



Consumer testing of alternatives for communicating the Environmental Footprint profile of products

Final report

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1. Introduction

1.1. Policy background

Globally, concern for the environment is rising and companies are increasingly interested in demonstrating that their activities are environmentally friendly, both at the level of individual goods and services being produced and offered and as organisations, towards consumers and other stakeholders.¹ This highlights the importance of not only using reliable ways to measure the environmental impacts of products, but also of adopting uniform manners in which environmental information is communicated to consumers. However, currently, a wide range of methodologies to calculate environmental impacts and a variety of communication vehicles are being used. Results of the Eurobarometer survey on attitudes of Europeans towards building the single market for green products reveal that consumers are confused by, and exhibit mistrust of, such incomparable and diverse environmental information.² As a consequence, approximately 50% of European consumers perceive difficulties in distinguishing between environmentally friendly and non-environmentally friendly products and do not trust manufacturer's claims about environmental performance.

Accordingly, the Communication on *A European Consumer Agenda - Boosting confidence and growth* posited that consumers should have access to non-misleading information about the environmental impacts of products throughout their life cycle stages and they should be able to easily identify the most environmentally friendly choice.³ As a response to these policy needs, the Commission is developing reliable methodologies to calculate the environmental performance of products and organisations throughout the product life cycle which would serve as the basis for communication to consumers. More specifically, the Commission adopted a Recommendation on *The use of common methods for measuring and communicating the life cycle environmental performance of products and organisations*. This recommendation introduced two methods to measure and communicate the potential life cycle environmental impact of a product or organisation, respectively: the Product Environmental Footprint (PEF) method and the Organisation Environmental Footprint (OEF) methods. These methods were developed by the Commission on the basis of existing, widely recognised methods.

The primary purpose of communicating Environmental Footprint information in a consumer context is to promote the purchase of environmentally friendly products. A secondary objective is to inform consumers about environmental performance to allow more informed purchase decisions and/or promote more environmentally friendly product use. Furthermore, through increased consumer demand, organisations are incentivised to improve the availability of environmentally friendly products and reduce their costs. In addition, organisations are rewarded that already provide environmentally friendly goods and services.

¹ Chang, C. H. (2011). The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. *Journal of Business Ethics*, 104(3), 361-370.

² Eurobarometer study: http://ec.europa.eu/commfrontoffice/publicopinion/flash/fl_367_en.pdf

³ Communication from the Commission: A European Consumer Agenda – Boosting confidence and growth: http://aei.pitt.edu/42568/1/com2012_0225.pdf

Product Environmental Footprint profile

The Product Environmental Footprint (PEF) is a multi-criteria common method for measuring the environmental performance of a good or service. It adopts a life cycle approach, which takes into account the product's entire range of resource flows and environmental interventions throughout its life cycle, that is, throughout all stages of a product system: from raw material acquisition, to processing, distribution, use, and final disposal. Throughout these stages, it includes all environmental impacts, such as resource-related threats and adverse health effects.

Calculations based on the PEF method generate results on *16 environmental impact categories* (e.g. climate change, acidification, eutrophication, use of mineral and metal resources, etc.). The results of the calculation are known as the PEF profile of the product. The results on the 16 impact categories are normalized and multiplied by a set of weighting factors to arrive at a *single performance score*. To obtain reliable results, it is important that the overarching PEF-defined analytical principles are strictly followed.

For specific product categories, Product Environmental Footprint Category Rules (PEFCRs) aim to provide detailed technical guidance on how to conduct a PEF study for that category. PEFCRs provide further specification at the process and/or product level. In particular, PEFCRs typically provide further specification and guidance in e.g. defining the goal and scope of the study, defining most relevant impact categories, processes and life cycle stages, identifying appropriate system boundaries for the analysis, identifying key parameters and life cycle stages, providing guidance on possible data sources, etc. The PEFCRs enable comparisons of the single performance score (and sub scores on the impact categories) to a *benchmark* and therefore indirectly also between products (e.g. product "A" is better than the average, whilst product "B" has an average performance). This type of comparison may be made between products belonging to the same category (e.g. two beers under the beer PEFCR) or sub-category (e.g. between two cheeses, but not between liquid milk and cheese under the dairy PEFCR).

Thus, for product categories for which PEFCRs are available, relative environmental performance of products could be communicated for all products within the same category. The comparative nature of the information should enable consumers to distinguish between products that have greater versus smaller environmental impacts, and encourage them to opt for products that are less harmful to the environment. However, to date it is unclear how PEF information can best be communicated to consumers. Would it be best to communicate just the overall performance of the product relative to the benchmark? Or do consumers prefer to receive more detailed information (e.g. performances on the most relevant impact categories)? And how would such PEF information interact with already existing environment-related labels and logos, such as the EU Ecolabel? During the Environmental Footprint pilot phase, several approaches to communicating PEF profiles to consumers were tested.⁴ The tests revealed some promising elements for communication, but these were not systematically tested in a way that is representative for the EU market.

⁴ http://ec.europa.eu/environment/eussd/smgrp/pdf/2018_pilotphase_commreport.pdf

1.2. Objectives and research questions

PEF information for products covered by PEFCRs

The key objective of the study is to gather insight into the most effective way(s) of communicating the Product Environmental Footprint (PEF) profile to consumers. More specifically, for products for which PEFCRs exist, the study aims to answer the following research questions:

1. Which combination of information is most effective in (1) attracting consumers' *attention*, (2) conveying an *understandable* and *trusted* message, and (3) encouraging consumers to take the information into *consideration* when buying products, promoting more environmentally friendly *choices*?
2. Which are the essential content elements in communicating PEF information, i.e. which are the elements that are most (vs. least) effective (in terms of attention, understanding, trust, and consideration in decision-making)?
3. Does the effectiveness of (combinations of) content elements differ between (a) Member States, (b) product types, and/or (c) consumer groups?
4. To what extent is the effectiveness of PEF information affected by the presence of other environment-related labels?

The present study tests alternatives for communicating Environmental Footprint information. The alternatives differ in terms of the *content* of the information. Whilst the tests carried out during the pilot phase (2013-2018) pointed to several promising elements for consumer communication, the combination of these elements has not been tested. The results of this study serve as input for developing future EU policies defining rules on how to communicate Environmental Footprint information.

PEF information for products not covered by PEFCRs

PEFCRs are available for a limited number of product categories. For product categories that are not in the scope of an existing PEFCR, the umbrella PEF method can be used to calculate the PEF profile of a product. By applying the general PEF method, similar calculations as for PEFCR-covered products can be performed for products not covered by a PEFCR. That is, producers can calculate results on the 16 impact categories, weighted and normalised single performance scores, and the contribution of different life cycle stages to the total. However, due to the freedom of choice producers have with respect to the sources of data and methodologies to use for the calculations and the absence of a benchmark to compare their performance to (i.e. results for an average product), it is impossible to use the calculations to indicate environmental performance relative to other products. For this reason, the purpose for providing PEF information would be different in this context. PEF information does not facilitate product comparisons on environmental aspects (and if it does, such comparisons would be inaccurate), but producers could use the PEF method to substantiate environmental claims.

The key question, here, is whether using the EU recommended PEF method, to substantiate claims enhances consumers' trust in these claims and improves their evaluation of the products for which such claims are being made. To answer this question, this study explores options to communicate PEF information in a non-misleading way for products not covered by PEFCRs, and examines how consumers react to such information. In this way, the present study aims to help determine

whether or not application of the umbrella method should be encouraged for non-PEFCR products. More specifically, it aims to answer the following research questions:

1. Do consumers trust claims that are substantiated by a PEF study more than claims that are not?
2. How does substantiation of claims via the PEF method affect consumers' perceptions of environmental friendliness and evaluation of products that use such claims? And how does it affect their perceptions and evaluation of products that do *not* use the PEF method to substantiate their claims (or do not use claims at all)?
3. To what extent are these effects dependent on the number of products (few vs. many) in an assortment that use the PEF method to support their claims?
4. What *type* of information based on the PEF profile is best understood and evaluated most positively?
5. Does exposure to claims that are substantiated by a PEF study increase general awareness of environmental impacts and environmental concern?

1.3. Research methodology and structure of the report

To answer the research questions, two large-scale multi-country online experiments were conducted, one looking at products that are covered by PEFCRs and one looking at product not covered by PEFCRs. These studies provide detailed insight into consumers' responses – i.e. their level of understanding of and trust in the information, their evaluation of the information, and the extent to which it affects their choices – towards different types and combinations of PEF information. In addition, an eye-tracking study was carried out to examine, for products falling under a PEFCR, which type of combination of PEF information is most effective in capturing consumers' attention.

Chapter 2 describes the general set-up of the experiments, including the specific types of PEF information that were tested and the experimental procedure. Chapter 3 presents the results for products covered by PEFCRs. Results for products not in the scope of a PEFCR are provided in Chapter 4. The results are synthesized in Chapter 5, which also provides recommendations.

2. General set-up of the experiments

This chapter outlines the types and combinations of PEF information that were tested in the experiments, for products covered (Section 2.1) and not covered by PEFCRs (Section 2.2). The general experimental procedures are explained in Section 2.3.

2.1. PEF information for products covered by PEFCRs

2.1.1. Types of PEF information included in the test

A product's PEF profile can be communicated in many different ways. For products covered by PEFCRs, a *single performance score* – the sum of weighted results on 16 impact categories – can be calculated and compared against the environmental performance of the average product on the market (the benchmark). In addition, to help consumers interpret such overall results, more detail can be provided regarding the product's scores (relative to the benchmark) on the impact categories that contribute most to this total footprint of the product. More specifically, the current study tests (combinations of) the following information elements:

- Overall environmental performance presented on a three-level scale ("better", "average", "worse") from green to red;
- Single performance score expressed as a percentage relative to the benchmark;
- An indication of the three most relevant impact categories;
- Performance on the three most relevant impact categories on three-level scales ("better", "average", "worse") from green to red.

In line with studies on food/nutritional labelling⁵ and eco-labelling,⁶ consumers consider an overall environmental performance indicator as helpful.⁷ Accordingly, it has been advised to always present such an overall score on an environmental footprint label.⁸ However, to increase consumer understanding and awareness of the factors that contribute most to the environmental footprint of a product, it could be desirable to provide additional information. The single performance score expressed as a percentage relative to the average provides more specific information compared to the three-level scale, as it also informs consumers about *how much* better or worse the product performs relative to the benchmark, allowing them to further discriminate between products that fall within the same crude category (e.g. "better"). Providing information on the impact categories that contribute most to the overall environmental performance of the product may help consumers grasp the meaning of the single

⁵ Grunert, K. G., Hieke, S., & Wills, J. (2014). Sustainability labels on food products: Consumer motivation, understanding and use. *Food Policy*, *44*, 177-189.

⁶ Leire, C., & Thidell, Å. (2005). Product-related environmental information to guide consumer purchases—a review and analysis of research on perceptions, understanding and use among Nordic consumers. *Journal of Cleaner Production*, *13*(10-11), 1061-1070.

⁷ Bio Intelligence Service for the European Commission. (2012). Study on different options for communicating environmental information for products; LSE & partners consortium for the European Commission. (2018).

⁸ Bio Intelligence Service for the European Commission. (2012). Study on different options for communicating environmental information for products; LSE & partners consortium for the European Commission. (2018).

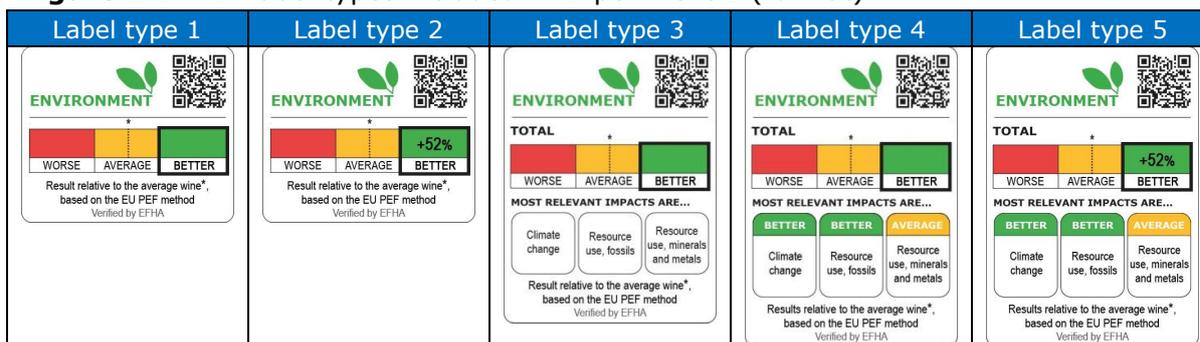
performance score. In addition, the performances on these most relevant impact categories could be presented as well, to provide even more detailed information about how the product scores on each of the relevant impacts.

All PEF labels used in Experiment 1 displayed the single performance score on a three-level scale. We tested the effects of (1) adding performance information as a percentage relative to the average, (2) adding information on the three most relevant impact categories, and (3) adding information on the product’s performance on the three most relevant impact categories (on three-level scales). We also tested the joint effect (1) and (3), see Table 2.1 and Figure 2.1.

Table 2.1. PEF label types included in Experiment 1

| Label type | Single performance score | | Impact categories | |
|------------|--|------------------------------------|-------------------------------|---------------------------|
| | 3-level scale (better, average, worse) | Percentage relative to the average | Indication of 3 most relevant | Scores on 3 most relevant |
| 1 | X | | | |
| 2 | X | X | | |
| 3 | X | | X | |
| 4 | X | | | X |
| 5 | X | X | | X |

Figure 2.1. PEF label types included in Experiment 1 (format)



Additional information

The comparative environmental performance indicators described above could be complemented by easily understandable statements derived from the PEF profile. Such statements could relate to:

- a relevant impact category (e.g. *“This product leads to reduced emission of greenhouse gases comparable to charging your mobile phone 400 times”* or *“The Earth’s mineral and metal resources are finite! Enjoy this wine knowing that it helps conserve minerals and metals”*);
- a relevant life cycle stage (e.g. *“Grape growing accounts for about 50% of the environmental footprint of wines. We reduce our impact by growing our grapes in a more environmentally friendly way”* or *“You are in charge of this detergent’s environmental footprint: much of its impact depends on how you use it. Follow the washing instructions!”*).

Such claims might help consumers to grasp the meaning of the performance results. It is important that the claims are reliable and valid, and that they relate to relevant performance aspects, as evidenced by the results of the PEF study. Note that if presented alone, such qualitative statements may be considered misleading because

they focus attention on specific aspects of environmental performance while ignoring relevant others.⁹ For that reason, in order to provide a comprehensive picture, such statements should always be accompanied by information on the overall environmental performance of the product.

Finally, using a life cycle approach, the PEF method can also be used to calculate and communicate:

- the percentage contribution of different life cycle stages to the total.

Rather than providing a qualitative claim regarding the life cycle stage in which most of the product's environment footprint is made, it is also possible to provide more complete insight into the relative contribution of the different life cycle stages – (1) raw material acquisition and pre-processing, (2) manufacturing, (3) distribution, (4) use, and (5) end of life – to the total environmental footprint of the product. Since this information is not available at the level of individual products, but rather for product groups, providing this information will not encourage between-product comparisons. Rather, the purpose of providing this type of information would be to make consumers more aware, for example, of their own contribution to the environmental performance of products and to act upon this knowledge. As an example, for shampoos and detergents, the use phase (e.g. how much of the product is used by the consumer, what temperature of water is used for washing) has a relatively strong impact on the total performance. Providing this information might promote more conscious usage behaviour.

Albeit using small-scale focus groups, it was demonstrated that consumers are generally unfamiliar with the idea of life cycle impacts of products (e.g. that a product can have environmental impacts before it is used).¹⁰ Previous research also showed that providing information on the life cycle stages could help improve consumer understanding of the factors that contribute most to the environmental impact of a product and the impact of their own behaviour on the environment.¹¹ It seems more effective to link such information to consumers' personal impact on the environment than providing more general environmental information.^{12,13}

Whilst providing more detail and additional information may help consumers to get a better idea of what is behind the overall performance score, previous research has demonstrated that there are limits to the amount of information that can be

⁹ Any combination of elements should adhere to the principles of transparency, availability and accessibility, reliability, *completeness*, comparability and clarity (see: Communication "Building the Single Market for Green Products: <http://ec.europa.eu/environment/eussd/smgp/>).

¹⁰ Bio Intelligence Service for the European Commission. (2012). Study on different options for communicating environmental information for products.

¹¹ Hartikainen, H., Roininen, T., Katajajuuri, J. M., & Pulkkinen, H. (2014). Finnish consumer perceptions of carbon footprints and carbon labelling of food products. *Journal of Cleaner Production*, 73, 285-293.

¹² Claim focused on personal environmental impact: "You can reduce your personal consumption of water, energy, and minimize waste products by using this detergent" versus general environmental claim: "We made this laundry using minimal amount of water, energy, and waste products".

¹³ Cho, Y. N. (2015). Different shades of green consciousness: The interplay of sustainability labeling and environmental impact on product evaluations. *Journal of business ethics*, 128(1), 73-82.

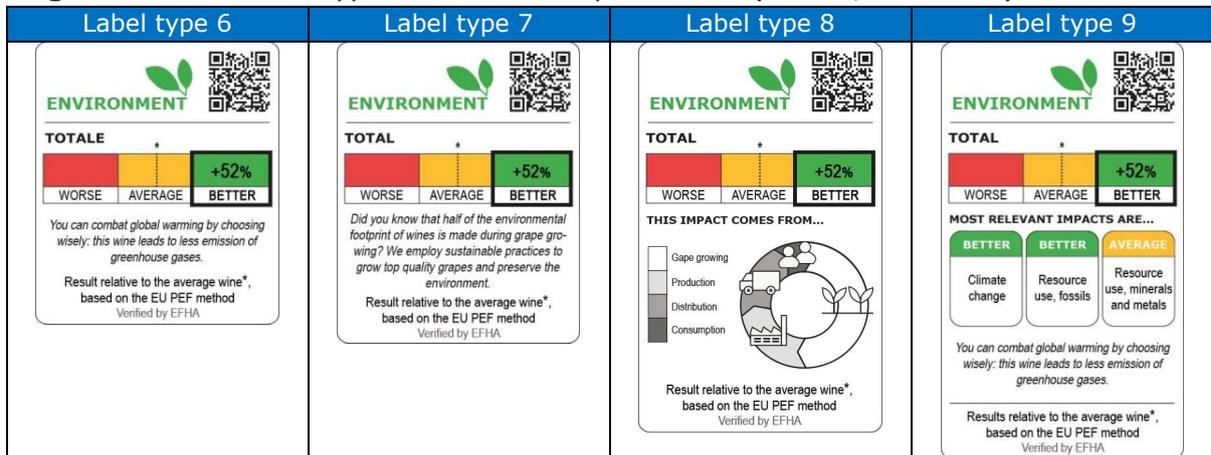
processed.¹⁴ Consumers have indicated to prefer limiting the number of additional elements to no more than *three* to avoid information overload.¹⁵ Relatedly, research has suggested that numeric as well as scientific terms (e.g., X grams CO₂-eq) are too complex for (subgroups of) consumers.^{16,17} It has been suggested that for interested consumers, additional information could be made available via QR codes or links.¹⁸

Experiment 1 tested the effects of (1) adding a qualitative statement about a relevant impact category, (2) adding a qualitative statement about a relevant life cycle stage, and (3) adding information on the contribution of life cycle stage to the total, using a label with the single performance score both indicated on a three-level scales and expressed in percentage relative to the average as a baseline (see Table 2.2 and Figure 2.2, label type 6-8). Further, providing a qualitative statement about one of the three most relevant impact categories might help consumers understand the meaning of the impact category information. Therefore, Experiment 1 also tested the combination of providing this type of qualitative statement and information on three most relevant impact categories (label type 9, see Table 2.2 and Figure 2.2).

Table 2.2. PEF label types included in Experiment 1 (continued)

| Label type | Single performance score | | Scores on 3 most relevant impact categories | Qualitative statement about a relevant... | | Percentage contribution of life cycle stages to the total |
|------------|--|------------------------------------|---|---|------------------|---|
| | 3-level scale (better, average, worse) | percentage relative to the average | | Impact category | Life cycle stage | |
| 6 | X | X | | X | | |
| 7 | X | X | | | X | |
| 8 | X | X | | | | X |
| 9 | X | X | X | X | | |

Figure 2.2. PEF label types included in Experiment 1 (format, continued)



¹⁴ Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. *The information society*, 20(5), 325-344.

¹⁵ Bio Intelligence Service for the European Commission. (2012). Study on different options for communicating environmental information for products; LSE & partners consortium for the European Commission. (2018). Assessment of different communication vehicles for providing Environmental Footprint information.

¹⁶ LSE & partners consortium for the European Commission. (2018). Assessment of different communication vehicles for providing Environmental Footprint information.

¹⁷ Bio Intelligence Service for the European Commission. (2012). Study on different options for communicating environmental information for products.

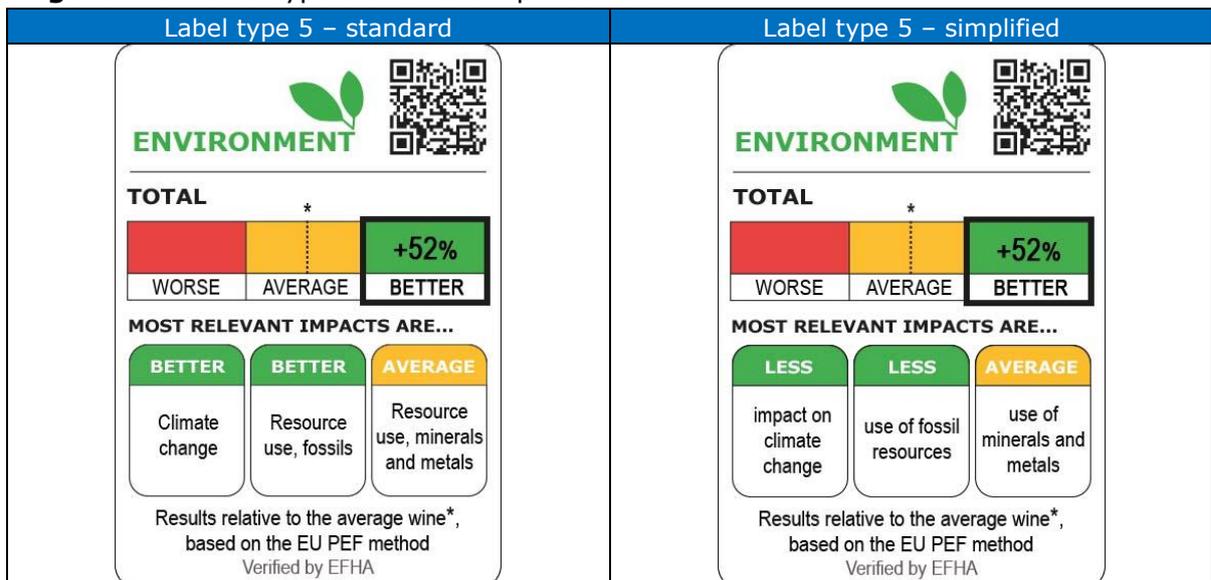
¹⁸ LSE & partners consortium for the European Commission. (2018). Assessment of different communication vehicles for providing Environmental Footprint information.

Strategies to enhance understanding

Among the tested alternatives are information labels that include detailed information regarding the most relevant impact categories and life cycle stages. Previous research suggests that consumers may have difficulty understanding such information¹⁹, which could be due to the complexity of the subject matter, but also to the complexity of the language used to describe the impacts. For most of the impact categories (e.g. ionizing radiation, photochemical ozone formation, acidification, eutrophication) the standard wording used does not conform to the CEFR-B1 language level, which is generally recommended for public communication to ensure that the information is comprehensible for the large majority of the public.²⁰

Due to the complexity of the terms used, a PEF label with information on the most relevant impact categories might be understood relatively poorly (and hence less effective in promoting environmentally friendly choices) as compared to a label that only displays the single performance score. However, when simpler terms are used for the impact categories (e.g. "radioactivity" instead of "ionizing radiation"), or when consumers receive easy-to-understand information on how the results are calculated, they might understand the two types of labels (simple vs. more detailed) equally well, and, in that case, might prefer the label with more detailed information. The present study compares labels with and without sub scores under three conditions: (1) using standard terms for the impact categories without (further) explanation, (2) using *more simplified wording* for the impact categories (this is implemented in a separate label type, see Figure 2.3), and (3) *explaining* to consumers how results are calculated (e.g. similar to running an information campaign). In this way, the study provides insight into whether reducing complexity of the more detailed information changes the relative effectiveness of labels displaying overall versus more detailed performance information, providing for a fairer comparison.

Figure 2.3. Label type 5 and its simplified version



¹⁹ Leire, C., & Thidell, Å. (2005). Product-related environmental information to guide consumer purchases—a review and analysis of research on perceptions, understanding and use among Nordic consumers. *Journal of Cleaner Production*, 13(10-11), 1061-1070.

²⁰ <http://www.delfdalf.fr/level-b1-cefr-common-european-framework-of-reference-for-languages.html>

Third-party certification

Whether consumers trust (the diverse types of) claims that are substantiated by a PEF study may be dependent on the presence of trust marks signalling to consumers that the PEF method is the EU approved and recommended method for calculating the environmental impact of products. The pilot study already revealed the importance of third-party certification for products falling under the PEFCR.²¹ Therefore, in the current study, the PEF information was always accompanied by the statement that the results were “calculated based on the EU PEF method” and “verified by EFHA” (a fictive organisation). There was no need to re-test the influence of third-party certification on trust in the information.

2.1.2. Presence of other environment-related labels

Currently, several other product labelling schemes exist to communicate environment-related information to consumers, some of which show an overlap with PEF information (EU Ecolabel) and some of which highlight specific and/or different aspects of environmental performance (e.g. EU organic logo, EU energy label). Since the provision of information on the PEF profile of products would change the landscape of EU labels, it is important to (also) examine consumer responses to PEF information in the presence of such already existing labels. The present study investigates how consumers respond to PEF information on products that carry an EU Ecolabel and those that carry an EU organic label.

EU Ecolabel

While the EU Ecolabel signals which products are “best in class” in terms of environmental performance (i.e. product either have an EU Ecolabel or not), PEF covers products at all levels of performance and allows for a more fine-grained comparison of the environmental impact of products within the category. Since both communicate information on the (overall) environmental performance of products, the coexistence of the EU Ecolabel and PEF information might cause confusion or produce perceptions of information redundancy among consumers.

EU organic logo

The situation might be different when some products have organic labels. Organic agriculture has important environmental advantages over conventional agriculture (such as enhanced soil fertility, higher biodiversity, and higher energy efficiency)²² and consumers typically associate organic products with low environmental impacts²³. However, research also suggests that while organic farming generally has lower environmental impacts per unit of area than conventional farming, this positive effect may be less pronounced or not present at all when impacts are expressed per product unit, because organic farming tends to have lower crop yields and hence require more land to achieve the same result.²⁴ Therefore, organic products might not necessarily

²¹ http://ec.europa.eu/environment/eussd/smgp/pdf/2018_pilotphase_commreport.pdf

²² Mäder, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P., & Niggli, U. (2002). Soil fertility and biodiversity in organic farming. *Science*, 296(5573), 1694-1697; Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Environmental impact of different agricultural management practices: conventional vs. organic agriculture. *Critical reviews in plant sciences*, 30(1-2), 95-124.

²³ Rousseau, S., & Vranken, L. (2013). Green market expansion by reducing information asymmetries: Evidence for labeled organic food products. *Food Policy*, 40, 31-43.

²⁴ Mondelaers, K., Aertsens, J., & Van Huylenbroeck, G. (2009). A meta-analysis of the differences in environmental impacts between organic and conventional farming. *British Food Journal*, 111(1), 1098-1119; Tuomisto, H. L., Hodge, I. D., Riordan, P., & Macdonald, D. W. (2012). Does organic farming reduce environmental impacts?—A meta-analysis of European research. *Journal of environmental management*, 112, 309-320.

have a low PEF score. As such, the joint presence of organic and PEF labels might cause confusion regarding which product is the most environmentally friendly. To reduce the cognitive dissonance that results from the seemingly conflicting messages, they may put less trust in the accuracy of one of the labels. The present study examines whether this occurs.

Such declines in trust might be preventable however by providing additional information about the unique characteristics (or benefits) of an organic product. For example, one characteristic of organic products is that they support biodiversity. Biodiversity is not directly included in the calculation of the environmental footprint score.²⁵ Importantly, when a biodiversity certification is presented on an organic product that does not show a “better-than-average” environmental performance, this might help consumers understand that organic products have unique characteristics that are not (fully) captured by the environmental footprint score – possibly preventing confusion and concerns about the accuracy of the environmental footprint score and/or organic logo. The current study tests whether the addition of a biodiversity certification (biodiversity friend logo, see Figure 2.4) on an organic product with an average environmental footprint score indeed prevents confusion and reductions in trust.

Figure 2.4. Other environment-related labels and biodiversity certification included in Experiment 1

| Other environment-related labels | | Biodiversity certification logos | |
|---|---|--|---|
| Organic logo | Ecolabel | Biodiversity friend | Ecocert biodiversity commitment |
|  |  |  |  |

2.2. PEF information for products not covered by PEFCRs

2.2.1. Types of PEF information included in the test

Based on the general PEF method, producers of products that are not covered by PEFCRs can also calculate results on the 16 impact categories, weighted and normalised single performance scores, the contribution of different life cycle stages to the total and generate information about the most relevant impact categories, processes and life cycle stages for the given product. However, due to the freedom of choice producers have with respect to the data sources and methodologies to use for the calculations and the absence of a benchmark to compare their performance to, the calculated results will be non-comparative by nature. To answer the question whether producers should nevertheless be encouraged to use the PEF method to substantiate their claims, it is important to first gain insight into the potential ways in which

²⁵ PEFCRs can oblige or recommend the provision of biodiversity information as additional environmental information. In addition, some of the impact categories indirectly reflect impacts on biodiversity (e.g. climate change, eutrophication and acidification indicators, etc.).

environmental footprint information resulting from a PEF study *can* be conveyed without being misleading. The present study examines the following information types:

- Qualitative statements about a relevant impact (e.g. *"You can combat global warming by making smart choices! Our TVs feature the newest energy-saving technologies to help reduce the emission of greenhouse gases"*);
- Percentage contribution of the different life cycle stages to the total;
- Percentage change in environmental impact over time (e.g. *"Over the last five years we have reduced our environmental footprint by 20%"*);
- Absolute results expressed in micro points.

However, each of these options has drawbacks. Qualitative statements pose the risk of focusing consumer attention on one – albeit relevant – specific performance aspect. Providing such partial information might be somewhat misleading in cases when the product has relatively poor performance on the other relevant impact categories or life cycle stages that are not mentioned.

Furthermore, in this case, the user of the PEF method could calculate the percentage contribution of different life cycle stages to the total for its own specific product. Therefore, whilst this information may be helpful in raising general awareness regarding, for instance, consumers' own contribution to the environmental impacts of the product under consideration, it does not facilitate product comparisons. These percentages may vary between two PEF studies conducted for similar products (due to different methodological choices different users may take) and may come across as confusing to consumers.

Furthermore, producers can perform PEF studies at different moments in time to provide insight into how environmental footprint changes over time, to substantiate claims regarding improved environmental performance. Here, a risk might be that for products that perform relatively worse, it is easier to achieve substantial (relative) reductions in environmental performance (i.e., there might be more room for change). This could, for example, lead consumers to underestimate the environmental impact of some products.

Finally, for absolute results (which can be provided for the overall performance or per impact category), a major problem relates to their non-comparative nature. Absolute results should therefore not be provided on a stand-alone basis. In the present study, we examine the effect of using absolute results to substantiate information regarding the percentage change in environmental performance over time (see Table 2.3 and Figure 2.5) on consumer choice behaviour. It is well-known that when absolute scores are provided for products, consumers tend to actively compare them²⁶, which in this case may result in faulty conclusions about the relative environmental impacts of the products. The present study tests whether this occurs.

²⁶ Simonson, I., Bettman, J. R., Kramer, T., & Payne, J. W. (2013). Comparison selection: An approach to the study of consumer judgment and choice. *Journal of Consumer Psychology*, 23(1), 137-149; Hieke, S., & Newman, C. L. (2015). The effects of nutrition label comparison baselines on consumers' food choices. *Journal of Consumer Affairs*, 49(3), 613-626.

Despite of the drawbacks, some of these options could still be considered more desirable than the current situation (i.e., in which non-substantiated claims are widely used²⁷). Specifically, despite its limitations, percentage change of environmental impacts could still provide a substantiated indication to consumers that the manufacturer is putting effort into lowering the environmental impacts of their products – and conversely, it allows manufacturers to show that they are working on improving the environmental impact of their products. Further, providing qualitative statements (e.g., “this product contains recycled material”) that are substantiated by a PEF study (e.g. revealing that the end-of-life stage end-of-life stage contributes most the total environmental footprint of a product and information on recycled content) would be a considerable improvement over non-substantiated claims which could highlight performance on a relatively irrelevant environmental aspect (e.g., claiming that the product package is made of secondary materials, whilst the contribution of packaging related processes at the end-of-life stage to the total footprint is relatively small).

