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## Effects of intra- and inter-category traffic-light carbon labels and the presence of a social norm cue on food purchases

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# **Effects of intra- and inter-category Traffic-Light carbon labels and the presence of a social norm cue on food purchases**

## **Abstract**

In two experiments replicating an online shopping context, we studied the effectiveness of two traffic-light carbon labeling systems that differ according to the set of reference with which product comparisons are made. While the inter-category system allows consumers to compare all food products to each other, the intra-category system only allows consumers to compare products within the same food category. We also examined whether providing a descriptive social norm cue could increase their effects. The impact of the labels was studied on: (1) the frequency of low/medium/high carbon impact products purchased, (2) the carbon footprint of consumers' baskets. Study 1, conducted on university students ( $n = 228$ ), showed that both carbon labeling systems tested had beneficial effects on consumers' behaviors and carbon footprint. Study 2 ( $n = 260$ ) on a general population sample, which was less responsive to carbon labels, showed that the addition of a descriptive social norm cue enhanced the labels' effectiveness. Overall, the intra-category traffic-light labeling system shifted purchasing the most.

**Keywords:** eco-labels, carbon labels, social norms, food purchasing behaviors, carbon footprint, intra-category, inter-category.

*In memory of our dear colleague and friend Denis James Hilton.*

## ***Introduction***

In France, food is responsible for about a third of greenhouse gas emissions (Barbier et al., 2019). While changes in food consumption and diets can bring significant environmental benefits, a necessary condition, and one to which many consumers subscribe (Lacroix et al., 2019), is that they should be informed about the environmental impacts of food products.

In 2020, the implementation of eco-labels was one solution proposed by the Citizens' Climate Convention in France, which the French government has committed to implement (Convention Citoyenne pour le Climat, 2020). Eco-labels are “symbols or seals that are designed to help consumers identify environmentally superior products and services and increase their confidence in making pro-environmental purchases” (Darnall et al., 2018). When the information provided by ecolabels relates more specifically to the carbon footprint of a product, they are referred to as “carbon labels” or “climate labels” (Sharp & Wheeler, 2013).

Many studies have been conducted to determine how to make labels' design more effective. They can work on two fronts: (1) reducing information asymmetry by providing consumers with the necessary knowledge to make informed choices, and (2) prompting consumers by providing a reminder of the virtuous decision to take. Following Mertens et al. (2022), labeling interventions aim to describe alternatives (decision information) or reinforce intentions (decision assistance). Besides, labels can promote two distinct types of substitutions. Inter-category labelling systems, such as the Eco-score (Appendix A1), promotes certain types of foods (*e.g.*, vegetables) over others (*e.g.*, meat). On the other hand, intra-category labelling systems such as exist in nutrition field (*e.g.*, Keyhole and Warning Signs) signal the best/worst

options among close substitutes<sup>1</sup>. These two types of substitutions may involve different behavioral costs and environmental benefits: switching to a better option within the same food category requires less effort on the part of consumers, but generates less carbon reduction than, for example, switching from meat.

According to numerous studies on nutrition (Storcksdieck et al., 2020), prescriptive and colorful labeling systems such as the British “Traffic Lights” or the French “Nutri-Score” generate more behavioral changes than purely descriptive and numerical labeling systems such as “Reference Intakes” (Dubois et al. 2021; Crosetto et al. 2020). These labels provide relative information allowing to situate foods in relation to each other; and therefore, are more easily understood by consumers than simple numerical data (Thøgersen & Nielsen, 2016). In addition, they are more efficient in capturing consumers’ attention, and play the role of easily interpretable reminder of the good behavior to adopt (Bialkova & van Trijp, 2010; Carrero et al., 2021). At least in the area of nutrition, labeling systems that act like easily understandable prompts through the use of traffic-light colors are more effective than those that mainly seek to inform through numerical information alone.

Nevertheless, consumers are less knowledgeable about environmental issues than they are about nutrition (Sharp & Wheeler, 2013). A colored traffic-light type of labeling system may act as a pro-environmental prompt but gives less information as it does not discriminate between foods in the same color class. However, the lack of consumer knowledge mainly concerns the differentiated environmental impact between products in the same food categories (*e.g.*, differentiating between various vegetables). Consumers are better able to correctly order the climate impact based on the type of food (*e.g.*, differentiating between vegetables and meat)

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<sup>1</sup> Here, the boundaries of food categories become crucial. The larger the category considered, the greater the scope of the substitutions promoted. In this article, this issue is not directly addressed. We have limited our analysis to the standard categories observed on store shelves.

(Shi et al. 2018). As such, an intra-category labeling system in which traffic-light colors are assigned within each food category should be more informative than an inter-category system in which color classes are assigned across all foods. Although the issue of an intra-category labeling system is being discussed by policymakers, there is currently no such format implemented or even tested in the field.

In this paper, we compare the specific impact of intra- vs. inter-category traffic-light labeling systems on food purchase. To do so and following Muller et al. (2019), we conducted two experimental studies within a realistic online shopping environment and on samples of two types of populations (*i.e.*, students and general population samples). The use of a simulated online shopping context produces stronger external validity compared to the usual choice experiments: as the task is less artificial and still monetarily incentivized. Moreover, it allows us to examine the impact of labelling systems on entire food baskets. Also, consumption behaviors are shaped by social norms (Melnyk et al., 2021), that is why we also examined the effect of both systems when they are combined with a descriptive social norm cue. Previous studies have shown that the addition of descriptive social norms information can be a way to improve the impact of labels (Demarque et al., 2015). By documenting the effectiveness of these approaches, this study provides insights into how labeling works for retailers and policy makers.

## ***Review of carbon label formats***

### **The Carbon Trust label**

Between 2008 and 2012, the Carbon Trust label (see Appendix A2) was applied to hundreds of products in the UK's largest supermarket chain, Tesco<sup>2</sup>. This period provided a rare opportunity

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<sup>2</sup> Tesco announced the discontinuation of the operation and the withdrawal of the carbon labels in 2012 because of the cost, in time and money, of calculating the carbon footprint of each product.

to study the purchasing behavior of consumers in the presence of carbon labels within a real world context (Hornibrook et al., 2015). According to loyalty cards data, carbon labels had no visible impact on the purchase of low-carbon products. Focus groups explained this lack of results in part by a significant lack of awareness, with a large majority of participants not even remembering having ever seen the label on products in stores. This result corroborates those of Beattie et al. (2010) who, in their eye-tracking laboratory study, observed that participants did not pay particular attention to the carbon information contained on the Carbon Trust labels.

More encouraging results are obtained when quantities of carbon dioxide equivalents are made salient. Perino et al. (2014) used a within-subject experimental design that focuses participants' attention on the carbon level of the products. In their experimental computer-based store, participants first made real purchase from a limited choice set without any carbon information and then started again with carbon information. The presence of the carbon label resulted in an average of 23.7% substitutions of high-carbon impact products with low-carbon products. Thus, the Carbon Trust labels seem to be effective as long as they are noticed by consumers.

