Appetite 76 (2014) 66–75

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Attention mediates the effect of nutrition label information on consumers' choice. Evidence from a choice experiment involving eye-tracking ☆

Svetlana Bialkova [a,*], Klaus G. Grunert [b], Hans Jørn Juhl [b], Grazyna Wasowicz-Kirylo [c], Malgorzata Stysko-Kunkowska [c], Hans C.M. van Trijp [d]

[a] Department of Communication Science – Corporate and Marketing Communication, University of Twente, De Zul 10, 7522 NJ Enschede, The Netherlands
[b] MAPP Centre for Research on Customer Relations in the Food Sector, Aarhus University, Denmark
[c] Department of Psychology, University of Warsaw, Poland
[d] Marketing and Consumer Behaviour Group, Wageningen University, The Netherlands

ARTICLE INFO

Article history:
Received 13 June 2013
Received in revised form 20 October 2013
Accepted 10 November 2013
Available online 3 February 2014

Keywords:
Attention
Choice
Nutrition labels
Eye tracking

ABSTRACT

In two eye-tracking studies, we explored whether and how attention to nutrition information mediates consumers' choice. Consumers had to select either the healthiest option or a product of their preference within an assortment. On each product a particular label (Choices logo, monochrome GDA label, or color-coded GDA label) communicated the product's nutrient profile. In study 1, participants had to select from 4 products differentiated, in addition to the nutrition information, by flavor (strawberry, muesli, apple, chocolate; varied within participants) and brand (local vs. global, varied between participants). Study 2 further explored brand effect within-participants, and thus only 2 flavors (strawberry, chocolate) were presented within an assortment. Actual choice made, response time and eye movements were recorded. Respondents fixated longer and more often on products with color-coded GDAs label than on products with monochrome GDAs or Choices logo. A health goal resulted in longer and more frequent fixations in comparison to a preference goal. Products with color-coded and monochrome GDAs had the highest likelihood of being chosen, and this effect was related to the attention-getting property of the label (irrespective of brand and flavor effects). The product fixated most had the highest likelihood of being chosen. These results suggest that attention mediates the effect of nutrition labels on choice.

Introduction

Many food choice decisions are made within the spur of the moment, often without too much close inspection of the alternatives at hand and with limited consideration and information processing (e.g., Grunert, Fernández-Celemin, Wills, Storcksdieck genannt Bonsmann, & Nureeva, 2010). This situation provides an important challenge for policy makers when the purpose is to drive consumers' attention towards a healthful option, and thus healthier eating. To attract consumer attention and to communicate product characteristics (Schoormans & Robben, 1997), packaging design is the major parameter that can be used at the point of sale (Luchs & Swan, 2011). However, many food packages contain a large number of informational cues (e.g., brand names, ingredient information, graphics and other visuals), which makes it difficult for health-related information to attract attention and affect consumer choice.

Recent research suggests that healthy food choices might be encouraged by optimizing nutrition labeling on food products (Grunert & Wills, 2007; Nayga, 2008; Verbeke, 2008). However, the majority of studies have dealt with consumers' ability to understand different formats of nutrition labels in situations of forced exposure to such labels (e.g., Borgmeier & Westenhoefer, 2009; Feunekes, Gortemaker, et al., 2008; Grunert, Wills, & Fernández-Celemin, 2010), whereas the major factor for nutrition label effects in real-world shopping situations may be the label's ability to attract consumer attention (Grunert, Fernández Celemín, Storcksdieck genannt Bonsmann, & Wills, 2012). Although

☆ *Acknowledgement:* This research was supported by the 7th EU Framework Programme Small Collaborative Project FLABEL (Contract no 211905). The content of the paper reflects only the views of the authors; the European Commission is not liable for any use that may be made of the information contained in this paper. We thank Magdalena Marczak, Karolina Olszewska, Jakub Wąsowicz-Kiryło, Katarzyna Żbikowska for the assistance with collecting the data.

* Corresponding author.
E-mail address: s.e.bialkova@utwente.nl (S. Bialkova).

http://dx.doi.org/10.1016/j.appet.2013.11.021
0195-6663/

nutrition labels could help consumers to compare the healthfulness of products (Grunert, Wills, et al., 2010), this does not mean that the nutrition information provided front-of-pack will automatically attract consumers' attention and will result in its use. Further investigation on the way in which nutrition labels attract attention and how attention mediates the effect of nutrition label information on consumer choices is needed. The current study addresses this issue.

As most food choices are made very quickly, in a complex environment, it appears natural to assume that (lack of) attention could be an important factor limiting the effect of nutrition labels on food choices. However, while a few studies have indeed addressed the attention-getting properties of nutrition labels, (Bialkova, Grunert, & Van Trijp, 2013; Bialkova & Van Trijp, 2010, 2011; Visschers, Hess, & Siegrist, 2010), it has not yet been addressed to which extent attention mediates the effect of nutrition labels on choice, and whether this process differs between different label formats. Getting more insight into this issue would be of major importance for assessing the potential of nutrition labels and designing optimal formats: if we can differentiate labels formats by the extent to which their effect on consumer choice is contingent on longer attention spans, we could single out those label formats that are most likely to have an effect on consumer choice even in a choice environment characterized by time pressure and information overload.

By combining an experimental choice task with eye-tracking methodology, the current study will be the first to investigate to which extent attention to nutrition labels mediates their effect on choice, and how this differs between different label formats.