Table 2.3. PEF-based claim types included in Experiment 2

| Type of PEF claim | Qualitative statement about a relevant impact category | Percentage contribution of life cycle stages to the total | Percentage change | Absolute results (in micro points) |
|-------------------|--|---|-------------------|------------------------------------|
| 1 | X | | | |
| 2 | | X | | |
| 3 | | | X | |
| 4 | | | X | X |

Figure 2.5. Examples of the different type of PEF claims in Experiment 2 (format)

| Claims type 1 | Claims type 2 | Claims type 3 | Claims type 4 |
|---|--|--|--|
| <p>Wir verhindern übermäßiges Algenwachstum, indem wir das erwärmte Wasser aus unseren Palmölplantagen kühlen, bevor es wieder in die Flüsse geleitet wird. So tragen wir dazu bei, den notwendigen Sauerstoffgehalt in den Flüssen aufrechtzuerhalten. Relevante Auswirkung gemäß der EU-PEF-Methode</p> | <p>Die Umweltauswirkungen dieses Produkts ergeben sich durch: Verwendung 15% Entsorgung 15% Vertrieb 15% Herstellung 15% Rohstoffe 60% Berechnet anhand der PEF-Methode der EU</p> | <p>In den letzten 5 Jahren haben wir unseren ökologischen Fußabdruck um 27% reduziert* Berechnet anhand der PEF-Methode der EU</p> | <p>Die Umweltauswirkung dieses Produkts ist... 80,71 Mikropunkte* In den letzten 5 Jahren haben wir unseren ökologischen Fußabdruck um 27% reduziert* Berechnet anhand der PEF-Methode der EU</p> |
| <p>We prevent excess algae growth by cooling the heated water from our palm oil plantations before it flows back into the rivers, helping to maintain necessary oxygen levels. (Eutrophication)</p> <p>Relevant impact based on the EU PEF method</p> | <p>The environmental impact of this product comes from...</p> <ul style="list-style-type: none"> Raw materials ...% Production ...% Distribution ...% Use ...% Disposal ...% <p>Calculated based on the EU PEF method</p> | <p>Over the past 5 years we reduced our environmental footprint with 27%</p> <p>Calculated based on the EU PEF method</p> | <p>This product's environmental impact is... 80.71 micro points</p> <p>Over the past 5 years we reduced our environmental footprint with 27%</p> <p>Calculated based on the EU PEF method</p> |

²⁷ Baum, L. M. (2012). It's not easy being green... or is it? A content analysis of environmental claims in magazine advertisements from the United States and United Kingdom. *Environmental Communication: A Journal of Nature and Culture*, 6(4), 423-440; European Commission (2014). Consumer Market Study on Environmental Claims for Non-Food Products. http://ec.europa.eu/consumers/consumer_evidence/market_studies/environmental_claims/index_en.htm.

2.2.2. Share of products with PEF-based claims

For products not in the scope of a PEFCR, the experiment investigates how substantiation of claims via the PEF method affects consumers' perceptions (e.g. environmental friendliness) and evaluation of products that use such claims, but also of products that do *not* use the PEF method to support their claims. These effects may depend on the share of products in the assortment that carry claims that are substantiated through a PEF study. Especially when the majority of products in an assortment have claims based on the PEF method, *not* showing PEF results might raise suspicion and result in less favourable product evaluations. This would be consistent with prior studies showing that if (environmental) information is present for some products while absent for others, consumers generally assume that (environmental) performance is relatively poor for (and are less likely to choose) products for which the information is absent.²⁸

2.3. General experimental procedures

Here, the overall set-up of the experiments is described. In addition, detailed information on the choice task and eye-tracking procedure is provided. More specific information about other methods and measures are provided when the results of the statistical analyses are discussed (Chapter 3 and 4).

2.3.1. Online experiments

Two online experiments were conducted in GfK's online panels in respectively eight and four countries to gain insight into consumer responses to various types and combinations of PEF information (more detail on the country and respondent samples will be provided in the next chapters). One online experiment focused on products covered by PEFCRs (Experiment 1), the other on products not covered by PEFCRs (Experiment 2). The experiments employed the same general procedure. Both experiments consisted of three parts:

- The first part aimed to provide insight into the impact of the presence and type of PEF information on **choice behaviour**. Respondents were exposed to three sets of products and asked to make product choices.
- The second part assessed consumer understanding and evaluation of the PEF information and trust in the information. In Experiment 1 (PEFCR), participants saw the (last) product assortment once more and were asked to identify either the most or least environmentally friendly product (randomly decided) (**objective understanding**). In Experiment 2 (non-PEFCR), in which the PEF information provided was of a non-comparative nature, respondents were asked to rate the perceived environmental friendliness of the products in the (last) assortment. Next, in both experiments, respondents saw a (certain type of) PEF label in isolation and answered questions assessing their level of **subjective understanding** of the label, their **evaluation** of and **trust** in the information.
- In the third part, which was presented as a new, unrelated study, **pro-environmental behaviour** was measured through a behaviour task. Using

²⁸ Meise, J. N., Rudolph, T., Kenning, P., & Phillips, D. M. (2014). Feed them facts: Value perceptions and consumer use of sustainability-related product information. *Journal of Retailing and Consumer Services*, 21(4), 510-519.

three scenarios, the pro-environmental behaviour task assessed the amount of time, money and effort the respondent would be willing to expend for a more environmentally friendly choice option in a different domain (transport). This task is explained in more detail in Chapter 3.

The complete questionnaires of Experiment 1 and 2 can be found in Appendix A and B, respectively.

Product category selection

In order to enhance the generalisability of the results, we examined the impact of the presence and type of PEF information for three product categories for which PEF CRs exist and three product categories for which PEF CRs do not (yet) exist. The product category selection is diverse, including food and non-food products, utilitarian and hedonistic products, more and less expensive products, and products with various types of other environment-related labels and logos (i.e. organic logo, ecolabel, energy label) etc., see Table 2.4.

Table 2.4. Product categories included in the experiments

| Covered by PEF CR | Product category | Use phase affects footprint | Purchase frequency | Cost | Food/ Non-food | Hedonistic/ Utilitarian | Other European label |
|-------------------|---------------------|-----------------------------|--------------------|--------|----------------|-------------------------|------------------------------------|
| Yes | Wine | No | Medium | Medium | Food | Hedonistic | Yes, EU Organic logo ²⁹ |
| | Decorative paints | No | Low | Medium | Non-food | Mixed | Yes, EU Ecolabel ³⁰ |
| | Household detergent | Yes ³¹ | High | Low | Non-food | Utilitarian | Yes, EU Ecolabel ³² |
| No | TV | Yes | Low | High | Non-food | Hedonistic | Yes, EU Energy Label |
| | Sport shoes | No | Medium | Medium | Non-food | Mixed | Yes, EU Ecolabel ³³ |
| | Chocolate spread | Yes | High | Low | Food | Hedonistic | Yes, EU Organic logo ³⁴ |

2.3.1.1. Product choice task

In the product choice task, respondents were asked to imagine going to a shopping mall to buy a number of items. Next, they were presented with choice sets of six product alternatives. In Experiment 1 (PEF CR), respondents were exposed to assortments of wines, wall paints, and laundry detergents. In Experiment 2 (non-PEF CR), respondents saw assortments of TVs, sport shoes, and chocolate spread. To

²⁹ https://ec.europa.eu/agriculture/organic/sites/orgfarming/files/docs/body/organic_logo-faq_en.pdf, see page 3 example: "organic wine"

³⁰ See cleaning products under "do-it-yourself"
<http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html>

³¹ See the Pilot study, in which this was mentioned.

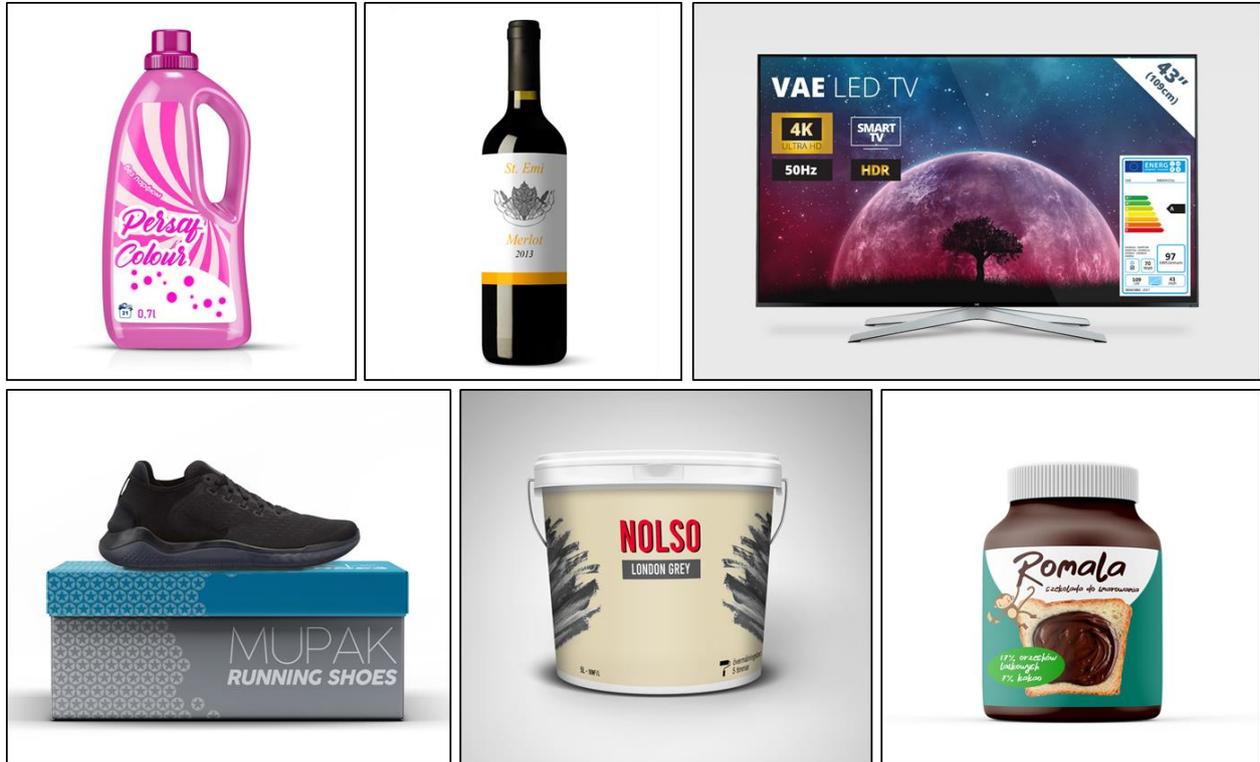
³² See cleaning products under "cleaning up"
<http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html>

³³ http://ec.europa.eu/environment/ecolabel/documents/UM_footwear_part_A_B_C_D_E.pdf

³⁴ <http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html>

control for order effects, both the display order of the product alternatives within each set and the order of the product sets were randomised. Respondents were asked to imagine seeing the products in a real store and make choices as they would do in reality.

Figure 2.6. Examples of mock-up products used in Experiment 1



To ensure high external validity, the cover story and task instructions did not explicitly draw respondents' attention to environmental information (which could create an experimental artefact). For this reason, the choice task preceded other outcome measures that did *require* attention to the label, such as label understanding, label evaluation and trust in the label.

The experiments employ an advanced experimental design to fully control for (i.e. rule out) any influences of product characteristics other than the *presence* and *type* of PEF information displayed on consumer choice behaviour. This is explained in the next paragraphs.

Product sets

Mock-up products, with fictive brand names, were developed especially for this study (see Figure 2.6 for examples). As in reality, the product alternatives in each set varied on several characteristics, such as brand, price, quality aspects, and their visual design. To avoid that a certain product would be so appealing that almost all respondents would choose it, which would render the experiment insensitive to variations in environmental footprint information, product prices were determined based on separate pretests, in which we asked small consumer samples (for Experiment 1: $N = 23$; 61% male; $Age_{mean} = 42$, min. = 19, max. = 71; for Experiment 2: $N = 19$; 63% male; $Age_{mean} = 40$, min. = 16, max. = 68) to indicate the expected purchase price of each product in the absence of environment-related information. The results of this pretest informed the prices on the products' price tags; products with more attractive characteristics (e.g. more appealing visual designs,

higher quality) as revealed by higher expected prices received higher prices in the experiment.³⁵

Environmental performance information

In Experiment 1 (PEFCR), all product alternatives in a set carried a PEF label. The products differed in their environmental performance (see Figure 2.7 for an example). Two products performed better than average, two products worse than average, and the remaining two products had an average performance. When overall performance was expressed as a percentage relative to the benchmark, respondents could use this information to further distinguish between products falling within the same colour category (e.g. +55% BETTER versus +43% BETTER, etc.). Which type of PEF label was presented on the products depended on the experimental condition the respondent was (randomly) assigned to (explained in more detail in Section 2.1, see Tables 2.1 and 2.2). Different groups of respondents saw the same products with different types of PEF labels, or no label at all (control group).

Figure 2.7. Differences in environmental performance within the product set (Exp. 1)



Note – Assortment of laundry detergents used in Experiment 1 with labels indicating overall performance on a three-level scale and as a percentage relative to the benchmark. Products were displayed on screen as in Figure 2.9. Note that the display order of the products in the set was randomised.

In contrast to Experiment 1 in which all products in the assortment carried a similar PEF label, the choice sets in Experiment 2 (non-PEFCR) consisted of a mix of products with and without environment-related claims. For products that are not in the scope of a PEFCR, manufacturers will be free to choose whether or not to conduct a PEF study and make claims based on its results. This is likely to create a situation in which some products carry environmental claims that are substantiated through a PEF study, some products carry environmental claims that are not substantiated via the PEF method, and others do not make environmental claims at all. The product sets used in Experiment 2 reflect this situation (see Figure 2.8 for an example). To be able to disentangle effects of the type of claim (PEF claim, non-PEF claim, no claim) from product-specific effects, such as effects of price information, packaging design, etc., which both vary *within* the product set, the products were randomised across the

³⁵ In the experiment, product prices were presented in the currency of the respective country (i.e. krona in Sweden, zloty in Poland, lev in Bulgaria, and in euros in all other countries).

different claims (or no claim). This randomisation ensured that each product-claim combination occurred, which allows us to compare the exact *same* product (a) with a PEF-based claim, (b) with a claim not based on PEF, and (c) without a claim. Furthermore, and as in Experiment 1, which *type* of PEF claim was presented on products that carried a PEF-based claim depended on the experimental group the respondent was in (randomly decided; see Table 2.3 for an overview of the types and combinations of information tested).

Figure 2.8. Differences in presence and type of claims within the product set (Exp. 2)



Note – Assortment of chocolate spreads used in Experiment 2 with PEF information provided through qualitative statements. Products were displayed on screen similar to Figure 2.3. Note that the claims were randomised across the six different products (i.e. different respondent saw different product-claim combinations) and the display order of the products in the set was randomised.

In the experimental groups, the PEF label was presented on the product package and had a realistic (small) size. As a result, respondents had to exert a little bit of effort to be able to read the information, as in reality (e.g. when taking a product off the shelf to take a closer look at it). In order to ensure that they could properly read the information on the PEF label if they wanted to, respondents were able to click on the product to see it in larger format. In addition, they could use a digital magnifying glass to inspect the product in detail (see Figure 2.9 for an example).

Figure 2.9. Example of product set display in the online questionnaire



Respondents could use a 'magnifying glass' to inspect each product in detail:



In total, 2928 images were developed for Experiment 1 (366 per country) and 4380 images for Experiment 2 (1095 per country).

Product choice

For each of the three product sets (i.e. sets of laundry detergents, wall paints, and wines in Experiment 1 and sets of TVs, sport shoes, and chocolate spreads in Experiment 2) respondents indicated which product they would buy if they would have to make a choice.

In Experiment 1 (PEFCR), the outcome measure of interest is the environmental performance of the product of their choice. Differences in the (average) environmental performance of the selected products are analysed by comparing, across the experimental groups:

1. the percentage of respondents that selected the product with the best PEF score in the assortment (i.e. product 1 in Figure 2.1); and
2. the percentage of respondents that selected a product scoring “better than average” (i.e. product 1 or 2 in Figure 2.1).

In Experiment 2 (non-PEFCR), in contrast, the environmental performance of products within the set cannot be directly compared. Here, we compare choice shares of (1) products with PEF-derived claims (i.e. product 1 and 2 in Figure 2.2), (2) products with claims that are not based on PEF, and (3) products without environmental claims. Obviously, the more products with a certain type of claim (e.g. PEF-based claim) are available in an assortment, the higher the likelihood that respondents choose a product with this claim type. By examining differences in *average* choice shares per claim type (PEF-based, not PEF-based, or no claim), our analyses properly control for the number of products that carry the specific type of claim.

2.3.2. Eye-tracking study

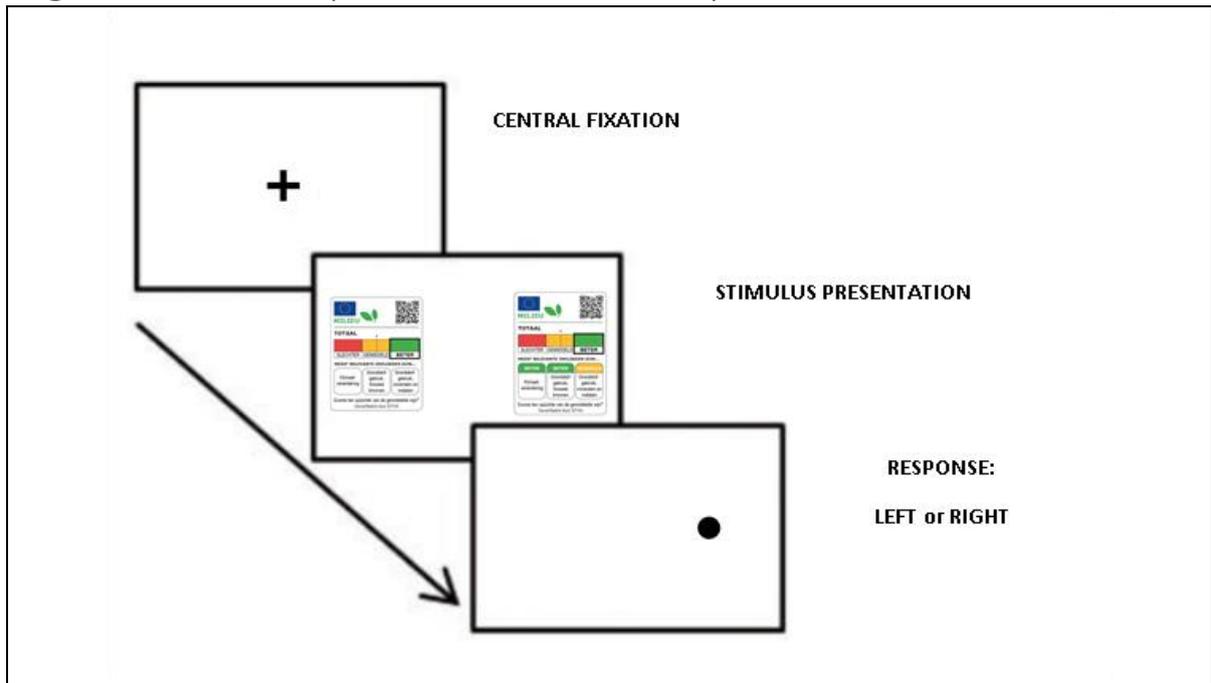
Initial attention capture of the ten label variants displayed in Figure 2.1-2.3 was examined in a separate study, in which eye movements of participants were recorded using infrared eye-tracking technology. A visual probe task was used (see Figure 2.10).³⁶ In this task, each possible label pair was presented twice, with each label being presented once on the left and once on the right. This resulted in 90 label pairs/trials (45 unique pairs). These trials were separated over two blocks, with each unique pair being presented once per block. The order of the trials within each block was randomized.

Each trial started with respondents first focussing on a fixation mark in the middle of the screen (for 800 msec.), after which two images (two different PEF labels) were presented next to each other for 1700 msec. Next, another mark (the visual probe) appeared in the location of one of the images. The respondent indicates the position of the probe (left or right) via button presses, as quickly as possible. This was done to keep the respondent engaged with the task. Further, prior to the visual probe task, respondents completed practice trials (including irrelevant stimuli) to get familiarized with the task. The key measure of interest was which label (left or right) is looked (fixated) at first: the label with the highest proportion of first fixations attracts the most attention.

The eye-tracking study was carried out among a sample of 129 undergraduate students at Tilburg University’s CentERlab in the Netherlands. The calibration and recording was considered successful for 101 participants. Their data were analysed.

³⁶ MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*(1), 15–20.

Figure 2.10. An example of one trial in the visual probe task



3. Consumer responses to PEF information: Products covered by PEFCRs

The primary purpose of Experiment 1 (PEFCR) was to examine which of the (combinations of) content elements of PEF information is understood, valued and trusted most, and is most effective in promoting environmentally friendly product choices. In the experiment, we investigated the effects of different types and combinations of PEF information on these outcome measures.

3.1. Sample description

The experiment was conducted online in eight countries: the Netherlands, Bulgaria, Finland, Germany, Italy, Poland, Portugal and Sweden. In total, 13005 respondents completed the experiment (between 1606 and 1641 respondents per country). Table 3.1 provides a description of the respondent sample, in total, and per country.

Table 3.1. Sample description: socio-demographics

| | Total | NL | BG | FI | DE | IT | PL | PT | SE |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Sample size | 13005 | 1628 | 1609 | 1641 | 1638 | 1606 | 1635 | 1619 | 1629 |
| <u>Gender</u> | | | | | | | | | |
| Male | 49,0% | 46,9% | 46,9% | 49,7% | 46,9% | 49,3% | 49,2% | 51,1% | 51,9% |
| Female | 51,0% | 53,1% | 53,1% | 50,3% | 53,1% | 50,8% | 50,8% | 48,9% | 48,1% |
| <u>Age</u> | | | | | | | | | |
| Age: 18-24 | 9,9% | 10,4% | 8,0% | 12,8% | 3,6% | 6,0% | 11,0% | 13,3% | 14,0% |
| Age: 25-34 | 19,5% | 13,6% | 24,2% | 17,3% | 20,1% | 20,7% | 22,0% | 19,8% | 18,0% |
| Age: 35-44 | 21,7% | 14,5% | 26,4% | 20,5% | 17,8% | 23,3% | 22,3% | 28,0% | 20,4% |
| Age: 45-54 | 21,3% | 27,5% | 20,1% | 20,6% | 25,0% | 22,0% | 16,3% | 21,5% | 17,4% |
| Age: 55-70 | 27,7% | 34,0% | 21,3% | 28,8% | 33,5% | 28,1% | 28,4% | 17,4% | 30,3% |
| <u>Education</u> | | | | | | | | | |
| Primary, partial secondary | 9,5% | 5,4% | 0,8% | 21,4% | 9,7% | 6,7% | 4,8% | 6,4% | 20,8% |
| Completed secondary | 43,5% | 55,2% | 28,9% | 40,3% | 55,4% | 49,9% | 42,9% | 36,8% | 39,1% |
| (Post) graduate | 47,0% | 39,4% | 70,3% | 38,4% | 34,9% | 43,4% | 52,3% | 56,9% | 40,1% |
| <u>Household financial situation</u> ³⁷ | 3,0 | 3,2 | 2,7 | 2,9 | 3,1 | 2,9 | 3,1 | 2,8 | 3,0 |

3.2. Results: Effects of the presence and type of PEF information

In this chapter, we examine the effects of the presence and type of PEF information for products covered by PEFCRs. A first analysis (Section 3.2.1) investigates whether consumers opt for more environmentally friendly product alternatives if PEF information is provided to consumers (versus not). In section 3.2.2, we subsequently compare consumer responses to different types and combinations of PEF information (Table 3.2 provides an overview of the tested types and combinations of PEF information).

³⁷ Financial situation ("Would you say that making ends meet every month is...") measured on a 5-point scale from 1 = *very difficult* to 5 = *very easy*.

Box 3.1. How to read the results tables

Throughout this (and the next) chapter, descriptive results (i.e. mean scores or percentages) per information condition are presented in tables, with superscripts indicating whether or not the differences in means or percentages are statistically significant.³⁸ In each column, the highest mean has superscript "a". Means with different superscripts are statistically significantly different from each other (at $p < 0,05$): the observed difference is highly unlikely to be due to chance (e.g. 19,9%^a versus 17,3%^b in Table 3.10, second column). Means with the same superscript are not significantly different from each other: the observed difference could be due to chance (e.g. 19,9%^a versus 20,2%^a in Table 3.10, second column). Some means have multiple superscripts (e.g. 36,4%^{ab} in Table 3.10, third column). These fall in between two means that are significantly different (e.g. 37,6%^a and 35,4%^b), but are themselves not significantly different from either mean.

Table 3.2. Overview of PEF label types included in Experiment 1

| Label type | Single performance score | | Impact categories | | Qualitative statement about a relevant... | | Percentage contribution of life cycle stages to the total |
|------------|--|------------------------------------|-------------------------------|---------------------------|---|------------------|---|
| | 3-level scale (better, average, worse) | Percentage relative to the average | Indication of 3 most relevant | Scores on 3 most relevant | Impact category | Life cycle stage | |
| 1 | X | | | | | | |
| 2 | X | X | | | | | |
| 3 | X | | X | | | | |
| 4 | X | | | X | | | |
| 5 | X | X | | X | | | |
| 6 | X | X | | | X | | |
| 7 | X | X | | | | X | |
| 8 | X | X | | | | | X |
| 9 | X | X | X | X | X | | |

3.2.1. Effects of the presence of PEF information

First, we examine effects of the presence of PEF information on consumers' choice behaviour, independent of its format. The results in Table 3.3 reveal that, averaged across all PEF information types included in the test, PEF information is effective in guiding choices towards more environmentally friendly product alternatives. If PEF information was present, products with better-than-average PEF performance were selected in 35,8% of the cases. The same products were selected in only 24,3% of the cases when PEF information was not provided.

In most cases, the PEF information enabled more fine-grained product comparisons on environmental aspects and the identification of the single best performing product in the product set. This single best performing product was selected in 19,8% of the cases when PEF information was present versus only 13,7% of the cases when such information was absent.

³⁸ In this and the next chapter, we report the results of statistical analyses that properly account for the measurement scales of the outcome variables (e.g. linear regression models for continuous outcomes and logit models for binary outcomes). All analyses controlled for the influence of the respondents' age, gender, financial situation (except for the models in which education was included as a predictor) and country.

Table 3.3. Effects on choice behaviour

| PEF information: | % of respondents that selected a product scoring "better than average" | % of respondents that selected the product with the best PEF score |
|-------------------------------|--|--|
| Absent | 24,3% ^b | 13,7% ^b |
| Present (independent of type) | 35,8% ^a | 19,8% ^a |

Generality of the findings

Follow-up analyses were performed to gain insight into the generality of the positive effect of PEF information on choice behaviour. Specifically, we examined whether (and if so, how) the effectiveness of PEF information differed across (1) product types, (2) consumer groups (in terms of age, gender, financial situation, level of education, and environmental concern), and (3) countries. Respondents' choices in the pro-environmental behaviour task (explained in more detail on page 55) were combined into an overall score, which was used as a proxy for environmental concern. Based on the number of times respondents opted for the environmentally friendly alternative in the pro-environmental behaviour task, they were categorised as having a low (33%), moderate (35%) or high (31%) level of concern for the environment.³⁹

The analysis revealed that the impact of the presence of PEF information, independent of its format, differed between product types. Providing PEF information was effective in promoting choice for better-than-average scoring products for all three product types⁴⁰, but its impact was significantly larger for wine and laundry detergent than for paint (see Table 3.4). Note, however, that these differences across product types could also be due to differences in the specific information provided (e.g. overall PEF scores ranged from -49% to +52% for the different wines and from -55% to +61% for the different wall paints), which was varied across product sets to enhance generalisability.

Furthermore, and perhaps not surprisingly, the impact of PEF information on choice behaviour was significantly stronger among consumers with higher (vs. lower) environmental concern (see Table 3.5)⁴¹. The effectiveness of PEF information did not significantly depend on the age⁴², gender⁴³, level of education⁴⁴, or financial situation of the respondent⁴⁵.

³⁹ Despite the domain-specific (transport) and hypothetical nature of choices in the pro-environmental behaviour task, it is assumed that this measure better discriminates between consumers with higher versus lower levels of environmental concern than direct self-reports (e.g. "I see myself as an environmentally-friendly person"). Using three scenarios, the pro-environmental behaviour task assessed the amount of time, money and effort the respondent would be willing to expend for a more environmentally friendly choice option (e.g. electric Green Cab versus petrol-fueled Blue Taxi). Environmental concern was measured as the number of times the environmentally friendly alternative was selected, and ranged from 0 (low concern) to 3 (high concern). 33% of the respondents did not select the environmentally friendly alternative in any of the cases (low concern), 31% selected the environmentally friendly alternative in all cases (high concern). The remaining respondents (35%) selected the environmentally friendly alternative in some of the cases and were categorized as having a moderate level of environmental concern.

⁴⁰ All p s < 0,001.

⁴¹ Significant PEF presence (vs. absence) x environmental concern interaction: p < 0,001.

⁴² No significant PEF presence (vs. absence) x age interaction: p = 0,510 (age as continuous variable) and p = 0,756 (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents).

⁴³ No significant PEF presence (vs. absence) x gender interaction: p = 0,993.

⁴⁴ No significant PEF presence (vs. absence) x educational level (low vs. moderate vs. high) interaction: p = 0,909. Compared to lower educated consumers, higher educated

The analysis also revealed (marginally) significant differences across countries in the impact of PEF information on consumers' choice for better-than-average performing products.⁴⁶ Averaged across all label types, providing PEF information was effective in guiding choices towards products with an above-average PEF performance in all surveyed countries⁴⁷, except Germany⁴⁸ (see Table 3.6, upper part). Further analysis demonstrated that environmental concern (as measured via the pro-environmental behaviour task) was also lowest among German respondents (see Table 3.6, bottom part).

Table 3.4. Effects on choice behaviour depend on product type

| PEF information: | % of respondents that selected a product scoring "better than average" | | |
|-------------------------------|--|--------------------|--------------------|
| | Wine | Paint | Laundry detergent |
| Absent | 22,0% ^b | 27,4% ^b | 23,6% ^b |
| Present (independent of type) | 36,2% ^a | 35,4% ^a | 35,9% ^a |
| Difference in %-points | +14,2 | +8,0 | +12,3 |

Table 3.5. Effects of choice behaviour depend on level of environmental concern

| PEF information: | % of respondents that selected a product scoring "better than average" | | |
|-------------------------------|--|--------------------|--------------------|
| | Low concern | Moderate concern | High concern |
| Absent | 22,5% ^b | 25,4% ^b | 25,3% ^b |
| Present (independent of type) | 27,9% ^a | 35,5% ^a | 44,4% ^a |
| Difference in %-points | +5,4 | +10,1 | +19,1 |

Table 3.6. Effects on choice behaviour depend on country

| PEF information: | % of respondents that selected a product scoring "better than average" | | | | | | | |
|-------------------------------|--|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | North | | East | | South | | West | |
| | FI | SE | BG | PL | IT | PT | DE | NL |
| Absent | 27,6% ^b | 23,9% ^b | 24,7% ^b | 26,4% ^b | 24,1% ^b | 24,7% ^b | 26,1% ^a | 17,0% ^b |
| Present (independent of type) | 36,2% ^a | 37,2% ^a | 36,2% ^a | 35,1% ^a | 38,6% ^a | 42,5% ^a | 29,9% ^a | 31,0% ^a |
| Difference in %-points | +8,6 | +13,3 | +11,5 | +8,7 | +14,6 | +17,8 | +3,8 | +14,0 |
| Environmental concern: | | | | | | | | |
| Low | 34,4% ^c | 36,8% ^{bc} | 23,8% ^d | 38,0% ^b | 25,7% ^d | 25,2% ^d | 45,7% ^a | 37,0% ^b |
| Moderate | 36,9% | 29,9% | 36,4% | 33,6% | 32,8% | 39,3% | 32,1% | 34,3% |
| High | 28,7% | 33,3% | 39,8% | 28,4% | 41,5% | 35,5% | 22,2% | 28,8% |

consumers were more likely to select an environmentally friendly product when PEF information was available (effect of education when PEF information was present: $p < 0,001$). Yet, the analysis shows that the effect of the presence of PEF information does *not* depend on the consumers' level of education; the same products were also more likely to be selected by higher educated consumers when PEF information was *not* available.

⁴⁵ No significant PEF presence (vs. absence) x financial situation (5-point scale) interaction: $p = 0,281$.

⁴⁶ Marginally significant PEF presence (vs. absence) x country interaction: $p = 0,086$.

⁴⁷ All $ps < 0,05$.

⁴⁸ $p = 0,295$.

A further analysis in which all nine label types are *individually* compared to the control condition in which environmental performance information is absent shows that *all* label types are effective in guiding choice behaviour, revealing increased choice for products with smaller environmental footprints when PEF information is provided versus not.⁴⁹ Now, the key question is which (combination) of PEF information is *most* effective. The next section examines this.

3.2.2. Effects of the type of PEF information

This section is structured as follows. First, we zoom in on the individual information elements presented on the PEF labels and provide insight into consumer understanding and evaluation of each individual element. Next, we analyse the effects of different types and combinations of PEF information on a range of outcome measures, namely the extent to which the information was paid attention to, understood and trusted, perceived as relevant and useful (evaluation), and encouraged consumers to opt for environmentally friendly alternatives.

3.2.2.1. Understanding and evaluation of individual information elements

In the experiment, respondents were exposed to one of the PEF label types listed in Table 3.2. They were asked to indicate (1) which parts they found difficult to understand, and (2) which parts they would like to see on a label ("Imagine that all products available in stores would receive a label that indicates the impact of the product on the environment. Please indicate which information you would like to see on this label"). Table 3.7 shows, for each information element, the percentage of respondents that find the element difficult to understand and the percentage of respondents that would like to see the element on the label.

The biodiversity certification (logo) and information on the relative contribution of different life cycle stages to the total environmental impact appear most difficult to understand. About a third of the respondents indicated to have difficulty understanding these information elements. About 20% of the respondents reported to find the single performance score difficult to understand. This percentage was slightly higher among respondents who were presented with overall performance information on a three-level scale and expressed as a percentage (21,9%) than among respondents who only saw the three-level scale on the label (18,1%).⁵⁰ On average, 23,6% found the information about the most relevant impact categories difficult to understand. The information was perceived as more clear if sub scores (better, average, worse) were provided per impact category than if the label only provided information regarding the most relevant impact categories without sub scores (20,6% vs. 32,7%⁵¹). Self-reported understanding was best for the qualitative statements. Only 16,2%, on average, found this information difficult to understand. Statements about relevant impact categories were perceived as more difficult to understand (17,2%) compared to a relevant life cycle stage (14,1%⁵²).

A large majority of respondents (70,8%) indicated that they would like to see overall performance information on the label. This percentage did not depend on whether or not, in addition to the three-level scale, the information was expressed as a percentage relative to the average (70,2% vs. 71,0%)⁵³. About half of the

⁴⁹ All p 's < 0,003.

⁵⁰ The difference is significant: $p = 0,002$.

⁵¹ $p < 0,001$.

⁵² $p = 0,048$.