### **Interpretative traffic-light colored label**

The Carbon Trust Label provides numerical information of carbon dioxide equivalents on a black footprint. Nevertheless, the nutrition labeling literature shows that the addition of traffic-light colors increases effectiveness (Storcksdieck et al. 2020). This is due to the fact that these labels are more easily understood by consumers, since they offer relative information that situate the products in regard to others (Thøgersen & Nielsen, 2016). Moreover, these color codes also convey normative statements that, through psychological and socio-cultural association, are easily recognized and assimilated by consumers (*e.g.*, green for “good” and red for “bad”) (Aslam, 2006). In a choice experiment on coffee, Thøgersen and Nielsen (2016) showed that a

colored Traffic Light (TL) Carbon Trust label had a greater impact on consumer choices than the classic Carbon Trust label.

Spaargaren et al. (2013) made the same comparison between the classic Carbon Trust label and its traffic-light colored version in a field study at a university restaurant. Whereas the classic Carbon Trust label had no effect, the colored version generated a small (3%) but significant decrease in the average carbon footprint of meals. In another field study, Vanclay et al. (2011) tested the impact of a green, yellow and black Carbon Trust label (for low, intermediate and high carbon footprint) on 37 products in an Australian grocery store. Sales of products with a black label decreased by 6% and sales of products with a green label increased by 4%. Nevertheless, the results of this study may have been accentuated by a strong press coverage at the time of data collection.

### **Intra-category vs. inter-category labeling systems**

The set of reference of a labeling system refers to the set with which the comparison of food is made (Muller & Ruffieux, 2020). In the inter-category system, the reference set includes all products since the same labeling rules apply to all. In the intra-category system, the reference set is restricted to products from the same food category with specific labeling rules for each. An intra-category labeling system allows consumers to compare products in the same food category (*e.g.*, red meat *vs.* white meat). This is for example the case for “best in category” labels, such as the Swiss Climatop label. Inter-category labels on the other hand allow comparisons between products in all food categories (*e.g.*, meat *vs.* fruit). By expressing the carbon footprint numerically, the Carbon Trust label (see Appendix A2) allows comparison between all products (*i.e.*, both within and between categories). Existing TL-type interpretative labeling systems, such as Casino’s “Indice Carbone” (see Appendix A3) and those tested in the above and other studies (Brunner et al. 2018; Feucht & Zander 2018), are also inter-category:



the carbon thresholds defining the distribution of color classes are the same for all products. To our knowledge, there is no example today of a TL system where these thresholds are specific to each food category. Yet, this would have the advantage of discriminating better between close substitutes.

While the issue of the set of reference is debated among label designers and policy makers (see for instance the report of the French Agency for Ecological Transition, 2021), it is very rarely addressed in behavioral studies. In their study on nutrition labels, Muller and Ruffieux (2020) found that inter- and intra-category traffic-light labels generated contrasting behavioral responses. They had a different impact on the nature and extent of substitutions made by consumers after they were confronted with TL nutrition labels. First, intra-category labels promoted substitutions within a food category, whereas inter-category labels promoted substitutions between categories. Second, the number of substitutions generated was also different. Consumers changed their food baskets more with intra- than with inter-category TL labels. The authors argued that switching foods to a close substitute requires less effort (replacing potato chips with light potato chips is easier than replacing them with radishes). Another argument could be that intra-category TL labels generated more changes because they are more informative since they enable a finer differentiation between products. As a result, the nature and the extent of the substitutions balanced each other out as the nutritional gain per unit of intra-category substitution was smaller. Can we draw the same conclusion for environmental labeling from these nutritional results? As with nutritional quality, the carbon footprint differs more between food categories than within them (Poore & Nemecek, 2018). Moreover, Shi et al. (2018) showed that consumers are better at ordering the carbon footprint of food categories than of products within categories. The same behavioral mechanisms observed in Muller and Ruffieux (2020) could therefore be replicated.

### **Carbon labels and descriptive social norms**

Descriptive social norms refer to individuals' perceptions of the prevalence of a certain behavior (Cialdini & Trost, 1998). Studies in social psychology and behavioral economics show that descriptive social norms cues can be used as a nudge (Thaler & Sunstein, 2008) to promote pro-environmental behaviors (for a review, see Farrow et al., 2017). Messages using descriptive norms (*i.e.*, what the others do) have been shown to be more effective than traditional environmental protection messages (Goldstein et al., 2008). Examples include the booking of eco-accommodation (Zanon & Teichman, 2016), the purchasing of non-over-packaged products (Elgaaied-Gambier et al., 2018), organic products (Melnyk et al., 2013), or sustainable clothing (Han & Stoel, 2015; Kim et al., 2012).

Descriptive social norms cues may advantageously complement carbon labels to better orientate consumer's purchasing behavior (Hilton et al., 2018). Indeed, compliance with descriptive social norms aims to meet intrapersonal goals of making effective and accurate decisions (Jacobson et al., 2015). Carbon labels constitute a supplementary mean to achieve the same goal. Demarque et al. (2015) examined the effects of descriptive social norms cues when combined with the European ecolabel and the French organic label. Their presence significantly increased the number of eco-labeled products purchased by participants. Nevertheless, the two types of labels used in this study were of the same "best in category" type and, to our knowledge, no study has investigated how social norm cues interact with traffic-light ecolabels and their intra- or inter-category nature.

### ***Research Overview***

The primary objective is to compare the effectiveness of interpretative carbon TL labels, whether color classes are assigned according to the same criteria for all the products (inter-category TL) or according to specific ones for each food category (intra-category TL). The secondary objective is to test whether the addition of a descriptive social norm cue improves the impact of these carbon labels. To do this, we observed the food purchases and carbon

footprints of consumers from the student population and the general population in a realistic online shopping environment.

### **Hypotheses about the effectiveness of Intra- vs. Inter-category traffic-light label**

We used two TL carbon labeling systems that only differ in their set of reference (Figure 1). The inter-category label (inter-TL) reference set is the entire product set: colors are assigned based on the average carbon footprint of all food in the shop, allowing for comparisons between and within product categories. The reference set for intra-category label (intra-TL) is the food category of the product being evaluated: colors are assigned based on the average carbon footprint of products in the same food category. As such, intra-TL limits comparability to products in the same food category.

[Insert Figure 1]

If we assume that the role of labels is only to reduce the information asymmetry between consumers and producers, then the more informative the label is (provided it is read), the more effective it should be. By numerically indicating the level of the carbon footprint, the monochrome Carbon Trust label provides a positive, science-based information. Because it is difficult for consumers to grasp and identify, it fails to attract the attention of consumers (Beattie & McGuire, 2015). TL carbon labels are more easily understandable by consumers and compensate for their limited attention by making the information more prominent (Bialkova & van Trijp, 2010). However, these labels are also less informative, since they do not differentiate foods within color classes. According to Shi et al. (2018) who find that consumers are already able to order the carbon footprint of food types, Inter-TL should therefore give no new information. Intra-TL on the other hand discriminates between foods within food categories and thus should be more informative. From this perspective, intra-TL should be more effective

than inter-TL in terms of changing consumer purchasing behavior towards products with a lower environmental impact.