Conceptual model and hypotheses

Previous research has suggested that attention to front-of-pack nutrition labels is affected by *bottom-up* (e.g., label size, location, chromaticity, familiarity with the label and its location, information density on pack; Bialkova & van Trijp, 2010; Bialkova et al., 2013) and *top-down* factors (e.g., motivational mind set with which consumers enter a shopping situation; Bialkova & van Trijp, 2011). However, it is still not clear whether and how attention to nutrition information determines the actual product choice. To address this question, we designed the current study. The main manipulations are based on the conceptual framework summarized in Fig. 1 and discussed below.

Attention

The degree to which consumers focus on specific stimuli within their range of exposure is usually defined as attention (e.g., Solomon, Bamossy, & Askegaard, 2002). Attending a nutrition label depends on factors such as label size, chromaticity (Bialkova & van Trijp, 2010), and information density on front-of-pack (Bialkova et al., 2013). We further hypothesize that a crucial factor in attention capture is the label format. There is currently a great variety of nutrition labels available on food products on the European market

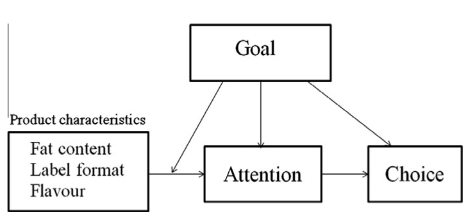

Fig. 1. A conceptual framework illustrating the mediation process.

(Bonsmann, Celemin, et al. 2010), which must be expected to differ in their ability to attract consumer attention.

A typology of label formats was recently suggested by Hodgkins et al. (2012) based on the degree to which the nutrition label allows direct conclusions on the healthfulness of a product to the consumer or leaves it up to the consumer to draw these conclusions. The typology distinguishes three types of labels, namely directive, semi-directive, and non-directive labels. In the current study, we use representatives of these three types of labels: the Choices logo as an example of a directive label, a traffic light (TL) color coded Guideline Daily Amounts (GDA) label as an example of a semi-directive label, and a monochrome GDA label as an example of a non-directive label, see Table 1.

GDA labels provide information on calories, fat, saturated fat, sugar and salt. Self-report studies (Grunert, Wills, et al., 2010) support that consumers indeed look for fat, sugar, and calories information when searching for nutrition information. Thus, in the current study we manipulate fat content medium vs. low, in order to investigate whether this information affects choice, to which extent this effect depends on the attention-getting properties of the label, and how the effects differ with respect to label formats (The effect of sugar and calories is the focus of another FLABEL study, and is reported in Bialkova, Grunert, Königstorfer, van Trijp, & Gröppel-Klein, working paper).

We further assume that fat level and label format effects on attention are affected by the shopping goal. Indeed, previous research suggests that the effect of nutrition information depends on whether consumers have a preference goal or a health goal when exposed to particular assortments and thus in making choices (Bialkova & Van Trijp, 2011). Therefore, we hypothesize:

H1. Fat level and label format affect attention.

H2. The effect of fat level and label format on attention is stronger for a health than for a preference goal.

Choice

We hypothesize that fat level and label format affect choice. As fat is one of the major pieces of nutritional information that consumers look for when evaluating the healthfulness of a food product (Grunert, Wills, et al., 2010), it is very likely that fat level influences the final product choice. Concerning the label format, the evidence on which label formats are best in facilitating healthy choice is still mixed (Grunert & Wills, 2007), and thus, we expect that different label formats may affect differently consumer food choice. In addition, we hypothesize that label format and fat level effects are stronger when consumers choose with a health goal in mind than if they choose by preference, as preference is also influenced by other factors, most notably taste, as food products within an assortment usually differ in flavor. We predict that:

H3. Fat level and label format affect choice.

H4. The effect of fat level and label format on choice is stronger for a health than for a preference goal.

Attention as a mediator of choice

Nutrition label information can have an impact on choice only if the label information receives attention (Grunert & Wills, 2007). Different label formats may differ in their attention capturing properties (Bialkova & van Trijp, 2010), and some label formats

Table 1
Design cells on manipulation for the label format and level of fat content.

Fat content	Label format		
	Choices logo	Monochrome GDAs	Color-coded GDAs
Low fat content	WIEM, CO WYBIERAM	Kalorie 106 5% · Cukry 13.8 g 15% · Tłuszcz 0 g 0% · Kwasy tłuszczowe nasycone 2.3 g 12% · Sól 0.2 g 3%	Kalorie 106 5% · Cukry 13.8 g 15% · Tłuszcz 0 g 0% · Kwasy tłuszczowe nasycone 2.3 g 12% · Sól 0.2 g 3%
Medium fat content	No logo	Kalorie 106 5% · Cukry 13.8 g 15% · Tłuszcz 9.1 g 13% · Kwasy tłuszczowe nasycone 2.3 g 12% · Sól 0.2 g 3%	Kalorie 106 5% · Cukry 13.8 g 15% · Tłuszcz 9.1 g 13% · Kwasy tłuszczowe nasycone 2.3 g 12% · Sól 0.2 g 3%

may require more attention than others in order to process the information given in such a way that it can affect choice. Indeed, while visual search studies reported faster attention capture with monochrome than color-coded labels (Bialkova & van Trijp, 2010), consumers seem to prefer color-coded, in particular traffic light labels (Kelly et al., 2009). Furthermore, some studies suggest that color-coded labels make it easier for consumers to evaluate the healthfulness of a product (e.g., Jones & Richardson, 2007), although the evidence is mixed (Grunert, Wills, et al., 2010). However, no one so far was able to investigate the entire path from the initial exposure to a particular label (product) until the final product choice, by looking at the relationship of attention and choice. We address this issue hypothesizing that:

H5. Attention may mediate the effect of fat level and label format on choice.

The above hypotheses we test in two consecutive studies as presented next.