⁵³ The difference is not significant: $p = 0,537$.

respondents would like to receive information on the most relevant impact categories (54,6%). This information was perceived as more useful to have on a PEF label if sub scores were provided (58,8%) as compared to when only the most relevant impact categories were listed (42,1%)⁵⁴. Furthermore, about 4 out of 10 respondents found it useful to have qualitative statements about relevant impacts on the label (42,9%) and a similar share of respondents (41,3%) would like to receive information on the relative contribution of different life cycle stages to the total footprint. Statements about the most relevant impacts and statements about the most relevant life cycle stages were perceived as equally relevant (43,4% and 42,0%, respectively⁵⁵).

Table 3.7. Understanding and evaluation of individual information elements

| Information element | Type | Difficult to understand | Would like to see on label |
|--|---|-------------------------|----------------------------|
| Single performance score | Overall | 20,9% | 70,8% |
| | 3-level scale | 18,1% | 70,2% |
| | 3-level scale plus percentage relative to the average | 21,9% | 71,0% |
| Impact categories | Overall | 23,6% | 54,6% |
| | 3 most relevant | 32,7% | 42,1% |
| | Scores on 3 most relevant | 20,6% | 58,8% |
| Qualitative statement derived from PEF profile | Overall | 16,2% | 42,9% |
| | Statement about relevant impact category | 17,2% | 43,4% |
| | Statement about relevant life cycle stage | 14,1% | 42,0% |
| Contribution of life cycle stages to the total | | 32,2% | 41,3% |
| <u>Other information</u> | | | |
| Biodiversity certification (wine, laundry detergent) | | 35,9% | 27,7% |
| Third-party verification ⁵⁶ | | 37,8% | 31,6% |

3.2.2.2. Overall performance and impact categories

In this and the next paragraphs, we examine the individual and joint impact of various information elements on attention, understanding and evaluation, and choice behaviour. The specific outcome measures used in the experiment are described in Box 3.2.

Box 3.2. Key outcomes measures in Experiment 1

Choice behaviour

In the product choice task, respondents were exposed to assortments of six wines, wall paints and laundry detergents and indicated, for each assortment, which product they would buy. All products within and across the product sets that the respondent saw carried the same *type* of PEF label (e.g. displaying overall performance on a three-level scale vs. displaying overall performance on a three-level scale and as a percentage, etc.), but the products within each set varied in terms of their environmental performance (as explained in Section 2.3.1.1).

Attention to the labels

Which type of label received most attention was assessed in two ways: via self-

⁵⁴ $p < 0,001$.

⁵⁵ $p = 0,499$.

⁵⁶ Included in PEF labels for *all* product types in the experiment, but tested only for wall paints (because these did not display biodiversity information).

reports in Experiment 1 and in a separate eye-tracking study (see Section 2.3.2 for more detail). In Experiment 1, after indicating their product choices, respondents were informed that the products they had seen had labels on their packages that provided information on the product's impact on the environment, and asked to indicate whether they had looked at these labels for at least some of the products.

Understanding, evaluation and trust

In the experiment, respondents could use the PEF information to compare the environmental performance of products in the set. To gain insight into whether they actually understood this information (objective understanding), respondents were asked to identify the most (or least⁵⁷) environmentally friendly option in the product set.⁵⁸ They also indicated how easy or difficult they considered this task.

Next, respondents were exposed to a PEF label of the type they saw on the product packages in the choice sets. Subjective label understanding was assessed via two items: "Overall, the information on this label is..." on a scale from (1) *very difficult to understand* to (7) *very easy to understand*, and "Overall, the information on this label is..." on a scale from (1) *very unclear* to (7) *very clear*.⁵⁹ Label evaluation ("Overall, the information on this label is...") was measured on 7-point scales from (1) *not useful at all* to (7) *very useful*, and from (1) *not important at all* to (7) *very important*.⁶⁰ Finally, trust in the label was assessed with two statements ("I trust the information on this label to be correct" and "I trust that this label provides accurate information about the environmental friendliness of products") on a scale from (1) *not at all* to (7) *very much so*.⁶¹

First, it is examined which combination of (1) overall environmental performance information on a three-level scale, (2) overall performance expressed as a percentage relative to the average, and (3) information on the most relevant impact categories is most effective. Two ways of presenting the third type information are examined: (1) just listing the three most relevant impacts to facilitate interpretation of the overall performance score, and (2) also providing sub scores (better, average, worse) on these impact categories. Table 3.8 provides examples of the different label types that are compared. In the next paragraphs, results are presented of statistical analyses that assessed the individual and joint contribution of the various information elements relative to the simplest label that displays overall performance on a three-level scale (the baseline). In the analyses, the presence (vs. absence) of performance expressed as a percentage, the presence (vs. absence) of impact category information, and their interaction were included as predictors. Significant interactions indicate that the joint impact on consumer responses of adding two information elements simultaneously is different from the sum of their individual contributions: the combination of the elements in a single label may create information synergies, but may also reduce the label's effectiveness (e.g. as a result of information overload).

⁵⁷ Whether respondents were asked to identify the most or least environmentally friendly product depended on the between-subjects condition they were randomly assigned to.

⁵⁸ Since these questions would draw consumers' attention to environment-related information, respondents performed this task only for the *last* of the three product sets, after having indicated all of their product choices.

⁵⁹ Cronbach's alpha = 0,92 (excellent internal consistency). Scores on the two items are averaged into an overall subjective understanding score.

⁶⁰ Cronbach's alpha = 0,90 (excellent internal consistency). Scores on the two items are averaged into an overall evaluation score.

⁶¹ Cronbach's alpha = 0,94 (excellent internal consistency). Scores on the two items are averaged into an overall trust score.

Table 3.8. Comparison of label types: examples (laundry detergent)

| Overall performance on three-level scale (baseline) plus... | | Overall performance expressed as percentage relative to the average | |
|---|------------------------------|--|--|
| | | Absent | Present |
| Scores on most relevant impact categories | Absent | <p>Score ten opzichte van het gemiddelde wasmiddel*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | <p>Score ten opzichte van het gemiddelde wasmiddel*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> |
| | Present (with sub scores) | <p>Score ten opzichte van het gemiddelde wasmiddel*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | <p>Score ten opzichte van het gemiddelde wasmiddel*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> |
| | Present (without sub scores) | <p>Score ten opzichte van het gemiddelde wasmiddel*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | |

Effects on choice behaviour

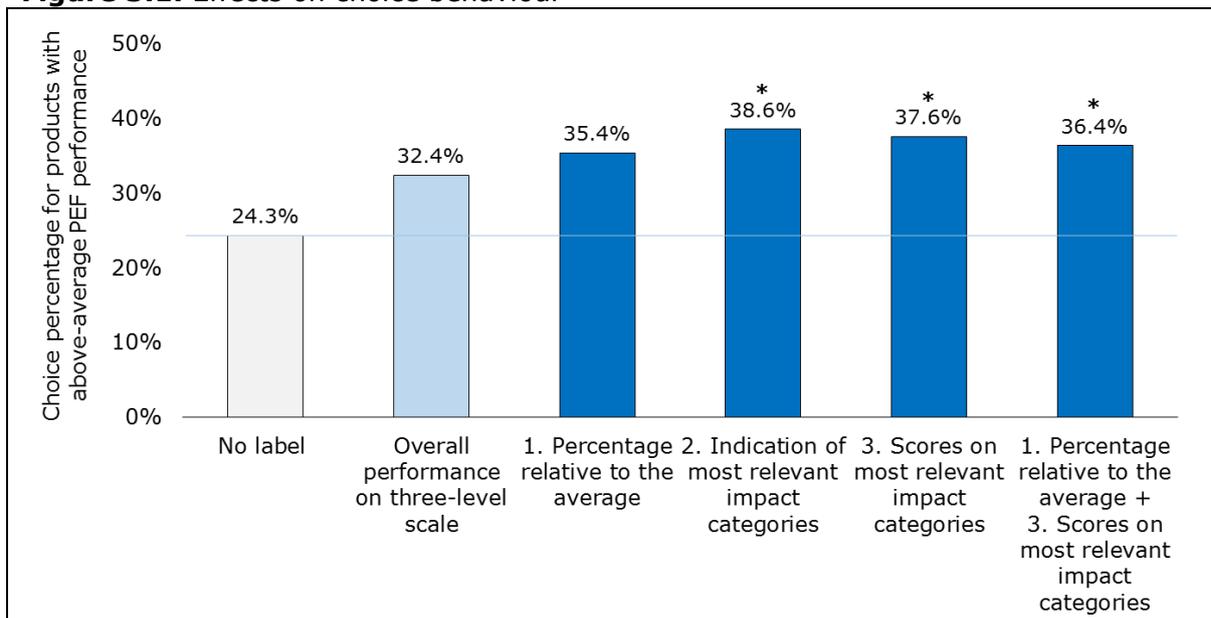
Table 3.9 provides the results of the choice task, averaged across the three product assortments. Results for the group of respondents who were exposed to the same product sets without PEF labels reflect the baseline attractiveness of the products of interest (i.e. how often they are selected in the absence of environment-related information).

Table 3.9 (third column) and Figure 3.1 show, per label type, the percentage of respondents that selected a product with better-than-average environmental performance (each set contained two of such products). Since all label types included

in the test displayed performance on a three-level scale, respondents could discern better-than-average scoring products in all cases when PEF information was provided. The results demonstrate that providing PEF information on a three-level scale is effective in guiding consumer choice towards better-than-average scoring products (32,4% versus 24,3%). When, in addition to the three-level scale (baseline), the label provided information on the most relevant impact categories, a significantly higher share of respondents (38,1%, on average) selected a product with better-than-average performance as compared to when such additional information was absent (32,4%). In contrast, the inclusion of overall performance information expressed as a percentage relative to the average did not significantly increase the likelihood that a better-than-average scoring product was selected, neither when this information was added to the baseline (three-level) label (35,4% versus 32,4%) nor when it was added to a label that also displayed the product’s scores on the most relevant impact categories (36,4% versus 37,6%).

Table 3.9 also shows the percentage of respondents that selected the product with the best PEF score per label type (second column). However, respondents were only able to discern this single best performing product when environmental performance was expressed as a percentage relative to the average. In the other cases, respondents did not have information that enabled them to identify the best performing product out of the two better-than-average performing products, but they may have selected this product by chance (these percentages are between brackets in Table 3.9). The findings suggest that providing overall performance information as a percentage relative to the average is effective in guiding choices towards the product with the product with the best PEF score (19,9% versus 17,3% and 13,7%). Interestingly, the percentage of respondents who chose the same product by chance when the labels contained information about the most relevant impact categories was just as high (20,5% and 20,2% for labels with and without sub scores). When the label displayed overall performance as a percentage, adding sub scores on impact categories did not further increase the likelihood that the best performing was selected (20,3% versus 19,9%).

Figure 3.1. Effects on choice behaviour



Note – Asterisks denote significant differences with the baseline label (light blue bar).

Table 3.9. Effects on choice behaviour

| Label type | % of respondents that selected a product scoring "better than average" | % of respondents that selected the product with the best PEF score |
|---|--|--|
| No label | (24,3% ^d) | (13,7% ^c) |
| Overall performance on three-level scale (baseline) | 32,4% ^c | (17,3% ^b) |
| + 1. Percentage relative to the average | 35,4% ^{bc} | 19,9%^a |
| + 2. Indication of most relevant impact categories | 38,6%^a | (20,2%^a) |
| + 3. Scores on most relevant impact categories | 37,6%^a | (20,5%^a) |
| + 1 + 3 | 36,4% ^{ab} | 20,3%^a |

Note – No label = baseline attractiveness of the product. Results between brackets are results for conditions in which respondents did not have sufficient information to be able to identify the product of interest (i.e. they did not receive any environmental information, or the information was not specific enough). These results between brackets reflect the percentage of respondents that selected the product of interest by chance.

All in all, the PEF label showing overall environmental performance on a three-level scale and information on the most relevant impact categories was most effective in encouraging environmentally friendly choices. The label showing performance on a three-level scale alone was least effective.

Generality of the findings

Again, follow-up analyses were conducted to assess the generality of the findings. The effectiveness of the various label types in encouraging choice for above-average scoring products did not (statistically) significantly depend on the age⁶², gender⁶³, level of education⁶⁴ or financial situation⁶⁵ of the respondent. The pattern of results also did not significantly differ across countries.⁶⁶

The impact of the various types of labels did depend on the level of environmental concern⁶⁷. Table 3.10 presents the choice percentages per label type for consumers with low, moderate and high levels of environmental concern. Table 3.11 shows the *change* in product choice as a result of providing the PEF information, which directly reflects the effectiveness of the label in guiding choices towards environmentally friendly alternatives. For consumers with moderate or high levels of environmental concern, *all* PEF label types were effective in encouraging choice for better-than-average performing products. For consumers with low environmental concern, only the labels that communicated impact category information in addition to overall performance information promoted environmentally friendly choices. These types of labels were also the most effective among consumers with higher environmental concern (see Table 3.11).

⁶² No significant label type x age interaction: $p = 0,534$ (age as continuous variable) and $p = 0,634$ (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents).

⁶³ No significant label type x gender interaction: $p = 0,903$.

⁶⁴ No significant label type x educational level (low vs. medium vs. high) interaction: $p = 0,905$.

⁶⁵ No significant label type x financial situation (5-point) interaction: $p = 0,373$.

⁶⁶ No significant label type x country interaction: $p = 0,698$.

⁶⁷ Significant label type x environmental concern interaction: $p < 0,001$.

Table 3.10. Effects on choice behaviour depend on environmental concern

| PEF information: | % of respondents that selected a product scoring "better than average" | | |
|--|--|---------------------|---------------------|
| | Low concern | Moderate concern | High concern |
| No label | 22,5% ^b | 25,4% ^c | 25,3% ^d |
| Overall performance on three-level scale | 25,5% ^{ab} | 32,8% ^b | 38,0% ^c |
| + 1. Percentage relative to the average | 26,3% ^{ab} | 35,5% ^{ab} | 44,5% ^b |
| + 2. Indication of most relevant impact categories | 28,0% ^a | 38,6% ^a | 51,1% ^a |
| + 3. Scores on most relevant impact categories | 29,6% ^a | 37,9% ^a | 46,8% ^{ab} |
| + 1 + 3 | 28,5% ^a | 35,8% ^{ab} | 46,4% ^{ab} |

Table 3.11. Effects on choice behaviour depend on environmental concern

| PEF information: | Effects on choice for products scoring "better than average" (difference with no label , in percent points) | | | | Differences between groups? |
|--|--|------------------|--------------|-------|-----------------------------|
| | Low concern | Moderate concern | High concern | Total | p-value |
| Overall performance on three-level scale | +3,0 | +7,4 | +12,7 | +8,1 | 0,016 |
| + 1. Percentage relative to the average | +3,8 | +10,1 | +19,2 | +11,1 | <0,001 |
| + 2. Indication of most relevant impact categories | +5,5 | +13,2 | +25,8 | +14,3 | <0,001 |
| + 3. Scores on most relevant impact categories | +7,1 | +12,6 | +21,6 | +13,3 | <0,001 |
| + 1 + 3 | +6,0 | +10,4 | +21,1 | +12,1 | <0,001 |

Note – Values in this table reflect the change in choice percentage (in percent points) as a result of providing (versus not providing) the specific type of PEF information. Values shaded green (light and dark) indicate significant changes (i.e. effective information). Dark green shading indicates the *most* effective PEF information for each consumer group. P-values < 0,05 in the last column indicate significant differences in effectiveness of the information type across groups with low, moderate and high environmental concern.

Effects on attention to the labels

Next, the effects of the various label types and combinations on attention to the labels are examined. Table 3.12 reports both the ability of the label to capture initial attention (as measured by the percentage of respondents that looked at this label first in the eye-tracking study) and the self-reported attention to the labels in Experiment 1 (as measured by the percentage of respondents who reported to have studied the labels in detail during product choice).

The results in Table 3.12 show that the label that combines all three elements – overall performance on a three-level scale and expressed as a percentage, and information on the most relevant impact categories – attracted more initial attention (i.e. was more often looked at first when presented with a random other PEF label; 50,9%) than the labels that display only overall performance information (46,9% and 43,9% for PEF labels with and without performance expressed as percentage, respectively). The performance in terms of initial attention capture of the labels that display information on the most relevant impact categories but do not show the

percentage relative to the average falls in between (48,6%). The better performance of labels that communicate information on the most relevant impact categories in encouraging environmentally friendly product choices might thus be (partly) explained by the larger size of those labels, which increases their visual salience on the product packaging.

In contrast, however, the analysis reveals no significant difference in self-reported attention to the labels between the different types of PEF labels (see Table 3.7). About a third of respondents reported to have studied the labels in detail when making product choices, regardless of the specific label type.

Table 3.12. Effects on attention to the labels

| Label type | Initial attention (% looked at this label first; eye-tracking) | Self-reported attention to the labels (% studied in detail) |
|--|--|---|
| Overall performance on three-level scale (baseline) | 43,9% ^c | 33,3% ^a |
| + 1. Percentage relative to the average | 46,9% ^{bc} | 36,2% ^a |
| + 2. Indication of most relevant impact categories | 48,6% ^{ab} | 36,4% ^a |
| + 3. Scores on most relevant impact categories | 48,6% ^{ab} | 35,2% ^a |
| + 1 + 3 | 50,9%^a | 35,4% ^a |

Effects on label understanding, evaluation and trust

Table 3.13 provides the results on objective understanding, which was measured using a product identification task. Only label types that included overall performance information expressed as a percentage enabled respondents to identify the single best and single worst performing product (out of the two better-than-average and two worse-than-average performing products in the set). Results between brackets in the first column of Table 3.13 reflect, for the label types that did not display such specific performance information, the share of respondents who selected the single best or worst product (out of the two better-than average products) by chance. For these label types, accurate identification of the best (or worst) performing product is reflected in the accurate identification of a better-than-average (or worse-than-average) performing product (second column of Table 3.13).

The results in Table 3.13 show that about 6 in 10 respondents were able to accurately identify better-than-average performing products when presented with overall performance information on a three-level scale. About half of the respondents were able to accurately identify the product alternative with the best or worst environmental performance from the set when more detailed overall performance information was available to them.⁶⁸ Respondents' ability to identify the best or worst performing product did not significantly differ between labels with versus without information on the most relevant impact categories, neither when overall performance information was expressed as a percentage (43,2% versus 48,3%), nor when it was solely shown on a three-level scale (61,8% and 60,8% versus 59,7%). Yet, respondents who were exposed to labels that only provided overall performance

⁶⁸ But note that these percentages (59,7% and 48,3%) cannot directly be compared as each product set contained two better-than-average scoring products but only one best performing product. As such, the success probability of guessing is higher for better-than-average scoring products than for single best performing products.

information indicated to find it easier, on average ($M = 4,88$ on a 7-point scale), to identify the best (or worst) performing product than respondents who were exposed to labels that also included sub scores ($M = 4,56$) or both types of information ($M = 4,58$).

Table 3.13. Effects on label understanding (objective)

| Label type | Accurate identification of best/worst performing product | | Ease of product identification (7-point) |
|---|--|-----------------------------------|--|
| | Better/worse-than-average scoring product | Single best/worst scoring product | |
| Overall performance on three-level scale (baseline) | 59,7% ^a | (29,2% ^c) | 4,88 ^a |
| + 1. Percentage relative to the average | (60,3% ^a) | 48,3% ^a | 4,89 ^a |
| + 2. Indication of most relevant impact categories | 60,8% ^a | (29,3% ^c) | 4,70 ^{ab} |
| + 3. Scores on most relevant impact categories | 61,8% ^a | (34,4% ^b) | 4,56 ^b |
| + 1 + 3 | (58,9% ^a) | 43,2% ^a | 4,58 ^b |

Note – Results between brackets in the first column reflect the percentage of respondents who selected the single best/worst scoring product by chance, as the PEF information they saw was not specific enough to enable identification of these products. Results between brackets in the second column reflect, for groups that received specific PEF information, the percentage of respondents who accurately identified the single best (or worst) performing product from the set *plus* the percentage of respondents who *falsely* identified the 'other' better-than-average (or worse-than-average) scoring product in the set as the best (or worst) performing product.

Table 3.14 provides the results on subjective label understanding, label evaluation, and trust in the label. The results show higher self-declared label understanding for the PEF labels that only provide overall performance information ($M = 5,46$ and $M = 5,42$ for the labels with and without percentage) than for the PEF labels that provide more detailed information on the most relevant impact categories ($M = 5,21$ and $M = 5,17$ for the labels with and without sub scores). Self-declared understanding is lowest for the PEF label that combines all three elements ($M = 4,96$). The perceived importance and usefulness of the information (label evaluation) and trust in the accuracy of the information on the label are also the highest for the label that only provides overall performance information on a three-level scale, and lowest for the label in which all three elements are combined. Interestingly, adding information on the percentage relative to the average also lowers trust in the label relative to the baseline label ($M = 5,20$ vs. $M = 5,36$; see Table 3.14). Perhaps, consumers question environmental performance information more when it is very specific.

Table 3.14. Effects on understanding, evaluation and trust

| Label type | Label understanding (7-point) | Label evaluation (7-point) | Trust in label (7-point) |
|---|-------------------------------|----------------------------|--------------------------|
| Overall performance on three-level scale (baseline) | 5,46^a | 5,55^a | 5,36^a |
| + 1. Percentage relative to the average | 5,42^a | 5,48 ^{ab} | 5,20 ^b |
| + 2. Indication of most relevant impact categories | 5,17 ^b | 5,41 ^{bc} | 5,26 ^{ab} |
| + 3. Scores on most relevant impact categories | 5,21 ^b | 5,42 ^{bc} | 5,30 ^{ab} |
| + 1 + 3 | 4,96 ^c | 5,31 ^c | 5,18 ^b |

Generality of the findings

In order to gain insight into the generality of the findings, follow-up analyses examined country and consumer differences in subjective understanding and evaluation of the various label types. Overall, subjective understanding of PEF information was higher among younger (vs. older) consumers⁶⁹, consumers with a better (vs. worse) financial situation⁷⁰, and consumers with higher (vs. lower) environmental concern⁷¹. It did not depend on gender⁷² or level of education (but *objective* understanding was significantly higher among consumers with a higher (vs. lower) education)⁷³. The PEF information was evaluated more positively among younger (vs. older) consumers⁷⁴, consumers with a better (vs. worse) financial situation⁷⁵, and consumers with higher (vs. lower) environmental concern⁷⁶, but also among women (vs. men)⁷⁷. The evaluation of the PEF information did not depend on the respondent's educational level.⁷⁸

While the average level of understanding and evaluation of PEF labels depended on socio-demographic factors, which specific types of labels were relatively well (or relatively poorly) understood and evaluated did not. That is, the impact of the various label types on understanding and evaluation did not (statistically) significantly depend on age⁷⁹, gender⁸⁰, level of education⁸¹, or financial situation⁸² of the respondent. The pattern of results also did not significantly differ across countries⁸³.

⁶⁹ Significant main effect of age: $p < 0,001$ (age as continuous variable) and $p < 0,001$ (age as dichotomous variable): $M = 5,35$ (18-44 years) vs. $M = 5,12$ (45-70 years).

⁷⁰ Significant main effect of financial situation (5-point): $p < 0,001$.

⁷¹ Significant main effect of environmental concern: $M = 4,87$ (low) vs. $M = 5,25$ (moderate) vs. $M = 5,61$ (high); $p < 0,001$.

⁷² No significant main effect of gender: $p = 0,278$.

⁷³ No significant main effect of educational level (low vs. moderate vs. high) on subjective label understanding: $p = 0,540$. Significant main effect of educational level on objective label understanding (accurate identification): $p < 0,001$. Accurate product identification was 53,6% among consumers with high education, 49,0% among consumers with medium level of education, and 42,2% among consumers with low education ($ps < 0,05$).

⁷⁴ Significant main effect of age: $p < 0,001$ (age as continuous variable) and $p < 0,001$ (age as dichotomous variable: $M = 5,56$ (18-44 years) vs. $M = 5,29$ (45-70 years)).

⁷⁵ Significant main effect of financial situation (5-point): $p = 0,001$.

⁷⁶ Significant main effect of environmental concern: $M = 4,88$ (low) vs. $M = 5,48$ (moderate) vs. $M = 5,93$ (high); $p < 0,001$.

⁷⁷ Significant main effect of gender: $M = 5,27$ (men) vs. $M = 5,58$ (women); $p < 0,001$.

⁷⁸ No significant main effect of educational level: $p = 0,254$.

⁷⁹ No significant PEF label type x age interaction effect on subjective label understanding: $p = 0,557$ (age as continuous variable) and $p = 0,474$ (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents). No significant label type x age interaction effect on label evaluation: $p = 0,570$ (age as continuous variable) and $p = 0,666$ (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents).

The result pattern did depend on the level of environmental concern (see Table 3.15)⁸⁴. Consumers with moderate and high levels of environmental concern evaluated all label types equally positively. Consumers with low environmental concern, in contrast, considered the simplest label showing overall performance on a three-level scale as more useful and relevant than the labels with sub scores on the most relevant impact categories, with the remaining labels falling in between (see Table 3.15).

Table 3.15. Effects on label evaluation depend on environmental concern

| PEF information: | Label evaluation (7-point) | | | |
|--|-------------------------------|-------------------|-------------------|--------------------|
| | Low concern | Medium concern | High concern | Total |
| Overall performance on three-level scale | 5,11 ^a | 5,60 ^a | 5,88 ^a | 5,55 ^a |
| + 1. Percentage relative to the average | 4,90 ^{ab} | 5,55 ^a | 5,96 ^a | 5,48 ^{ab} |
| + 2. Indication of most relevant impact categories | 4,83 ^{ab} | 5,60 ^a | 5,88 ^a | 5,41 ^{bc} |
| + 3. Scores on most relevant impact categories | 4,79 ^b | 5,58 ^a | 6,00 ^a | 5,42 ^{bc} |
| + 1 + 3 | 4,68 ^b | 5,40 ^a | 5,96 ^a | 5,31 ^c |

Which combination is most effective?

Table 3.16 provides an overview of the effects of the different information elements on the set of outcome measures across the full respondent sample. For each outcome of interest (attention, understanding, etc.), information elements that contribute positively to that outcome are shaded green and elements that have a negative impact on that outcome are shaded red.

Unfortunately, the results do not enable the identification of a single combination of information elements that is most effective on the full range of outcomes. In fact, Table 3.16 shows that each addition of information element(s) contributed to better outcomes on some of the measures, but worse outcomes on others. More specifically, positive individual and joint effects of adding overall performance information as a percentage relative to the average and information on the three most relevant impact categories on the likelihood of choosing environmentally friendly product alternatives went hand in hand with negative effects on understanding and evaluation of the information, the level of trust respondents had in the accuracy of the information, or both (see Table 3.16).

⁸⁰ No significant PEF label type x gender interaction: $p = 0,232$ (subjective label understanding) and $p = 0,878$ (label evaluation).

⁸¹ No significant PEF label type x educational level interaction: $p = 0,168$ (subjective label understanding) and $p = 0,142$ (label evaluation).

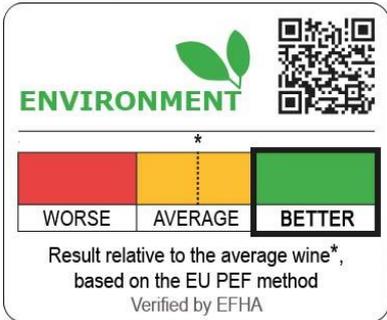
⁸² No significant PEF label type x financial situation interaction: $p = 0,454$ (subjective label understanding) and $p = 0,209$ (label evaluation).

⁸³ No significant PEF label type x country interaction: $p = 0,755$ (subjective label understanding) and $p = 0,767$ (label evaluation).

⁸⁴ Significant label type x environmental concern interaction on label evaluation: $p = 0,050$. Environmental concern did not moderate the effect of label type on subjective label understanding: $p = 0,272$.

All in all, a label with impact category information (regardless of presence of percentage relative to the average) was most effective in capturing attention and encouraging environmentally friendly choices. However, labels without impact category information (regardless of presence of percentage relative to the average) were best understood and perceived as providing most useful and important information. The simplest label, i.e. without impact category information and performance expressed as a percentage, was trusted most.

Table 3.16. Overview of findings: overall performance and impact categories

| Baseline = overall performance on three-level scale | | | | | |
|--|----------------------------------|------------------------|---------------------|------------------|----------------|
|  | | | | | |
| Effects of adding information on: | Environmentally friendly choices | Attention to the label | Label understanding | Label evaluation | Trust in label |
| 1. Percentage relative to the average | | | | | |
| 2. Indication of most relevant impact categories | | (initial) | | | |
| 3. Scores on most relevant impact categories | | (initial) | | | |
| 1 + 3 | | (initial) | | | |

3.2.2.3. Additional PEF information

In addition to the comparative environmental performance indicators described earlier, Experiment 1 tested the effects of three additional types of PEF-derived information, namely:

- Qualitative statements about relevant impact categories;
- Qualitative statements about relevant life cycle stages;
- Information on the relative contribution of different life cycle stages to the total.

Furthermore, since providing a qualitative statement about one of the three most relevant impact categories might help consumers understand the meaning of the impact category information, Experiment 1 also tested a PEF label with this type of qualitative statement in combination with the three most relevant impact categories. All label types were tested against a PEF label that just displayed overall performance information (both on a three-level scale and expressed as a percentage). Table 3.17 provides examples of the label types that are compared in this section.

Table 3.17. Comparison of label types: examples (wine)

| | Baseline | + Qualitative statement about relevant impact category (1) | + Qualitative statement about relevant life cycle stage (2) |
|---|--|---|--|
| Baseline | <p>Score ten opzichte van de gemiddelde wijn*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | <p>Score ten opzichte van de gemiddelde wijn*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | <p>Score ten opzichte van de gemiddelde wijn*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> |
| + Sub scores on the three most relevant impact categories (3) | <p>Score ten opzichte van de gemiddelde wijn*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | <p>U kunt het broeikas effect tegengaan door wijn op een verantwoorde wijze te kiezen: deze wijn leidt tot minder uitstoot van broeikasgassen.</p> <p>Score ten opzichte van de gemiddelde wijn*, op basis van de EU PEF-methode Geverifieerd door EFHA</p> | |
| + Contribution of life cycle stages to the total (4) | <p>Result relative to the average wine*, based on the EU PEF method Verified by EFHA</p> | | |

To add realism, all product alternatives within each product assortment had PEF labels with overall performance information, but qualitative statements were added to only a subset of the PEF labels. Since the qualitative statements highlight a specific relevant impact category or life cycle stage, and good performance on the highlighted aspect can be compensated by poor performance on other aspects, such qualitative statements can also appear on products with average or even worse-than-average overall performance (see Figure 3.2). Furthermore, the type of qualitative statements was varied. Some respondents were exposed to PEF labels with impact category statements (for products 1, 3 and 5), some to PEF labels with life cycle statements

(for products 1, 3, and 5), and some respondents to PEF labels without statements (randomly decided). Table 3.18 gives an overview of the qualitative statements used in the experiment.

Figure 3.2. Product set with PEF labels with qualitative statements (example)



Note – Assortment of laundry detergents used in Experiment 1 with (some) labels containing qualitative statements. Products were displayed on screen as in Figure 2.9. Note that the order of the products in the set was randomised.

Table 3.18. Qualitative statements used in Experiment 1

| Statements about relevant impact categories | | |
|--|--|--|
| Wine | Paint | Laundry detergent |
| <i>You can combat global warming by choosing wisely: this wine leads to less emission of greenhouse gases</i> | <i>This product leads to reduced emission of greenhouse gases comparable to charging your mobile phone 400 times.</i> | <i>This product saves an amount of greenhouse gases comparable to driving 27 km.</i> |
| <i>This product saves an amount of fossil resources comparable to powering a 60W LED light for 12 hours.</i> | <i>Clean air is essential to our health and the environment. Choose this product and contribute to reducing the amount of fine dust in the air.</i> | <i>With this laundry detergent, every wash will save an amount of fossil resources equivalent to charging your mobile phone 7 times.</i> |
| <i>The Earth's mineral and metal resources are finite! Enjoy this wine knowing that it helps conserve minerals and metals.</i> | <i>This product saves 24 fish from dying of acid rain.</i> | <i>Choose this product and save 3 trees from dying of acid rain!</i> |
| Statements about relevant life cycle stages | | |
| Wine | Paint | Laundry detergent |
| <i>Did you know that half of the environmental footprint of wines is made during grape growing? We employ sustainable practices to grow top quality grapes and preserve the environment.</i> | <i>The raw materials in wall paint generally account for more than half of its environmental impact. Choose this paint made from sustainable raw materials and help protect the environment!</i> | <i>You are in charge of this detergent's environmental footprint: much of its impact depends on how you use it. Follow the washing instructions!</i> |
| <i>Life cycle analyses show that grape growing is the largest contributor to the environmental impact of wines. We grow our grapes with respect for environment and human health.</i> | <i>More than half of the environmental impact of paint is associated with its raw materials. We reduce our impact by using more environmentally friendly pigments and binders.</i> | <i>Washing at lower temperatures is better for the environment. This laundry detergent gives great results at 30°C.</i> |
| <i>Grape growing accounts for about 50% of the environmental footprint of wines. We reduce our impact by growing our grapes in a more environmentally friendly way.</i> | <i>The main environmental impacts associated with paint come from the manufacture of its ingredients. We use ingredients that are less harmful to the environment.</i> | <i>Using more detergent than needed harms the environment. Read our washing instructions!</i> |

Effects on choice behaviour

Table 3.19 and Figure 3.3 provide the results of the choice task. Here, the label displaying overall PEF performance on a three-level scale and expressed as a percentage relative to the average product is the baseline label: All new information combinations compared in this section had these two information elements as a basis (see Table 3.19). While all label types significantly outperformed the condition in which respondents did not receive environmental information in terms of encouraging pro-environmental choice behaviour ('no label' in Table 3.19 and Figure 3.3), none of the additional information elements – i.e. qualitative statements about a relevant impact category (whether or not in combination with scores on the most relevant impact categories) or life cycle stage, or information on the relative contribution of the different life cycle stages – outperformed the baseline label (see Table 3.19 and Figure 3.3).