Nevertheless, TL carbon labels not only make the information more prominent and understandable, they also issue a normative judgement. By psychological and socio-cultural association, traffic-light colors (red, amber and green) are meaningful colors that can have a profound impact on consumers' cognition and emotions (Aslam, 2006; Elliot & Maier, 2007; Muller & Prevost, 2016). As a result, color-coded labels may motivate consumers to change their choices even without providing new information. Carbon labels can act as pro-environmental prompts, leading individuals to adopt more environmentally virtuous consumption behavior (Moussaoui et al., 2020). Prompts act as reminder of the right behavior to adopt, compensating for individuals' limited attention (Schultz, 2014). Given this framework, Inter-TL should be more effective since switching between food categories represents a larger gain per unit of substitution. Inter-TL prompts individuals to favor certain low-carbon categories over others (*e.g.*, switching from the meat category to products in other categories instead of switching to white meat). In addition, Intra-TL may encourage consumers to choose more green-rated products in high-carbon food categories.

Thus, there are compelling theoretical explanations for either of the TL labels being more effective. Our approach concerning the effectiveness of intra- or inter- TL labels in terms of changing pro-environmental behaviors towards more virtuous choices, and reducing the carbon footprint of consumer's baskets, was therefore exploratory.

### **Hypothesis on the impact of adding a descriptive social norm cue to TL carbon labels**

A descriptive social norm refer to what most people in a group think, feel or do (Cialdini & Trost, 1998). Thus, cueing a descriptive social norm mainly consists of telling the target population how the majority of other individuals behaved in the same situation. In our carbon

label experimental setting, the descriptive social norm cue was how many green-labeled foods were purchased on average in previous sessions.

Numerous studies have shown that, while individuals under-detect their influence, the use of normative information messages produced a greater change in behavior than traditional information messages (Bergquist et al., 2019; Nolan et al., 2008). Since compliance with descriptive norms is intended to meet intrapersonal goals of making accurate and efficient decisions (Jacobson et al., 2015), the information conveyed by carbon labels could help individuals meet these goals. We can therefore expect that the combined presence of a descriptive social norm cue and a carbon label will lead to greater changes in behavior than the presence of the label alone, since the social norm cue provides a goal to be achieved, and the label provides the information to achieve that goal. In addition, the ease of meeting the goal set by the norm could depend on the label's effectiveness in conveying an useful and understandable information to consumers. In an exploratory way, we therefore sought to study whether the intra- or inter- category nature of TL labels could interact differently with the norm. Our results are contrasted with those of Demarque et al. (2015) who assessed the impact of social norm cues combined with organic labels.

*Hypothesis. The presence of a label combined with a descriptive social norm cue is more effective than the presence of a label alone.*

### **A realistic purchasing setting: The GreenShop**

Most studies that have shown a significant impact of carbon labels were choice experiments that offered limited product choices. Can these results hold in a more realistic shopping environment? In this study, we used an improved version of the *GreenShop* used by Demarque et al. (2015).

The GreenShop is an experimental online store with a large number of products covering several food categories. It comprises 144 food products divided into 6 shelves: fruits and vegetables, meat and fish, dairy products and eggs, frozen food, savoury groceries and sweet groceries. The visuals of the products and their prices corresponded to products of a real store near the university where the first experiment took place. An equivalent number of products was distributed to each color class of the TL labeling system. The attribution of colors was made on the basis of the carbon footprint estimations produced by Tesco (2012) and from ADEME, the French Agency for Ecological Transition (2020)<sup>3</sup>. To design an intra-category label, it is necessary to consider how the categories should be constituted. The more specific a category is, the finer the discrimination between the products in it will be (*e.g.*, grouping all meats in the same category allows for less discrimination between products than grouping red meat and white meat separately). We decided here to use the shelves observed in real stores as categories. Thus, for the intra-category TL label, products from the same food shelf were ranked according to their carbon footprint. The lowest third was tagged green, the middle third amber and the highest third red. For the inter-category TL label, we used the same method but this time instead of ranking by shelf, all the products in the GreenShop were taken into account in determining the thirds. The average carbon footprints of the store's products according to their color class and according to the type of label (intra- or inter-) can be seen in Table 1.

### ***Experiment 1***

This first experiment compared the effects of intra- vs. inter-category traffic-light carbon labels on individuals' purchasing behaviors and on their baskets' carbon footprint. The relative effectiveness of these competing systems was assessed through: (1) the proportion of green,

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<sup>3</sup> In line with real-world carbon labels actually in use, the unit used was kgCO<sub>2</sub>/kg.

amber and red products in shopping baskets and (2) the carbon footprint of the shopping baskets.

## **Method**

### *Participants*

An *a priori* power analysis, conducted on G\*Power 3.1.9.2 (Faul et al., 2009), indicated that at least 128 participants were required to identify moderate size effects ( $f = .30$ ), with a  $\alpha$ -level of .05 and a power of .80 for an ANOVA with 4 conditions (Perugini et al., 2018). This means that we needed at least 147 participants in the case we wanted to perform a non-parametric Kruskal-Wallis test (*i.e.*, a 15% larger sample size than for a parametric test; Lehmann, 2006).

A convenience sample of 228 humanities and social sciences students from the University of Aix-Marseille participated in this experiment. 115 were recruited on campus and 113 were first-year psychology students who participated in the study in exchange for university credits<sup>4</sup>. The sample consisted of 174 women and 54 men. The average age of the sample was 19.8 years ( $SD = 2.71$ ).

### *Procedure*

Recruited participants were invited to our experimental store, the “GreenShop”, on campus in sessions of 1 to 4 participants. They were asked to shop as they would at home on the Internet. In order to make the experiment incentive compatible, they were given a budget of €25 to do their shopping. At the end of the experiment, they had a 1/5 chance of being given their shopping basket.<sup>5</sup> Participants answered a socio-demographic questionnaire after completing the shopping task.

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<sup>4</sup> No significant differences were identified between the two groups for our variables of interest.

