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What cognitive sciences have to say about the impacts of nutritional labelling formats

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ABSTRACT

Social sciences have been exploring how different labelling systems affect people's food choices, whereas cognitive psychology has largely ignored that question. We propose a normalization of the criteria that discriminate labels between them, which we use as a framework to review the cognitive processes involved when using these labelling systems. We insist on the heated debate between Traffic Light and Guideline Daily Amount labels, but did also address other labelling schemes like the Keyhole system. We conclude on which labels are cognitively the less effortful and the quickest to process.

1. Introduction

1.1. General background

For the past couple of years, policy makers are trying to reduce food related health issues (Janssen, Katzmarzyk, & Ross, 2004; Roberts & Barnard, 2005) by helping consumers make better food choices (Caraher & Coveney, 2004; French, Story, Fulkerson, & Faricy Gerlach, 2003; Robertson et al., 2003). Labelling is an efficient way to modulate people's behaviour (Lusk, Roosen, & Shogren, 2011). Various formats of nutritional labelling are already in use in many countries (Drichoutis, Nayga, & Lazaridis, 2011). Among the most prevalent ones, we find the *Guideline Daily Amount* system (GDA) initiated by the UK in 1996 and adopted by Australia in 2006, by the European Union in 2009 and by the US in 2012, the *Traffic Lights*

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system that finds support in UK and Germany, or the *Keyhole* system (KH) established in Sweden in 1989 and accepted throughout the European Nordic region in 2009. These labelling schemes differ in many aspects. First, either numeric or chromatic *symbols* convey the information. For instance, GDA displays percentage of recommended daily value while TL uses a colour-coded scale. Second, label may signal the whole entity of the food item like in KH or provide a finer *granularity* as GDA that breaks down nutrients. Third, each labelling scheme may utilize a different *baseline*: contrary to TL, KH only relates food items that belong to identical food groups and GDA is diet-related. Deciding on options for symbol, granularity and baseline is pivotal to decision makers because the generated effects on consumers and the food industry may well highly depend upon those choices.

These questions are currently intensely debated in Europe (Feunekes, Gortemaker, Willems, Lion, & Van den Kommer, 2008; Grunert & Wills, 2007) but also in the US and Canada (Drichoutis, Lazaridis, & Nayga, 2006). Changes in the legislation surrounding nutritional labels in the UK have been made two years in a row (FSA, 2008, 2009). Similarly, new strategies and guidelines are issued regularly (COM, 2006, 2007, 2008) in Europe. The European Commission has asked consumers and stake holders about food labelling (EC, 2006) and issued a proposal (COM, 2008) to update the previous legislation of 2000. Consumers expressed their interest for questions pertaining to the format of nutritional labels (EATWELL, 2011) and communicated their preference towards comprehensive information (Hodgkins et al., 2012) but, paradoxically, also towards simpler labels (Hawley et al., 2013). Besides, desires stated by consumers regarding labelling formats do not systematically match their actual behaviour and purchases (List & Gallet, 2001; Morwitz, Steckel, & Gupta, 2007). There is still a crucial need for policy makers for objective and conclusive reports on how to efficiently convey nutritional information in order to modulate people's behaviour. This work reviews what cognitive psychology can contribute to this question. Contrary to social science and economics which have already started thoroughly investigating this question, cognitive sciences are behind and we advocate for more empirical studies in this field of research to guide policy makers.

1.2. Scientific background

There is a large amount of studies and data on the modulation of behaviours caused by various food labels (e.g., Aschemann-Witzel et al., 2013; Borgmeier & Westenhoefer, 2009; Campos, Doxey, & Hammond, 2011; Lusk et al., 2011). But very little is known concerning how these modulations actually occur. Cognitive psychology has produced very few studies on this subject. With the generalization of functional cerebral imaging techniques, some studies have started to explore the neural mechanisms behind these behavioural changes (Grabenhorst, Schulte, Maderwald, & Brand, 2013; Linder et al., 2010; Ng, Stice, Yokum, & Bohon, 2011) giving some insight into the cognitive mechanisms at stake. In particular, these studies highlight the role of emotional and reward regions of the brain (amygdala, insula), but also of regions important for valuations of options and choices (medial prefrontal and frontal cortices). For instance, Crespi et al. (2015) showed that the ventromedial prefrontal cortex was involved for both the evaluation and the choice of food products, whereas other areas might be more specific of a potential deliberative thinking during the evaluation process. Activity in this same ventromedial prefrontal region predicted individuals' preference for two anonymous colas, but Coca or Pepsi labels changed the taste preference and the brain regions predicting these preferences (McClure et al., 2004). Neuroeconomy has thus started to help decipher the mechanism behind labels effectiveness.

Feeding is one of the few essential needs, or biological motives, we have, meaning that our survival depends on it (Tiger, 1992). As such, nature has attached strong emotions to information and behaviour attached to it so that whenever these needs are not satisfied, we seek the reward associated to satisfying these needs. The whole process starts with a need (feeding), followed by a drive (hunger), then a response (obtaining food), a reward (pleasure), and a diminution of the initial need (Woods, Schwartz, Baskin, & Seeley, 2000). In this context, each and every cognitive processes mentioned in the present manuscript will be influenced in some way by the emotions attached to food. This means that a competition of motives will take place when our biological immediate motives (hunger) are in opposition with our delayed motives (healthy diet). Research has showed that hunger and emotions attached to food (immediate pleasure) often win over other non-essential needs (Jacquier, Bonthoux, Baciu, & Ruffieux, 2012). Hence, labels that convey strong emotions (red colour in TL) might be better competitors against the emotional meaning associated with food. This example illustrates well how cognition and psychology are exploring the mental processes that are at play during labelling utilisation. But it also illustrates the serious lack of applied studies in cognitive psychology for this question, such that the present work was needed to collect together findings about the mental processes likely involved during labelling utilisation.

1.3. Our contribution

Previous literature reviews on nutritional labels have generally excluded the cognitive processes that are involved when seeing, understanding and using each type of labels, or barely mentioning some of them. Using the most recent advances in cognitive psychology, we address the key steps that are necessary for label utilisation. For instance, processing of numbers is different than processing colours, and thus, likely to produce variation in understanding, in mental manipulation, and finally in behavioural effects. Another point that is covered below is the difficulty of translating nutritional information into health-related information. This translation cannot happen without previous knowledge when using the classical NF and is likely one of the reasons the debate started for a "better" nutritional labelling system. To remove this need for previous knowledge, labels like GDA, TL, or KH are trying to make this translation for the consumers. Two or more pieces of information are more