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Assessing attentional prioritization of front-of-pack nutrition labels using change detection

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ABSTRACT

We used a change detection method to evaluate attentional prioritization of nutrition information that appears in the traditional "Nutrition Facts Panel" and in front-of-pack nutrition labels. Results provide compelling evidence that front-of-pack labels attract attention more readily than the Nutrition Facts Panel, even when participants are not specifically tasked with searching for nutrition information. Further, color-coding the relative nutritional value of key nutrients within the front-of-pack label resulted in increased attentional prioritization of nutrition information, but coding using facial icons did not significantly increase attention to the label. Finally, the general pattern of attentional prioritization across front-of-pack designs was consistent across a diverse sample of participants. Our results indicate that color-coded, front-of-pack nutrition labels increase attention to the nutrition information of packaged food, a finding that has implications for current policy discussions regarding labeling change.

1. Introduction

Obesity is associated with increased rates of morbidity, mortality (Pi-Sunyer, 1993) and health costs (Finkelstein et al., 2003; Finkelstein, Trogdon, Cohen and Dietz, 2009). Given the high prevalence of obesity in society and its negative impacts, the US Government has articulated a vested interest in curbing the epidemic (Office of Foods, Center for Food Safety and Applied Nutrition, Center for Veterinary Medicine, & Office of Regulatory Affairs (2012); US White House Task Force on Childhood Obesity, 2010). One approach to do so involves regulating environmental factors; examples include: subsidizing healthy foods, limiting the sales of nutrient empty foods in places like schools, and taxing nutrient-empty foods (Brownell and Horgen, 2007). Nutrition labeling offers a cost-effective intervention with potential for wide reach in an readily accessible format (Campos et al., 2011; Hawley, 2012; Kelly et al., 2009; Roberto et al., 2012; Temple and Fraser, 2014).

To increase the use and impact of nutrition labels, there has been a global push to adopt front-of-pack formats. These labels typically present a few key ingredients on the principal display panel of a package. Formatting can be text based, though it often includes color-coding to present a qualitative evaluation of the health of the food product (for review see Schor et al., 2010). Examples include the Multiple Traffic Light System (MTL), a color-coded system introduced by the Food Standards Association in the UK, and the Guideline Daily Amount (GDA), which is a monochromatic format introduced by the Food and Drink Federation in the European Union.

The US Government has also expressed interest in developing a standardized front-of-pack label that is supported by empirical research. More specifically, the Whitehouse's Task Force on Childhood Obesity has explicitly recommended the development and implementation of standardized front-of-pack nutritional label based on scientific research (White House Task Force on Childhood Obesity, 2010), and the US Food and Drug Administration has identified investigation of potential front-of-pack labels as a key

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initiative in its 2012–2016 Strategic Plan (Office of Foods, Center for Food Safety and Applied Nutrition, Center for Veterinary Medicine, & Office of Regulatory Affairs, 2012). Similarly, the Institute of Medicine has called for objective evaluation of the efficacy of front-of-pack labels, including recommendations regarding design requirements (Nathan et al., 2011).

1.1. Research investigating front of pack labeling

There has been a recent flurry of research investigating front-of-pack labeling (for review see Hawley et al., 2013). While the ultimate research goal is to identify labeling techniques that influence dietary choices, the application of models of information processing suggests that information must go through a number of serial stages of processing (DeJoy, 1991) before it can impact decision making. More specifically, prior to influencing decision making, information presented on the label must be attended, encoded into working memory, and understood by the consumer.

Much of the research regarding the design of nutrition labels has focused primarily on relatively late stages of information processing stages involving comprehension (for review see Vyth et al., 2012). While the comprehension of the label is important, this research typically by-passes the attentional stage by giving participants explicit instructions to attend to nutrition information. Doing so is problematic for two reasons. First, there is ample evidence that conscious recognition of information requires attention (Becker and Pashler, 2005; Rensink, O'Reagan and Clark, 1997; Simons, 1996). As a result, if a label design does not garner attention, the processing of the nutrition information will be derailed early in the processing stream, never reaching the comprehension stage. Second, by-passing the attentive stage ignores the fact that one of the reasons to adopt a front-of-pack label is to increase the conspicuity of the nutrition information, thereby making it more likely to receive attention.