<sup>5</sup> In practice, those participants did not get their baskets handed to them directly, but rather a voucher worth €25 and the address of a store near the laboratory where they could find the same products as those chosen in the GreenShop. The participants only learned that they would receive a voucher and not the products at the end

## *Conditions*

Participants were randomly assigned to one of the four following experimental conditions (participants in the same session were assigned to the same condition):

- (1) **Control condition** ( $n = 56$ ) in which no specific instruction and no information on the carbon footprint of products was given.
- (2) **Control condition n°2 (or environmental priming condition)** ( $n = 58$ ) identical to the previous condition, but in which the pro-environmental objective of the study was explicit. A short text mentioned the fact that each product has a carbon footprint, gave a short definition of it, and a reminder of the fact that a large carbon footprint contributes to global warming and that it is therefore important to pay attention to the carbon footprint generated by our food consumption (see Appendix B).
- (3) **The intra-category TL label condition (Intra-TL)** ( $n = 58$ ) identical to the control condition with a short definition of the carbon footprint and an explanation on how to interpret the intra-category TL label. Examples were also given for illustration (see Appendix C). Each product was accordingly assigned the color green, amber or red.
- (4) **The inter-category TL label condition (Inter-TL)** ( $n = 56$ ) identical to the previous condition but with an explanation and examples corresponding to the intra-category TL label (see Appendix D). Each product was assigned the color green, amber or red according to the new distribution rule.

## **Results**

### *Proportions of color classes*

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of the sessions, after they had made their choices in the GreenShop. Thus, they could not anticipate the possibility of actually being able to purchase products other than those chosen during the experimental session.



Individuals' compliance with each label type was assessed by counting the proportion of green, amber, and red products in participants' baskets. Since green, amber or red products were not the same depending on whether the labeling was intra- or inter-category, we computed the respective proportions of green, amber or red products for each experimental condition first based on the intra-category classification and second based on the inter-category classification. Accordingly, we were able to see the effect of each condition on people's choices under both classifications, even if the classification did not match the labels displayed in the GreenShop. The two situations in which there was congruence between the labeling system used during the experiment and the product classification used to compute the product proportions appear in grey in Table 2.

Both control conditions give an overview of behaviors in the absence of carbon labels. When in an inter-category classification in control condition n°2, for example, individuals chose more green products than amber ( $t(57) = 5.26, p < .001$ ) or red ( $t(57) = 4.65, p < .001$ ) ones<sup>6</sup>. Therefore, in the absence of carbon labels, individuals seemed to already favor products from low-carbon footprint categories. On the other hand, if we look at the intra-category classification, individuals did not seem to differentiate between products within the same categories since they didn't chose a significantly different proportion of green products than amber ( $t(57) = .55, ns$ ) or red ( $t(57) = -.51, ns$ ) ones.

We opted for non-parametric tests since most of our data did not follow normal distribution (Shapiro-Wilk tests)<sup>7</sup>. Thus, we conducted non-parametric Kruskal-Wallis tests to measure the overall impact of the experimental conditions on the proportions of products of each color in

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<sup>6</sup> Results are similar for control condition n°1. In inter-category classification: green vs. amber ( $t(55) = 3.37, p < .001$ ), green vs. red ( $t(55) = 2.86, p < .01$ ). In intra-category classification: green vs. amber ( $t(55) = -.57, ns$ ), green vs. red ( $t(55) = -2.26, ns$ ).

<sup>7</sup> Results of Shapiro-Wilk tests for each variable: intra- green products proportion ( $W = .986; p < .05$ ), intra- amber products ( $W = .989; ns$ ), intra- red products ( $W = .981; p < .01$ ), inter- green products ( $W = .991; ns$ ), inter- amber products ( $W = .977; p = .001$ ), inter- red products ( $W = .981; p < .01$ ), carbon footprint kgCO<sub>2</sub>/Kg ( $W = .941; p < .001$ )

the baskets. With the intra-category classification, we found a significant effect on the proportion of green products ( $\chi^2_{(3, N=228)} = 47.7, p < .001, \varepsilon^2 = .21$ ) and on the proportion of red products ( $\chi^2_{(3, N=228)} = 55.6, p < .001, \varepsilon^2 = .25$ ), but not on the proportion of amber products ( $\chi^2_{(3, N=228)} = 1.66, ns, \varepsilon^2 = .01$ ). Similarly, with the inter-category classification, we found significant effects for the proportion of green products ( $\chi^2_{(3, N=228)} = 33.5, p < .001, \varepsilon^2 = .15$ ) and the proportion of red products ( $\chi^2_{(3, N=228)} = 33.8, p < .001, \varepsilon^2 = .15$ ), but not for the proportion of amber products ( $\chi^2_{(3, N=228)} = 2.47, ns, \varepsilon^2 = .01$ ).

Having obtained significant effects in the omnibus tests, we then performed Dwass-Steel-Critchlow-Fligner tests (Hollander & Wolfe, 1999) in order to make pairwise comparisons of the means (Table 2). We found no difference between our two control conditions. Knowing the pro-environmental objective of the study did not have a significant impact on participants' purchasing behavior. Therefore, any differences observed in the experimental conditions with labels were due to label effects only, thereby excluding social desirability effects (Grimm, 2010). From then, control condition n°2 (with environmental priming) was used as the baseline for our comparisons.

The presence of an intra-TL label led individuals to purchase a significantly higher proportion of green products compared to the control condition n°2 (54% vs. 33.4%) ( $W = 7.34; p < .001$ ) and to purchase a significantly lower proportion of red products (16% vs. 35%) ( $W = -8.54; p < .001$ ). Similarly, the inter-TL label led individuals to purchase significantly more green products (57% vs. 43%) ( $W = 5.80; p < .001$ ) and significantly fewer red products (17% vs. 28%) ( $W = -5.87; p < .001$ ).

Overall, participants were compliant in both TL conditions. Nevertheless, the intra-TL condition generated more changes than the inter-TL: +21% of green-labeled product for intra-

TL compared to the control condition vs. +14% for inter-TL ( $\chi^2(1) = 7.67, p < .01$ ) and -18% vs. -11% of red-labeled products ( $\chi^2(1) = 12.6, p < .001$ )<sup>8</sup>.

### *Baskets' carbon footprint*

The effects of the experimental conditions on the carbon footprint of baskets in kilograms of CO<sub>2</sub> per kilogram of product (kg CO<sub>2</sub>/kg) are shown in Table 3.

Kruskal-Wallis tests showed significant effects ( $\chi^2(3, N = 228) = 35.4, p < .001, \epsilon^2 = .16$ ). Dwass-Steel-Critchlow-Fligner pairwise comparison tests showed that there were no significant differences between the two control conditions. Like for the proportion of green products, displaying the pro-environmental objective of our study did not generate significantly lower carbon footprint of baskets. Differences between control condition n°2 (with environmental priming) and the intra-TL ( $W = -5.43; p < .001$ ), and the inter-TL ( $W = -5.1; p < .01$ ), were all significant. Both the intra- and the inter-categorical TL systems led to significantly lower carbon footprints, but there was no significant difference between these two conditions.