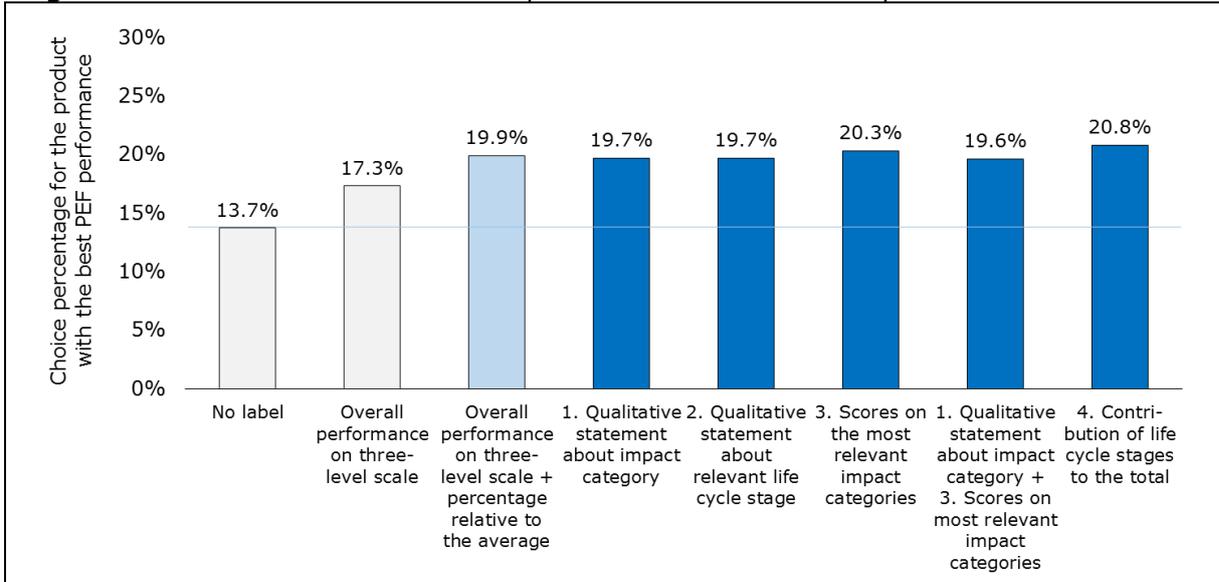
Table 3.19. Effects on choice behaviour

| Label type | % of respondents that selected a product scoring "better than average" | % of respondents that selected the product with the best PEF score |
|--|--|--|
| No label | (24,3% ^c) | (13,7% ^c) |
| Overall performance on three-level scale | 32,4% ^b | (17,3% ^b) |
| Overall performance on three-level scale + percentage relative to the average (baseline) | 35,4% ^{ab} | 19,9%^a |
| + 1. Qualitative statement about impact category | 35,0% ^{ab} | 19,7% ^{ab} |
| + 2. Qualitative statement about life cycle stage | 35,2% ^{ab} | 19,7%^a |
| + 3. Scores on most relevant impact categories | 36,4%^a | 20,3%^a |
| + 1 + 3 | 34,5% ^{ab} | 19,6% ^{ab} |
| + 4. Percentage contribution of life cycle stages to the total | 37,4%^a | 20,8%^a |

Note – Results between brackets are results for conditions in which respondents did not have sufficient information to be able to identify the product of interest (i.e. they did not receive any environmental information, or the information was not specific enough). These results between brackets reflect the percentage of respondents that selected the product of interest by chance.

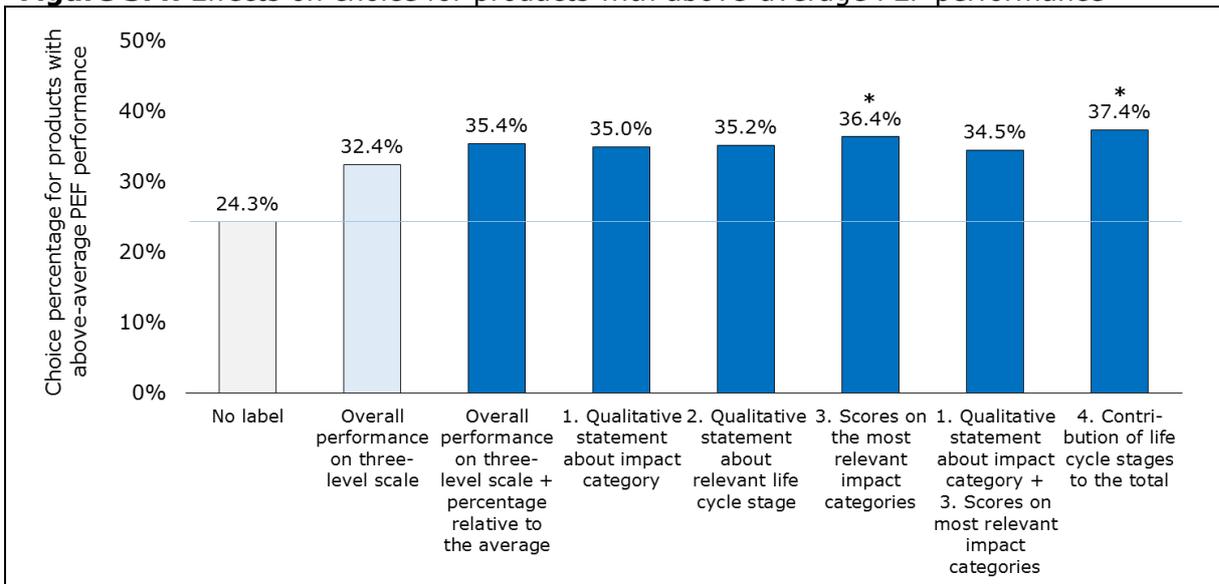
Table 3.19 and Figure 3.4 also show, per label type, the percentage of respondents that selected a product with a better-than-average (but not necessarily the best) PEF score. In line with the earlier findings, none of PEF labels with additional (non-comparative) PEF information outperformed the baseline label (i.e. overall performance on three-level scale and as a percentage) in promoting choice of better-than-average scoring products. Compared to the simplest PEF label showing overall results on a three-level scale, only the label showing sub scores on the most relevant impact categories (but not the one with an additional qualitative statement) and the label with information on the relative contribution of the different life cycle stages resulted in more choice for products with above-average PEF performance (see Figure 3.4).

Figure 3.3. Effects on choice for the product with the best PEF performance



Note – Asterisks denote significant differences with the baseline label (light blue bar).

Figure 3.4. Effects on choice for products with above-average PEF performance



Note – Asterisks denote significant differences with the PEF label showing overall performance on a three-level scale (light blue bar).

The finding that there are no differences between the different types of PEF labels in the extent to which respondents opted for environmentally friendly alternatives may not be very surprising, given that the extra information does not help consumers to distinguish between more and less environmentally friendly products. Since the qualitative statements only appeared on half of the products in the set, with different overall performance scores, a more interesting question here is whether the presence of qualitative claims increases the attractiveness of the product relative to products that do not make such claims. Moreover, we investigate whether the influence of qualitative claims differs depending on the overall performance of the product on which the claim appears. For example, does the presence of a qualitative statement about a relevant impact also increase the attractiveness of products with a worse-than-average overall PEF score? To test this, further analyses were performed with product choice (product is selected/not selected) at the individual product level as

outcome variable and (1) whether or not the PEF label contained a qualitative statement (claim presence), (2) whether the respondents saw impact category statements, life cycle statements, or no statements at all (statement type), (3) the overall environmental performance of the product (better, average, worse) as independent predictors.

The interaction effects of interest were not significant. That is, exposure to qualitative claims did not increase choice for products with such claims (relative to the control condition in which the same products did not have claims).⁸⁵ Furthermore, this effect also did not depend on the overall environmental performance of the product⁸⁶: Exposure to qualitative claims did not increase choice for products with such claims, neither for products with a relatively poor environmental performance, nor for products with a relatively good environmental performance. As shown in Table 3.20, about 1 in 5 respondents selected the product with the best PEF score and this share remained unchanged when a qualitative claim was added to this product's PEF label.

Generality of the findings

The results in Table 3.20 demonstrated that none of the additional information elements – i.e. qualitative statements about a relevant impact category (whether or not in combination with scores on the most relevant impact categories) or life cycle stage, or information on the relative contribution of the different life cycle stages – outperformed the baseline label in promoting choice for the product with the best overall PEF score. Follow-up analyses were conducted to examine country and consumer differences in responses to the various types of PEF information.

Again, we find that the impact of the PEF label types on choice behaviour differs between consumers with higher versus lower concern for the environment.⁸⁷ Table 3.20 shows the percentage of respondents that selected a product with better-than-average PEF performance (upper part) and the percentage of respondents that selected the single best scoring product (lower part), per label type for each of the groups. Table 3.21 shows, for each label type and consumer group (low, moderate, high environmental concern), the change in choice percentage (in percent points) as a result of providing the specific type of PEF information, which directly reflects the effectiveness of the information in promoting choice of the product with the best overall PEF score. The results show that for consumers with high levels of environmental concern, *all* label types encouraged the selection of products with above-average PEF performance (Table 3.21, upper part) and also more specifically of the product with the best PEF score in the set (Table 3.21, lower part). For consumers with low levels of concern, however, certain types of PEF labels promoted choice of products with above-average PEF performance, namely those with qualitative claims or sub scores (but not both), and those showing the relative contribution of the different life cycle stages (Table 3.21, upper part). However, none of the PEF label types effectively encouraged consumers with low environmental concern to choose the product with the best overall PEF score (Table 3.21, lower part).

⁸⁵ Interactions between claim presence and label type were non-significant: $ps > 0,13$.

⁸⁶ Interactions between claim presence, label type and overall environmental performance were non-significant: $ps > 0,29$.

⁸⁷ Significant label type x environmental concern (low vs. moderate vs. high) interaction on choice for better-than-average performing products: $p = 0,010$. Significant label type x environmental concern (low vs. moderate vs. high) interaction on choice for the product with the best PEF score: $p = 0,004$.

The relative effectiveness of the various label types in promoting choice of the product with the best overall PEF score did not significantly depend on the country⁸⁸, age⁸⁹, gender⁹⁰, financial situation⁹¹ or level of education⁹² of the respondent.

Table 3.20. Effects on choice behaviour depend on environmental concern

| PEF information: | % of respondents that selected a product scoring "better than average" | | | |
|--|--|-----------------------|----------------------|----------------------|
| | Low concern | Moderate concern | High concern | Total |
| No label | (22,5%) ^b | (25,4%) ^c | (25,3%) ^c | (24,3%) ^c |
| Overall performance on three-level scale | 25,5% ^{ab} | 32,8% ^b | 38,0% ^b | 32,4% ^b |
| Overall performance on three-level scale + percentage relative to the average (baseline) | 26,3% ^{ab} | 35,5% ^{ab} | 44,5% ^{ab} | 35,4% ^{ab} |
| + 1. Qualitative statement about impact category | 28,2% ^a | 32,7% ^b | 44,2% ^a | 35,0% ^{ab} |
| + 2. Qualitative statement about life cycle stage | 28,1% ^a | 34,2% ^{ab} | 43,5% ^{ab} | 35,2% ^{ab} |
| + 3. Scores on most relevant impact categories | 28,5% ^a | 35,8% ^{ab} | 46,4% ^a | 36,4% ^a |
| + 1 + 3 | 26,9% ^{ab} | 34,6% ^{ab} | 41,6% ^{ab} | 34,5% ^{ab} |
| + 4. Percentage contribution of life cycle stages to the total | 29,6% ^a | 37,7% ^a | 44,6% ^a | 37,4% ^a |
| PEF information: | % of respondents that selected a product with the best PEF score | | | |
| | Low concern | Moderate concern | High concern | Total |
| No label | (13,0%) ^a | (14,5%) ^c | (13,6%) ^c | (13,7%) ^c |
| Overall performance on three-level scale | (12,5%) ^a | (18,4%) ^{ab} | (20,2%) ^b | (17,3%) ^b |
| Overall performance on three-level scale + percentage relative to the average (baseline) | 12,3% ^a | 20,2% ^{ab} | 27,2% ^a | 19,9% ^a |
| + 1. Qualitative statement about impact category | 15,8% ^a | 17,8% ^{bc} | 25,6% ^a | 19,7% ^{ab} |
| + 2. Qualitative statement about life cycle stage | 14,4% ^a | 18,7% ^{ab} | 26,3% ^a | 19,7% ^a |
| + 3. Scores on most relevant impact categories | 14,8% ^a | 20,3% ^{ab} | 26,8% ^a | 20,3% ^a |
| + 1 + 3 | 15,3% ^a | 17,6% ^{bc} | 25,9% ^a | 19,6% ^{ab} |
| + 4. Percentage contribution of life cycle stages to the total | 15,9% ^a | 21,7% ^a | 24,6% ^{ab} | 20,8% ^a |

⁸⁸ No significant label type x country interaction: $p = 0,576$.

⁸⁹ No significant label type x age interaction: $p = 0,427$ (age as continuous variable) and $p = 0,474$ (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents).

⁹⁰ No significant label type x gender interaction: $p = 0,875$.

⁹¹ No significant label type x financial situation (5-point) interaction: $p = 0,072$.

⁹² No significant label type x educational level (low, moderate, high) interaction: $p = 0,231$.

Table 3.21. Effects on choice behaviour depend on environmental concern

| PEF information: | Effects on choice for products scoring "better than average" (difference with no label , in percent points) | | | | Differences between groups? |
|--|--|------------------|--------------|-------|-----------------------------|
| | Low concern | Moderate concern | High concern | Total | p-value |
| Overall performance on three-level scale | +3,0 | +7,4 | +12,7 | +8,1 | 0,016 |
| Overall performance on three-level scale + percentage relative to the average (baseline) | +3,8 | +10,1 | +19,2 | +11,1 | <0,001 |
| + 1. Qualitative statement about impact category | +5,7 | +7,3 | +18,9 | +10,7 | 0,003 |
| + 2. Qualitative statement about life cycle stage | +5,6 | +8,8 | +18,2 | +10,8 | 0,002 |
| + 3. Scores on most relevant impact categories | +6,0 | +10,4 | +21,1 | +12,1 | <0,001 |
| + 1 + 3 | +4,4 | +9,2 | +16,3 | +10,1 | 0,004 |
| + 4. Percentage contribution of life cycle stages to the total | +7,1 | +12,4 | +19,3 | +13,0 | 0,003 |
| PEF information: | Effects on choice for the product with the best PEF score (difference with no label , in percent points) | | | | Differences between groups? |
| | Low concern | Moderate concern | High concern | Total | p-value |
| Overall performance on three-level scale | (-0,5) | (+3,9) | (+6,6) | +3,6 | 0,037 |
| Overall performance on three-level scale + percentage relative to the average (baseline) | -0,7 | +5,7 | +13,6 | +6,2 | <0,001 |
| + 1. Qualitative statement about impact category | +2,8 | +3,3 | +12,0 | +6,0 | 0,016 |
| + 2. Qualitative statement about life cycle stage | +1,4 | +4,2 | +12,7 | +6,0 | 0,001 |
| + 3. Scores on most relevant impact categories | +1,8 | +5,8 | +13,2 | +6,6 | 0,001 |
| + 1 + 3 | +2,3 | +3,1 | +12,3 | +5,9 | 0,007 |
| + 4. Percentage contribution of life cycle stages to the total | +2,9 | +7,2 | +11,0 | +7,1 | 0,027 |

Note – Values in this table reflect the change in choice percentage (in percent points) as a result of providing (versus not providing) the specific type of PEF information. Values shaded green (light and dark) indicate significant changes (i.e. effective information). Dark green shading indicates the *most* effective PEF information for each consumer group. P-values < 0,05 in the last column indicate significant differences in effectiveness of the information type across groups with low, moderate and high environmental concern.

Effects on attention to the labels

Table 3.22 shows the effectiveness of the different types of label in capturing (eye-tracking study) and retaining consumers' attention during product choice (Experiment 1). The PEF label with information on the contribution of the different life cycle stages to the total significantly outperformed all other label types in capturing initial attention (60,0% of respondents looked at this label first when it was presented next to a random other PEF label). The statistical analysis further revealed a marginally significant interaction between the presence of sub scores on impact categories and the presence of a qualitative claim about a relevant impact category on the extent to which the label was able to capture initial attention.⁹³ Here, the label including scores on the most relevant impact categories *and* a qualitative statement related to a relevant impact was able to grab respondent's attention significantly more (55,0%) than label types in which only one of these two elements was present (50,9% and 47,3%; see Table 3.22). Finally, PEF labels with qualitative statements about relevant impacts were not more effective in capturing initial attention as compared to the same label without such a statement (the baseline label; see Table 3.22).

There were no differences in self-reported attention to the labels during product choice, however. About a third of the respondents indicated to have studied the environmental information in detail. This percentage did not significantly depend on the type of label respondents were exposed to (see Table 3.22).

Table 3.22. Effects on attention to the labels

| Label type | Initial attention (% looked at this label first; eye-tracking) | Self-reported attention to the labels (% studied in detail) |
|--|--|---|
| Overall performance on three-level scale | 43,9% ^e | 33,3% ^a |
| Overall performance on three-level scale + percentage relative to the average (baseline) | 46,9% ^{de} | 36,2% ^a |
| + 1. Qualitative statement about impact category | 47,3% ^{de} | 33,3% ^a |
| + 2. Qualitative statement about life cycle stage | 49,2% ^{cd} | 34,5% ^a |
| + 3. Scores on most relevant impact categories | 50,9% ^c | 35,4% ^a |
| + 1 + 3 | 55,0% ^b | 36,8% ^a |
| + 4. Percentage contribution of life cycle stages to the total | 60,0%^a | 34,4% ^a |

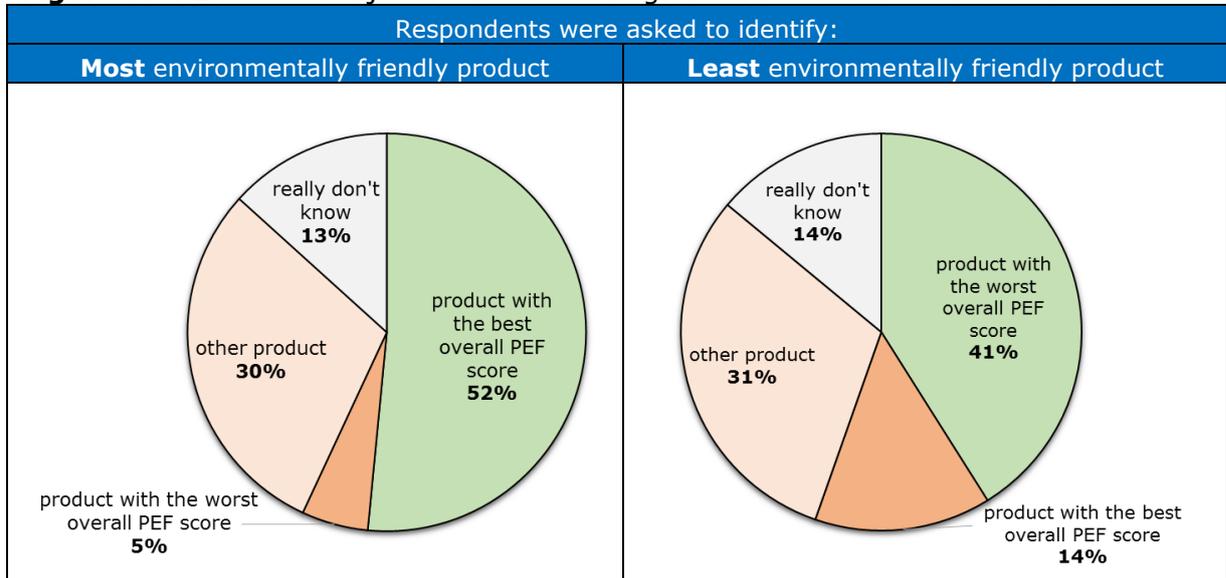
Effects on understanding, evaluation and trust

In order to gain insight into the level of objective comprehension, half of the respondents had to identify the most environmentally friendly product alternative in the set, while the other half were asked to identify the least environmentally friendly alternative. Figure 3.5 shows the percentage of accurate and false identifications among respondents who were exposed to PEF information that enabled them to select the single best or single worst performing products (that is, all labels with overall performance expressed as a percentage relative to the average). On average, accurate identification was higher in the group that looked for the best performing product (52% vs. 41%). 14% of the respondents who were asked to select the least

⁹³ $p = 0,069$.

environmentally friendly product selected the product with the *best* overall PEF score. In about 30% of the cases, one of the 'middle' options was selected (most often the second-best or second-worst performing alternative). Across the two groups, about 14% of respondents indicated that they didn't know which product was most or least environmentally friendly.

Figure 3.5. Effects on objective understanding: accurate and false identifications



The results in Table 3.23 show the relative effectiveness of the various (combinations of) PEF information elements in increasing understanding, evaluation and trust in the label. Accurate identification of the product with the best (or worst) PEF performance ranged from 43,2% for the PEF label with sub scores on the most relevant impact categories to 48,3% for the PEF label with more detailed information on the relative contribution of the life cycle stages to the total. Only the difference between these two extremes reached statistical significance (see Table 3.23). Further analyses showed that the pattern of accurate identifications, false identifications and don't know responses did not significantly differ between label types.⁹⁴

There were significant differences in the extent to which respondents found it easy to identify the best (or worst) performing product in terms of environmental aspects. Consistent with the results in Section 3.2.2.2, respondents considered it more difficult to identify the best (or worst) performing option when scores on the most relevant impact categories were presented on the PEF label, regardless of whether or not this information was accompanied by a qualitative statement ($M = 4,57$ and $M = 4,58$, respectively), than when this information was absent ($M = 4,89$). In contrast, adding (only) qualitative statements about relevant impacts ($M = 4,87$ and $M = 4,86$) or information on the relative contribution of the different life cycle stages ($M = 4,84$) did not make the product identification task more difficult.

⁹⁴ $p = 0,723$ (identification of most environmentally friendly product) and $p = 0,439$ (identification of least environmentally friendly product).

Table 3.23. Effects on understanding, evaluation and trust

| Label type | Objective label understanding | | Subjective label understanding (7-point) | Label evaluation (7-point) | Trust in label (7-point) |
|--|--|----------------------------------|--|----------------------------|--------------------------|
| | Accurate identification of single best/worst scoring product | Ease of identification (7-point) | | | |
| Overall performance on three-level scale | (29,2% ^c) | 4,88^a | 5,46^a | 5,55^a | 5,36^a |
| Overall performance on three-level scale + percentage relative to the average (baseline) | 48,3% ^{ab} | 4,89^a | 5,42 ^{ab} | 5,48 ^{ab} | 5,20 ^b |
| + 1. Qualitative statement about impact category | 45,8% ^{ab} | 4,87^a | 5,39 ^{ab} | 5,49 ^{ab} | 5,30 ^{ab} |
| + 2. Qualitative statement about life cycle stage | 45,5% ^{ab} | 4,86^a | 5,31 ^b | 5,47 ^{ab} | 5,36^a |
| + 3. Scores on most relevant impact categories | 43,2% ^b | 4,58 ^b | 4,96 ^c | 5,31 ^c | 5,18 ^b |
| + 1 + 3 | 46,4% ^{ab} | 4,57 ^b | 5,07 ^c | 5,39 ^{bc} | 5,27 ^{ab} |
| + 4. Percentage contribution of life cycle stages to the total | 48,3%^a | 4,84^a | 5,03 ^c | 5,28 ^c | 5,25 ^{ab} |

Subjective understanding of the label and the perceived usefulness and importance of the information (label evaluation) remained highest for the simplest PEF label that only displays overall performance on a three-level scale, but the differences with the labels that display overall performance as a percentage or a qualitative statement about a relevant impact category were not significant (see Table 3.23). Understanding and evaluation of the label were lowest for the labels that included scores on the most relevant impact categories and information on the relative contribution of life cycle stages. The addition of a qualitative statement related to one of the impact categories to the PEF label with sub scores on the most relevant impact categories decreased the difference in evaluation with the overall performance label (baseline), but not the difference in label understanding.

Trust in the label and the accuracy of the information, in contrast, was higher for PEF labels with a qualitative statement about a relevant life cycle ($M = 5,36$) than for the same label without such a qualitative statement (baseline; $M = 5,20$), and equally high as trust in the simplest three-level performance label ($M = 5,36$). Respondents' trust in the other label types did not significantly differ from the baseline (see Table 3.24).

Generality of the findings

Several follow-up analyses were conducted to examine country and consumer differences in the extent to which consumers (felt they) understood the various types of PEF information. The results revealed that, on average, subjective understanding of the PEF information was higher among younger (versus older) consumers⁹⁵, women (vs. men)⁹⁶, consumers with a better (vs. worse) financial situation⁹⁷, and

⁹⁵ Significant main effect of age: $p < 0,001$ (age as continuous variable) and $p < 0,001$ (age as dichotomous variable): $M = 5,35$ (18-44 years) vs. $M = 5,11$ (45-70 years).

⁹⁶ Significant main effect of gender: $M = 5,19$ (men) vs. $M = 5,27$ (women); $p = 0,045$.

consumers with higher (vs. lower) level of environmental concern⁹⁸. Subjective understanding of the PEF labels did not depend on the respondent's level of education, but – as before – objective comprehension of the information was higher among consumer with higher (vs. lower) education.⁹⁹

The analyses did not reveal significant country or consumer differences in the relative effectiveness of the various types of PEF information in promoting high levels of (subjective) understanding. More specifically, the impact of the different label types on understanding did not depend on age¹⁰⁰, gender¹⁰¹, level of education¹⁰², or financial situation¹⁰³ of the respondent. The pattern of results also did not significantly differ across the selected countries¹⁰⁴.

Which combination is most effective?

The previous section provided detailed insights into the contribution of additional PEF-derived information to the overall effectiveness of the PEF label. Table 3.24 provides an overview of the findings, comparing the individual and joint contribution of impact category statements and scores on the most relevant impact categories, and the added value of providing life cycle information (in the form of qualitative statements and information about the relative contribution of the different stages) relative to the (baseline) PEF label that only provides overall performance information (on a three-level scale and as a percentage). Again, positive impacts are shaded green and negative impacts are shaded red in the table.

None of the (combinations of) information elements increased the choice for the most environmentally friendly alternatives in the product sets relative to the PEF label that provides overall performance information on a three-level scale and as a percentage relative to the average (the baseline here).

Qualitative statements appeared to have little effect on consumers' responses to products and labels. The only impact observed was that trust in the label was slightly higher, on average, when the PEF label contained a qualitative claim about a relevant life cycle stage, compared to when this information was not provided. Note, however, that, albeit statistically significant, the difference was relatively small in absolute sense. Similar to the results in section 3.2.2.2, the findings demonstrate that adding sub scores on the most relevant impact categories draws more attention to the label (regardless of whether or not this information is further supported by a qualitative claim), but reduces label understanding and evaluation. Finally, adding information on the relative contribution of the different life cycle stages to the total increased the ability of the label to capture initial attention, but also resulted in lower levels of understanding and a less positive evaluation of the information.

⁹⁷ Significant main effect of financial situation (5-point): $p = 0,001$.

⁹⁸ Significant main effect of environmental concern: $M = 4,86$ (low) vs. $M = 5,22$ (moderate) vs. $M = 5,61$ (high); $p < 0,001$.

⁹⁹ No significant main effect of educational level: $p = 0,063$. Significant main effect of educational level on objective label understanding (accurate identification): $p < 0,001$. Accurate product identification was 39,4% among consumers with high education, 38,7% among consumers with medium level of education, and 33,1% among consumers with low education ($ps < 0,001$).

¹⁰⁰ No significant PEF label type x age interaction: $p = 0,345$ (age as continuous variable) and $p = 0,795$ (age as dichotomous variable: younger [18-44] vs. older [45-70] respondents).

¹⁰¹ No significant PEF label type x gender interaction: $p = 0,525$.

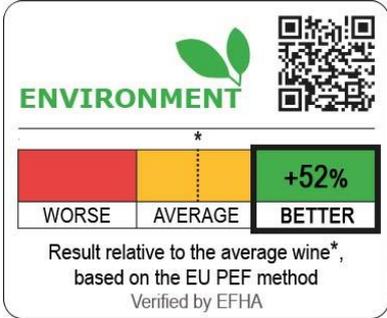
¹⁰² No significant PEF label type x educational level interaction: $p = 0,188$.

¹⁰³ No significant PEF label type x financial situation interaction: $p = 0,239$.

¹⁰⁴ No significant PEF label type x country interaction: $p = 0,480$.

Table 3.24. Overview of findings: Experiment 1 (continued)

Baseline = overall performance on three-level scale + percentage relative to the average



| | Environ- mentally friendly choices | Attention to the label | Label under- standing | Label evaluation | Trust in label |
|--|---|------------------------------|-----------------------------|---------------------|-------------------|
| Effects of adding information on: | | | | | |
| 1. Qualitative statement about impact category | | | | | |
| 2. Qualitative statement about life cycle stage | | | | | |
| 3. Scores on most relevant impact categories | | (initial) | | | |
| 1 + 3 | | (initial) | | | |
| 4. Percentage contribution of life cycle stages to the total | | (initial) | | | |

3.2.2.4. Effect of life cycle information on usage intentions, responsibility perceptions, and pro-environmental behaviour

Rather than to promote environmentally friendly product choices directly, information on the contribution of life cycle stages to the total footprint of a product may be provided to make consumers more aware, for instance, of their own contribution or that of producers and to act upon that knowledge. The information could also elevate their general concern about the environment, which may be reflected in more pro-environmental behaviour in other domains as well. The next section tests this.

Effect of life cycle information on usage intentions and responsibility perceptions

For laundry detergents, the use phase accounts for more about 90% of the total impacts. To gain insight into whether providing this information affects responsibility perceptions and promotes more conscious detergent usage behaviour, respondents who were exposed to PEF labels with life cycle information during product choice were shown the laundry detergent of their choice once more and asked to imagine that they were now about to use that detergent at home for washing their coloured laundry. They were asked to indicate (1) how much detergent they would use, (2) at what temperature they would wash their coloured laundry. For each question, respondents were given five choice options, with the smallest detergent amount and lowest temperature labeled as "recommended by the manufacturer". Next, responsibility

perceptions were assessed via two statements (“I think using less detergent makes no difference for the environment” and “I can help the environment by using less detergent”), on a scale from (1) *completely disagree* to (7) *completely agree*.¹⁰⁵ The same questions were asked to respondents in two comparison groups: those who were exposed to products carrying the baseline PEF label without life cycle information (see Figure 3.5) and those who were exposed to products without PEF labels.

Table 3.25. Effects on usage intentions and responsibility perceptions (laundry detergent)

| Label type | Usage intentions | | Responsibility perceptions | |
|---|--|--|--|---|
| | % of respondents choosing the recommended (smallest) amount of detergent | % of respondents choosing the recommended washing temperature (30°C) | “I think using less detergent makes no difference to the environment” (7 = completely agree) | “I can help the environment by using less detergent” (7 = completely agree) |
| No environment-related information (control) | 47,4% ^a | 41,5% ^a | 3,05 ^a | 5,31 ^a |
| Overall performance on three-level scale plus percentage relative to the average (baseline) | 46,8% ^a | 45,3% ^a | 3,08 ^a | 5,34 ^a |
| + qualitative statement about most relevant life cycle | 51,4% ^a | 45,6% ^a | 3,00 ^a | 5,39 ^a |
| + information on contribution of the life cycle stages to the total | 48,3% ^a | 42,5% ^a | 3,06 ^a | 5,33 ^a |

The results, summarized in Table 3.25, show that about half of the respondents chose the recommended (smallest) amount of laundry detergent. This percentage was slightly higher (51,4%) among respondents who were exposed to PEF labels that included a life cycle statement (e.g. “You are in charge of this detergent’s environmental footprint: much of its impact depends on how you use it. Follow the washing instructions!”) than among respondents who saw PEF labels without life cycle information (46,8%¹⁰⁶) or no PEF labels at all (47,4%¹⁰⁷). Other differences in usage intentions between the label type conditions were not significant. Also, responsibility perceptions were unaffected by exposure to the life cycle information (see Table 3.25).

Effect of life cycle information on pro-environmental behaviour

We further hypothesized that the provision of life cycle information may increase consumers’ general concern about the environment, which is reflected in more pro-environmental behaviour in other domains (spill-over effect)¹⁰⁸. To test this, respondents performed a pro-environmental behaviour task in which they were asked

¹⁰⁵ Cronbach’s alpha = 0,40 (poor internal consistency). Therefore, responses to the two statements were analysed separately (see Table 3.17).

¹⁰⁶ The difference is marginally significant: $p = 0,088$.

¹⁰⁷ The difference is marginally significant: $p = 0,070$.

¹⁰⁸ See e.g. Whitmarsh, L., & O’Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305-314.

to make transport-related choices.¹⁰⁹ To prevent demand characteristics, the task was included at the end of the questionnaire and framed as a separate, unrelated study.

In short, via three scenarios, the pro-environmental behaviour task assessed the amount of time, money and effort the respondent would be willing to expend for a more environmentally friendly choice option, in this case, a ride with electric taxi "GreenCab" (rather than with the petrol-fueled "Blue Taxi"). An example of the scenarios – the "waiting time" scenario – is provided in Box 3.3. Respondents indicated their preference for GreenCab or Blue Taxi, and indicated, if they chose GreenCab, how much longer they would wait (scenario 1), how much extra they would pay (scenario 2), and how much effort they would invest (scenario 3).

Box 3.3. Example scenario (waiting time)

[Introduction]

Imagine that you have just been on a holiday and you are on your flight back home. After landing, you pick up your bags at the baggage claim. Now, you need to take a taxi to get home.

At the information counter, you find out that there are two taxi companies: Blue Taxi and GreenCab. All taxis from Blue Taxi are petrol-fuelled. All taxis from GreenCab are electric.

Indeed, walking out of the airport, you can see a taxi from Blue Taxi and a taxi from GreenCab waiting. The taxi drivers are there too. You speak to both drivers to get more information.

[Scenario 1: waiting time]

Imagine that both taxi companies charge the same for the trip home and the amount of time to get home will be the same.

However, the taxi driver from Blue Taxi tells you he can bring you immediately. The taxi driver from GreenCab tells you he has to take a brief mandatory break first, and can take you home after that. He also tells you when he will be back.

What would you do?