Experiment 1

Method

Participants

Eighty university students took part in this experiment. All had age below 35, normal or corrected-to-normal vision and full color vision.

Stimuli and design

An experimental choice paradigm combined with eye-tracking (Bialkova & Van Trijp, 2011) was employed. The task was organized in 16 trials. On each trial pictures of front-of-packs of four yoghurt products were shown. The pictures were simplified labels showing brand, flavor, and nutrition information. Brand and flavor have been shown to be the label elements that attract most consumer attention in a store setting (Königstorfer & Gröppel-Klein, 2012) and were therefore chosen to construct stimuli with a high degree of realism. Four flavors (strawberry, apple, muesli, and chocolate) were chosen and were varied within each choice set. Half of the participants were presented with a global market brand (Fig. 2, top-panel) and the other half with a local market brand (Fig. 2, down-panel).

Stimuli were generated as follows. There were three types of label formats, e.g., directive (Choices logo); semi-directive (polychromatic, traffic light color-coded Guideline Daily Amounts, GDAs), and non-directive (monochrome GDAs). For each of the label formats the level of fat content was manipulated, e.g., low vs. medium, which was reflected in different figures (grams of fat) and percentages (% of GDA), and in different colors (green vs. amber, respectively) for color-coded GDAs. Crossing 3 label formats with 2 fat levels led to 6 types of label appearances on a product (see Table 1). As we had a 4 products assortment, only 4 out 6 label types could be realized on one screen. The permutation of 4 out of 6 led to 15 possible combinations. In each combination the label positioning was fixed for all participants (see Fig. 2 for examples of these combinations). The positioning of the labels within a combination was generated with a MATLAB program in advance. This was done to assure that all combinations and their sequence appear in a balanced manner.

Procedure

The combinations were presented one by one on a 19-in. computer screen in full color, 1280 × 1024 pixels resolution. The order of appearance of combinations was generated by a MATLAB program in advance. At the beginning of the experiment, an initial trial (control condition) where no label appeared on any of the products was presented. Before each trial a fixation cross appeared for 500 ms. The beginning of the experiment was announced with the word START and the end with the sentence "*Experiment over*" displayed on the screen in self-paced mode.

Half of the participants had to select the healthiest product and the other half a product of their preference. Participants had to say aloud the chosen product (e.g., strawberry) and to press the space bar to get the next set of stimuli. An experimenter recorded the choice made. The response time and eye movements were recorded with a Remote Eye-tracking Device (RED) of SensoMotoric Instruments (SMI) integrated under the computer screen on which the stimuli were displayed. Before the stimulus display, a calibration procedure was run (average error in gaze position less than 0.5°). The distance between the respondents and the computer with the integrated RED was about 60 cm.

Analytical procedure

Two types of measures, eye-tracking and choice made, are used in the analysis as dependent variables. The analysis proceeds in three steps. First, Model 1 looks at the effects of fat level and label format on attention (as operationalized by eye-tracking measures), testing H1 and H2. Then, Model 2 estimates the effect of fat level and label format on choice, testing H3 and H4. Finally, Model 3 tests whether attention mediates choice, testing H5.

Eye-tracking data are reported in terms of fixation duration and number of fixation (e.g., Rayner, 1998; Rayner, 2009). Fixation duration and number of fixations were calculated for each product, as each product was defined as a separate area of interest. Following a dispersion threshold algorithm for fixation identification we used the threshold value of 80 ms (for details on technicalities see Bialkova & van Trijp, 2011). The first analysis looked at the

Fig. 2. An example of a trial for global (top panel) and local (down panel) brand presentation.

number of fixations per product, as a function of the label format (directive, semi-directive, non-directive), fat content (low vs. medium), flavor (muesli, apple, strawberry, chocolate) as within-participants factors; and shopping goal (health vs. preference) as a between participants factor. In addition, the effect of brand (global vs. local) was explored (in a repeated measures ANOVA design). Post hoc contrasts were analysed using Fisher's test statistic. The second analysis explored the same factors as in the previous analysis (goal, label format, fat content, flavor, brand), but using fixation duration as the dependent variable. As not all participants looked at each product on each screening (meaning that some products did not get attention at all on a particular screening), in some of the design cells we had missing values, and thus only 64 participants could be included in the second analysis.

Probability of choosing (Model 2) was explained by label format, fat and flavor using a multinomial logit model (estimated in LatentGOLD software, Statistical Innovations Inc.). Different parameters were estimated for participants grouped according to health or preference goals (two class model). The Wald test statistic is used to test for significant effects of attributes on choice, and also for significant differences between attribute effects depending on health vs. preference goal. As the inclusion of an interaction between label format and fat level did not result in a significant improvement in model fit, only main effects are reported.

In order to test whether the effect of fat level and label format on choice is mediated by attention, Model 3 reestimates Model 1 after adding a factor indicating whether the product chosen was the one that received maximal attention (as measured by number of fixations, hereafter referred to as MaxFix) or not.

Results

Model 1 : $Attention = f(Fat, Label, Flavour, Goal)$

In the following, we report the main effects and interactions relevant to the hypotheses tested, and Table 2 presents a summary of statistical tests with regard to the hypotheses tested.

The effect of label format on the number of fixations was significant ($F(2,152) = 50.97$, $p < .0001$). Color-coded GDA (semi-directive) labels received the highest number of fixations, followed by a monochrome GDA (non-directive) labels, and this effect was more pronounced for low fat products (significant interaction label by fat, $F(2,152) = 10.04$, $p < .0001$), see Fig. 3, top panel. The effect of fat content was also significant ($F(1,76) = 47.29$, $p < .0001$), showing a higher number of fixations for low than medium fat products. There was a higher number of fixations with health than preference goal in mind, as shown by the main effect of goal ($F(1,76) = 8.20$, $p < .005$). The health goal increased attention for low fat content products (significant interaction, goal by fat, $F(1,76) = 4.82$, $p < .05$). Neither the interaction goal by label format, nor the triple interaction goal, label format, fat content reached significance, all p's > .3.