## **Discussion**

On the one hand, participants were more compliant with the more informative intra-category TL system. The intra-category TL label was the one that most led individuals to opt for green products and forgo red products compared to the behaviors observed in the control conditions. On the other hand, the less informative inter-category TL system did not lead individuals to strongly change their behavior compared to what they already did in the no-label control condition. That is why an inter-category classification is not significantly better than the intra-TL. Moreover, even though it generates to a lesser extent shifts towards greener products, this

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<sup>8</sup> The Chi-squared test was conducted on a 2x2 matrix comparing the intra- and inter- TL conditions in columns, with the number of additional green products (or withdrawn red products) induced by the label compared to what would theoretically have been expected according to the control condition in the first row, and the number of remaining (non-green or non-red) products in the second row.

is offset by a larger per-unit gain. As a result, both types of labels had similar beneficial effects on the carbon footprint of baskets.

## ***Experiment 2***

The second experiment had two main objectives. First, it replicated the test from Experiment 1 on the effectiveness of intra- and inter-category TL carbon labels on a general population sample. Second, it tested whether the presence of a descriptive social norm cue could reinforce the effectiveness of carbon labels and explored how it interacts with the intra- or inter-category nature of the label. Moreover, compared to student populations who are known to have strong pro-environmental attitudes (Félonneau & Becker, 2008), the presence of a descriptive social norm cue could be a necessary boost to the effect of carbon labels for a general population sample.

## **Method**

### *Participants*

Following the same *a priori* power analysis carried out in Experiment 1, we set a threshold of at least 161 participants to be able to perform non-parametric Kruskal-Wallis tests. 260 participants from the general population were recruited via flyers and announcements in local newspapers and radio stations. In order to be included, participants had to be responsible for food shopping for their household. The sample size was reduced to 256 participants without the outliers<sup>9</sup>. Our final sample size was composed of 202 females and 54 males. The average age was 45.4 years ( $SD = 10.1$ ).

### *Procedure*

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<sup>9</sup> We kept participants with scores within  $\pm 3$  SD of the mean.

Sessions with 16 to 20 participants took place in a dedicated room in the Grenoble National Polytechnic Institute. The procedure was strictly identical to Experiment 1 except for the participants' reward. Each participant received a gift voucher worth €25 as compensation for their participation. In addition to this, one winner was randomly drawn at the end of each session to receive delivery of all the products they had purchased during the experiment (as in Study 1, they had a €25 budget to spend in the GreenShop). Participants answered socio-demographic questions after having completed the shopping task. The GreenShop included exactly the same products and the carbon labeling systems followed the same rules as those in Experiment 1.

### *Conditions*

Participants were randomly assigned to one of the five following experimental conditions (participants in the same session were all allocated to the same experimental condition):

- (1) **Control condition** ( $n=38$ ), identical to control condition n°2 in Experiment 1 (see Appendix B).
- (2) **Intra-TL label condition** ( $n=54$ ), identical to that of Experiment 1 (see Appendix C).
- (3) **Inter-TL label condition** ( $n=51$ ), identical to that of Experiment 1 (see Appendix D).
- (4) **Intra-category Traffic-light with social norm cue condition (Intra-TL and norm)** ( $n=58$ ), identical to the Intra-TL condition, but with the presence of a descriptive social norm within the GreenShop, located at the level of the home page of the shop and under the basket (see Appendix E).
- (5) **Inter-category Traffic-Light with social norm cue condition (Inter-TL and norm)** ( $n=55$ ), identical to the Inter-TL condition, but with the presence of the descriptive social norm.

### *The descriptive social norm cue*

Our descriptive social norm cue was based on the actual data from Experiment 1. It concerned the average number of green labeled products in baskets of the two TL experimental conditions ( $M = 6.07$ ;  $SD = 2.65$ ). We based our social norm cue on real information mainly for two reasons. First, the use of false information could alter consumer confidence, ultimately leading to public rejection of norms (Hilton et al., 2019). Second, it is effective in getting individuals with low environmental preferences to make more sustainable consumption choices (Demarque et al., 2015). Nevertheless, the risk of such a descriptive norm is that, while it leads individuals who normally buy less green products to buy more, it may cause those who normally buy more than average to buy less. This counterproductive consequence is called the “boomerang” effect (Byrne & Hart, 2016). However, the addition of an injunctive norm (*i.e.*, a message about the appropriate behavior) may be sufficient to eliminate this effect (Schultz et al., 2007). In our case, the boomerang effect of our descriptive norm can thus be mitigated by the presence of the pro-environmental instruction on the GreenShop homepage.

Several types of wording were pre-tested for the descriptive norm, and only the one that was both the most understandable and the most effective in giving the impression that a large number of individuals had purchased green products was retained, namely: “Most consumers buy an average of at least 6 products with a green environmental label”. The norm, highlighted in a green box, was present both on the GreenShop homepage and under the consumer’s basket. It was always visible when browsing the different shelves of the store.

## Results

Since the data of most of our variables of interest did not follow normal distribution (Shapiro-Wilk tests)<sup>10</sup>, we opted for non-parametric tests.

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<sup>10</sup> Results of Shapiro-Wilk tests for each variable: intra- green products proportion ( $W = .994$ ; *ns*), intra- amber products ( $W = .991$ ; *ns*), intra- red products ( $W = .978$ ;  $p < .001$ ), inter- green products ( $W = .994$ ; *ns*), inter- amber products ( $W = .982$ ;  $p < .01$ ), inter- red products ( $W = .977$ ;  $p < .001$ ), carbon footprint kgCO<sub>2</sub>/Kg ( $W = .944$ ;  $p < .001$ )

### *Proportion of color classes*

Table 4 summarizes the proportion of products purchased according to their color classes. Congruent situations where the intra- or inter-category labeling matched the product classification are highlighted in grey.

In the control condition (*i.e.*, in the absence of carbon labels), individuals favored purchasing products from low-carbon food categories. This was reflected by the significantly higher proportion of green products chosen compared to amber ( $t(37) = 4.25, p < .001$ ) or red ( $t(37) = 5.44, p < .001$ ) ones in an inter-category classification. Nevertheless, they were less likely to choose the lowest carbon products within the categories. Indeed, in intra-category classification the proportion of green products was even significantly lower than that of amber ( $t(37) = -2.14, p < .05$ ) or red ( $t(37) = -2.87, p < .01$ ) ones.

We conducted non-parametric Kruskal-Wallis tests to investigate the effects of the overall conditions on the proportion of products of different colors. In an intra-category product classification, we had a significant effect of our experimental conditions on the proportion of green products ( $\chi^2_{(4, N=256)} = 45.8, p < .001, \epsilon^2 = .18$ ) and on the proportion of red products ( $\chi^2_{(4, N=256)} = 45.4, p < .001, \epsilon^2 = .18$ ), but not on the proportion of amber products ( $\chi^2_{(4, N=256)} = 4.79, ns, \epsilon^2 = .02$ ). In an inter-category product classification, we had a significant effect of our experimental conditions on the proportion of green products ( $\chi^2_{(4, N=256)} = 18.5, p < .001, \epsilon^2 = .07$ ), on the proportion of red products ( $\chi^2_{(4, N=256)} = 20.3, p < .001, \epsilon^2 = .08$ ) and on the proportion of amber products ( $\chi^2_{(4, N=256)} = 10, p < .05, \epsilon^2 = .04$ ).