- I would go with Blue Taxi.*
- I would go with GreenCab if the waiting time is ... minutes maximum.*

The results in Table 3.26 show no significant differences in the extent to which respondents showed pro-environmental behaviour between the different label type conditions, however. That is, the maximum time respondents would wait, the maximum extra costs they would pay, and the maximum amount of effort they would invest (measured in terms of the maximum number of people lined up in front of the ticket machine¹¹⁰) for the more environmentally friendly option did not differ between respondents who saw labels with life cycle information and respondents who saw labels without such information, or no PEF labels at all (see Table 3.26).¹¹¹

¹⁰⁹ Inspired by: Lange, F., Steinke, A., & Dewitte, S. (2018). The Pro-Environmental Behavior Task: A laboratory measure of actual pro-environmental behavior. *Journal of Environmental Psychology*, 56, 46-54.

¹¹⁰ Keeping time of departure (and hence waiting time) constant across the more and less environmentally friendly options.

¹¹¹ All pairwise comparisons: $ps > 0,10$.

Table 3.26. Spill-over effects on pro-environmental behaviour in different domain

| Label type | Time | | Money | | Effort | |
|---|---|-----------------------------------|---|---|---|---------------------------------------|
| | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum waiting time (in minutes) | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum costs (in euros) ¹¹² | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum number of people in the queue |
| No environment-related information (control) | 50,5% ^a | 5,30 ^a | 59,9% ^a | €9,42 ^a | 46,1% ^a | 4,49 ^a |
| Overall performance on three-level scale plus percentage relative to the average (baseline) | 46,9% ^a | 5,84 ^a | 58,6% ^a | €9,71 ^a | 43,6% ^a | 4,62 ^a |
| + qualitative statement about most relevant life cycle | 48,0% ^a | 5,86 ^a | 58,0% ^a | €9,92 ^a | 45,0% ^a | 4,65 ^a |
| + information on contribution of the life cycle stages to the total | 48,6% ^a | 5,47 ^a | 57,5% ^a | €10,01 ^a | 43,3% ^a | 4,51 ^a |

3.3. Results: Effects of strategies to enhance understanding

The findings in Section 3.2 showed that the presence of information about the most relevant impact categories had a negative effect on subjective label understanding. PEF labels with such information were considered more difficult to understand than labels that only displayed overall performance information. It is unclear, however, to what extent this lower understanding of labels with impact category information is due to the intrinsic complexity of the subject matter or to the fact that the information is provided in a limited way, without much explanation. To allow for a fairer comparison of labels with and without impact category information, the experiment tested their relative effectiveness in two additional situations: (1) a situation in which consumers were pre-informed about the PEF labels and how results are calculated (i.e. prior to exposure to product assortments)¹¹³, (2) a situation in which the impact category information on the PEF labels was expressed in more understandable language (see Figure 3.6).

The results in Tables 3.27-3.29 demonstrate that pre-informing consumers about the presence of footprint labels and how the single performance score is calculated (1) encourages more environmentally friendly choices, (2) results in more attention to the PEF labels, (3) enhances objective¹¹⁴ and subjective understanding of the PEF information, (4) increased the perceived usefulness and importance of the information (label evaluation), and (5) increases trust in the label. Using simpler wording for the

¹¹² In the experiment, monetary costs were presented in krona in Sweden, zloty in Poland, lev in Bulgaria, and in euros in all other countries.

¹¹³ To this end, some of the respondents were informed that before leaving the house to go shopping, the front of the newspaper caught their attention: "You read that the European Union has introduced mandatory labels on a variety of products. These labels aim to inform consumers about how good or bad a product is for the environment, and to make it easier for them to compare products." Next, they were asked to read parts of the newspaper article which explained how the PEF profile of a product is calculated. Other respondents did not receive this information.

¹¹⁴ The difference between 71,6% (prior information) and 59,0% (control) is marginally significant: $p = 0,068$.

impact categories significantly increased self-declared understanding of the information, but did not affect other outcomes.

Figure 3.6. Examples of PEF labels with standard (left) versus simplified (right) information on the three most relevant impact categories

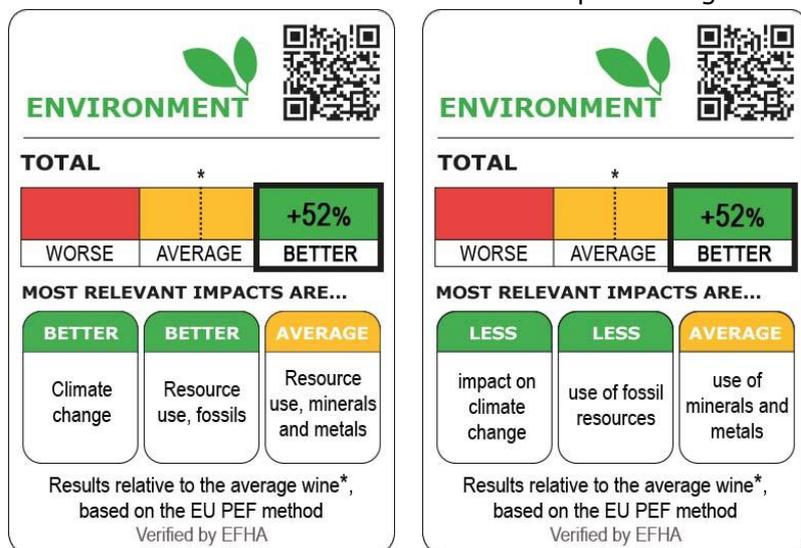


Table 3.27. Effects on choice behaviour

| Strategies to enhance understanding | % of respondents that selected a product scoring "better than average" | % of respondents that selected the product with the best PEF score |
|-------------------------------------|--|--|
| No | 36,4% ^b | 20,3% ^b |
| Prior information | 50,9% ^a | 32,4% ^a |
| Simpler wording | 36,1% ^b | 20,5% ^b |

Note - Baseline = Single performance score plus percentage relative to the average plus scores on most relevant impact categories.

Table 3.28. Effects on attention to the labels

| Strategies to enhance understanding | Self-reported attention to the labels | | |
|-------------------------------------|---------------------------------------|------------------------|-----------------------------|
| | Studied them in detail | Briefly looked at them | Did not look at them at all |
| No | 35,4% ^b | 47,3% | 17,4% |
| Prior information | 52,8% ^a | 39,5% | 7,8% |
| Simple wording | 34,7% ^b | 46,3% | 19,0% |

Note - Baseline = Single performance score plus percentage relative to the average plus scores on most relevant impact categories.

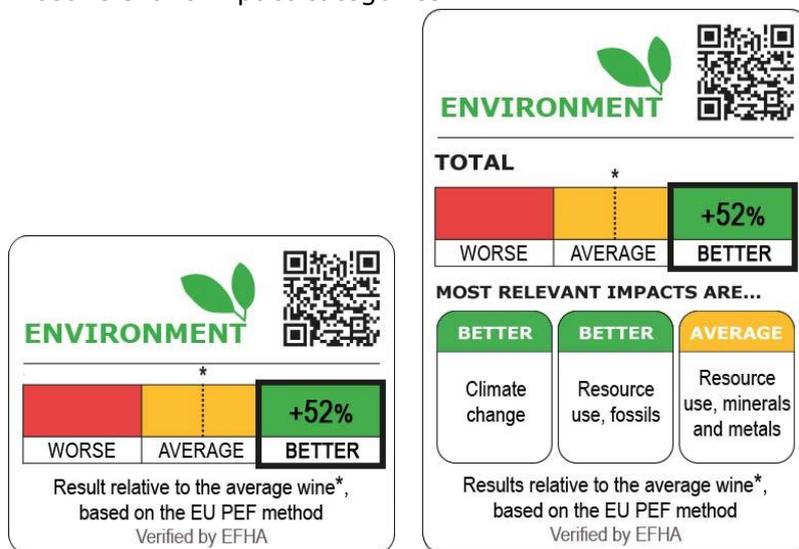
Table 3.29. Effects on understanding, evaluation, and trust

| Strategies to enhance understanding | Objective understanding | | Subjective label understanding (7-point) | Label evaluation (7-point) | Trust in label (7-point) |
|-------------------------------------|--|--|--|----------------------------|--------------------------|
| | Accurate identification of best/worst performing product | Ease of product identification (7-point) | | | |
| No | 59,0% ^a | 4,58 ^b | 4,96 ^b | 5,31 ^b | 5,18 ^b |
| Prior information | 71,6% ^a | 4,91 ^a | 5,17 ^a | 5,49 ^a | 5,33 ^a |
| Simple wording | 67,0% ^a | 4,75 ^{ab} | 5,16 ^a | 5,33 ^b | 5,21 ^{ab} |

Note - Baseline = Single performance score plus percentage relative to the average plus scores on most relevant impact categories.

The results outlined above show that providing prior information strongly increases the effectiveness of a PEF label that displays sub scores on the three most relevant impact categories (i.e. a label providing detailed information). The key question now is how exposure to prior information influences the *relative* effectiveness of a more elaborate label with impact category information versus a simpler overall performance label. Whereas the results in section 3.2.2 revealed generally positive effects of providing impact category information on choice behaviour, we observed negative effects on label understanding and evaluation. We explore here whether explaining to consumers how the overall performance results are calculated enhances understanding (and hence evaluation) of a PEF label with sub scores, and closes the gap with the PEF label that only displays the overall PEF score.

Figure 3.7. Examples of PEF labels with (right) and without (left) information on the most relevant impact categories



We tested the impact of prior information for two types of labels: (1) a PEF label showing overall PEF performance (on a three level-scale and expressed as a percentage) and (2) a similar PEF label with sub scores (see Figure 3.7). The analysis revealed, as before, strong and positive effects of prior information on attention to the PEF labels (the percentage of respondents who studied the PEF labels in detail increased from about 35% to about 50%; see Table 3.31) and pro-environmental product choices (the percentage of respondents who selected the product with the best PEF performance increased from about 20% to about 32%; see Table 3.30).

Attention to the labels and environmentally friendly product choices increased to an equal extent for the two types of labels.

When it was explained to consumers how the overall PEF results are calculated, the PEF label with sub scores was evaluated as positively as the overall PEF performance label without explanation, and identification of best and worst performing products was no longer considered more difficult. However, the pre-information did not close the gap in subjective understanding, which still lagged behind for the PEF label with sub scores. Moreover, providing prior information had similar positive effects on understanding and evaluation for the simpler overall performance label too (see Table 3.32).¹¹⁵

Table 3.30. Effects on choice behaviour

| Presence of impact category information on the PEF label* | Prior information | % of respondents that selected a product scoring "better than average" | % of respondents that selected the product with the best PEF score |
|---|-------------------|--|--|
| No | No | 35,4% ^b | 19,9% ^b |
| | Yes | 53,3% ^a | 32,5% ^a |
| Yes | No | 36,4% ^b | 20,3% ^b |
| | Yes | 50,9% ^a | 32,4% ^a |

* No = PEF label with overall PEF performance on three-level scale and as a percentage; Yes = PEF label with overall PEF performance on three-level scale and as a percentage plus sub scores on most relevant impact categories.

Table 3.31. Effects on attention to the labels

| Presence of impact category information on the PEF label* | Prior information | Self-reported attention to the labels | | |
|---|-------------------|---------------------------------------|------------------------|-----------------------------|
| | | Studied them in detail | Briefly looked at them | Did not look at them at all |
| No | No | 36,2% ^b | 44,2% | 19,6% |
| | Yes | 50,6% ^a | 41,4% | 8,0% |
| Yes | No | 35,4% ^b | 47,3% | 17,4% |
| | Yes | 52,8% ^a | 39,5% | 7,8% |

* No = PEF label with overall PEF performance on three-level scale and as a percentage; Yes = PEF label with overall PEF performance on three-level scale and as a percentage plus sub scores on most relevant impact categories.

¹¹⁵ All interactions between the label type (simple vs. detailed) and prior exposure to information (yes vs. no) were non-significant: all $ps > 13$.

Table 3.32. Effects on understanding, evaluation, and trust

| Presence of impact category information on the PEF label* | Prior information | Objective understanding | | Subjective label understanding (7-point) | Label evaluation (7-point) | Trust in label (7-point) |
|---|-------------------|--|--|--|----------------------------|--------------------------|
| | | Accurate identification of best/worst performing product | Ease of product identification (7-point) | | | |
| No | No | 48,3% ^{bc} | 4,89 ^b | 5,42 ^b | 5,48 ^b | 5,20 ^b |
| | Yes | 52,9% ^a | 5,25 ^a | 5,57 ^a | 5,62 ^a | 5,43 ^a |
| Yes | No | 43,2% ^c | 4,58 ^c | 4,96 ^d | 5,31 ^c | 5,18 ^b |
| | Yes | 51,8% ^{ab} | 4,91 ^b | 5,17 ^c | 5,49 ^{ab} | 5,33 ^a |

* No = PEF label with overall PEF performance on three-level scale and as a percentage; Yes = PEF label with overall PEF performance on three-level scale and as a percentage plus sub scores on most relevant impact categories.

3.4. Results: Effects of exposure to multiple environment-related labels

In the online experiment, the presence of an EU Ecolabel (for laundry detergents) or organic logo (for wines) was systematically varied, which allows us to study whether and how consumer responses to the PEF label are influenced by the presence of such other environment-related labels.

3.4.1. Interaction with organic logo

It was hypothesized that, since organic products might not have a low PEF score, the joint presence of organic and PEF labels may cause confusion as to which product is the most environmentally friendly. If an organic product does not have better-than-average PEF score, consumers might question the accuracy of the PEF label to resolve the cognitive dissonance resulting from the seemingly contradictory messages. It was also predicted that the presence of a biodiversity certification on an organic product could prevent such confusion and concerns about the accuracy of one of the labels, as this information might help consumers understand that organic products have unique characteristics that are not (fully) captured by the PEF score.

Table 3.33. Effects on choice behaviour (wine)

| Environmental footprint information | Organic logo (on P3) | Biodiversity certification (on P1 & P3) | % of respondents that selected the wine with the best PEF score (P1) | % of respondents that selected the organic wine (P3) |
|-------------------------------------|----------------------|---|--|--|
| Yes* | No | No | 20,2% ^a | 14,5% ^a |
| | | Yes | 20,6% ^a | 12,7% ^a |
| | Yes | No | 20,3% ^a | 12,3% ^a |
| | | Yes | 19,0% ^a | 11,2% ^a |

* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

Table 3.33 provides the results of the choice task and Table 3.34 the results related to label understanding and evaluation. Analyses with the presence (versus absence) of the organic label, the presence (versus absence) of the biodiversity label, and their interaction as predictors revealed no significant individual or joint effects of the presence of an organic logo (on product 3) and biodiversity certification (on products 1 and 3) on the choice shares of either of these products¹¹⁶, understanding of the PEF

¹¹⁶ All $ps > 0,10$.

label¹¹⁷, perceived usefulness and importance of the information on the PEF label (label evaluation)¹¹⁸, or the level of trust in the PEF information¹¹⁹. Thus, the extent to which consumers understood, valued and trusted the PEF label, the likelihood of choosing the wine with the best PEF performance and the likelihood of choosing the organic wine were unaffected by the presence of the organic logo and/or biodiversity certification.

Figure 3.8. Assortment of wines with organic logo (P3) and biodiversity certification (P1 & P3)

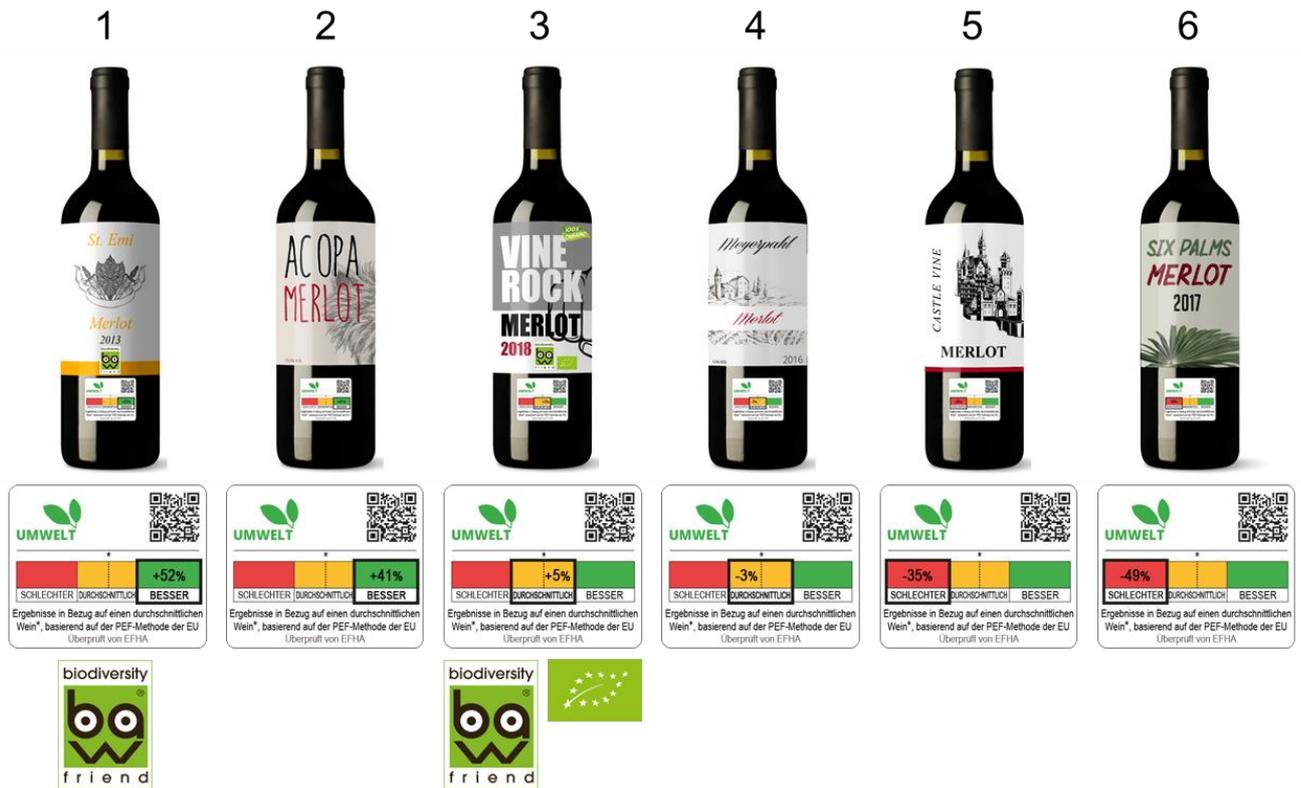


Table 3.34. Effects on understanding and evaluation (wine)

| Environmental footprint information | Organic logo | Biodiversity certification | Understanding of the environmental footprint label (incl. biodiversity information) (7-point) | Evaluation of the environmental footprint label (incl. biodiversity information) (7-point) | Trust in... | |
|-------------------------------------|--------------|----------------------------|---|--|--|------------------------|
| | | | | | Environmental footprint label (incl. biodiversity information) (7-point) | Organic logo (7-point) |
| Yes* | No | No | 5,40 ^a | 5,37 ^a | 5,27 ^a | NA |
| | | Yes | 5,36 ^a | 5,41 ^a | 5,42 ^a | NA |
| | Yes | No | 5,40 ^a | 5,41 ^a | 5,29 ^a | 5,01 ^a |
| | | Yes | 5,23 ^a | 5,37 ^a | 5,25 ^a | 5,02 ^a |

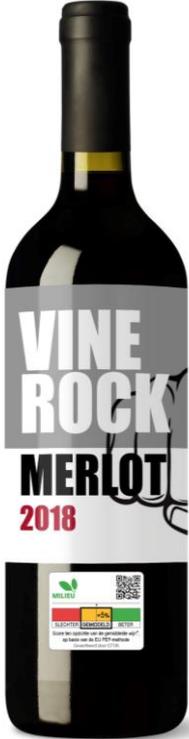
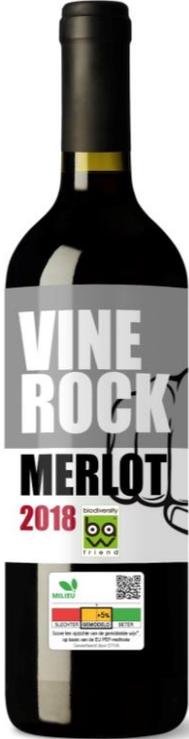
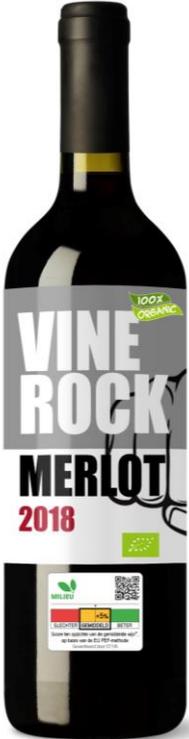
* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

¹¹⁷ All *ps* > 0,26.

¹¹⁸ All *ps* > 0,31.

¹¹⁹ All *ps* > 0,10.

Table 3.35. Presence (vs absence) of organic logo and biodiversity certification

| | | Biodiversity certification | |
|--------------|---------|---|---|
| | | Absent | Present |
| Organic logo | Absent |  |  |
| | Present |  |  |

The questionnaire also assessed to what extent consumers felt well-informed about the environmental impact of the product and to what extent they thought the information about the environmental aspects of the product was confusing (both on a scale from (1) *not at all* to (7) *very much so*). The presence (vs. absence) of the biodiversity friend logo on a wine with an average PEF score made consumers feel better informed about the environmental impact of the wine ($M = 5,12$ vs. $M = 4,77$; see Table 3.36). In line with this finding, respondents evaluated the information as less confusing when the wine carried a biodiversity certification alongside the PEF label ($M = 3,12$) as compared to when the PEF label was presented alone ($M = 3,55$). The information that the wine (with average PEF performance) is organic did not have the same positive effect on the feeling of being well-informed (see Table 3.36), which might be the result of the seemingly contradictory messages (organic wine and average PEF score), as predicted.¹²⁰

We further hypothesized that the biodiversity information could help understand why the organic wine did not have a better-than-average PEF score. However, when the wine was presented as organic, the presence of biodiversity information did not reduce confusion ($M = 3,61$ vs. $M = 3,56$; see Table 3.36)¹²¹. Since it requires quite a high level of environmental knowledge to understand the meaning of and relationships between PEF, organic farming and biodiversity, a follow-up analysis examined whether the pattern of results was different for consumers with higher versus lower levels of environmental concern¹²², assuming that those who are more concerned about the environment are also more knowledgeable, on average. The results showed that while higher levels of environmental concern were generally associated with stronger feelings of being well-informed¹²³ and lower levels of confusion¹²⁴, the effect of the (joint) presence of the organic logo and biodiversity certification did not significantly depend on the level of environmental concern¹²⁵. Thus, the presence of a biodiversity friend logo on the organic wine with an average PEF score also did not lower confusion among consumers with high environmental concern.

Table 3.36. Effects on confusion (wine)

| Environmental footprint information | Organic logo | Biodiversity certification | "I feel well-informed about the environmental impact of this product" (7 = very much so) | "The information about the environmental aspects of this product is confusing" (7 = very much so) |
|-------------------------------------|--------------|----------------------------|--|---|
| Yes* | No | No | 4,77 ^b | 3,55 ^a |
| | | Yes | 5,12 ^a | 3,12 ^b |
| | Yes | No | 4,74 ^b | 3,56 ^a |
| | | Yes | 5,12 ^a | 3,61 ^a |

* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

¹²⁰ Note that this result does not imply that the organic logo was ineffective. In the experiment, the organic logo always appeared on a product with a suboptimal PEF score (i.e. not scoring "better than average"). As such, the test is informative about the impact of the organic logo on a product with a suboptimal PEF performance, but not about its general effectiveness.

¹²¹ Significant interaction between organic logo and biodiversity certification: $p < 0,05$.

¹²² Measured via the pro-environmental behaviour task, as before.

¹²³ $p = 0,002$.

¹²⁴ $p < 0,001$.

¹²⁵ $ps > 0,15$.

Finally, respondents who were exposed to the organic wine with a PEF label were asked to what extent they perceived some or all of the environment-related information on the bottle as redundant (see Table 3.37). Most respondents (61,6%) indicated that they considered none of the information redundant. About a quarter of the respondents (23,3%) perceived the organic label as redundant, while only 9,0% perceived the PEF information as redundant.

Table 3.37. Redundancy perceptions (wine)

| Perceived as redundant by ...% of respondents | | | |
|---|--------------|------------------------------|--------------------------------------|
| PEF information | Organic logo | All information is redundant | None of the information is redundant |
| 9,0% | 23,3% | 6,1% | 61,6% ^a |

3.4.2. Interaction with ecolabel

While the EU Ecolabel signals which products are “best in class” in terms of environmental performance (i.e. product either have an Ecolabel or not), PEF information allows for a more fine-grained comparison of the environmental impact of products (whether performing well or not) within the category. Since both communicate information on the (overall) environmental performance of products, the coexistence of the EU Ecolabel and PEF information might produce perceptions of information redundancy or confusion among consumers.¹²⁶ To test this, the presence (vs. absence) of the EU Ecolabel was systematically varied (between-subjects) for laundry detergents and wall paints (see Table 3.38). If the Ecolabel was present, it appeared on the product with the smallest footprint (product 1 in Figure 3.9).

Figure 3.9. Assortment of laundry detergents with Ecolabel (P1)



Table 3.38 shows that, if PEF information was available, the presence of the EU Ecolabel on the product with the best PEF score did not further increase the likelihood that this best performing product was selected. If the EU Ecolabel was absent, 19,8% of the respondents selected the product, compared to 18,8% if it was present (the difference is not statistically significant). Note that these results do *not* show that the EU Ecolabel was ineffective in encouraging environmentally friendly choices. Rather,

¹²⁶ Janßen, D., & Langen, N. (2017). The bunch of sustainability labels – Do consumers differentiate? *Journal of Cleaner Production*, 143, 1233-1245.

they show that the added benefit of the EU Ecolabel is low when PEF information is already available to consumers.

Table 3.38. Effects on choice behaviour (paint and laundry detergent)

| Environmental footprint information | Ecolabel (P1) | % of respondents that selected the paint with the best PEF score (P1) |
|-------------------------------------|---------------|---|
| Yes* | No | 19,8% ^a |
| | Yes | 18,8% ^a |

* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

While the EU Ecolabel did not affect choice behaviour for the product with best PEF performance if PEF information was available, its presence reduced understanding of the PEF label ($M = 5,24$ versus $M = 5,43$; Table 3.39) and slightly increased confusion ($M = 5,36$ versus $M = 5,17$ ¹²⁷; Table 3.41). However, trust in the PEF information was higher when the Ecolabel was present ($M = 5,37$) rather than absent ($M = 5,17$; see Table 3.39).

Table 3.39. Effects on understanding, evaluation and trust (paint and laundry detergent)

| Environmental footprint information | Ecolabel | Understanding of the environmental footprint label | Evaluation of the environmental footprint label | Trust in... | |
|-------------------------------------|----------|--|---|---|--------------------|
| | | | | Environmental footprint label (7-point) | Ecolabel (7-point) |
| Yes* | No | 5,43 ^a | 5,54 ^a | 5,17 ^a | NA |
| | Yes | 5,24 ^b | 5,46 ^a | 5,37 ^b | 4,86 |

* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

Table 3.40. Effects on confusion (paint and laundry detergent)

| Environmental footprint information | Ecolabel | "I feel well-informed about the environmental impact of this product" (7 = very much so) | "The information about the environmental aspects of this product is confusing" (7 = very much so) |
|-------------------------------------|----------|--|---|
| Yes* | No | 5,14 ^a | 3,17 ^a |
| | Yes | 5,07 ^a | 3,36 ^a |

* Baseline = PEF label with overall performance on a three level scale and expressed as percentage relative to the average.

Finally, respondents who were exposed to the product (laundry detergent or wall paint) with both a PEF label and the EU Ecolabel were asked to what extent they perceived some or all of the environment-related information as redundant (see Table 3.41). Again, most respondents (62,6%) indicated that they considered none of the information redundant. The Ecolabel was perceived as providing redundant information by 27,1% of the respondents, while only 5,1% perceived the PEF information as redundant.

¹²⁷ This difference is marginally significant: $p = 0,058$.

Table 3.41. Redundancy perceptions (paint and laundry detergent)

| Perceived as redundant by ...% of respondents | | | |
|---|----------|------------------------------|--------------------------------------|
| PEF information | Ecolabel | All information is redundant | None of the information is redundant |
| 5,1% | 27,1% | 5,3% | 62,6% |

4. Consumer responses to PEF information: Products not covered by PEFCRs

The second experiment focused on products that are not in the scope of a PEFCR. The primary objective of the experiment is to provide insight into how consumers react to claims that are substantiated using the PEF method versus claims that are not. Such insights help to determine whether the use of the PEF method should be encouraged for products not covered by PEFCRs, and if so, what information elements would be most appropriate. The PEF information presented in the experiment is not based on actual PEF studies. Rather, results from available life cycle assessments (LCAs) were used to ensure that the PEF information presented accurately reflects the most relevant environmental impacts and plausible absolute PEF results.¹²⁸

The general set-up of the experiment was similar to Experiment 1, and explained in Section 2.3.1.1. In the experiment, respondents read the scenario that they were planning to go shopping, and wanted to buy, among other things, chocolate spread, sport shoes and a new TV. Respondents were presented with three product sets, each consisting of six different product alternatives (TVs, sport shoes, or chocolate spreads) with fictive brands, and asked to indicate which product they would buy.

4.1. Experimental design

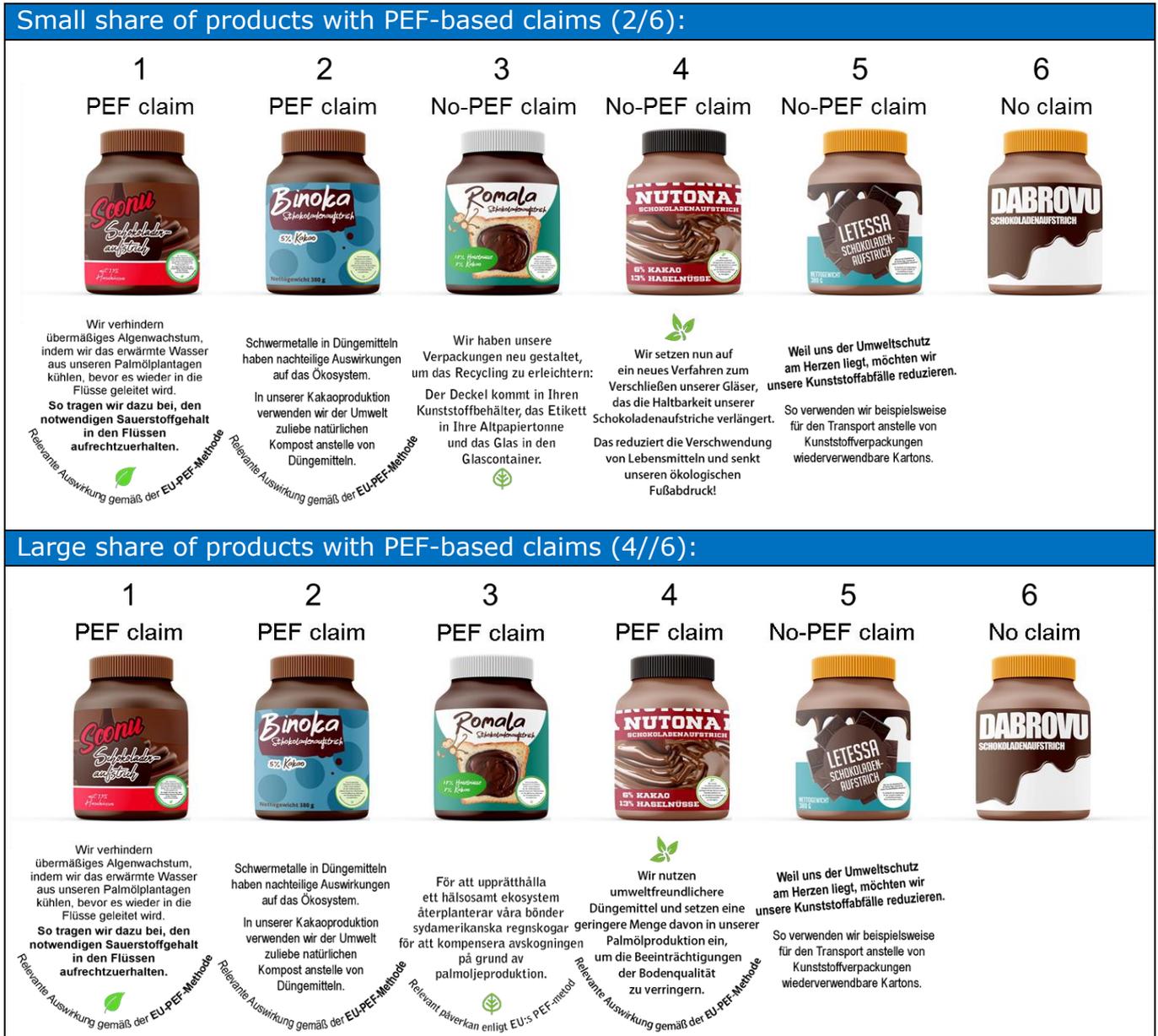
The design of the choice experiment was a 3 (presence/type of claim) x 4 (type of PEF-based claims) x 2 (share of products with PEF-based claims) mixed design with two hanging control groups (which are explained later on).

Presence and type of claim

In the experiment, whether or not a certain claim was substantiated via the PEF method was systematically varied. Each respondent was exposed to product assortments that included products with environmental claims derived from a PEF study as well as products with environmental claims *not* based on PEF (e.g. how it is currently done), and products without environmental claims (see Figure 4.1).

¹²⁸ E.g. Konstantas, A., Jeswani, H. K., Stamford, L., & Azapagic, A. (2018). Environmental impacts of chocolate production and consumption in the UK. *Food research international*, 106, 1012-1025; Cheah, L., Ciceri, N. D., Olivetti, E., Matsumura, S., Forterre, D., Roth, R., & Kirchain, R. (2013). Manufacturing-focused emissions reductions in footwear production. *Journal of cleaner production*, 44, 18-29; Gül, S., Spielmann, M., Lehmann, A., Eggers, D., Bach, V., & Finkbeiner, M. (2015). Benchmarking and environmental performance classes in life cycle assessment—development of a procedure for non-leather shoes in the context of the Product Environmental Footprint. *The International Journal of Life Cycle Assessment*, 20(12), 1640-1648; <https://www.lg.com/global/sustainability/environment/greener-products/products-application>.