The analysis on fixation duration reported again the main effect of label format being significant, $F(2,120) = 50.19$, $p < .0001$. This reflected longest fixations on products carrying color-coded GDAs, followed by products carrying monochrome GDAs. Participants fixated longer on low than medium fat products (significant main effect of Fat, $F(1,60) = 56.77$, $p < .0001$), and longer with health than preference goal (significant main effect of Goal, $F(1,60) = 4.84$, $p < .05$). The interactions label and fat ($F(2,120) = 6.33$, $p < .005$), as well as label, fat and goal ($F(2,120) = 3.90$, $p < .05$) reached significance. Participants fixated longest on products carrying color-coded GDAs, but this effect was more pronounced for low than medium fat content, and with health than preference goal in mind, see Fig. 3, middle panel.

Model 2 : $Choice = g(Fat, Label, Flavor, Goal)$

A product was most likely to be selected if carrying a color-coded label, followed by the monochrome label and the Choices logo, Wald = 94.98, $p < .0001$. A product was also considerably more likely to be selected if labeled low fat, Wald = 108.46, $p < .0001$. The only significant difference between the health and preference goal conditions, Wald = 97.74, $p < .0001$, is the effect of flavor – in the health goal condition, respondents were more likely to choose the muesli flavor and less likely to choose the chocolate flavor, see Table 3.

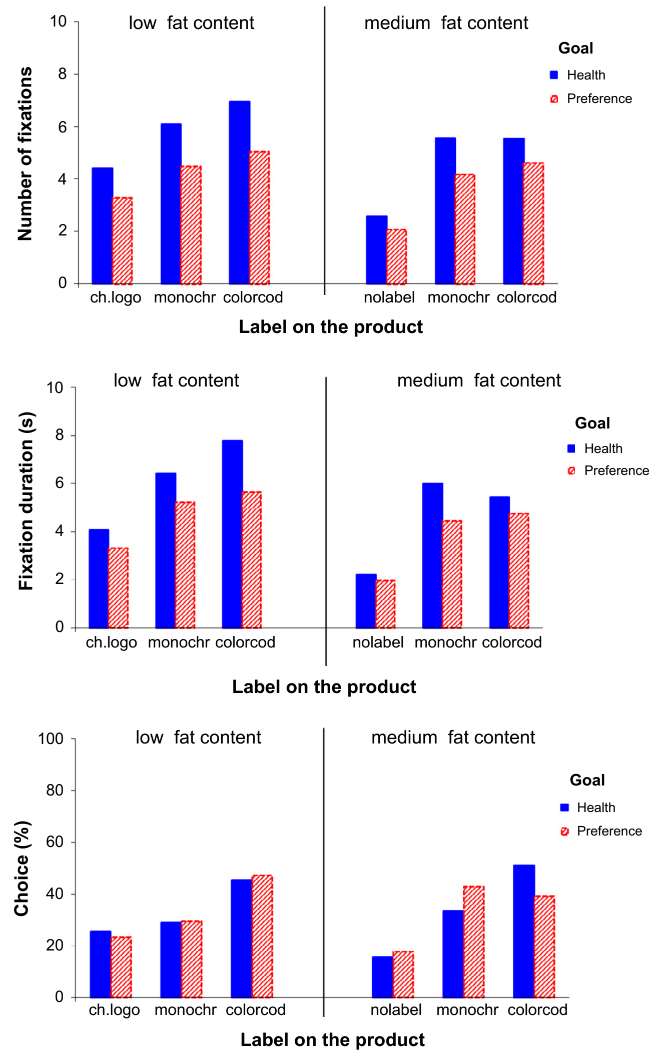

Fig. 3. Top panel: number of fixations; middle panel: fixation duration; down panel: choice made in Experiment 1, as a function of the goal (health vs. preference), fat level (low vs. medium), and label on the product (Choices logo, monochrome GDAs, color-coded GDAs).

Model 3 : $Choice = h(Fat, Label, Flavor, Goal, Attention)$

Comparing the results with those of model 2, the inclusion of attention increased the explanatory power of the model. From the estimates for the predictor MaxFix (see Table 4), it is clearly seen how important the attention variable is. The product among the four options that has obtained the maximum has a much

Table 2
Summary of the statistics testing hypotheses on determinants of attention.

Hypothesis	Factor	Experiment 1				Experiment 2			
		Number fixations		Fixation duration		Number fixations		Fixation duration	
		F	p	F	p	F	p	F	p
H1	Label format	50.97	<.0001	50.19	<.0001	34.96	<.0001	37.01	<.0001
H1	Fat	47.29	<.0001	56.77	<.0001	29.52	<.0001	10.51	<.005
	Goal	8.20	<.005	4.84	<.05	4.71	<.05	9.74	<.005
H1	Label * Fat	10.04	<.0001	6.33	<.005	23.31	<.0001	9.85	<.0001
H2	Label * Goal	1.08	.339	1.21	.303	5.39	<.005	6.08	<.005
H2	Fat * Goal	4.82	<.05	2.44	.123	.79	.377	.61	.436
H2	Label * Fat * Goal	1.09	.338	3.90	<.05	.18	.835	1.02	.363
	Flavor	43.60	<.0001	23.73	<.0001	71.42	<.0001	27.35	<.0001
	Brand	20.02	<.0001	.09	.764	.54	.463	.02	.891

NB: Goal is a between subjects factor.