For the omnibus tests that were significant, we then performed Dwass-Steel-Critchlow-Fligner tests allowing pairwise comparisons of means (non-significant comparisons are shown in Table 4.). In both intra- and inter-TL conditions without descriptive social norm cue, participants chose significantly fewer red-labeled products: respectively according to the intra-and inter-

category product classification, 22% vs. 38% ( $W = -6.64, p < .001$ ), and 18% vs. 27% ( $W = -4.80, p < .01$ ). Participants chose significantly more green-labeled products according to the intra- classification (46% vs. 27%,  $W = 6.30, p < .001$ ) but not to the inter- classification (57% vs. 45%,  $W = 3.80, ns$ ). The proportion of amber products were very similar in both TL conditions and the control condition.

With descriptive social norm cue, both intra- and inter-TL labels led to significantly higher proportion of green-labeled products than in the control condition (51% vs. 27% and 57% vs. 45%) ( $W = 5.70; p < .001$  and  $W = 4.66; p < .01$ , respectively) and to a significantly lower proportion of red-labeled ones (19% vs. 38% and 16% vs. 24%) ( $W = -7.58; p < .001$  and  $W = -5.64; p < .001$ , respectively). TL conditions with norms had no significant differences with the TL conditions without norms for the proportion of green-labeled products (51% vs. 45% for intra-TL and 57% vs. 57% for inter-TL) ( $W = 3.40; ns$  and  $W = .27; ns$ , respectively) or red-labeled ones (19% vs. 22% and 16% vs. 17%) ( $W = -1; ns$  and  $W = -.31; ns$ , respectively).

As in Experiment 1, Intra-TL, with and without norms, generated a larger increase in the proportion of green-labeled products than inter-TL (+21% vs. +12% when pooling data with and without norms,  $\chi^2(1) = 15.8, p < .001$ ) and a larger decrease in the proportion of red-labeled ones (-17% vs. -10%,  $\chi^2(1) = 10.4, p < .001$ ).

### *Baskets' carbon footprint*

The effects of the experimental conditions on the carbon footprint of baskets in kilograms of CO<sub>2</sub> per kilogram of product (kg CO<sub>2</sub>/kg) are shown in Table 5.

Non-parametric Kruskal-Wallis tests showed significant effects of experimental conditions on the carbon footprint of participants' baskets in kgCO<sub>2</sub>/kg ( $\chi^2_{(4, N = 256)} = 13.93, p < .01, \epsilon^2 = .05$ ). Pairwise comparisons using Dwass-Steel-Critchlow-Fligner tests showed that only the



intra-TL and norm condition led to a significantly lower carbon footprint than the control condition ( $W = -5.49; p < .001$ ).

## **Discussion**

Experiment 2 only partially replicated the results of the first experiment. As with the student sample in Experiment 1, TL labels shifted the general population's purchasing behaviors toward low-carbon foods. However, they were not as effective since, unlike Experiment 1, no statistical significance could be reached for the improvement in the carbon footprint of the baskets when the inter-TL and intra-TL conditions were considered separately. Younger generations are known to be more sensitive to environmental issues (Douenne & Fabre, 2019). Also, students may have been more prone to social desirability bias (Grimm, 2010) in seeking to meet the experimenter's believed expectations.

Our hypothesis was partially verified. The addition of a descriptive social norm cue only increased the effectiveness of the intra-category TL system. Participants became more compliant (choosing green products and forgoing red ones) and the improvement in the carbon footprint of baskets became significant. In contrast, adding a descriptive social norm cue to the inter-category TL system did not improve either compliance or the carbon footprint of baskets. The descriptive social norm cue acts as a nudge to motivate individuals to change (Farrow et al., 2017). Nevertheless, individuals may not change their decision if the cost of the behavior seems too prohibitive (White & Simpson, 2013). The cost of change is apparently higher in the inter-category TL system where colors are concentrated in product groups (such as green in the vegetable category and red in the meat category). Thus, we could argue that switching foods within a category (*e.g.*, red meat *vs.* white meat) is less costly than switching foods between categories (*e.g.*, meat *vs.* vegetables).

## ***General discussion***

### *Intra- vs. Inter-category systems*

The levers of TL labels to change purchasing behavior are twofold: (1) they tell uninformed consumers which foods are more virtuous (*i.e.*, reducing information asymmetry) and (2) they prompt consumers to make the right decision. In the first paradigm, the more informative system should trigger more responses from consumers. If we accept that consumers know how to assess the carbon footprint of food categories but are less well informed about carbon footprint differentiation within categories (Shi et al. 2018), an intra-category TL system is more informative than an inter-category TL system. This is indirectly confirmed by the no-carbon-label control conditions of the present experiments where individuals already favored purchasing products from low-carbon food categories (*i.e.*, products that would have been labeled green in an inter-category classification of products) but were less likely to choose low-carbon products within food categories (*i.e.*, products that would have been labeled green based on an intra-category classification). When implemented in both experiments, the Intra-TL system indeed generated a larger increase in the proportion of green products (and conversely larger decrease in the proportion of red products) compared to the control conditions.

In the second paradigm, the role of the labeling system is to encourage the most beneficial substitutions. When it comes to reducing the carbon footprint of food, switching from one product in one food group to another food group generates more carbon reductions on average than switching from one product to another within the same food group (Table 1). In both experiments, Inter-TL compensated for the greater compliance found in Intra-TL with more efficient substitutions, resulting in an equivalent level of basket carbon footprint. These observations echo those of Muller and Ruffieux (2020) on the impact of Intra-TL and Inter-TL labels on the nutritional quality of baskets.

Should policymakers then favor a labeling scheme that corrects consumers' lack of knowledge or prompts them to make the most efficient substitutions (*i.e.*, between food categories)? If only

carbon impact is considered, the experimental results show that the reference set is not decisive. Moving beyond the limitations of this study, which focuses solely on consumer purchasing behavior and carbon footprint of their basket, other implications can be considered. First, informing consumers is an important duty of public authorities. For equal effectiveness, the most informative system should be preferred. Second, labels have an impact not only on consumer behavior, but also on supply (Cohen & Vandenberg, 2012; Vandenberg et al., 2011). Because an intra-category system primarily distinguishes between close substitutes, it fuels competition between firms that operate in the same food sector. The intra-category label is an opportunity for firms to signal quality and thus becomes a powerful driver for improving production processes. This is less the case for an inter-category system where it is impossible for some food categories to catch up with others. In addition, the introduction of quality signals may also lead to price increases for green-labeled products that our experiment did not account for since prices remained the same between all the experimental conditions. One would expect more severe price variations in an intra-category system than in an inter-category system.