Figure 4.1. Differences in presence, type and number of PEF claims within the product set



Note – Assortment of chocolate spreads used in Experiment 2 with PEF information provided through qualitative statements. Note that the claims were randomised across the six different products (i.e. different respondent saw different product-claim combinations) and the display order of the products in the set was randomised.

Type of PEF-based claims

Experiment 2 further compared the effects of four different types of PEF-based claims, as per Table 4.1. The type of PEF information that was provided was varied between experimental groups. Thus, if PEF-based information was displayed on a product, the type of information presented was systematically varied such that different respondent groups saw different types of information. The non-PEF claims were always qualitative statements about less relevant impacts (e.g. "We do our very best to contribute to a better world. 80% of this shoe box is made from recycled cardboard").

Table 4.1. PEF-based claim types included in Experiment 2

| Type of PEF claim | Qualitative statement about a relevant impact category | Percentage contribution of life cycle stages to the total | Percentage change over time | Absolute results (in micro points) |
|-------------------|--|---|-----------------------------|------------------------------------|
| 1 | X | | | |
| 2 | | X | | |
| 3 | | | X | |
| 4 | | | X | X |

Share of products with PEF-based claims

Finally, we also systematically varied the share of products in the assortment with PEF-derived claims (small vs. large share; see Figure 4.1). Potential differences in perceived attractiveness and perceived environmental friendliness between products that use the PEF method to substantiate claims and products that do not might become more pronounced when more producers use the PEF method to substantiate their claims. In such situations consumers might become more suspicious of products that do not use PEF to substantiate claims (or do not make environmental claims at all).

Controlling for potential confounding factors

Table 4.2 provides an overview of the experimental conditions in Experiment 2. To be able to disentangle effects of the presence and type of claims from product-specific effects (e.g. effects of price information, packaging, etc.), the six mock-up products in each assortment were randomly paired with the various claims (or no claim). Thus, for example, “PEF Claim 1” was shown on “Product 1” for respondent 1, but on “Product 2” for respondent 2, on “Product 3” for respondent 3, etc. The product randomisation ensured that each product-claim combination occurred, which allows us to separate claim effects from influences of product-specific characteristics (e.g. price, packaging, etc.). In addition, the display order of the products (and hence the claims) in the product set was randomised, to control for order effects.

To be able to also provide insights into whether exposure to PEF-based claims leads to enhanced awareness of the environmental impact of products and pro-environmental behaviour more generally, two control conditions were added in which no PEF-based claims were shown: one control condition in which none of the claims was based on PEF (reflecting the current situation), and one in which none of the products had an environmental claim (see Table 4.2).

Table 4.2. Experiment 2: Overview of experimental conditions

| Type of PEF claim | Share of products with PEF claim | C1 | C2 | C3 | C4 | C5 | C6 |
|---|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------|
| Control 1 | - | No claim | No claim |
| Control 2 | - | No PEF Claim 1 | No PEF Claim 2 | No PEF Claim 3 | No PEF Claim 4 | No PEF Claim 5 | No claim |
| Qualitative statement about a relevant impact category | Small | PEF Claim 1 | PEF Claim 2 | No PEF Claim 3 | No PEF Claim 4 | No PEF Claim 5 | No claim |
| | Large | PEF Claim 1 | PEF Claim 2 | PEF Claim 3 | PEF Claim 4 | No PEF Claim 5 | No claim |
| Percentage contribution of life cycle stages to the total | Small | PEF Claim 1 | PEF Claim 2 | No PEF Claim 3 | No PEF Claim 4 | No PEF Claim 5 | No claim |
| | Large | PEF Claim 1 | PEF Claim 2 | PEF Claim 3 | PEF Claim 4 | No PEF Claim 5 | No claim |
| Percentage change over time | Small | PEF Claim 1 | PEF Claim 2 | No PEF Claim 3 | No PEF Claim 4 | No PEF Claim 5 | No claim |
| | Large | PEF Claim 1 | PEF Claim 2 | PEF Claim 3 | PEF Claim 4 | No PEF Claim 5 | No claim |
| Percentage change over time plus absolute results (in micro points) | Small | PEF Claim 1 | PEF Claim 2 | No PEF Claim 3 | No PEF Claim 4 | No PEF Claim 5 | No claim |
| | Large | PEF Claim 1 | PEF Claim 2 | PEF Claim 3 | PEF Claim 4 | No PEF Claim 5 | No claim |

Note – Columns represent within-subjects conditions (i.e. each respondent is exposed to six products, some of which make environmental claims based on PEF, some of which make environmental claims not based on PEF, and others do not make environmental claims at all). Rows represent between-subjects conditions (i.e. different respondents see different types of PEF-based claims and different numbers of products in the assortment carrying such claims).

4.2. Sample description

The experiment was conducted online in four countries: Germany, Italy, Poland and Sweden. In total, 4121 respondents completed the experiment (between 1006 and 1051 respondents per country). Table 4.3 provides a description of the respondent sample, in total, and per country.

Table 4.3. Sample description: socio-demographics

| | Total | DE | IT | PL | SE |
|--|-------|-------|-------|-------|-------|
| Sample size | 4121 | 1006 | 1051 | 1031 | 1033 |
| <u>Gender</u> | | | | | |
| Male | 48,8% | 48,6% | 49,6% | 47,8% | 49,3% |
| Female | 51,2% | 51,4% | 50,4% | 52,2% | 50,7% |
| <u>Age</u> | | | | | |
| Age: 18-24 | 9,5% | 7,4% | 13,0% | 7,6% | 9,9% |
| Age: 25-34 | 21,6% | 20,0% | 23,35 | 21,3% | 21,7% |
| Age: 35-44 | 23,6% | 18,0% | 26,1% | 29,6% | 20,5% |
| Age: 45-54 | 19,8% | 23,0% | 14,1% | 24,0% | 18,4% |
| Age: 55-70 | 25,5% | 31,7% | 23,5% | 17,6% | 29,5% |
| <u>Education</u> | | | | | |
| Primary, partial secondary | 9,8% | 4,9% | 6,0% | 7,8% | 20,3% |
| Completed secondary | 49,3% | 64,3% | 44,3% | 51,3% | 37,8% |
| (Post) graduate | 40,9% | 30,8% | 49,7% | 40,8% | 42,0% |
| Household financial situation ¹²⁹ | 3,04 | 3,10 | 3,13 | 2,88 | 3,04 |

4.3. Results: effects of the presence and type of PEF information

4.3.1. Effects of the presence of PEF information on environmental awareness

First, we examine the effect of the presence (versus absence) of PEF-substantiated claims on product packages on environmental awareness and pro-environmental behaviour. The idea is that exposure to PEF-substantiated claims may enhance general awareness of the impact of their choices on the environment and encourage consumers to act more pro-environmentally also in other domains (spill-over). Awareness was assessed via four statements, two related to efficacy beliefs, that is, the extent to which people believe they can have an impact on the environment through the choices they make ("By making sensible product choices people can help to solve environmental problems" and "People have an impact on the environment through the product choices they make")¹³⁰ and two related to awareness of consequences ("The way a product is made has a negligible impact on the environment" and "The way a product is used has a negligible impact on the environment", reverse-scored)¹³¹, all measured on 7-point scales from (1) *completely disagree* to (7) *completely agree*. To assess pro-environmental behaviour, the same,

¹²⁹ Financial situation ("Would you say that making ends meet every month is...") measured on a 5-point scale from 1 = *very difficult* to 5 = *very easy*.

¹³⁰ Adapted from: Doran, R., Hanss, D., & Larsen, S. (2015). Attitudes, efficacy beliefs, and willingness to pay for environmental protection when travelling. *Tourism and Hospitality Research*, 15(4), 281-292.

¹³¹ Adapted from: Wall, R., Devine-Wright, P., & Mill, G. A. (2007). Comparing and combining theories to explain pro-environmental intentions: The case of commuting-mode choice. *Environment and behavior*, 39(6), 731-753. See also: Onwezen, M. C., Antonides, G., & Bartels, J. (2013). The Norm Activation Model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. *Journal of Economic Psychology*, 39, 141-153; Van Riper, C. J., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology*, 38, 288-297.

seemingly unrelated, behaviour task was used as in Experiment 1, which measured the amount of time, money and effort a respondent would be willing to invest for a more environmentally friendly (transport) option.

Table 4.4 shows no difference in the extent to which respondents believe their product choices have an impact on the environment (efficacy beliefs) between the group that was exposed to product sets with PEF-based claims ($M = 5,66$), with claims not based on PEF ($M = 5,62$) and no environmental claims at all ($M = 5,68$). Surprisingly, however, awareness of consequences (i.e. awareness of the impacts that products have on the environment) was somewhat higher among respondents who were not exposed to environmental claims at all ($M = 4,95$) than among respondents who saw products with claims ($M = 4,68$ and $M = 4,55$, see Table 4.4). Thus, exposure to claims did not increase awareness.

Table 4.4. Effects on environmental awareness

| Presence of PEF information | | Efficacy beliefs (7-point) | Awareness of consequences (7-point) |
|-----------------------------|--|-------------------------------|--|
| Absent | No environmental claims at all (control 1) | 5,68 ^a | 4,95 ^a |
| | None of the claims based on PEF (control 2) | 5,62 ^a | 4,68 ^b |
| Present | Large share of claims based on PEF (independent of type) | 5,66 ^a | 4,55 ^b |

The results of the pro-environmental behaviour task are in Table 4.5, showing no differences in the extent to which respondents opted for environmentally friendly alternatives between the three groups. The maximum time respondents would wait, the maximum extra costs they would pay, and the maximum amount of effort they would invest (measured in terms of the maximum number of people lined up in front of the ticket machine¹³²) for the more environmentally friendly transport option did not differ between respondents who were exposed to claims based versus not based on the PEF method (see Table 4.5).¹³³ Thus, these results do not provide evidence that exposure to PEF-based claims encourage environmentally friendly choices more generally.

¹³² Keeping time of departure (and hence waiting time) constant across the more and less environmentally friendly options.

¹³³ All pairwise comparisons: $ps > 0,10$.

Table 4.5. Spill-over effects on pro-environmental behaviour in different domain

| Presence of PEF information | | Time | | Money | | Effort | |
|-----------------------------|--|---|-----------------------------------|---|---|---|---------------------------------------|
| | | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum waiting time (in minutes) | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum costs (in euros) ¹³⁴ | % of respondents that would choose the <i>less</i> environmentally friendly alternative | Maximum number of people in the queue |
| Absent | No environmental claims at all (control 1) | 50,8% ^a | 5,40 ^a | 59,0% ^a | €9,47 ^a | 47,0% ^a | 4,55 ^a |
| | None of the claims based on PEF (control 2) | 50,9% ^a | 5,22 ^a | 59,7% ^a | €9,25 ^a | 49,1% ^a | 4,24 ^a |
| Present | Large share of claims based on PEF (independent of type) | 53,1% ^a | 4,86 ^a | 58,3% ^a | €9,51 ^a | 48,7% ^a | 4,02 ^a |

4.3.2. Effects of the type of PEF information

Now, we examine to what extent the effects of PEF information for products not covered by PEFCRs are dependent on the specific *type* of information that is provided to consumers. Subsection 4.3.2.1 examines consumer understanding and evaluation of the claims themselves. Subsection 4.3.2.2 examines consumer responses to products with different types of claims (e.g. based on the PEF method versus not) as well as different types of PEF-based claims (e.g. qualitative statement, percentage change over time, etc.).

4.3.2.1. Understanding, evaluation and comparison of claims

In the experiment, respondents were exposed to one of the types of PEF-based claims shown in Table 4.1 (i.e. percentage change over time, relative contribution of the life cycle stages, etc.), or a (qualitative) claim that was not based on the PEF method.¹³⁵ Claim understanding ("This information is...") was measured on two 7-point scales from (1) *difficult to understand* to (7) *easy to understand*, and from (1) *unclear* to (7) *clear*, claim credibility on a scale from (1) *not credible* to (7) *credible*, claim evaluation on two scales from (1) *not useful* to (7) *useful*, and from (1) *not important* to (7) *important*, and perceived comparability of the information on a scale from (1) *difficult to compare across products* to (7) *easy to compare across products*. The results are in Table 4.6.

As shown in Table 4.6, claim understanding was highest for qualitative claims that were not based on the PEF method ($M = 5,48$ on a 7-point scale), while claim evaluation was highest for PEF-substantiated qualitative claims ($M = 5,04$). Understanding of PEF-based claims strongly depended on the type of claim, with qualitative claims being best understood ($M = 5,15$), followed by information showing

¹³⁴ In the experiment, monetary costs were presented in krona in Sweden, zloty in Poland, and in euros in Germany and Italy.

¹³⁵ Each respondent saw a claim that had been presented on a product in the last of the three product sets in the choice task. Since the order of the three products sets (for TVs, sport shoes, and chocolate spreads) was randomised, different respondents saw claims for different products. The results presented here are average results across the three different products, which decreases the probability that effects are due to the specific content or visual format of a single claim and increases the generalisability of the findings.

the percentage change in the product's environmental footprint over time ($M = 4,60$), and the relative contribution of the different life cycle stages to the total ($M = 4,39$). Understanding was lowest ($M = 4,03$) for the combination of information on change in environmental performance over time and absolute results (in micro points). Furthermore, counter to the prediction, PEF claims were not perceived as more credible than non-PEF claims (see Table 4.6). More specifically, there was no difference in perceived credibility between PEF-based qualitative statements about a relevant impact ($M = 4,75$) and non-PEF qualitative statements about a less relevant impact ($M = 4,83$). PEF-based information on the change in environmental performance over time, regardless of whether this information was accompanied by absolute results ($M = 4,40$) or not ($M = 4,51$) was perceived as least credible.

Table 4.6. Effects on claim understanding, evaluation and comparison

| Claim type | Type of information | Claim understanding (7-point) | Claim evaluation (7-point) | Claim credibility (7-point) | Perceived comparability (7-point) |
|---------------------------------------|---|-------------------------------|----------------------------|-----------------------------|-----------------------------------|
| Claims based on PEF method | Qualitative claim about relevant impact category | 5,15 ^b | 5,04^a | 4,75^a | 4,45^a |
| | Contribution of life cycle stages to the total | 4,39 ^d | 4,66 ^b | 4,67^a | 4,16 ^{bc} |
| | Percentage change over time | 4,60 ^c | 4,73 ^b | 4,51 ^b | 4,19 ^b |
| | Percentage change over time + absolute results (micro points) | 4,03 ^e | 4,59 ^b | 4,40 ^b | 3,99 ^c |
| Claims <u>not</u> based on PEF method | Qualitative claim about less relevant impact category | 5,48^a | 4,68 ^b | 4,83^a | 4,57^a |

Finally, perceived comparability of the information was significantly lower for PEF information presented as the percentage change over time accompanied by absolute results (in micro points) as compared to all other types of information (see Table 4.6). This seems to suggest that consumers understood that the absolute results cannot be compared across products. Yet, while actual comparability is low for all PEF information types, respondents' average rating of the comparability of the information was around the mid-point of the scale. It could be that respondents indicated how useful they considered the information in making product comparisons, rather than the extent to which they thought the information itself was comparable across products.

When PEF-based information was provided in terms of the percentage change in performance over time and absolute results in micro points, different values were used in different claims on products within the same assortment (e.g. "Over the past 5 years, we reduced our environmental footprint with 35%" versus "Our environmental footprint decreased with 12% over the past five years"). To gain more insight into consumers' comparison behaviour, we analysed the choice probabilities for these individual products. If respondents compared the percentage change and/or absolute results across the product alternatives within a set, this should be reflected in higher

choice probabilities for (ostensibly) better performing products. If respondents did not compare absolute values, the products with the same type of PEF-based claim but a different percentage change or different absolute results in micro points should have equal probabilities of being chosen.¹³⁶ Table 4.7 shows the average choice percentages for the four product alternatives with similar types of PEF claims but different absolute values. When environmental performance was expressed as a percentage change over time (Table 4.7, left part), products claiming a larger reduction of their environmental footprint (e.g. "Over the past 5 years, we reduced our environmental footprint with 35%") attracted significantly more choices than products claiming smaller reductions (e.g. "Our environmental footprint decreased with 12% over the past five years"). These results suggest that consumers had the tendency to compare the percentages in the different claims.

Whether they also compared absolute PEF scores in micro points is somewhat more difficult to determine, because these scores were always accompanied by claims related to the percentage change over time (which respondents seemed to compare). To be able to gain insight into whether respondents compared any of the information (percentage or micro points), products claiming larger reductions in the environmental footprint over time also had better (lower) micro point scores.¹³⁷ Furthermore, to find out whether consumers compared the absolute scores, the product with the best result in micro points and the product with the largest change over time were not the same product (see Table 4.7, right part). The results in Table 4.7 show no significant differences in choice percentages for the four different product alternatives, which seems to suggest that respondents did not compare the information.¹³⁸ However interestingly, most respondents selected the product with the *highest* absolute score in micro points, which seems to suggest that they misinterpreted higher scores as reflecting better environmental performance. In that case, the choice percentages may be more or less the same because some respondents put more weight on the size of the change over time, while others put more weight on the micro point score (falsely believing that higher scores reflect better environmental performance).

Table 4.7. Average choice percentages for products with similar PEF claim types but different absolute scores (for assortments with a relatively many PEF claims)

| Percentage change over time | | Percentage change over time plus absolute results (in micro points) | | |
|-----------------------------|---------------------|---|-----------------------------------|--------------------|
| Product ranking | Choice | Product ranking: change over time | Product ranking: absolute results | Choice |
| 1 (largest change) | 16,2% ^a | 1 (largest change) | 2 | 13,2% ^a |
| 2 | 15,4% ^a | 2 | 1 (lowest score) | 13,3% ^a |
| 3 | 13,5% ^{ab} | 3 | 4 (highest score) | 16,0% ^a |
| 4 (smallest change) | 11,9% ^b | 4 (smallest change) | 3 | 12,4% ^a |

¹³⁶ Note that product characteristics cannot explain differences in choice probabilities, because claims were randomly paired with product images.

¹³⁷ If products with larger percentages change over time had higher micro point scores (i.e. worse results), we would not be able to disentangle whether equal choice probabilities are the result of the absence of comparison behaviour or because some respondents compared the percentage change (and were more likely to choose the product with the larger change over time), while others compared the absolute results in micro points (and were more likely to choose the product with the lowest micro point score).

¹³⁸ $p = 0,248$.

4.3.2.2. Consumer responses to products with different types of PEF-based claims

Next, we examine how the type of PEF information displayed affects consumer responses to products that provide such information. More specifically, we examine the effect of the various PEF information types on the likelihood that a product with a PEF claim was selected in the choice task, the perceived attractiveness and environmental friendliness of the product, how much attention was paid to the environmental claims and their perceived credibility. After the choice tasks in which respondents made choices for three types of products (TVs, sport shoes and chocolate spreads), they were asked to rate, for *each* product in the last presented set, the perceived attractiveness of the product ("Overall, I find this product..." on a scale from (1) *unattractive* to (7) *attractive*), the perceived environmental friendliness of the product ("Compared to other [TVs], I think this TV is..." on a scale from (1) *bad for the environment* to (7) *good for the environment*; respondents could also select the "Don't know" option). Next, they were informed that (some of) the products had a sticker or label with information on the product's impact on the environment. They were asked to what extent they had looked at this information (studied it in detail, looked at it briefly, did not look at it at all) and to rate, for each product in the set that carried an environmental claim, the perceived credibility of that claim (on a scale from (1) *not credible* to (7) *credible*). Table 4.8 shows the results. Percentages (or means) with different superscripts in (sub) columns denote statistically significant differences ($p < 0,05$).

Statistical analyses were performed for each of the outcome measures with (1) the type of PEF information, (2) the share of products with PEF information (small vs. large), and (3) their interaction as predictors. The analysis of the choice data properly accounted for the number of products in the set which carry the same type of claim (so, differences in choice percentages for products with a certain type of claim cannot be explained by differences in the number of products with that type of claim).

The results revealed increased choice for a product with a PEF-based claim if this concerned a qualitative claim about a relevant impact category (14,9%) as compared to information on the contribution of different life cycle stages to the total (13,7%; see Table 4.8, bottom part). Other differences between types of PEF claims were not significant, and did also not depend on the share of products with PEF claims in the set.¹³⁹ In line with the findings on choice behaviour, products with PEF-based claims were perceived as most attractive ($M = 4,49$ on a 7-point scale) and most environmentally friendly ($M = 4,94$) if the PEF information was provided in the form of a qualitative statement about a relevant impact category, and least attractive ($M = 4,25$) and environmentally friendly ($M = 4,60$) if life cycle information was provided. These differences between information types were more pronounced when there were only few products with PEF-based information (of the same type) in the set (see Table 4.8).¹⁴⁰

¹³⁹ Main and interaction effects are non-significant: $ps > 0,29$.

¹⁴⁰ PEF information type x PEF share interaction: $p = 0,029$ (perceived environmental friendliness) and $p = 0,312$ (product attractiveness).

Table 4.8. Effects of type of PEF information for products with PEF-based claims

| Share of products with PEF claim | Type of PEF claim | Products with claim based on PEF method | | | | |
|----------------------------------|---|---|----------------------------------|--|--|---------------------------------------|
| | | Choice share | Product attractiveness (7-point) | Perceived environmental friendliness (7-point) | Attention to the claims (% studied in detail)* | Perceived claim credibility (7-point) |
| Small (2/6) | Qualitative claim about relevant impact category | 15,3% ^a | 4,56^a | 5,12^a | 36,6% ^a | 4,68 ^a |
| | Contribution of life cycle stages to the total | 13,8% ^a | 4,18 ^b | 4,48 ^c | 36,7% ^a | 4,53 ^a |
| | Percentage change over time | 13,7% ^a | 4,29 ^b | 4,82 ^b | 33,4% ^a | 4,50 ^a |
| | Percentage change over time + absolute results (micro points) | 13,6% ^a | 4,27 ^b | 4,77 ^b | 35,4% ^a | 4,54 ^a |
| Large (4/6) | Qualitative claim about relevant impact category | 14,7% ^a | 4,46 ^a | 4,85 ^a | 33,0% ^b | 4,56 ^a |
| | Contribution of life cycle stages to the total | 13,6% ^a | 4,28 ^a | 4,67 ^a | 28,6% ^b | 4,53 ^a |
| | Percentage change over time | 14,1% ^a | 4,41 ^a | 4,69 ^a | 39,7%^a | 4,48 ^a |
| | Percentage change over time + absolute results (micro points) | 14,1% ^a | 4,41 ^a | 4,81 ^a | 32,4% ^b | 4,49 ^a |
| Total | Qualitative claim about relevant impact category | 14,9%^a | 4,49^a | 4,94^a | 34,8% ^a | 4,60 ^a |
| | Contribution of life cycle stages to the total | 13,7% ^b | 4,25 ^b | 4,60 ^c | 32,6% ^a | 4,53 ^a |
| | Percentage change over time | 14,0% ^{ab} | 4,37 ^b | 4,73 ^b | 36,6% ^a | 4,48 ^a |
| | Percentage change over time + absolute results (micro points) | 14,0% ^{ab} | 4,36 ^b | 4,80 ^b | 33,9% ^a | 4,51 ^a |

Note – different superscripts – **(sub) column-wise** – indicate significant differences ($p < 0,05$).

* In the condition in which claims were not substantiated through the PEF method, 32,2% of respondents reported to have studied the environmental information in detail. This is not significantly different from any of the PEF information types ($p > 0,13$).

Which type of claims received most attention significantly depended on the number of products with PEF-based claims in the set.¹⁴¹ There were no differences in (self-reported) attention to the environmental claims between the different PEF information types when there were relatively few products with PEF-based claims in the assortment. However, when the share of products with PEF-based claims was larger, significantly more respondents paid close attention to the environmental claims when PEF information was provided as percentage change over time (39,7%) as compared to the other PEF information types (between 28,6% and 33,0%; see Table 4.8, middle

¹⁴¹ PEF information type x PEF share interaction: $p = 0,027$.

part). Finally, there were no significant differences in the perceived credibility of the different PEF information types.¹⁴²

Generality of the findings

Follow-up analyses were performed to gain insight into the generality of the observed differences in the impact of PEF-based claims (qualitative statement, relative contribution of different life cycle stages to the total, etc.) on choices for products with such claims. The analyses did not reveal significant differences between countries¹⁴³ or consumer groups (in terms of age¹⁴⁴, gender¹⁴⁵, educational level¹⁴⁶, financial situation¹⁴⁷, or environmental concern¹⁴⁸) in the impact of the different claim types. Yet, in general, products with PEF-based claims were significantly more likely to be chosen in Poland than in Germany and Sweden¹⁴⁹, by younger (vs. older) consumers¹⁵⁰, and by consumers with higher (vs. lower) environmental concern¹⁵¹. The choice for products with PEF-based claims did not depend on the respondent's gender¹⁵² or level of education¹⁵³.

4.3.2.3. Consumer responses to products with versus without PEF-based claims

The specific design of the experiment also allows us to examine whether consumer responses to products with claims that are substantiated through PEF differ from their responses to products that do not use PEF to substantiate claims, and their responses to products that do not make environmental claims at all. In addition, we investigate whether such differences in responses to products with PEF versus non-PEF claims (or no claims) depend on the specific type of PEF information that is provided.

Tables 4.9-4.15 show the average choice percentages, perceived product attractiveness, environmental friendliness and claim credibility per claim type (PEF vs. no-PEF vs. no claim), PEF information type (i.e. percentage change over time, qualitative statement, etc.), and assortment type (small vs. large share of products with PEF-based claims). Statistical analyses were performed to assess the extent to which these outcomes were explained by (1) whether the product carried a PEF claim, no-PEF claim, or no claim at all (claim type effect), (2) the type of PEF claim that was provided (PEF information type effect), and (3) the share of products with PEF-based claims within the set (PEF share effect) and all possible interactions between these factors. In Tables 4.9-4.15, percentages (or means) with different superscripts – row-wise – denote statistically significant differences ($p < 0,05$).

¹⁴² Main and interaction effects are non-significant: $ps > 0,23$.

¹⁴³ No significant PEF information type x country interaction: $p = 0,556$.

¹⁴⁴ No significant PEF information type x age interaction: $p = 0,499$ (age as continuous variable) and $p = 0,237$ (age as dichotomous variable: 18-42 years versus 43-70 years).

¹⁴⁵ No significant PEF information type x gender interaction: $p = 0,717$.

¹⁴⁶ No significant PEF information type x educational level (low, moderate, high) interaction: $p = 0,276$.

¹⁴⁷ No significant PEF information type x financial situation (5-point) interaction: $p = 0,280$.

¹⁴⁸ No significant PEF information type x environmental concern (low, moderate, high) interaction: $p = 0,094$.

¹⁴⁹ Significant main effect of country: $M = 15,5\%^a$ (Poland) vs. $M = 14,6\%^{ab}$ (Italy) vs. $M = 13,5\%^{bc}$ (Germany) vs. $M = 12,9\%^c$ (Sweden); $p < 0,001$.

¹⁵⁰ Significant main effect of age: $p < 0,001$ (age as continuous variable) and $p < 0,001$ (age as dichotomous variable): $M = 14,9\%$ (18-42 years) vs. $M = 13,3\%$ (43-70 years).

¹⁵¹ Significant main effect of environmental concern: $M = 13,5\%$ (low) vs. $M = 14,2\%$ (moderate) vs. $M = 14,3\%$ (high); $p = 0,001$.

¹⁵² No significant main effect of gender: $p = 0,430$.

¹⁵³ No significant main effect of educational level: $p = 0,643$.

Table 4.9. Average choice percentages

| Share of products with PEF claim | Type of PEF claim | Products with claim based on PEF method | Products with claim <i>not</i> based on PEF method | Products without environmental claim |
|----------------------------------|---|---|--|--------------------------------------|
| Small (2/6) | Qualitative claim about relevant impact category | 15,3%^a | 14,1%^{ab} | 12,3%^b |
| | Contribution of life cycle stages to the total | 13,8% ^a | 13,8% ^a | 12,5% ^a |
| | Percentage change over time | 13,7% ^a | 14,2% ^a | 14,6% ^a |
| | Percentage change over time + absolute results (micro points) | 13,6% ^a | 14,6% ^a | 13,2% ^a |
| | Average | 14,1% ^a | 14,2% ^a | 13,1% ^a |
| Large (4/6) | Qualitative claim about relevant impact category | 14,7% ^a | 12,8% ^a | 14,2% ^a |
| | Contribution of life cycle stages to the total | 13,6% ^a | 14,6% ^a | 14,6% ^a |
| | Percentage change over time | 14,1%^a | 16,1%^a | 11,6%^b |
| | Percentage change over time + absolute results (micro points) | 14,1% ^a | 13,1% ^a | 15,0% ^a |
| | Average | 14,2% ^a | 14,1% ^a | 13,8% ^a |
| Average | | 14,1% ^a | 14,2% ^a | 13,5% ^a |

Note – different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Effects on choice behaviour

The analysis results show that the relative attractiveness of products with PEF-based claims (versus products with no-PEF claims and no claims) significantly depends on the type of PEF information displayed and the share of products with such claims.¹⁵⁴ Averaged across all types of PEF information (qualitative claims, percentage change over time, etc.), there is no difference in choice shares between products with PEF claims (14,2%), products with claims not based on PEF (14,1%), and products without claims (13,5%; note that these choice shares can be directly compared; any influences of product characteristics other than the claims are ruled out by design, i.e. by the random pairing of product images with claims).

Yet, specific types of PEF information contributed to higher choice percentages for products with PEF-substantiated claims as compared to no claims. When PEF information was presented in the form of a qualitative statement about a relevant impact category, and there were relatively few products with PEF-based claims in the assortment, the choice probability was significantly higher for products with PEF claims (15,3%) than for products that did not carry environmental claims at all (12,3%; see Table 4.9). The difference with products with claims that are not based on the PEF

¹⁵⁴ The three-way interaction (Claim type x PEF information type x PEF share) is significant: $p = 0,012$.

method (14,1%) was not statistically significant, however. Similarly, when PEF information was presented as a percentage change over time – and there were relatively many products that provided PEF information in this manner – products without environmental claims (11,6%) were less likely to be selected than products with claims, regardless of whether or not the claim was based on the PEF method (14,1% and 16,1%, difference is not significant, see Table 4.9).

Other differences in choice shares (row-wise) are not statistically significant ($p > 0,05$). Thus, while – under certain specific conditions – a product with a PEF-based claim was more likely to be chosen than a product without an environmental claim, it was *not* more likely to be selected than a product with a non-PEF claim.

Generality of the findings

Follow-up analyses examined the extent to which the average choice shares of products with PEF-based claims, products with non-substantiated claims and products without environmental claims were different across countries and consumer groups.

The results revealed that the impact of the different types of claims (PEF claim, no-PEF claim, no claim) differed between countries.¹⁵⁵ Swedish respondents were more likely to choose products with non-substantiated claims than products with PEF-based claims, on average (see Table 4.10). In contrast, there were no differences in average choice percentages for the various claim types in Germany, Poland and Italy.

Whether consumers were more likely to opt for a product with a PEF-substantiated claim also depended on their level of environmental concern¹⁵⁶ and gender¹⁵⁷. For consumers with low environmental concern and for male consumers, choices were independent of the presence and type of claim (see Table 4.11 and Table 4.12). Thus, in these groups, products with PEF-based claims were equally likely to be selected as products with no-PEF claims and products without claims. Consumers with higher levels of environmental concern and female consumers, in contrast, were more likely to choose a product if it had an environmental claim. However, they were not more likely to choose a product with a PEF-based claim than a product with a claim not based on the PEF method.

The impact of the different claim types on choice behaviour did not depend on age¹⁵⁸, financial situation¹⁵⁹ or level of education¹⁶⁰.

¹⁵⁵ Significant claim type x country interaction: $p = 0,041$.

¹⁵⁶ Significant claim type x environmental concern (low, moderate, high) interaction: $p = 0,042$.

¹⁵⁷ Significant claim type x gender interaction: $p = 0,047$.

¹⁵⁸ No significant claim type x age interaction: $p = 0,411$ (age as continuous variable) and $p = 0,395$ (age as dichotomous variable: 18-42 years vs. 43-70 years).

¹⁵⁹ No significant claim type x financial situation (5-point) interaction: $p = 0,703$.

¹⁶⁰ No significant claim type x educational level interaction (low, moderate, high): $p = 0,969$.

Table 4.10. Average choice percentages depend on country

| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim |
|---------|---|--|--------------------------------------|
| Germany | 13,5% ^a | 12,5% ^a | 12,4% ^a |
| Poland | 15,5% ^a | 14,8% ^a | 14,1% ^a |
| Italy | 14,6% ^a | 14,6% ^a | 13,5% ^a |
| Sweden | 12,9% ^b | 14,7% ^a | 13,8% ^{ab} |

Note – different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Table 4.11. Average choice percentages depend on environmental concern

| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim |
|------------------|---|--|--------------------------------------|
| Low concern | 13,0% ^a | 13,8% ^a | 14,1% ^a |
| Moderate concern | 14,8% ^a | 14,1% ^{ab} | 13,2% ^b |
| High concern | 14,7% ^a | 14,7% ^a | 13,1% ^b |

Note – different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Table 4.12. Average choice percentages depend on gender

| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim |
|--------|---|--|--------------------------------------|
| Male | 13,9% ^a | 13,8% ^a | 14,2% ^a |
| Female | 14,3% ^a | 14,5% ^a | 12,8% ^b |

Note – different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Effects on product perceptions

Figure 4.2 and Table 4.13 show the relative (rated) attractiveness of products with PEF-based claims, products with claims not based on PEF, and products with no claims at all. As predicted, the relative attractiveness of the three product types depended on the share of products with PEF-based claims in the assortment.¹⁶¹ Yet, the differences are small in absolute terms. On average, products with PEF-substantiated and non-substantiated claims were perceived as equally attractive, and more attractive than products without environmental claims, if there were relatively few products with PEF-substantiated claims in the assortment. However, if the share of products with PEF-based claims was relatively large, products with PEF-based claims were considered more attractive, on average, than products with non-substantiated claims (see Figure 4.2). Products without environmental claims remained the least attractive.

¹⁶¹ The claim type x PEF share interaction is significant: $p = 0,029$.

