ± 3.52	23.62 ± 6.86	22.86 ± 3.41

Table 2 Visual attention, food choice, reason for food choice and recognition of nutritional information (mean and standard deviation) following the provision of menu labelling

	Non-Directive (Condition 1) N=28	**Directive (Condition 2) N=28**	**Semi-Directive (Condition 3) N=28**
Visual Attention			
Time to First Fixation (s)	2.65 ± 2.41	2.28 ± 1.98	2.73 ± 2.50
Total Fixation duration (s)	1.63 ± 1.34	2.51 ± 1.91	2.1 ± 1.60
Total Fixation Count (s)	7.81 ± 5.99	11.85 ± 8.40	10.20 ± 6.71
Total Visit Count (s)	3.75 ± 2.39	4.94 ± 3.28	5.55 ± 3.73
Food Choice			
Calories Selected (kcal)*	2147.07 ± 65.31	1619.36 ± 487.04	1779.93 ± 411.85
Reason for food Choice			
Natural Content	4.21 ± 1.64	4.96 ± 2.36	4.54 ± 1.62
Weight Control	6.14 ± 1.88	6.86 ± 2.24	6.86 ± 1.69
Health Concern	5.04 ± 2.24	5.68 ± 2.48	6.18 ± 1.69
Sensory Appeal	10.32 ± 1.91	9.82 ± 1.79	9.71 ± 1.90
Mood	7.39 ± 2.39	6.50 ± 2.47	6.79 ± 2.20
Familiarity	8.68 ± 1.54	7.96 ± 2.44	7.57 ± 1.83
Recognition Task			
Accuracy	.50 ± .31	.58 ± .27	.50 ± .31
Time (s)	5.59 ± 1.87	5.49 ± 2.44	6.79 ± 3.32

* Indicates a main effect ($P < .05$)

Figure 1 Non-directive labelling (Condition 1)

Figure 2 Directive labelling (Condition 2)

Figure 3 Semi-directive labelling (Condition 3)