#### *Descriptive social norm cue*

The descriptive social norm cue used in this study was based on actual behaviors observed in Experiment 1. As mentioned earlier, the presence of a descriptive norm can sometimes have a “boomerang effect” leading individuals who would normally behave above average to do less (Byrne & Hart, 2009). The presence of an injunctive norm, reminding individuals of the right behavior to adopt, can cancel this effect (Schultz et al., 2007). The effects of the descriptive social norm cue in our study must therefore be considered bearing in mind that an injunctive norm was present in the form of the pro-environmental instruction on the GreenShop homepage.

The descriptive social norm cue acts as a nudge to motivate individuals to change their behaviors (Nolan et al., 2008). Individuals do change if (1) the message conveyed is sufficiently motivating and (2) the cost of change is not too prohibitive. Its addition to the TL carbon labels

did improve purchasing behaviors with the intra-category system but not with the inter-category system, confirming only partially the results of Demarque et al. (2015). Both motivation and cost may explain these differential effects.

First, the target set by the students (*i.e.*, purchasing 6 green items) was relatively more ambitious with the intra-category system. Without carbon label in the control condition, the general population was already choosing 5 green items in average with the inter-category classification whereas they were only choosing 3.16 green items with the intra-category classification. Therefore, the descriptive social norm cue in the intra-TL system had more leverage to raise the performance of the general population.

Second, we could argue that changing foods within a food category (*e.g.*, red meat *vs.* white meat), as suggested by the intra-category system, requires less effort (preferences, habits) than changing foods between categories (*e.g.*, meat *vs.* vegetables). By requiring less radical changes, the social norm cue is easier to follow under the intra-category system.

#### *Student vs. general population*

Carbon labels affected the student sample to a greater extent than the sample from the general population. Students represent a specific segment of the population for which the adoption of pro-environmental behaviors is pro-normative (Félonneau & Becker, 2008). They are known to have a greater capacity for innovation in consumption, a trait that facilitates the adoption of new green consumption behaviors (Chen, 2014; Englis & Phillips, 2013). Moreover, they may have been more prone to desirability bias (Grimm, 2010). With an experimental setting located at their own university, motivation to meet the presumed expectations of the experimenter may have been stronger for students than for the general population.

Nevertheless, the results are qualitatively robust across both populations. Although the magnitude of the responses differed, they were all in the direction of low-carbon products. The

experimental conditions effects were likewise replicated. For both populations, the intra-TL system generated the most responses (increase in green products and decrease in red products) but with an equivalent decrease in the carbon footprint of the baskets compared to the inter-category system.

### *Limitations*

The GreenShop benefits from the many advantages of a laboratory grocery store. In particular, it ensures *ceteris paribus* conditions between our competing systems and the presence of counterfactuals, thus ensuring high internal validity. However, our results are contingent on the experimental environment. The simplicity of the latter allows for a greater control of the explanatory variables but generates artefacts. First, participants' attention to carbon labels is increased and demand effects can occur (especially for the student sample). A pro-environmental priming was present on the Greenshop homepage. Thus, our experimental results most likely overestimate the extent of the carbon labels impact. Second, the GreenShop's limited food supply and the arbitrary rules that defined our TL color classes shaped our participants' purchasing behaviors. 144 food products are certainly not sufficient to reflect the variety of possible choices (opportunity costs) that exist in real-world settings. Some of the choices observed must have been default choices. Regarding the labeling system rules, the same number of items were distributed in each TL color class. While this rule was the most understandable to our participants, other rules might be more relevant from a public policy perspective. Moreover, our results are certainly contingent on the way our categories were set. As we mentioned earlier, the most common categorization by shelves that we can observe in real shops was used here, but it's very likely that the way in which products are grouped into categories will have an impact on the effects of an intra-category label. Further research should be conducted in order to check the effects of different type of categorization and the robustness of the results in real world contexts.

Furthermore, the way the Greenshop was designed, and the between-subjects experimental design we used, did not allow us to collect precise data on the product substitutions made by participants. In the future, using a within-subjects design could enable a comparison of the contents of participants' baskets before and after the implementation of the labels, providing a more refined view of how the labels influence consumer behavior. This type of within-subjects design, however, leads to other experimental biases, such as making the labels more salient, and exerting more pressure on individuals to change their behavior.

Finally, the descriptive social norm cue used in this study is not strictly applicable outside the laboratory. The number of green-labeled products to be reached was based on the behavior of a specific segment of the population (which turned out to be more pro-environmental) with a pre-determined budget. Reaching the social target becomes easier if one spends more, which leads to counterproductive effects. In be enforceable, norms would instead refer, for example, to proportions of products (*e.g.*, “consumers buy a majority of...”, “buy fewer...”, etc.).

## ***Conclusion***

This article examined the relative effectiveness of intra- and inter-category carbon Traffic Lights (TL) labeling systems in directing purchasing behaviors and ultimately reducing the carbon footprint of shopping baskets. The article also examines whether the effectiveness of these two labeling systems could be reinforced by the provision of a descriptive social norm cue. To do so, two studies were conducted in a realistic online shopping environment, the first with a convenient student sample and the second with a general population sample.

Carbon labels increased consumption of low-carbon foods and decreased consumption of high-carbon foods, with a larger effect on students. Intra- and inter-category TL systems generated a similar decrease in the carbon footprint of baskets. However behavioral responses differed. Choosing between intra- and inter-category TL systems means choosing between favoring substitutions within food categories and substitutions between categories respectively. Intra-TL

system triggered more changes because individuals are less good at discerning the lower impact products within the categories than at selecting products from low-carbon food categories. This increased information value offsets the lower carbon gain per unit of substitution within categories. The addition of a descriptive social norm cue only improves the intra-TL system. In order to achieve the target set by the norm, the additional effort required by the inter-category system proved too high. It is easier to change to a close substitute (red meat for white meat) than to change diet (meat for vegetables). Ultimately, the combination of the intra-category TL label and the descriptive social norm cue was the most effective.

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	Carbon foot print of each color class in kgCO2/kg		
	GREEN	AMBER	RED
Intra-categorical labeling	2.26 (2.41)	3.66 (2.62)	7.35 (5.12)
Inter-categorical labeling	1.23 (.53)	3.01 (.72)	8.98 (4.15)

**Table 1.** Mean carbon footprints by color classes according to the intra- and inter-category classification. Standard deviations are shown between brackets.