Table 4.13. Effects on product attractiveness (7-point)

| Share of products with PEF claim | Type of PEF claim | Products with claim based on PEF method | Products with claim <i>not</i> based on PEF method | Products without environmental claim |
|----------------------------------|---|---|--|--------------------------------------|
| Small (2/6) | Qualitative claim about relevant impact category | 4,56 ^a | 4,46 ^a | 4,30 ^b |
| | Contribution of life cycle stages to the total | 4,18 ^{ab} | 4,21 ^a | 4,03 ^b |
| | Percentage change over time | 4,29 ^a | 4,34 ^a | 4,20 ^a |
| | Percentage change over time + absolute results (micro points) | 4,27 ^a | 4,30 ^a | 4,04 ^b |
| | Average | 4,33 ^a | 4,33 ^a | 4,14 ^b |
| Large (4/6) | Qualitative claim about relevant impact category | 4,46^a | 4,22^b | 4,24 ^b |
| | Contribution of life cycle stages to the total | 4,28 ^a | 4,21 ^{ab} | 4,14 ^b |
| | Percentage change over time | 4,41 ^a | 4,32 ^{ab} | 4,22 ^b |
| | Percentage change over time + absolute results (micro points) | 4,41 ^a | 4,42 ^a | 4,37 ^a |
| | Average | 4,39^a | 4,29^b | 4,24 ^b |
| Average | | 4,37 ^a | 4,32 ^a | 4,19 ^b |

Note - Perceived product attractiveness (7-point): 1 = unattractive, 7 = attractive. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

The difference in perceived attractiveness between products with PEF-based claims and products with non-substantiated environmental claims did not significantly depend on the specific type of PEF information that was provided (see Table 4.10).¹⁶² Yet, further analysis revealed that the higher attractiveness of products with PEF-based claims versus non-substantiated claims in assortments in which relatively many products carried PEF-based claims was mainly driven by a higher attractiveness of products with PEF-substantiated qualitative statements (versus non-substantiated qualitative statements; see Table 4.13).

¹⁶² The claim type x PEF information type interaction is not significant ($p = 0,109$), nor is the claim type x PEF information type x PEF share interaction ($p = 0,579$).

Figure 4.2. Effects on product attractiveness

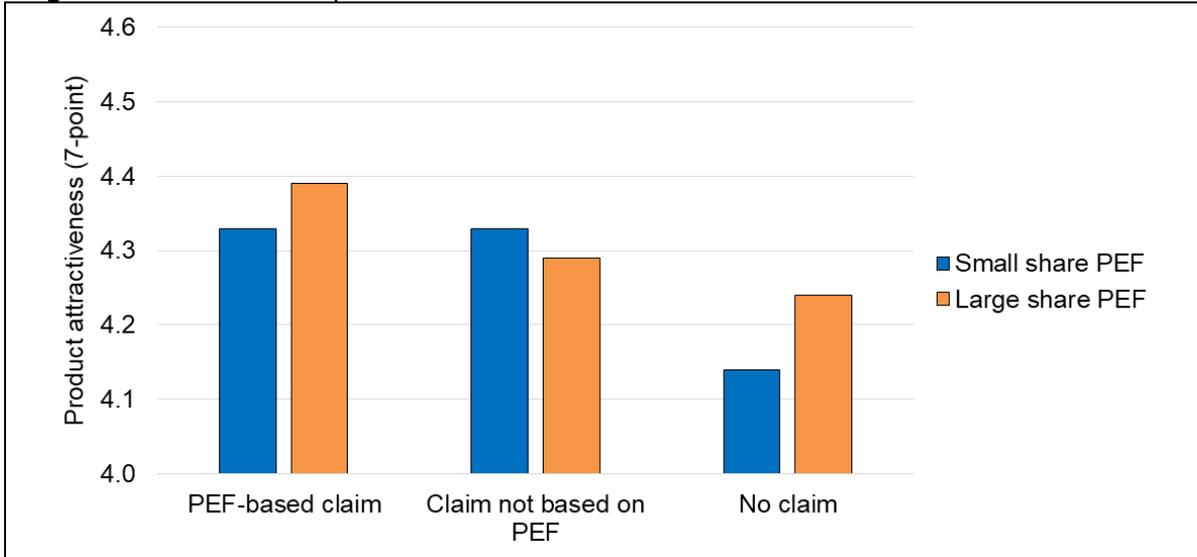
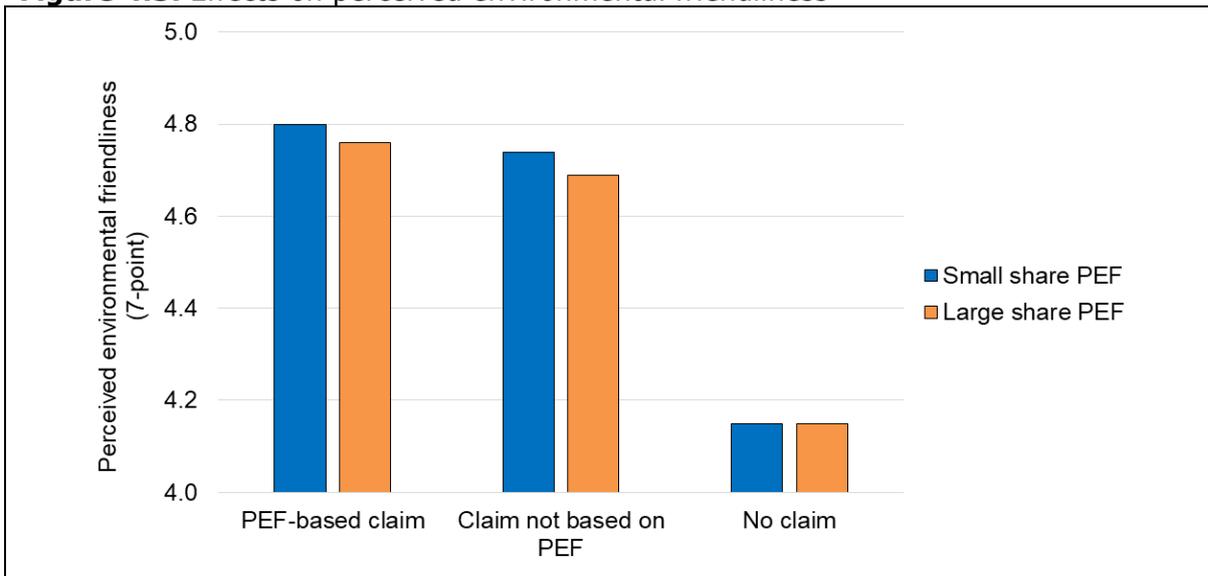


Table 4.14 and Figure 4.3 show that respondents perceived products with PEF-based claims as more environmentally friendly, on average, as compared to products with non-substantiated claims.¹⁶³ The difference is statistically significant, albeit small, and exists independent of the share of products with PEF-substantiated claims in the assortment (see Figure 4.3).¹⁶⁴ Furthermore, this difference in perceived environmental friendliness of products with PEF-substantiated versus non-substantiated claims was largest, on average, when PEF information was provided in the form of qualitative claims about a relevant impact category or expressed as a percentage change over time (see Table 4.14).¹⁶⁵ When the PEF information was presented as the relative contribution of the different life cycle stages to the total, products with PEF-based claims were not perceived as more environmentally as compared to products with non-substantiated claims.

Figure 4.3. Effects on perceived environmental friendliness



¹⁶³ Effect of claim type: $p < 0,001$.

¹⁶⁴ The claim type x PEF share interaction is not significant ($p = 0,996$), nor is the claim type x PEF information type x PEF share interaction ($p = 0,399$).

¹⁶⁵ The claim type x PEF information type interaction is significant: $p < 0,001$.

Table 4.14. Perceived environmental friendliness

| Share of products with PEF claim | Type of PEF claim | Products with claim based on PEF method | Products with claim <i>not</i> based on PEF method | Products without environmental claim |
|----------------------------------|---|---|--|--------------------------------------|
| Small (2/6) | Qualitative claim about relevant impact category | 5,12 ^a | 4,96 ^b | 4,34 ^c |
| | Contribution of life cycle stages to the total | 4,48 ^a | 4,57 ^a | 4,07 ^b |
| | Percentage change over time | 4,82 ^a | 4,67 ^b | 4,10 ^c |
| | Percentage change over time + absolute results (micro points) | 4,77 ^a | 4,74 ^a | 4,08 ^b |
| | Average | 4,80^a | 4,74^b | 4,15^c |
| Large (4/6) | Qualitative claim about relevant impact category | 4,85 ^a | 4,77 ^a | 4,09 ^b |
| | Contribution of life cycle stages to the total | 4,67 ^a | 4,73 ^a | 4,19 ^b |
| | Percentage change over time | 4,69 ^a | 4,62 ^a | 4,12 ^b |
| | Percentage change over time + absolute results (micro points) | 4,82 ^a | 4,67 ^b | 4,20 ^c |
| | Average | 4,76^a | 4,69^b | 4,15^c |
| Average | | 4,77^a | 4,73^b | 4,15^c |

Note - Perceived environmental friendliness (7-point): 1 = bad for the environment, 7 = good for the environment. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Effects on claim perceptions

Finally, we examine how types of claims and types of PEF information influenced the perceived credibility of the claim (Table 4.15). The analysis revealed very small, but statistically significant, differences in the perceived credibility of PEF-based versus non-substantiated claims¹⁶⁶: Claims based on the PEF method were considered slightly more credible, on average (4,53 versus 4,50 on a 7-point scale; see Table 4.15). The perceived credibility of PEF-based versus non-substantiated claims did not significantly depend on the specific type of PEF claim used or the share of products with PEF claims in the product assortment.¹⁶⁷

¹⁶⁶ Effect of claim type: $p = 0,001$.

¹⁶⁷ Effects of (and interactions with) PEF information type and PEF share are not significant: $ps > 0,37$.

Table 4.15. Perceived claim credibility

| Share of products with PEF claim | Type of PEF claim | Claim based on PEF method | Claim <u>not</u> based on PEF method |
|----------------------------------|---|---------------------------|--------------------------------------|
| Small (2/6) | Qualitative claim about relevant impact category | 4,68 ^a | 4,62 ^a |
| | Contribution of life cycle stages to the total | 4,53 ^a | 4,50 ^a |
| | Percentage change over time | 4,50 ^a | 4,48 ^a |
| | Percentage change over time + absolute results (micro points) | 4,54 ^a | 4,44 ^b |
| | Average | 4,56^a | 4,51^b |
| Large (4/6) | Qualitative claim about relevant impact category | 4,56 ^a | 4,53 ^a |
| | Contribution of life cycle stages to the total | 4,53 ^a | 4,49 ^a |
| | Percentage change over time | 4,48 ^a | 4,42 ^a |
| | Percentage change over time + absolute results (micro points) | 4,49 ^a | 4,43 ^a |
| | Average | 4,51^a | 4,47^b |
| Average | | 4,53^a | 4,50^b |

Note - Perceived claim credibility (7-point): 1 = not credible, 7 = credible. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Together, these results show that the information that the result is calculated based on the EU PEF method has positive, yet very small, effects on the perceived credibility of the claim and the perceived environmental friendliness of the product. It also enhances the attractiveness of the product, but only when relatively many products carry PEF-based claims. Albeit statistically significant, the differences are small in absolute terms, however, which might explain why they did not result in observable shifts in choice behaviour.

Generality of the findings

It was demonstrated earlier that the effects of the presence and type of claim (based vs. not based on PEF) on choice behaviour differed between countries, between consumers with higher versus lower levels of environmental concern, and between men and women. Here, we present the results of follow-up analyses that examined the extent to which products with claims based versus not based on PEF were perceived differently across these groups.

There were significant differences in the perceived credibility of PEF and non-PEF claims (see Table 4.18)¹⁶⁸, and the perceived environmental friendliness (see Table

¹⁶⁸ Significant claim type x environmental concern (low, moderate, high) interaction: $p < 0,001$.

4.17)¹⁶⁹ and attractiveness (see Table 4.16)¹⁷⁰ of products with different claim types between consumer groups with lower versus higher levels of concern for the environment. Consistent with the choice results, we observe that for consumers with low environmental concern, perceived attractiveness of the product is not influenced by the presence or type of environmental claim. These consumers do believe that products with environmental claims – independent of whether these are based on PEF – are more environmentally friendly compared to products without such claims, but do not consider PEF-based claims more credible than non-substantiated claims. Consumers with high environmental concern, in contrast, do not only perceive products with environmental claims as more environmentally friendly than products without such claims, they also perceive PEF-substantiated claims as more credible than non-substantiated claims, and products with PEF claims as more environmentally friendly as compared to products with claims that are not based on PEF. This ability to distinguish between PEF and non-PEF claims is not reflected in their evaluation of the products, however. Here, we observe a similar pattern of results as for product choice: Products with environmental claims are perceived as more attractive as compared to products without such claims, independent of the whether or not the claims is based on the PEF method.

Furthermore, there were significant differences between men and women in the perceived environmental friendliness of products with versus without environmental claims.¹⁷¹ Whereas both groups perceived products with environmental claims as better for the environment as compared to products without such claims, the difference was larger for men than for women (see Table 4.18). The relative attractiveness of products with different claim types, and the perceived credibility of PEF versus non-PEF claims did not significantly depend on gender.¹⁷² There were also no significant differences between countries in the perceived attractiveness and environmental friendliness of products with different claim types, or the perceived credibility of PEF versus non-PEF claims.¹⁷³

Table 4.16. Effects on product attractiveness (7-point) per level of environmental concern

| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim |
|----------------|---|--|--------------------------------------|
| Low concern | 4,41 ^a | 4,36 ^a | 4,35 ^a |
| Medium concern | 4,33 ^a | 4,26 ^a | 4,15 ^b |
| High concern | 4,36 ^a | 4,34 ^a | 4,04 ^b |

Note - Perceived product attractiveness (7-point): 1 = unattractive, 7 = attractive. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

¹⁶⁹ Significant claim type x environmental concern (low, moderate, high) interaction: $p < 0,001$.

¹⁷⁰ Significant claim type x environmental concern (low, moderate, high) interaction: $p < 0,001$.

¹⁷¹ Significant claim type x gender interaction: $p < 0,001$.

¹⁷² No significant claim type x gender interactions: $p = 0,489$ (product attractiveness) and $p = 0,173$ (claim credibility).

¹⁷³ No significant claim type x country interactions: $p = 0,207$ (product attractiveness), $p = 0,513$ (perceived environmental friendliness) and $p = 0,988$ (claim credibility).

Table 4.17. Effects on perceived environmental friendliness (7-point) and claim credibility (7-point) per level of environmental concern

| | Perceived environmental friendliness of the product (7-point) | | | Perceived credibility of the claim (7-point) | |
|------------------|---|--|--------------------------------------|--|--|
| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method |
| Low concern | 4,82 ^a | 4,77 ^a | 4,58 ^b | 4,48 ^a | 4,50 ^a |
| Moderate concern | 4,74 ^a | 4,75 ^a | 4,02 ^b | 4,47 ^a | 4,49 ^a |
| High concern | 4,75 ^a | 4,65 ^b | 3,78 ^c | 4,67 ^a | 4,51 ^b |

Note - Perceived environmental friendliness (7-point): 1 = bad for the environment, 7 = good for the environment) and perceived claim credibility (7-point): 1 = not credible, 7 = credible. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

Table 4.18. Effects on perceived environmental friendliness (7-point) per gender

| | Products with claim based on PEF method | Products with claim <u>not</u> based on PEF method | Products without environmental claim |
|--------|---|--|--------------------------------------|
| Male | 4,84 ^a | 4,80 ^b | 4,07 ^c |
| Female | 4,70 ^a | 4,65 ^b | 4,23 ^c |

Note - Perceived environmental friendliness (7-point): 1 = bad for the environment, 7 = good for the environment. Different superscripts – **row-wise** – indicate significant differences ($p < 0,05$).

5. Conclusion and discussion

In response to an increasing consumer interest in accurate and understandable information about the environmental aspects of the products they purchase, a common method for calculating the environmental impact of a product, the PEF method, was developed. Calculations based on this method generate results on 16 environmental impact categories, reflecting the PEF profile of the product. The present study aimed to provide insight into the most effective way(s) of communicating the PEF profile to consumers.

Two large online experiments and an eye-tracking study examined the impact of various types and combinations of PEF information elements on consumer responses. Experiment 1 focused on products for which product-specific Product Environmental Footprint Category Rules (PEFCRs) are available. PEFCRs provide detailed guidance on how to conduct a PEF study for a product within that specific product category. They enable comparisons of the PEF results to a benchmark, allowing for the communication of a product's relative PEF performance. Experiment 2 focused on products that are not in the scope of PEFCRs. In that case, results of a PEF study employing the umbrella method can be used to substantiate environment-related product claims. Due to different methodological choices different users may take in this case, PEF results are not comparable across products, however.

5.1. Products covered by PEFCRs

Experiment 1 revealed that PEF information was effective in guiding choices towards more environmentally friendly alternatives. Providing PEF information resulted in a 11,5 percent point increase in the choice for products with above-average PEF performance across the consumer sample (from 24,3% to 35,8%). Providing PEF information was most effective in guiding choice behaviour of consumers with high concern for the environment (19,5 percent point increase in choice for products with above-average PEF performance), but also encouraged more environmentally friendly choices among groups with low and moderate levels of environmental concern (+5,4 and +10,1 percent point, respectively).

5.1.1. Which combination of information elements is most effective?

Table 5.1 provides an overview of all (combinations of) PEF information elements that were tested in the first online experiment. Importantly, the results revealed that *each* of the tested combinations was effective in guiding choices towards products with smaller footprints. Also, the PEF information was generally well understood, perceived as useful and relevant, and trusted to be accurate (average ratings were above the mid-point of the response scale for all PEF label types tested). These results confirm that consumers generally prefer to buy products that are environmentally friendly and use information about the environmental performance of products in their choice process if this information is readily available to them.

Some PEF information combinations were more effective than others, however. Table 5.1 presents the integrated results on the range of outcome measures for all of the tested combinations. The green and red colours used in the table do not indicate good and bad performance per se, but the performance of the specific PEF information combination relative to the other alternatives that were included in the test. Green shaded outcomes indicate best performing PEF labels, red shaded outcomes indicate

worst performing PEF labels, and non-shaded outcomes reflect average performance.¹⁷⁴ Finally, outcomes shaded grey indicate that the performance of that PEF label was neither significantly different from the best, nor from the worst performing label(s). The table clearly shows that each of the PEF information combinations has positive as well as negative aspects. Interestingly, the PEF labels that are most effective in guiding choices towards more environmentally friendly product alternatives generally have lower scores on understanding and evaluation, and vice versa. Formulating recommendations regarding the most effective combination of PEF information is therefore difficult as it requires a prioritisation of these performance aspects.

Effects on choice behaviour

If the primary purpose of communicating PEF information is to promote more environmentally friendly choices, the best strategy – according to Table 5.1 – is to complement **overall PEF performance information** with more detailed information describing the **most relevant impact categories or life cycle stages** (relative contribution to the total footprint). Adding further information in the form of a qualitative statement again reduced the label's effectiveness in encouraging environmentally friendly choices; it may have made the label too complex. It is not very clear, however, *why* information about the most relevant impact categories or life cycle stages increases choice for products with a better *overall* PEF performance. The idea was that the overall PEF score might be rather abstract to consumers, and that providing more detail regarding which types of impacts contribute most to the overall performance may help consumers to better understand the overall PEF score, which in turn would increase the likelihood that the information is being used in decision-making. The current findings do not support this explanation, however. Self-reported understanding of the information on the label was lower rather than higher, and evaluation of the information more negative rather than more positive, if the label contained more detailed information on the most relevant impact categories or life cycle stages.

An alternative explanation for the pattern of findings for PEF labels including information on the most relevant impact categories relates to the colour scheme used. Labels that include sub scores on impact categories display more 'green' if the product performs well, and it could be that consumers are simply attracted to products with good scores (i.e. literally a 'greener' label), independent of their precise meaning. This might explain why, if impact category information was provided, increased choice for products with good overall PEF performance went hand in hand with reduced subjective comprehension levels. However, the fact that we observe the same pattern of results for a PEF label that simply lists the three most relevant impact categories, without sub scores, renders this explanation unlikely. A more convincing explanation relates to the concreteness of the information. Research has shown that environmental messages are generally more persuasive if they present more concrete information about *how* the product actually contributes to environmental well-being.¹⁷⁵ By providing more specific information regarding which impact categories and/or life

¹⁷⁴ The table shows the results of the *statistical* analyses of the differences between the various label types. Multiple combinations may be shaded green (or red) if the difference in their performance on that aspect is not significant (i.e. differences may be due to chance).

¹⁷⁵ Davis, J. J. (1993). Strategies for environmental advertising. *Journal of Consumer marketing*, 10(2), 19-36; Chan, R. Y. (2000). The effectiveness of environmental advertising: the role of claim type and the source country green image. *International Journal of Advertising*, 19(3), 349-375.

cycle stages contribute most the overall PEF performance of products, the overall performance information may become more meaningful to consumers, and therefore more influential in their product choices. At the same time, comprehensibility of the information may decrease due to increased complexity. If this indeed accounts for the findings, the effectiveness of the information in encouraging environmentally friendly product choices could be contingent on the meaningfulness of the displayed impact categories to consumers. For the three tested product types, climate change was the most relevant impact category, which is one of the main environmental concerns among European citizens.¹⁷⁶ Yet, other impact categories, such as acidification (which was included in the PEF label for laundry detergents) and eutrophication, may be less well-known and hence less meaningful to consumers. If providing more detailed information increases the likelihood that the overall PEF score is considered in purchasing decisions because it makes the PEF score more meaningful, the effect is expected to be present only if the impact categories themselves are understood and meaningful to consumers.

Finally, the positive impact of certain types of PEF labels on environmentally friendly choices may also be driven, at least partly, by better attention-grabbing capabilities of the respective labels. Labels with more information generally have a higher likelihood of being looked at, which might explain their better performance in encouraging environmentally friendly choices. While there were no differences in the share of respondents that reported to have looked at the PEF information in detail between label types, the results of the eye-tracking study demonstrated that the label showing the relative contribution of the different life cycle stages, and – albeit to a lesser extent – the labels including sub scores, were better able to grab attention than labels that only displayed overall performance information, which may be (partly) explained by their larger size. In particular for the label displaying information on the relative contribution of the different life cycle stages to the total, which relatively few consumers considered useful to have on the PEF label, this attention explanation cannot be ruled out (see Table 5.1).

Perceived usefulness of information elements

In the survey, consumers were also directly asked which of the elements they would like to see on a PEF label, if such a label were to be used on products in stores. Only two label elements were selected by a majority of consumers: (1) the **overall performance score** (71%) and (2) information on the **most relevant impact categories** (55%). While the strong preference for overall performance information on the label did not depend on how this information was provided, on a three-level scale (70%) or (additionally) expressed as a percentage (71%), impact category information only received support from a majority of consumers if the product's scores on the most relevant impact categories were included as well (59%, versus 42% if sub scores were not provided). Information about the relative contribution of the different life cycle stages (e.g. raw materials, production, distribution, etc.) to the total and qualitative statements about a relevant impact category (e.g. "This product leads to reduced emission of greenhouse gases comparable to charging your mobile phone 400 times") or life cycle stage (e.g. "Grape growing accounts for about 50% of the environmental footprint of wines. We reduce our impact by growing our grapes in a more environmentally friendly way") were all considered useful to have on the label by only about 4 out of 10 consumers.

¹⁷⁶ European Commission (2017). Special Eurobarometer 468: Attitudes of European citizens towards the environment.

All in all, the combination of overall PEF performance on a three-level scale and more specific information on the most relevant impact categories thus seems most effective. These information elements are considered useful to have on a PEF label by the majority of consumers and together they effectively encourage consumers to choose products with better-than-average PEF performance.

Effects on objective and subjective understanding

A secondary objective of PEF information is to inform consumers about the environmental performance of products to enable product comparisons on this aspect and promote well-informed purchase decisions. Consumers should be able to correctly understand and use the information to distinguish between products with better versus worse PEF performance. On average, about 6 in 10 respondents were able to accurately identify above-average and below-average performing products in a product assortment when overall performance information was displayed on a three-level scale. About half of the respondents accurately identified single best or worst performing product when the overall PEF score was additionally expressed as a percentage. The remaining respondents often selected the second-best or second-worst performing product (14%), which suggests that they just didn't search well enough¹⁷⁷, or indicated not to know the answer (14%). 1 in 10 consumers selected the worst performing alternative when they were asked to find the best performing one, or vice versa. These consumers might have misinterpreted 'higher' scores as reflecting larger environmental footprints.¹⁷⁸ While the differences in objective comprehension across label types were small, the simpler overall performance labels were considered easier to understand than the labels with more detailed information.

Thus, while the combination of the two elements perceived as most useful by consumers, namely overall performance information and information on the most relevant impact categories, outperformed the other combinations in promoting environmentally friendly choices, this combination is not considered the most easy to understand. Simpler label types showing only overall performance information were considered clearer. Consumers also reported to find it more difficult to find best or worst performing products if the label contained sub scores on the most relevant impact categories. These sub scores provide additional comparative information that cannot be understood at a glance: It requires some cognitive effort to understand how the sub scores relate to overall scores and to understand which information should be used to identify the best (or worst) performing product overall, which may explain the lower levels of subjective understanding and higher product identification difficulty.

Importantly, however, *objective* understanding was not lower for labels with sub scores as compared to simpler overall performance labels. Thus, while consumers experienced more difficulty finding the best or worst performing product if sub scores were present (versus absent), the percentage of accurate product identifications did not significantly decrease.

¹⁷⁷ In the experiment, respondents had to take a closer look at a product (by clicking on it) to be able to read the information on the PEF label. In order to compare PEF information on all products, they had to do this for each product.

¹⁷⁸ To avoid that the question itself caused confusion, respondents were asked to select the "most environmentally friendly" product, rather than the product with the "smallest environmental footprint".

Table 5.1. PEF label types included in Experiment 1 and their *relative* performance

| Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | |
|--|--------------------------------|---|--------------------------------|---|--------------------------------|
| | | Indication of most relevant impact categories | | Scores on most relevant impact categories | |
| | Choice | | Choice | | Choice |
| | Attention | | Attention | | Attention |
| | Objective understanding | | Objective understanding | | Objective understanding |
| | Ease of product identification | | Ease of product identification | | Ease of product identification |
| | Subjective understanding | | Subjective understanding | | Subjective understanding |
| | Evaluation | | Evaluation | | Evaluation |
| | Trust | | Trust | | Trust |
| Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | |
| Percentage relative to the average | | Percentage relative to the average | | Percentage relative to the average | |
| | | Scores on most relevant impact categories | | Scores on most relevant impact categories | |
| | | | | Qualitative statement about impact category | |
| | Choice | | Choice | | Choice |
| | Attention | | Attention | | Attention |
| | Objective understanding | | Objective understanding | | Objective understanding |
| | Ease of product identification | | Ease of product identification | | Ease of product identification |
| | Subjective understanding | | Subjective understanding | | Subjective understanding |
| | Evaluation | | Evaluation | | Evaluation |
| | Trust | | Trust | | Trust |
| Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | | Overall PEF performance on three-level scale | |
| Percentage relative to the average | | Percentage relative to the average | | Percentage relative to the average | |
| Qualitative statement about impact category | | Qualitative statement about life cycle stage | | Percentage contribution of life cycle stages to the total | |
| | Choice | | Choice | | Choice |
| | Attention | | Attention | | Attention |
| | Objective understanding | | Objective understanding | | Objective understanding |
| | Ease of product identification | | Ease of product identification | | Ease of product identification |
| | Subjective understanding | | Subjective understanding | | Subjective understanding |
| | Evaluation | | Evaluation | | Evaluation |
| | Trust | | Trust | | Trust |

Effects on trust

Consumers generally trusted the PEF information (trust ratings were above 5 on a 7-point scale for all label alternatives). However, some information combinations were trusted more than other combinations. The simplest PEF label showing only overall performance information on a three-level scale and the label with a qualitative claim about a relevant life cycle stage were trusted most, while the simple label with overall performance additionally expressed as a percentage and the label displaying overall performance information on a three-level scale and as a percentage and sub scores on the most relevant impact categories were trusted the least (see Table 5.1). It seems that consumers have less trust in the accuracy of the information if the information is highly specific (e.g. 52% better than average), potentially because they cannot see how such a precise result can be calculated. The relatively low level of trust in the label with a three-level scale, percentage and sub scores goes hand in hand with relatively poor performance on most other outcome measures (see Table 5.1). If multiple comparative indicators are presented on the same label, more cognitive effort is required to understand how to use the different types of information for product comparisons. Having three types of comparative indicators (three-level scale, percentage and sub scores) on the same label may be too much to process for the average consumer, depressing consumer responses to this label type across a wide range of outcomes, including trust.

Most promising information strategies

Based on the integrated results in Table 5.1, we identify two different information strategies that may work well. If environmentally friendly choice behaviour is the primary objective of communicating PEF information, the combination of overall performance information on a three-level scale and information on the most relevant impact categories (with or without sub scores) seems most promising. Further research could examine how the visual format of this element combination can be improved to enhance understanding and evaluation of the information. The present study suggests that expressing the impact category information in more natural language (changing "*BETTER: Resource use, fossils*" into "*LESS use of fossil resources*", for instance) does not facilitate understanding of the information. However, the impact categories included in the test were not the most difficult to understand to begin with, which may explain why using simplified language did not help much. Using simplified wording may be more helpful, and perhaps even crucial, for more difficult to understand categories, such as "ionizing radiation" or "eutrophication".

A second promising strategy would be to only communicate overall PEF performance information, and look for ways to increase the information's impact on choice behaviour. PEF labels including only overall performance information were considered most easy to understand and useful, and well performing products were most easy to find if this type of label was presented. The strong benefit of communicating overall performance information both on a three-level scale and as a percentage is that this enables consumers to further distinguish between products falling in the same broad category (better, average, worse). While adding such more specific overall performance information reduced understanding of the more elaborate PEF labels with sub scores, it did not harm the comprehensibility of the information in the simpler overall performance label (see Table 5.1). However, it decreased consumers' trust in the accuracy of the information, which may be due to the high specificity of the information.

If the increased attention-grabbing capabilities of more elaborate PEF labels indeed explain part of their impact on choice behaviour, increasing the visual salience of the overall performance label (e.g. by making it larger or visually stand out more) might increase its effectiveness in guiding choice behaviour. However, increasing attention to the information alone may not be sufficient. Additional interventions may be required to increase the meaningfulness of the rather abstract PEF score to consumers. As an example, the present study revealed that the effectiveness of PEF information strongly increased when consumers were informed about the availability of this information and it was explained to them how the PEF score is calculated prior to exposure to the product assortments. This pre-information resulted in strong increases in attention to the PEF labels (the percentage of respondents who reported to have studied the information in detail rose from about 35% to about 50%), higher levels of understanding, perceived relevance and perceived trustworthiness of the information, higher trust in the accuracy of the information, and more choices for environmentally friendly alternatives (the choice share of the best performing product rose from about 20% to about 32%). Thus, communicating simple PEF information in the form of an overall performance score may work well if it is combined with other communication strategies that focus on increasing attention to the PEF information and enhancing its meaningfulness to consumers.

Finally, qualitative statements appeared to have little effect on consumers' responses to products and PEF labels. Adding such statements did not contribute to better outcomes, but generally didn't hurt the effectiveness of the label either.

5.1.2. Effectiveness of PEF information: country and consumer differences

Responses to PEF information significantly depended on socio-demographic factors. Self-reported understanding of PEF information was higher among younger (vs. older) consumers, consumers with a better (vs. worse) financial situation, and – in some cases – higher among women (vs. men). Self-reported understanding of PEF information did not depend on the level of education, but objective comprehension was consistently higher for higher (vs. lower) educated consumers. While certain consumer groups considered PEF information more difficult to understand than others, the impact of the presence and type of PEF information on understanding and choice behaviour did not significantly depend on socio-demographic factors (age, gender, financial situation, level of education).

We did observe strong differences in the overall impact of PEF information and the relative effectiveness of different types and combinations of PEF information between consumers with higher versus lower levels of concern for the environment, however. Not surprisingly, PEF information was most effective in promoting environmentally friendly choice behaviour among consumers with high concern for the environment. For these consumers, *all* combinations of PEF information were effective in guiding choices towards environmentally friendly alternatives. Labels that included information on the most relevant impact categories (particularly those *without* sub scores) increased choice for products with above-average PEF performance most: 51% of environmentally concerned consumers selected a product with above-average PEF performance if this information was provided. For consumers with lower environmental concern, only specific types of PEF information resulted in more environmentally friendly product choices. These consumers were not encouraged to choose a product with better-than-average PEF performance if the label only presented overall PEF performance information, but also not if the label was too elaborate (i.e. including overall performance as a percentage, sub scores and a qualitative statement). Among

this group, none of the label types that allowed for the identification of the single best performing product in the assortment effectively encouraged choice for that product.

We did not observe strong differences in the impact of the presence and type of PEF information across countries. The PEF information was effective in guiding choice behaviour towards products with better PEF scores in all of the surveyed countries, except Germany. German respondents also reported lower levels of environmental concern, on average, than respondents from other countries.

5.1.3. Effectiveness of PEF information: presence of other labels

It was also examined to what extent the effectiveness of PEF information is affected by the presence of other environment-related labels, namely the organic logo and the EU Ecolabel. In the experiment, the organic logo was presented on a product with an average PEF performance, and the EU Ecolabel on the product with the best PEF performance. The choice shares of the product with best PEF performance and the organic product with average PEF performance were unaffected by the presence (vs. absence) of the organic logo. Also, the extent to which consumers understood, valued and trusted the PEF information did not depend on the presence of the organic logo.

Furthermore, if PEF information was available, the presence of the EU Ecolabel on the product with the best PEF score did not further increase (or decrease) the likelihood that this product was chosen. Compared to the situation in which only PEF information was available to respondents, the simultaneous display of a good PEF score and EU Ecolabel slightly depressed self-reported understanding and evaluation of the PEF information, but slightly increased trust in the accuracy of this information. When asked to what extent they perceived some or all of the environment-related information as redundant, a majority of respondents (62%) indicated to consider none of the information redundant. Among the remainder of respondents, the perceived information redundancy was higher for the EU Ecolabel (27%) than for the PEF information (5%), which could be due to the fact that the PEF information is more informative regarding products that are not “best in class” in terms of environmental performance. In other words, whereas products either have an EU Ecolabel or not, PEF information allows for a more fine-grained assessment of the relative environmental performance of different products, especially when the PEF score is expressed as a percentage relative to the average.