Table 3
Estimates for the choice made (model without attention) in Experiment 1.

	Health goal	Preference goal	Overall			
R^2	0.112	0.049	0.103			
$R^2(0)$	0.212	0.058	0.136			
Attributes			Wald	*p*-value	Wald(=)	*p*-value
Flavor						
Muesli	0.936	−0.029	159.58	0.000	97.74	0.000
Strawberry	0.324	0.163				
Apple	0.089	−0.139				
Chocolate	−1.35	0.006				
Fat						
Low Fat	0.427	0.293	108.46	0.000	3.66	0.056
Medium Fat	−0.427	−0.293				
Label format						
Choices log	−0.416	−0.439	94.98	0.000	2.78	0.250
Monochrome GDA	−0.035	0.101				
Color-coded GDA	0.452	0.338				

higher probability of being chosen. The effects for flavor and low/medium fat did not change, while the pattern of label format effects changed. The effects of color coded and monochrome label on choice decreased when controlling for attention, whereas the effect of the Choices logo increased. This indicates that the effect of the color coded and monochrome labels on choice are partly due to the fact that these labels lead to more attention to the product bearing that label. Also the range of the label format coefficients is smaller than in the model without attention, suggesting that the overall label format effect on choice decreases when controlling for the attention effect of label format. This supports the hypothesis that attention (at least partly) mediates choice.

In sum, these results show that fat level and label format affect attention (H1) and choice (H3). The effect of fat level and label format on attention was stronger for a health than for a preference goal (H2). The effect of fat level and label format on choice did not differ between the two shopping goal classes, and thus did not provide support for H4. Attention partly mediated the effect of fat level and label format on choice, confirming H5.

We have to point out that flavor and brand effects emerged as well, see Table 2. Longer and more fixations were made for muesli and strawberry products, than for apple and chocolate products (p's < .0001). The same tendency held for the choice made. There was a higher number of fixations for global than local brand

Table 4
Estimates for the choice made including attention (MaxFix model) in Experiment 1.

	Health goal	Preference goal	Overall			
R^2	0.397	0.533	0.4825			
$R^2(0)$	0.465	0.538	0.5015			
Attributes			Wald	*p*-value	Wald(=)	*p*-value
Flavor						
Muesli	0.749	−0.230	44.88	0.000	32.06	0.000
Strawberry	0.311	0.218				
Apple	0.298	0.024				
Chocolate	−1.357	−0.013				
Fat						
Low fat	0.372	0.262	50.39	0.000	1.45	0.230
Medium fat	−0.372	−0.262				
Label format						
Choices logo	0.0516	−0.076	15.55	0.003	2.02	0.370
Monochrome GDA	−0.272	−0.091				
Color-coded GDA	0.220	0.167				
MaxFix						
01:01	1.453	1.802	788.07	0.000	9.14	0.420
2	−0.417	−0.673				
3	−0.275	−0.539				
4	−0.759	−0.588				
02:01	−0.400	−0.910				
2	1.325	1.606				
3	−0.558	−0.377				
4	−0.366	−0.319				
03:01	−0.403	−0.342				
2	−0.339	−0.272				
3	1.603	1.944				
4	−0.861	−1.328				
04:01	−0.649	−0.549				
2	−0.568	−0.659				
3	−0.769	−1.027				
4	1.987	2.236				

Fig. 4. An example of a trial for brand location global–local (top panel) and local–global (down panel).

products, $F(1,76) = 20.02$, $p < .0001$. Note that brand was a between subject factor, and therefore one may argue whether the above findings could be validated when different brands appear within the same assortment context (which is most likely to happen in real-shopping environment). Thus, in Experiment 2, we suggest brand manipulation as a within-participants factor.

Experiment 2

Design and procedure in Experiment 2 were the same as in Experiment 1. The only difference concerned the stimuli: in Experiment 2, different brands appeared within the same assortment context, see Fig. 4.

Method

Participants

Eighty university students took part in Experiment 2. All had normal or corrected-to-normal vision and full color vision, and age below 35; and they did not take part in Experiment 1.

Design and procedure were the same as in Experiment 1.

Stimuli

On each trial pictures of front-of-packs of four yoghurt products (strawberry global market brand, chocolate global market brand, strawberry local market brand, and chocolate local market brand) were displayed. For half of the participants, the global market