	Proportion of color classes (%) in Experiment 1					
	Intra-labeling product classification			Inter-labeling product classification		
	GREEN	AMBER	RED	GREEN	AMBER	RED
<b>Control n°1</b>	30.5 <sup>a</sup> (12.2)	32 <sup>a</sup> (11.6)	37.6 <sup>a</sup> (13.9)	41.2 <sup>a</sup> (17.6)	27.7 <sup>a</sup> (14.9)	31.0 <sup>a</sup> (12.6)
	<i>3.30 (1.45)</i>	<i>3.50 (1.48)</i>	<i>4.07 (1.61)</i>	<i>4.50 (2.17)</i>	<i>3.02 (1.69)</i>	<i>3.36 (1.45)</i>
<b>Control n°2</b>	33.4 <sup>a</sup> (12.8)	31.8 <sup>a</sup> (11.6)	34.8 <sup>a,b</sup> (11.6)	43.1 <sup>a</sup> (13.4)	28.2 <sup>a</sup> (11.4)	28.7 <sup>a</sup> (12.7)
	<i>4.02 (1.77)</i>	<i>3.71 (1.38)</i>	<i>4.10 (1.59)</i>	<i>5.14 (1.95)</i>	<i>3.26 (1.16)</i>	<i>3.43 (1.68)</i>
<b>Intra-TL</b>	54.3 (23.4)	29.3 <sup>a</sup> (17.0)	16.4 (16.4)	54.9 <sup>b</sup> (17.9)	24.5 <sup>a</sup> (14.1)	20.6 <sup>b</sup> (20.0)
	<i>5.66 (2.6)</i>	<i>3.10 (1.94)</i>	<i>1.71 (1.70)</i>	<i>5.74 (2.11)</i>	<i>2.60 (1.57)</i>	<i>2.12 (1.34)</i>
<b>Inter-TL</b>	41.4 (16.8)	29.8 <sup>a</sup> (13.1)	28.8 <sup>b</sup> (15.2)	57.1 <sup>b</sup> (20.7)	25.4 <sup>a</sup> (15.2)	17.5 <sup>b</sup> (14.1)
	<i>4.73 (2.22)</i>	<i>3.34 (1.55)</i>	<i>3.18 (1.66)</i>	<i>6.48 (2.68)</i>	<i>2.80 (1.55)</i>	<i>1.96 (1.61)</i>

**Table 2.** Mean proportion of green, amber and red products purchased in the 4 conditions. Standard deviations are shown between brackets. The average absolute numbers of products purchased and their standard deviations are shown in italics. <sup>a,b</sup> Means per column with the same letter are not significantly different at the 5% level (Dwass-Steel-Critchlow-Fligner pairwise comparisons).

	Carbon footprint of baskets in Experiment 1 in kgCO2/kgO2/kg
<b>Control n°1</b>	3.06 <sup>a</sup> (1.14)
<b>Control n°2</b>	2.75 <sup>a</sup> (.87)
<b>Intra-TL</b>	2.16 <sup>b</sup> (.81)
<b>Inter-TL</b>	2.18 <sup>b</sup> (.86)

**Table 3.** Mean carbon footprint per condition. Standard deviations are shown between brackets. <sup>a,b</sup> means per column with the same letter are not significantly different at the 5% level (Dwass-Steel-Critchlow-Fligner pairwise comparisons).



	<b>Proportion of color classes (%) in Experiment 2</b>					
	Intra-labeling product classification			Inter-labeling product classification		
	GREEN	AMBER	RED	GREEN	AMBER	RED
<b>Control</b>	27.1 <sup>a</sup> (13.1) <i>3.16 (1.91)</i>	34.9 <sup>a</sup> (13.3) <i>3.76 (1.50)</i>	37.9 <sup>a</sup> (13.7) <i>4.16 (1.65)</i>	45.3 <sup>a</sup> (14.0) <i>5.00 (1.80)</i>	27.4 <sup>a</sup> (13.9) <i>2.97 (1.64)</i>	27.4 <sup>a</sup> (10.2) <i>3.11 (1.57)</i>
<b>Intra-TL</b>	45.5 <sup>b,c</sup> (19.4) <i>5.00 (2.41)</i>	32.1 <sup>a</sup> (14.4) <i>3.61 (2.00)</i>	22.3 <sup>b</sup> (16.7) <i>2.43 (1.83)</i>	50.7 <sup>a,b</sup> (19.0) <i>5.74 (2.69)</i>	26.9 <sup>a</sup> (14.5) <i>2.87 (1.45)</i>	22.4 <sup>a,b</sup> (12.9) <i>2.43 (1.35)</i>
<b>Inter-TL</b>	35.7 <sup>a,b</sup> (17.2) <i>4.16 (2.56)</i>	31.8 <sup>a</sup> (15.5) <i>3.49 (1.65)</i>	32.5 <sup>a</sup> (17.7) <i>3.53 (1.85)</i>	56.6 <sup>a,b</sup> (20.7) <i>6.49 (3.04)</i>	25.9 <sup>a</sup> (13.4) <i>2.82 (1.52)</i>	17.5 <sup>b</sup> (14.2) <i>1.86 (1.52)</i>
<b>Intra-TL and norm</b>	51.2 <sup>c</sup> (17.8) <i>5.76 (2.18)</i>	29.3 <sup>a</sup> (13.4) <i>3.36 (1.85)</i>	19.5 <sup>b</sup> (16.0) <i>2.17 (1.68)</i>	59.4 <sup>b</sup> (16.4) <i>6.71 (2.27)</i>	20.6 <sup>a</sup> (14.1) <i>2.38 (1.74)</i>	20 <sup>b</sup> (11.9) <i>2.21 (1.33)</i>
<b>Inter-TL and norm</b>	37.7 <sup>b</sup> (15.3) <i>4.27 (2.05)</i>	29.8 <sup>a</sup> (14.1) <i>3.33 (1.71)</i>	32.5 <sup>a</sup> (14.5) <i>3.51 (1.46)</i>	57.5 <sup>b</sup> (18.3) <i>6.38 (2.25)</i>	26.1 <sup>a</sup> (14.9) <i>2.89 (1.58)</i>	16.4 <sup>b</sup> (12.7) <i>1.84 (1.45)</i>

**Table 4.** Mean proportion of green, amber and red products purchased according to the 5 conditions. Standard deviations are shown between brackets. The average absolute numbers of products purchased and their standard deviations are shown in italics. <sup>a,b,c</sup> Means per column with the same letter are not significantly different at the 5% level (Dwass-Steel-Critchlow-Fligner pairwise comparisons).

	<b>Carbon footprint of baskets in Experiment 2 in kgCO<sub>2</sub>/kg</b>
<b>Control n°1</b>	2.55 <sup>a</sup> (.61)
<b>Intra-TL</b>	2.43 <sup>a,b</sup> (.91)
<b>Inter-TL</b>	2.35 <sup>a,b</sup> (.85)
<b>Intra-TL and norm</b>	2.07 <sup>b</sup> (.67)
<b>Inter-TL and norm</b>	2.22 <sup>a,b</sup> (.77)

**Table 5.** Mean carbon footprint per condition. Standard deviations are shown between brackets. <sup>a,b</sup> means per column with the same letter are not significantly different at the 5% level (Dwass-Steel-Critchlow-Fligner pairwise comparisons).