Recognizing this short coming, a handful of researchers have begun to evaluate attention to front-of-pack labels. Some of these investigations have used visual search tasks (Bialkova and van Trijp, 2010). While visual search has a long history in basic research on visual attention (Wolfe, 1998), the technique typically involves informing participants about the search target. For instance, in a study by Bialkova and van Trijp (2010), participants were asked to search for front-of-pack labels on existing products' principal display panels. This approach is an effective method of determining how quickly people can access the information presented on the front-of-pack label *when that is their goal*. However, labels that attract attention even when goals are not explicit to dietary needs are more likely to convey nutritional information to a wider segment of the population. Traditional visual search requires pre-specifying the target, which makes it ill-suited for evaluating attention to nutrition labels among participants who are not given an explicit nutritional goal.

1.2. Our contribution

Here, we use a flicker change detection method (Rensink, et al., 1997) to investigate attention to nutrition labels, including a variety of front-of-pack labels. In flicker change detection, an image and a slightly altered image are continually alternated while separated by a brief blank screen (Fig. 1A). In this type of display the blank screen interrupts the motion transient that would draw attention to the change in the image if the change was made during steady viewing. As a result, the detection of the change requires focal attention on the aspect of the scene that changes (Rensink et al., 1997). Thus, the time required to detect the change can be used as a proxy of the time when attention was first deployed to the location of the change (Bix et al., 2010; Tse, 2004). That is, the change detection task acts like a visual search task, but the participant searches for a change rather than an explicit, pre-specified target. As such, it allows evaluation of attentional prioritization of nutrition labels in their various formats without informing participants that nutritional information is important to our study, and without letting participants know that we are tracking attentional deployment.

Using this method, we evaluated whether front-of-pack labels attract attention more readily than the traditional Nutrition Facts Panel. In addition, by making comparisons of the change detection times for different types of front-of-pack label designs, we evaluated which types of design characteristics were most attention grabbing.

2. Materials and methods

2.1. Study participants

All procedures were approved by the Institutional Review Board of the Michigan State University. To obtain a diverse socioeconomic sample, we recruited participants from a community center in a low income neighborhood in Lansing, MI, from the Work First/PATH Program of Lansing Community College (a community organization that helps unemployed people on public assistance to find employment), and from a family resource list serv comprised of families within and surrounding Michigan State University. Participants had to be 18 or older, not legally blind and have no history of seizure.

Five participants discontinued participation before completing the experiment and the data from two participants was unusable due to technical issues. Analyses included data from the remaining 55 participants (38 Female), who ranged in age from 18 to 74 (Mean ± SD = 31.45 ± 16.37 years). Table 1 presents the participant characteristics in terms of ethnicity, household income, education level, and weight status.

2.2. Package designs

To avoid confounds associated with participants' familiarity or preconceived notions with existing brands, we created three novel brands to be used as test stimulus in this study (see Fig. 2). Further, we purposefully avoided using spokes-characters or photos from nature to preclude a graphically suggestive message about nutrient value. Designs included a background comprised of muted colors with a photo depicting the intended product. As shown in Fig. 2, stimuli were presented as flattened images showing both the front of the cereal box and the side panel with the traditional Nutrition Facts Panel. All stimuli had a front of pack label in the lower right corner (see below for further details).

2.2.1. Front-of-pack label designs

We designed a total of twelve front-of-pack labels that resulted from a factorial combination of 3 (text, facial Icons, checkmarks) x 2 (color/no color) x 2 (healthy/unhealthy) design elements (see Figs. 3 and 4). The front-of-pack labels contained nutrition information for calories, fat, saturated fat, sugar and salt. These nutrients are the ones that appear in the Multiple Traffic Light system used in the UK and have been suggested to be the most commonly used for front-of-pack labels worldwide (Wartella et al., 2010).

The Text system used descriptive text-cues (i.e. "high", "med" or "low") to indicate the relative health value of each nutrient in the front-of-pack label. In turn, the Face Icon system replaced text cues with facial expression icons to indicate the relative health value of each nutrient in the front-of-pack label. High, medium, and low nutritional values of individual nutrients were depicted by sad,