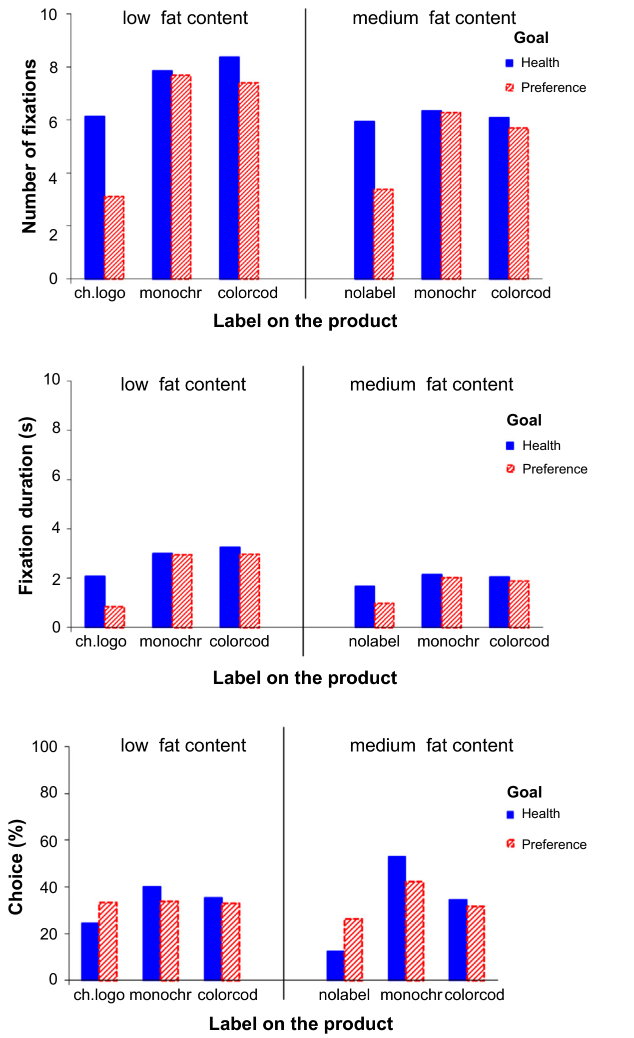

Fig. 5. Top panel: number of fixations; middle panel: fixation duration; down panel: choice made in Experiment 2, as a function of the goal (health vs. preference), Fat level (low vs. medium), and label on the product (Choices logo, monochrome GDAs, color-coded GDAs).

brand appeared on the left-hand side and the local brand on the right-hand side of the visual scene (Fig. 4, top-panel) and for the other half of the participants, the location of the brands was reversed, e.g., local–global (Fig. 4, down-panel).

Results

The analytical procedure followed the one of Experiment 1.

Model 1 : $Attention = f(Fat, Label, Flavor, Goal, Brand)$

The first analysis looked at the number of fixations as a function of the label format (Choices logo, monochrome GDAs, color-coded GDAs), fat content (low vs. medium), shopping goal (health vs. preference), flavor (strawberry vs. chocolate). The effects of brand (global vs. local), and brand location (global–local vs. local–global) were also explored. The effects of label ($F(2,152) = 34.96$, $p < .0001$), fat ($F(1,76) = 29.52$, $p < .0001$), goal ($F(1,76) = 4.71$, $p < .05$), and flavor ($F(1,76) = 71.42$, $p < .0001$) were significant, see Table 2 for the summary of the statistical results. There was a higher number of fixations for the health than for the preference goal; and for strawberry rather than chocolate products. Higher number of fixations was also registered for low rather than medium fat products, and for GDA rather than Choices logo labeled products. The latter effect was more pronounced for the health than the preference goal (significant interaction label and goal, $F(2,152) = 5.39$, $p < .005$), and for the medium rather than the low fat condition (significant interaction label and fat, $F(2,152) = 23.31$, $p < .0001$), see Fig. 5, top panel. Neither the effect of brand nor brand location were significant, p's > .4.

The second ANOVA looked at the fixation durations and had the same factors as in the previous analysis (some participants did not fixate at all on some products, thus for them, we do not have measures in all design cells and their data dropped out from this analysis). The effects of label ($F(2,94) = 37.01$, $p < .0001$), fat ($F(1,47) = 10.51$, $p < .005$), goal ($F(1,47) = 9.74$, $p < .005$), and flavor ($F(1,47) = 27.35$, $p < .0001$) were significant and confirmed the general tendencies emerging from the previous analyses. There was longer fixation duration for the health than the preference goal, and for strawberry rather than chocolate products. Fixation duration was longer when GDAs rather than the Choices logo appeared on the product. The label effect was affected by the goal ($F(2,94) = 6.08$, $p < .005$), and fat ($F(2,94) = 9.85$, $p < .0001$), see Fig. 5, middle panel. For the health goal condition, fixation duration was longer for color-coded GDAs than monochrome GDAs than Choices logo labeled products; while for the preference goal condition, longest fixation duration was registered for monochrome followed by color-coded GDAs. For the low fat condition, longer fixation duration was registered for the color-coded GDAs than monochrome GDAs than Choice logo; while for medium fat condition, color-coded and monochrome GDAs labeled products were fixated equally long. Concerning brand manipulation, neither the

Table 5
Estimates for the choice made (model without attention) in Experiment 2.

	Health goal	Preference goal	Overall			
R^2	0.112	0.011	0.083			
$R^2(0)$	0.257	0.015	0.135			
Attributes			Wald	p-value	Wald(=)	p-value
Flavor						
Strawberry	0.830	0.119	209.991	0.000	98.170	0.000
Chocolate	−0.83	−0.119				
Brand						
Danone	−0.126	−0.040	8.763	0.013	1.974	0.160
Bakoma	0.126	0.040				
Fat						
Low Fat	0.518	0.165	100.927	0.000	24.927	0.000
Medium Fat	−0.518	−0.165				
Label format						
Choices logo	−0.477	−0.104	51.665	0.000	15.020	0.000
Monochrome GDA	0.376	0.128				
Color-coded GDA	0.100	−0.024				

Table 6
Estimates for the choice made including attention (MaxFix model) in Experiment 2.

	Health goal	Preference goal	Overall			
R^2	0.616	0.658	0.650			
$R^2(0)$	0.679	0.661	0.670			
Attributes			Wald	*p*-value	Wald(=)	*p*-value
Flavor						
Strawberry	0.589	0.097	27.600	0.0000	10.933	0.000
Chocolate	−0.589	−0.097				
Brand						
Danone	−0.123	−0.051	3.694	0.16	0.521	0.470
Bakoma	0.123	0.051				
Fat						
Low fat	0.474	0.040	31.532	0.000	14.582	0.000
Medium fat	−0.474	−0.040				
Label format						
Choices logo	0.001	0.230	11.405	0.000	3.973	0.140
Monochrome GDA	0.216	−0.060				
Color-coded GDA	−0.218	−0.169				
MaxFix						
01:01	1.972	2.264	891.658	0.000	14.696	0.099
2	−0.007	−0.467				
3	−0.916	−0.779				
4	−1.048	−1.018				
02:01	−0.530	−0.348				
2	1.9	2.310				
3	−1.265	−1.410				
4	−0.103	−0.551				
03:01	−0.416	−0.010				
2	−1.381	−0.977				
3	2.596	2.014				
4	−0.799	−1.026				
04:01	−1.025	−1.906				
2	−0.511	−0.865				
3	−0.414	0.175				
4	1.951	2.596				

effect of brand, nor brand location was significant, p's > .3. Brand did not affect neither label nor fat effects, p's > .3.

Model 2 : $Choice = g(Fat, Label, Flavor, Goal, Brand)$

Effects on choice were analyzed by estimating multinomial logit models, see Table 5 for the parameter estimates. Respondents were more likely to select the local than the global brand. It was more probable to select a low rather than medium fat product, and this effect was more pronounced with the health than the preference goal in mind (Wald = 100.93, $p < .0001$; class difference: Wald = 24.93, $p < .0001$). It was most probable to select a product carrying monochrome GDAs, followed by color-coded GDAs and the Choices logo; these differences were more pronounced for the health goal. It was more probable to select strawberry than chocolate flavor, Wald = 209.99, $p < .0001$; and this effect was much more pronounced when the health goal was active, Wald = 98.17, $p < .0001$.

Model 3 : $Choice = h(Fat, Label, Flavor, Goal, Brand, Attention)$

The models testing whether attention mediates choice were run in analogy to the models for choice, but this time, an additional factor indicating whether a product was the one that received most fixations was included. Again, the inclusion of this variable significantly increased the explanatory power of the model. The pattern of flavor and medium/low fat effects did not change. However, the pattern of label formats effects changed in the same way as it did in Experiment 1. The effect of color-coded and monochrome GDAs on choice decreased, while the effect of the Choices logo increased.

In sum, the main tendencies emerging in Experiment 1, that fat level and label format affect attention (H1) and choice (H3), were again confirmed. The effect of label format on attention was stronger for a health than for a preference goal (H2). The effect of fat level and label format on choice differed between the two shopping goal classes, supporting H4. Controlling attention (MaxFix factor) changed the pattern of label format effects, confirming H5.

Discussion and conclusions

A challenging question for policy makers is how to drive consumers' attention towards a healthful option, and thus encourage healthier eating. Although recent research suggests that healthy food choices might be facilitated by optimizing nutrition labeling on food products (Grunert & Wills, 2007; Nayga, 2008; Verbeke, 2008), the literature so far has mainly addressed consumers' ability to understand different formats of nutrition labels in situations of forced exposure to such labels (e.g., Borgmeier and Westenhoefer, 2009; Feunekes et al., 2008; Grunert, Wills, et al., 2010). However, the crucial factor for nutrition label effects in real-world shopping situations may be the label's ability to attract consumer attention (Grunert et al., 2012), an issue that needs further elaboration. The current study addresses this issue, by being the first to investigate not only to which extent nutrition labels differ in their attention-getting properties, but also to test whether and how these attention-getting properties mediate the effect of labels on choice.

Our results show that the tested label formats differed in their attention capture (H1). This was presumably due to the fact that some label formats may require more attention than others in order to process the information given (Bialkova & van Trijp, 2010). In particular, color-coded and monochrome GDAs resulted in more attention (measured in terms of number of fixations and fixation duration) compared to the Choices logo. A similar effect was found when looking at the effect of the different label formats on choice, showing that products carrying color-coded GDAs labels were selected most. However, when controlling for attention, the pattern of the effects of label format on choice changed: the impact of color-coded and monochrome GDAs decreased, whereas the effect of the Choices logo increased. This suggests that the effect of color-coded and monochrome GDAs on choice is partly due to more attention given to products carrying these labels.

Furthermore, if we look at the interaction between label format and fat level, it did not significantly improve the model fit, suggesting that low fat generates higher choice probability, whatever the label, but also that color-coded GDA generates higher choice probability, whatever the fat content. Put differently, the color coded label affects choice not because it is better in communicating the fat level, but because it is better in attracting attention.

We should also note that shopping goal is an important factor affecting consumer attention and choice. The health vs. preference goal had an effect on overall amount of attention allocated to the labels (see Table 2). It had no effect on the pattern of results of the different label formats on choice (see Tables 4 and 6). It did have an effect on how fat level affects on attention and choice. We should also note that explanatory power of product attributes in predicting choice was generally higher for health than for preference goals, which may be related to the fact that individual preferences for different flavors differ across subjects.

In discussing the implications of these results for public policy with regard to nutrition labeling, two lines of thoughts can be derived. The first is that color-coded and monochrome GDAs seem to attract attention and encourage consumers to spend more time processing the labeling information, which in turn leads to an increased impact of the labeling information on choice. On the other hand, and as noted above, the increased attention given to the GDA-based label formats can be related to more time needed to processing the information presented before it can be used for making a choice. One may thus distinguish between the attention-getting and the attention-holding properties of a specific nutrition label format. A color-coded GDA label may attract attention because of its color, and then it may hold attention due to the need to process the information given. By contrast, as the Choices logo represents a combination of several pieces of information in a simple format, it may not require such an elaborated (and thus time consuming) processing of information.

The policy implications of our results are therefore contingent on the external validity of the experimental setting compared to a real-world shopping situation with regard to both attention-getting and attention-holding effects. It is conceivable that, in an experimental situation, respondent motivation to make sense of the information presented is stronger than in a real-world shopping situation, which may be characterized by time pressure and habitual purchases. In such a situation, the attention-getting properties of a label may still be there, but consumers may stop processing the information once they realize that they would need to spend extra time making sense of the information. In real shopping environment, a logo type information like the Choices logo could actually have more influence on consumer choice, as its effect is not contingent on longer duration and higher number of fixation, as shown in the current study. Although studies on actual attention getting properties of nutrition labels in real store settings have been hampered by practical difficulties and the fact that effects of nutrition labels may drown in a host of other factors affecting choice, it should be possible to replicate the current study under conditions where some of the factors or real life shopping are simulated. For example, including time pressure as an experimental factor may answer which label is best in terms of shopping time efficiency. Increasing the number of products (flavors and/or brands) within the assortment would bring the lab setting closer to the supermarket realism and thus would definitely increase the prediction power of the models tested.

Another aspect that should be taken into account is the fact that consumers can differ both, in motivation for healthy eating and in information processing style. More motivated consumers will be more likely to spend additional time trying to make sense of labeling information than less motivated consumers. Also, factors like cognitive level of processing information may have an impact on whether consumers prefer to process multi-nutrient information or prefer to base their choice on information summarized in the form of a health logo. Hybrid label formats, consisting of key nutrient information combined with a health logo may be a solution, and thus, an interesting avenue to further explore nutrition labeling.

References

Bialkova, S., Grunert, K., Königstorfer, J., van Trijp, H., & Gröppel-Klein, A. (working paper). Consumer attention and choice in response to augmented nutrition labelling formats.

Bialkova, S., Grunert, K. G., & Van Trijp, H. (2013). Standing out in the crowd. The effect of information clutter on consumer attention for front-of-pack nutrition labels. *Food Policy, 41*, 65–74.

Bialkova, S., & van Trijp, H. (2010). What determines consumer attention to nutrition labels? *Food Quality and Preference, 21*(8), 1042–1051.

Bialkova, S., & Van Trijp, H. (2011). An efficient methodology for assessing attention to and effect of nutrition information front of pack. *Food Quality and Preference, 22*, 592–601.

Bonsmann, S. S. G., Celemin, L. F., et al. (2010). Penetration of nutrition information on food labels across the EU-27 plus Turkey. *European Journal of Clinical Nutrition, 64*(12), 1379–1385.

Borgmeier, I., & Westenhoefer, J. (2009). Impact of different food label formats on healthiness evaluation and food choice of consumers. A randomized-controlled study. *BMC Public Health, 9*, 184–196.

Feunekes, G. I., Gortemaker, I. A., et al. (2008). Front-of-pack nutrition labelling. Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries. *Appetite, 50*(1), 57–70.

Grunert, K. G., Fernández Celemín, L., Storcksdieck genannt Bonsmann, S., & Wills, J. M. (2012). Motivation and attention are the major bottlenecks in nutrition labelling. *International Journal of Food Science and Technology, 26*(1), 19–21.

Grunert, K. G., Fernández-Celemin, L., Wills, J. M., Storcksdieck genannt Bonsmann, S., & Nureeva, L. (2010). Use and understanding of nutrition information on food labels in six European countries. *Journal of Public Health, 18*, 261–277.

Grunert, K., & Wills, J. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health, 15*(5), 385–399.

Grunert, K. G., Wills, J. M., & Fernández-Celemin, L. (2010). Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite, 55*, 177–189.

Hodgkins, C., Barnett, J., Wasowicz-Kirylo, G., Stysko-Kunkowska, M., Gulcan, Y., Kustepeli, Y., et al. (2012). Understanding how consumers categorise nutritional labels. A consumer derived typology for front-of-pack nutrition labelling. *Appetite, 59*, 806–817.

Jones, G., & Richardson, M. (2007). An objective examination of consumer perception of nutrition information based on healthiness ratings and eye movements. *Public Health Nutrition, 10*(3), 238–244.

Kelly, B., Hughes, C., Chapman, K., Louie, J., Dixon, H., Crawford, J., et al. (2009). Consumer testing of the acceptability and effectiveness of front-of-pack food labelling systems for the Australian grocery market. *Health Promotion International, 24*(2), 120–129.

Königstorfer, J., & Gröppel-Klein, A. (2012). Wahrnehmungs- und Kaufverhaltenswirkungen von Nährwertkennzeichnungen auf Lebensmitteln. *Marketing-ZFP, 34*, 213–226.

Luchs, M., & Swan, K. S. (2011). Perspective. The emergence of product design as a field of marketing inquiry. *Journal of Product Innovation and Management, 28*, 327–345.

Nayga, R. M. (2008). Nutrition, obesity and health. Policies and economic research challenges. *European Review of Agricultural Economics, 35*(3), 281–302.

Rayner, K. (1998). Eye movements in reading and information processing. 20 years of research. *Psychological Bulletin, 124*, 372–422.

Rayner, K. (2009). Eye movements and attention in reading, scene perception, and visual search. *The Quarterly Journal of Experimental Psychology, 62*(8), 1457–1506.

Schoormans, J. P. L., & Robben, H. S. J. (1997). The effect of new package design on product attention, categorization and evaluation. *Journal of Economic Psychology, 18*(2–3), 271–287.

Solomon, M., Bamossy, G., & Askegaard, S. (2002). *Consumer behaviour. A European perspective*. Pearson Education Ltd.

Verbeke, W. (2008). Impact of communication on consumers' food choices. *Proceedings of the Nutrition Society, 67*(3), 281–288.

Visschers, V. H., Hess, R., & Siegrist, M. (2010). Health motivation and product design determine consumers' visual attention to nutrition information on food products. *Public Health Nutrition, 13*(7), 1099–1106.