5.2. Products not covered by PEFCRs

Experiment 2 examined the influence of the presence and type of PEF information for products that are not covered by existing PEFCRs. The primary objective of this experiment was to provide insight into how consumers react to claims that are substantiated using the PEF method versus claims that are not, and whether this depends on the specific type of PEF-based claim that is provided.

5.2.1. Effects of claims based versus not based on the PEF method

Results from available life cycle assessments (LCAs) were used to ensure that the PEF information presented in the experiment reflected relevant environmental impacts. The non-PEF claims, in contrast, were qualitative statements about *less* relevant impacts (e.g. *We do our very best to contribute to a better world. 80% of this shoe box is made from recycled cardboard*). Table 5.2 provides an overview of the results. The left side of the table shows the integrated results for the comparison between relevant claims based on the PEF method and less relevant claims not based on PEF.

Again, the green and red colours indicate the performance of each alternative relative to the other alternative (non-shaded outcomes indicate no difference in performance).

Table 5.2. Claim types included in Experiment 2 and their *relative* performance

| Type of claim (based versus not based on PEF) | | Type of PEF-based claim | | | |
|---|--------------------------------------|--|-------------------------|---|-------------------------|
| 1. Claim based on PEF | | 1A. Qualitative claim about relevant impact category | | 1B. Contribution of life cycle stages to the total | |
| Low concern | High concern | | Claim credibility | | Claim credibility |
| Claim credibility | Claim credibility | | Claim understanding | | Claim understanding |
| Perceived environmental friendliness | Perceived environmental friendliness | | Claim evaluation | | Claim evaluation |
| Product attractiveness | Product attractiveness | | Perceived comparability | | Perceived comparability |
| Choice | Choice | | Choice | | Choice |
| 2. Claim not based on PEF | | 1C. Percentage change over time | | 1D. Percentage change over time + absolute results (micro points) | |
| Low concern | High concern | | Claim credibility | | Claim credibility |
| Claim credibility | Claim credibility | | Claim understanding | | Claim understanding |
| Perceived environmental friendliness | Perceived environmental friendliness | | Claim evaluation | | Claim evaluation |
| Product attractiveness | Product attractiveness | | Perceived comparability | | Perceived comparability |
| Choice | Choice | | Choice | | Choice |

Note – This table shows the integrated results of the *statistical* analyses of the differences between PEF-based claims (1) and claims not based on PEF (2) in a product context (left part of the table), as well as a separate, more detailed comparison between specific types of PEF-based claims (1A-1D; right part of the table). The latter results reflect differences in consumer responses to the different types of PEF-based claims in isolation (credibility, understanding, evaluation and comparability) as well as in a product context (choice behaviour). The presented results are averaged across product sets with small and large shares of PEF-based claims. Green shaded outcomes indicate best performing alternatives, red shaded outcomes indicate worst performing alternatives, and non-shaded outcomes reflect average performance. Multiple alternatives may be shaded green (or red) if the difference in their performance on that aspect is not statistically significant (i.e. differences may be due to chance).

The results revealed that consumers’ reaction to claims that are substantiated via the PEF method versus claims that are not substantiated via this method strongly depended on the consumers’ level of environmental concern. The product preferences of consumers with relatively low levels of environmental concern were unaffected by the presence or type of environment-related claims. These consumers did not perceive PEF-based claims as more credible than claims that were not based on the PEF method, and did not perceive the products carrying PEF-based claims as more environmentally friendly as compared to products with non-PEF claims (see Table 5.2, left part). They did perceive products with environmental claims, both those based and not based on the PEF method, as more environmentally friendly as compared to products without environmental claims, but these product perceptions did not affect their product choices.

In contrast, consumers with relatively high levels of environmental concern found PEF-based claims (slightly) more credible and perceived products carrying such claims as

(slightly) more environmentally friendly than products with non-substantiated claims (see Table 5.2, left). These differences in perceived credibility of PEF-based and non-substantiated claims were statistically significant (i.e. highly unlikely to be due to chance), but very small in absolute terms, which might explain why they did not translate into more choices for products with PEF-based claims. This consumer segment did show a general preference for products with environmental claims over products without such claims, but was not more likely to opt for products that carried PEF-substantiated claims.

Share of products with PEF-based claims

We further predicted larger differences in the perceived attractiveness of products with relevant claims based on the PEF method vis-à-vis products with less relevant claims not based on the PEF method if more products in an assortment carried PEF-based claims about relevant impacts, which could raise suspicion towards producers that do not use the PEF method to substantiate their claims. In line with this prediction, consumers evaluated products with relevant PEF-based claims and products with less relevant non-PEF claims as equally attractive, when there were relatively few products with PEF-based claims in the product assortment. In contrast, when relatively many products in the assortment had PEF-based claims, products with such claims were considered (slightly) more attractive than products with non-PEF claims, on average. Further analysis revealed that this effect was primarily driven by a higher attractiveness of products with PEF-based *qualitative* claims about relevant impacts (see section 5.2.2). Furthermore, the differences were very small in absolute terms, and did not translate into differences in actual choices.

Effects on environmental awareness and concern

Providing PEF information for products not covered by PEFCRs could also serve a more general purpose of increasing environmental awareness and concern among consumers. The current findings do not provide evidence that exposure to PEF-substantiated claims directly increases general environmental awareness and concern for the environment, however. More specifically, consumers who were exposed to assortments in which most of the products carried PEF-substantiated claims neither reported higher levels of environmental awareness nor showed more pro-environmental choice behaviour (in the pro-environmental behaviour task) as compared to consumers who saw the same assortment with non-substantiated claims, or no environment-related claims at all.

5.2.2. Which type of PEF-derived information is most appropriate?

In the experiment, four types of information based on the PEF profile were tested: (1) qualitative claims about relevant environmental impacts, (2) information on the relative contribution of the different life cycle stages to the total, (3) information on the percentage change in PEF performance over time, and (4) information on the percentage change over time accompanied by absolute PEF results in micro points. Qualitative claims about relevant environmental impacts and information on the relative contribution of different life cycle stages to the total were perceived as more credible than information on the percentage change over time (see Table 5.2, right part). Compared to the other types of PEF information, qualitative claims were considered most easy to understand and products carrying such claims were perceived as most attractive and most environmentally friendly. In contrast, information on the relative contribution of the different life cycle stages was considered most difficult to understand and products with this type of claim were perceived as least attractive and least environmentally friendly. Yet, for none of the information types, significant

differences in choice shares for products with PEF-based versus non-substantiated claims were observed (see Table 5.2).

The results further provided some evidence that consumers have the tendency to compare quantitative PEF-derived information for products not in the scope of PEFCRs, if this information is readily available for multiple product alternatives in the assortment. Information on the percentage change in a product's PEF performance over time, for instance, should not be compared across product alternatives, not only because larger changes do not necessarily reflect better environmental performance, but also because the PEF calculations may be performed using different methodologies and data sources. Yet, consumers were more likely to choose products claiming larger (vs. smaller) improvements in their environmental performance over time, which suggests that they looked at this information for the different product alternatives and took it into account in their product choice.

5.2.3. Should use of the PEF method be encouraged for products not covered by PEFCRs?

Whereas the present study showed strong positive effects of providing *comparative* PEF information for products covered by PEFCRs, the added value of non-comparative PEF information for products not in the scope of existing PEFCRs seems very limited. While at least in some consumer groups (high environmental concern), in some situations (relatively many products with PEF-based claims), and for specific types of PEF-derived information (qualitative claims), relevant PEF-based claims were perceived as slightly more credible and valued more than less relevant non-PEF claims, the more positive perceptions and evaluations of products with PEF-based claims did not translate into larger choice shares for such products. The current findings also do not provide evidence that exposure to products with relevant environment-related claims based on the PEF method directly enhances environmental awareness or concern. Finally, there were some indications that consumers compared quantitative PEF-derived information if this information was available for various product alternatives. Thus, if anything, communication of PEF results via qualitative statements seems most appropriate. Compared to the other information types included in the test, qualitative statements about the most relevant impacts were also understood best and evaluated most positively by consumers.

More generally, the results suggest that consumers find it difficult to distinguish between claims about relevant environmental impacts as calculated based on the PEF method and less relevant claims. Only consumers with high levels of environmental concern seemed to be able to discern relevant (PEF-based) from less relevant (non-substantiated) environmental claims, but even in this group the difference in the perceived credibility of the two types of claims was very small. As in Experiment 1, where we observed strong positive effects of pre-informing consumers on how PEF scores are calculated, receiving more information about the PEF method might increase consumers' ability to distinguish between relevant and less relevant environmental claims.

Appendix A. Experiment 1: Questionnaire

| Value of X1 | Label type | Other label present (vs. absent) | Simplification (explanation vs. simple wording vs. absent) | Number of respondents per country |
|-------------|------------|----------------------------------|--|-----------------------------------|
| 1 | Type 1 | N/A | N/A | 100 |
| 2 | Type 2 | Absent | Absent | 100 |
| 3 | Type 3 | N/A | N/A | 100 |
| 4 | Type 4 | N/A | N/A | 100 |
| 5 | Type 5 | N/A | Absent | 100 |
| 6 | Type 6 | N/A | N/A | 100 |
| 7 | Type 7 | N/A | N/A | 100 |
| 8 | Type 8 | N/A | N/A | 100 |
| 9 | Type 9 | N/A | N/A | 100 |
| 10 | Type 10 | Absent | N/A | 100 |
| 11 | Type 2 | Present | N/A | 100 |
| 12 | Type 7 | Present | N/A | 100 |
| 13 | Type 2 | N/A | Explanation | 100 |
| 14 | Type 5 | N/A | Explanation | 100 |
| 15 | Type 11 | N/A | Simple wording | 100 |
| 16 | Absent | N/A | N/A | 100 |

| Value of X2 | Product type | Number of respondents per country |
|-------------|--------------|-----------------------------------|
| 1 | Wine | 1600 |
| 2 | Paint | 1600 |
| 3 | Detergent | 1600 |

| Value of X3 | Choice questions | Number of respondents per country |
|-------------|------------------|-----------------------------------|
| 1 | Group 1 | 800 |
| 2 | Group 2 | 800 |

| Value of X4 | Product order | | | | Number of respondents per country |
|-------------|--------------------|--------------------|--------------------|--------------------|-----------------------------------|
| | Part 1A | Part1B | Part1C | Part 2 and 3 | |
| 1 | Wine (X2 = 1) | Paint (X2 = 2) | Detergent (X2 = 3) | Detergent (X2 = 3) | ±533 |
| 2 | Paint (X2 = 2) | Detergent (X2 = 3) | Wine (X2 = 1) | Wine (X2 = 1) | ±533 |
| 3 | Detergent (X2 = 3) | Wine (X2 = 1) | Paint (X2 = 2) | Paint (X2 = 2) | ±533 |

Scripter: Respondents are **randomly assigned** to the levels of **X1**, **X3** and **X4**. Each respondent will be exposed to all product types (all values of **X2**). The order depends on the value of **X4**.

If X4 = 1, then X2 = 1 (PART 1A), X2 = 2 (PART 1B), X2 = 3 (PART 1C and other parts).

If X4 = 2, then X2 = 2 (PART 1A), X2 = 3 (PART 1B), X2 = 1 (PART 1C and other parts).

If X4 = 3, then X2 = 3 (PART 1A), X2 = 1 (PART 1B), X2 = 2 (PART 1C and other parts).

Screen 1 [Socio-demographics]

All respondents:

Q1. What is your gender?

1 Man

2 Woman

Q2. What is your age?

GENERAL INTRODUCTION

Screen 2 [General introduction]

All respondents:

This questionnaire consists of two separate studies.

The first study is about shopping. We are interested in how people form impressions of the products they encounter during a shopping trip, and how they make buying decisions.

After completing the first study, you will automatically proceed to the second study, which is about choices related to transport.

In total, the questionnaire will take about 15 minutes to complete.

PART 1. PRODUCT CHOICE

Images to be displayed in Part 1 (depending on X2):

| X2 = 1 (wine): | X2 = 2 (paint): | X2 = 3 (detergent): |
|----------------|-----------------|---------------------|
| V1_T1_P1.jpg | V1_T2_P1.jpg | V1_T3_P1.jpg |
| V1_T1_P2.jpg | V1_T2_P2.jpg | V1_T3_P2.jpg |
| V1_T1_P3.jpg | V1_T2_P3.jpg | V1_T3_P3.jpg |
| V1_T1_P4.jpg | V1_T2_P4.jpg | V1_T3_P4.jpg |
| V1_T1_P5.jpg | V1_T2_P5.jpg | V1_T3_P5.jpg |
| V1_T1_P6.jpg | V1_T2_P6.jpg | V1_T3_P6.jpg |
| V2_T1_P1.jpg | V2_T2_P1.jpg | V2_T2_P1.jpg |
| V2_T1_P2.jpg | V2_T2_P2.jpg | V2_T2_P2.jpg |
| V2_T1_P3.jpg | V2_T2_P3.jpg | V2_T2_P3.jpg |
| V2_T1_P4.jpg | V2_T2_P4.jpg | V2_T2_P4.jpg |
| V2_T1_P5.jpg | V2_T2_P5.jpg | V2_T2_P5.jpg |
| V2_T1_P6.jpg | V2_T2_P6.jpg | V2_T2_P6.jpg |
| . | . | . |
| . | . | . |
| . | . | . |
| . | . | . |
| V16_T1_P1.jpg | V16_T2_P1.jpg | V16_T3_P1.jpg |
| V16_T1_P2.jpg | V16_T2_P2.jpg | V16_T3_P2.jpg |
| V16_T1_P3.jpg | V16_T2_P3.jpg | V16_T3_P3.jpg |
| V16_T1_P4.jpg | V16_T2_P4.jpg | V16_T3_P4.jpg |
| V16_T1_P5.jpg | V16_T2_P5.jpg | V16_T3_P5.jpg |
| V16_T1_P6.jpg | V16_T2_P6.jpg | V16_T3_P6.jpg |

Part 1A

Screen 3 [Introduction choice task]

All respondents:

Imagine that you are going to a shopping mall. You plan to buy wall paint at the DIY store and a bottle of wine at the liquor store. Also, you need to buy some groceries at the supermarket in the mall.

On the next screens, you will see various choice options. Please imagine seeing these options in a real store and make choices as you would in reality.

Screen 4 [Explanation]

If X1 = 13 OR X1 = 14:

Before you leave the house, the front page of the newspaper catches your attention. You read that the European Union has introduced mandatory labels on a variety of products. These labels aim to inform consumers about how good or bad a product is for the environment, and to make it easier for them to compare products.

On the next three screens, you will see parts of the article. Please read these carefully.

Screen 5 [Explanation]

If $X1 = 13$ OR $X1 = 14$:

Products influence the environment in many ways

Climate, soil and water are important parts of our environment. Products you buy can affect these aspects of the environment. When products are made, used or disposed of, the soil can become polluted, particles can enter the air and our lungs, raw materials can be depleted, and greenhouse gases emitted, to name a few examples. Some products are more or less harmful in comparison to others.

Screen 6 [Explanation]

If $X1 = 13$ OR $X1 = 14$:

One simple score to compare them all

To indicate how good or bad a product is for the environment, a total score can be given that summarises all impacts of the product on the environment. Based on that total score, a product is divided into one of three groups: better than average, average or worse than average. The label also indicates *how much* better or worse a product is for the environment. For example, the label could state that a product is 50% better for the environment than the average product on the market.

Screen 7 [Explanation]

If $X1 = 13$ OR $X1 = 14$:

How the score is calculated

The total score is calculated by looking at the impact of a product on 16 different environmental aspects. This includes, for example, the extent to which the product contributes to climate change (due to the emission of greenhouse gases), the emission of particulate matter into the air, acidification of water and soil (resulting in e.g. acid rain), and the depletion of resources, such as fossil fuels (e.g. oil and natural gas) and minerals and metals (e.g. sand, aluminium and iron). Each product receives a score on each of the 16 aspects. Then, the scores on the separate aspects are summarised into the total score.

To give consumers some insight into what underlies the total score, the label may also provide information on the most important environmental aspects. For example, the label may show that a product performs better than average on "climate change", average on "particulate matter" and better than average on "acidification".

After you have read the article, you go shopping.

Screen 8-10 [Choice]

For each product type (TX depending on $X2$) and label variant (VX depending on $X1$), there are six products with labels (P).

Scripter: for each respondent, three product sets ($T1$, $T2$, $T3$) are determined, as in this example:

If $X1 = 1$ AND $X2 = 1$, then display $V1_T1_P1.jpg$ to $V1_T1_P6.jpg$. (six images)

If $X1 = 2$ AND $X2 = 3$, then display $V2_T3_P1.jpg$ to $V2_T3_P6.jpg$. (six images)

Etc.

Scripter: display product sets as follows:



Screen 8 [Choice: product type 1]

All respondents:

First, you are visiting [if $X2 = 1$, then the liquor store; if $X2 = 2$, then the DIY store; if $X2 = 3$, then the supermarket]. You are looking for [if $X2 = 1$, then a bottle of Merlot wine; if $X2 = 2$, then grey wall paint; if $X2 = 3$, then laundry detergent for coloured clothing, amongst other things]. Imagine that you consider buying one of the six [if $X2 = 1$, then wines; if $X2 = 2$, then paint buckets; if $X2 = 3$, then laundry detergents] on the next screen.

Screen 9 [Choice: product type 1]

All respondents:

Q3. If you had to make a choice, which of these [if $X2 = 1$, then wines; if $X2 = 2$, then paint buckets; if $X2 = 3$, then laundry detergents] would you choose?

On the left side of the screen you can see the six [if $X2 = 1$, then wines; if $X2 = 2$, then paint buckets; if $X2 = 3$, then laundry detergents] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (wine) display "VX_T1_P1.jpg to VX_T1_P6.jpg"

If X2 = 2 (paint) display "VX_T2_P1.jpg to VX_T2_P6.jpg"

If X2 = 3 (detergent) display "VX_T3_P1.jpg to VX_T3_P6.jpg"

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Part 1B

Screen 10 [Choice: product type 2]

All respondents:

Now, you are visiting [if X2 = 1, then the liquor store; if X2 = 2, then the DIY store; if X2 = 3, then the supermarket]. You are looking for [if X2 = 1, then a bottle of Merlot wine; if X2 = 2, then grey wall paint; if X2 = 3, then laundry detergent for coloured clothing, amongst other things]. Imagine that you consider buying one of the six [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] on the next screen.

Screen 11 [Choice: product type 2]

All respondents:

Q4. If you had to make a choice, which of these [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] would you choose?

On the left side of the screen you can see the six [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (wine) display "VX_T1_P1.jpg to VX_T1_P6.jpg"

If X2 = 2 (paint) display "VX_T2_P1.jpg to VX_T2_P6.jpg"

If X2 = 3 (detergent) display "VX_T3_P1.jpg to VX_T3_P6.jpg"

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Part 1C

Screen 12 [Choice: product type 3]

All respondents:

Finally, you are visiting [if X2 = 1, then the liquor store; if X2 = 2, then the DIY store; if X2 = 3, then the supermarket]. You are looking for [if X2 = 1, then a bottle of Merlot wine; if X2 = 2, then grey wall paint; if X2 = 3, then laundry detergent for coloured clothing, amongst other things]. Imagine that you consider buying one of the six [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] on the next screen.

Screen 13 [Choice: product type 3]

All respondents:

Q5. If you had to make a choice, which of these [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] would you choose?

On the left side of the screen you can see the six [if X2 = 1, then wines; if X2 = 2, then paint buckets; if X2 = 3, then laundry detergents] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger

image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (wine) display "VX_T1_P1.jpg to VX_T1_P6.jpg"

If X2 = 2 (paint) display "VX_T2_P1.jpg to VX_T2_P6.jpg"

If X2 = 3 (detergent) display "VX_T3_P1.jpg to VX_T3_P6.jpg"

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Scripter: Save the chosen detergent in Part 1A, 1B, or 1C (depending on X4) as "chosendetergent.jpg" (for later reference in the questionnaire).

Screen 14 [Attention to the labels]

If X1 < 16:

Q6. You just saw several products: laundry detergents, wines, and buckets of paint. The packages of these products had labels on them that provided information on the product's impact on the environment. Did you look at these labels for at least some of these products?

1 Yes, I studied them in detail

2 Yes, I briefly looked at them

3 No, I did not look at them at all

PART 2. LABEL UNDERSTANDING (OBJECTIVE)

Scripter: In this part, the exact same product set is presented as in Part 1C (Thus, PX is fixed to the values used in Part 1C, no new randomisation on this factor).

If X1 = 16, then skip Part 2.

Screen 15 [Product identification accuracy]

If X1 < 16:

Q7. Products can be more or less environmentally friendly. Here, you see the six [if X2 = 1, then wines; if X2 = 2, then buckets of wall paint; if X2 = 3, then laundry detergents] once more. Which of these is the [if X3 = 1, then most; if X3 = 2, then least] environmentally friendly?

If X1 = 1 OR X1 = 3 OR X1 = 4, then display: If you think multiple products are [if X3 = 1, then most; if X3 = 2, then least] environmentally friendly, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Screen 16 [Product identification difficulty]

If X1 < 16:

Q8. How difficult was it to find the [if X3 = 1, then most; if X3 = 2, then least] environmentally friendly product?

| | | | | | | | | |
|----------------------|---|---|---|---|---|---|---|----------------|
| Not difficult at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Very difficult |
|----------------------|---|---|---|---|---|---|---|----------------|

Screen 17 [Product identification accuracy: impact category 1]

For X1 = 4 OR X1 = 5 OR X1 = 7 OR X1 = 14 OR X1 = 15:

Q9. Which of these [if X2 = 1, then wines; if X2 = 2, then paints; if X2 = 3, then laundry detergents] contributes [if X3 = 1, then least; if X3 = 2, then most] to climate change?

If you think multiple products contribute [if X3 = 1, then least; if X3 = 2, then most] to climate change, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Screen 18 [Product identification accuracy: impact category 2]

For X1 = 4 OR X1 = 5 OR X1 = 7 OR X1 = 14 OR X1 = 15:

If X2 = 1 OR X2 = 3:

Many products contribute to the depletion of fossil resources. Fossil resources are used, for example, in the production and packaging of [if X2 = 1, then wine; if X2 = 3, then laundry detergent]. Some [if X2 = 1, then wines; if X2 = 3, then laundry detergents] use more fossil resources than others, and thus contribute more to the depletion of these resources.

Q10. Which of these [if X2 = 1, then wines; if X2 = 3, then laundry detergents] contributes [if X3 = 1, then least; if X3 = 2, then most] to the depletion of fossil resources?

If you think multiple products contribute [if X3 = 1, then least; if X3 = 2, then most] to the depletion of fossil resources, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

If X2 = 2:

Many products contribute to the emission of particulate matter. Particulate matter is emitted, for example, during the production and packaging of paint. Some types of paint contribute more to the emission of particulate matter than others.

Q10. Which of these paints contributes [if X3 = 1, then least; if X3 = 2, then most] to the emission of particulate matter?

If you think multiple products contribute [if X3 = 1, then least; if X3 = 2, then most] to the emission of particulate matter, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Screen 19 [Product identification accuracy: impact category 3]

For X1 = 4 OR X1 = 5 OR X1 = 7 OR X1 = 14 OR X1 = 15:

If X2 = 2 OR X2 = 3:

Many products contribute to the acidification of soil and water. This occurs, for example, during the production of [if X2 = 2, then paints; if X2 = 3, then laundry detergents;]. Some [if X2 = 2, then types of paint; if X2 = 3, then laundry detergents] contribute more to the acidification of soil and water than others.

Q11. Which of these [if X2 = 2, then paints; if X2 = 3, then laundry detergents;] contributes [if X3 = 1, then least; if X3 = 2, then most] to the acidification of soil and water?

If you think multiple products contribute [if X3 = 1, then least; if X3 = 2, then most] to the acidification of soil and water, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

If X2 = 1:

Many products contribute to the depletion of minerals and metals. Mineral and metal resources are used, for example, in the production of wine grapes. Some wines use more minerals and metals than others, and thus contribute more to the depletion of these resources.

Q11. Which of these wines contributes [if X3 = 1, then least; if X3 = 2, then most] to the depletion of minerals and metals?

If you think multiple products contribute [if X3 = 1, then least; if X3 = 2, then most] to the depletion of minerals and metals, please just select one of them.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Scripter: Display product set as before:

If X2 = 1 (wine), then display "VX_T1_P1.jpg to VX_T1_P6.jpg", same set and order as in Part 1C

If X2 = 2 (paint), then display "VX_T2_P1.jpg to VX_T2_P6.jpg", same set and order as in Part 1C

If X2 = 3 (detergent), then display "VX_T3_P1.jpg to VX_T3_P6.jpg", same set and order as in Part 1C

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

PART 3. LABEL UNDERSTANDING (SUBJECTIVE), LABEL EVALUATION AND TRUST

Images to be displayed in Part 3 (depending on X2):

| X2 = 1 (wine): | X2 = 2 (paint): | X2 = 3 (detergent): |
|-----------------|-----------------|---------------------|
| W_V3_PRT.jpg | P_V3_PRT.jpg | D_V3_PRT.jpg |
| W_V4_PRT.jpg | P_V4_PRT.jpg | D_V4_PRT.jpg |
| W_V5_PRT.jpg | P_V5_PRT.jpg | D_V5_PRT.jpg |
| W_V6_PRT.jpg | P_V6_PRT.jpg | D_V6_PRT.jpg |
| W_V7_PRT.jpg | P_V7_PRT.jpg | D_V7_PRT.jpg |
| W_V8_PRT.jpg | P_V8_PRT.jpg | D_V8_PRT.jpg |
| W_V9_PRT.jpg | P_V9_PRT.jpg | D_V9_PRT.jpg |
| W_V10_PRT.jpg | P_V10_PRT.jpg | D_V10_PRT.jpg |
| W_V12_PRT.jpg | P_V12_PRT.jpg | D_V12_PRT.jpg |
| W_V14_PRT.jpg | P_V14_PRT.jpg | D_V14_PRT.jpg |
| W_V15_PRT.jpg | P_V15_PRT.jpg | D_V15_PRT.jpg |
| W_V1_FULLL.jpg | P_V1_FULLL.jpg | D_V1_FULLL.jpg |
| W_V2_FULLL.jpg | P_V2_FULLL.jpg | D_V2_FULLL.jpg |
| W_V3_FULLL.jpg | P_V3_FULLL.jpg | D_V3_FULLL.jpg |
| W_V4_FULLL.jpg | P_V4_FULLL.jpg | D_V4_FULLL.jpg |
| W_V5_FULLL.jpg | P_V5_FULLL.jpg | D_V5_FULLL.jpg |
| W_V6_FULLL.jpg | P_V6_FULLL.jpg | D_V6_FULLL.jpg |
| W_V7_FULLL.jpg | P_V7_FULLL.jpg | D_V7_FULLL.jpg |
| W_V8_FULLL.jpg | P_V8_FULLL.jpg | D_V8_FULLL.jpg |
| W_V9_FULLL.jpg | P_V9_FULLL.jpg | D_V9_FULLL.jpg |
| W_V10_FULLL.jpg | P_V10_FULLL.jpg | D_V10_FULLL.jpg |
| W_V11_FULLL.jpg | P_V11_FULLL.jpg | D_V11_FULLL.jpg |
| W_V12_FULLL.jpg | P_V12_FULLL.jpg | D_V12_FULLL.jpg |
| W_V13_FULLL.jpg | P_V13_FULLL.jpg | D_V13_FULLL.jpg |
| W_V14_FULLL.jpg | P_V14_FULLL.jpg | D_V14_FULLL.jpg |
| W_V15_FULLL.jpg | P_V15_FULLL.jpg | D_V15_FULLL.jpg |

Screen 20 [Introduction Part 3]

If $X1 > 2$ & $X1 < 16$, but not $X1=11$ or $X1 = 13$:

Each of the products you saw earlier carried a label with information on the product's impact on the environment. We are interested in what you think of the different parts of this label.

Screen 21 [Subjective understanding per element]

If $X1 > 2$ & $X1 < 16$, but not $X1=11$ or $X1 = 13$:

Below, you see the label that was displayed on the [if $X2 = 1$, then wines; if $X2 = 2$, then paint buckets; if $X2 = 3$, then laundry detergents]. The label contains various pieces of information, which are outlined in blue and numbered.

If $X1 = 3$ & $X2 = 1$, then display "W_V3_PRT.jpg"

If $X1 = 3$ & $X2 = 2$, then display "P_V3_PRT.jpg"

If $X1 = 3$ & $X2 = 3$, then display "D_V3_PRT.jpg"

If $X1 = 4$ & $X2 = 1$, then display "W_V4_PRT.jpg"

If $X1 = 4$ & $X2 = 2$, then display "P_V4_PRT.jpg"

If $X1 = 4$ & $X2 = 3$, then display "D_V4_PRT.jpg"

If $X1 = 5$ & $X2 = 1$, then display "W_V5_PRT.jpg"

If $X1 = 5$ & $X2 = 2$, then display "P_V5_PRT.jpg"

If $X1 = 5$ & $X2 = 3$, then display "D_V5_PRT.jpg"

Etc.

Q12. Is there any information on this label that you find difficult to understand? If so, please indicate below which part(s) of the label you find difficult to understand. You can tick multiple boxes. If you think all information is clear, you can also indicate this.

1 Part 1

2 Part 2

3 Part 3 (display only if X1 = 7)

5 All information is clear

Screen 22 [Evaluation per element]

If X1 > 2 & X1 < 16, but not X1=11 or X1 = 13:

If X1 = 3 & X2 = 1, then display "W_V3_PRT.jpg"

If X1 = 3 & X2 = 2, then display "P_V3_PRT.jpg"

If X1 = 3 & X2 = 3, then display "D_V3_PRT.jpg"

If X1 = 4 & X2 = 1, then display "W_V4_PRT.jpg"

If X1 = 4 & X2 = 2, then display "P_V4_PRT.jpg"

If X1 = 4 & X2 = 3, then display "D_V4_PRT.jpg"

If X1 = 5 & X2 = 1, then display "W_V5_PRT.jpg"

If X1 = 5 & X2 = 2, then display "P_V5_PRT.jpg"

If X1 = 5 & X2 = 3, then display "D_V5_PRT.jpg"

Etc.

Q13. Imagine that all products available in stores would receive a label that indicates the impact of the product on the environment. Please indicate which information you would like to see on this label. You can tick multiple boxes. If you think none of the information is useful, you can also indicate this.

1 Part 1

2 Part 2

3 Part 3 (display only if X1 = 7)

4 None of the information is useful

Screen 23 [Overall label understanding and evaluation]

If X1 = 1 OR X1 = 2 OR X1 = 11 OR X1 = 13:

Each of the products you saw earlier carried a label with information on the product's impact on the environment. On the next screens, you will see the label up close. Please indicate what you think of this label overall.

If X1 > 2 & X1 < 16, but not X1=11 or X1=13:

Here, you see the label again in its entirety. Please now indicate what you think of this label overall.

If X1 = 2 & X2 = 1, then display "W_V2_FULL.jpg"

If X1 = 2 & X2 = 2, then display "P_V2_FULL.jpg"

If X1 = 2 & X2 = 3, then display "D_V2_FULL.jpg"

If X1 = 3 & X2 = 1, then display "W_V3_FULL.jpg"

If X1 = 3 & X2 = 2, then display "P_V3_FULL.jpg"

If X1 = 3 & X2 = 3, then display "D_V3_FULL.jpg"

If X1 = 4 & X2 = 1, then display "W_V4_FULL.jpg"

If X1 = 4 & X2 = 2, then display "P_V4_FULL.jpg"

If X1 = 4 & X2 = 3, then display "D_V4_FULL.jpg"

Etc.

[Subjective understanding]

| | | | | | | | |
|--|------------------------------|---|---|---|---|---|-------------------------|
| | Very difficult to understand | | | | | | Very easy to understand |
| Q14_1. Overall, the information on this label is... | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Very unclear | | | | | | Very clear |
| Q14_2. Overall, the information on this label is... | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

[Evaluation]

| | | | | | | | |
|--|----------------------|---|---|---|---|---|----------------|
| | Not useful at all | | | | | | Very useful |
| Q15_1. Overall, the information on this label is... | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Not important at all | | | | | | Very important |
| Q15_2. Overall, the information on this label is... | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 24 [Confusion]

If X1 = 2 OR X1 = 10:

Now, please take a close look at the product below and then indicate to what extent each of the following statements applies to you.

If X1 = 11 OR X1 = 12:

As you know, the label you just saw provides information about the environmental impact of products. However, there are also other labels and logos that provide information about environmental aspects of products. A product package can have multiple labels.

Here, you see a [if X2 = 1, then a bottle of wine; if X2 = 2, then paint bucket; if X2 = 3, then laundry detergent] with multiple labels. Please take a close look at the product and then indicate to what extent each of the following statements applies to you.

If X1 = 2 OR X1 = 10 OR X1 = 11 OR X1 = 12:

If you click on the product, a square "magnifying glass" appears which allows you to inspect the product in detail.

If X1 = 2 & X2 = 1 (wine), then display "V2_T1_P3.jpg"

If X1 = 2 & X2 = 2 (paint), then display "V2_T2_P1.jpg"

If X1 = 2 & X2 = 3 (detergent), then display "V2_T3_P1.jpg"

If X1 = 10 & X2 = 1 (wine), then display "V10_T1_P3.jpg"

If X1 = 10 & X2 = 2 (paint), then display "V10_T2_P1.jpg"

If X1 = 10 & X2 = 3 (detergent), then display "V10_T3_P1.jpg"

If X1 = 11 & X2 = 1 (wine), then display "V11_T1_P3.jpg"

If X1 = 11 & X2 = 2 (paint), then display "V11_T2_P1.jpg"

If X1 = 11 & X2 = 3 (detergent), then display "V11_T3_P1.jpg"

If X1 = 12 & X2 = 1 (wine), then display "V12_T1_P3.jpg"

If X1 = 12 & X2 = 2 (paint), then display "V12_T2_P1.jpg"

If X1 = 12 & X2 = 3 (detergent), then display "V12_T3_P1.jpg"

Scripter: Respondents should be able to zoom in on each product image, as follows:



| | Not at all | | | | | | Very much so |
|---|------------|---|---|---|---|---|--------------|
| Q16_1. I feel well-informed about the environmental impact of this product. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q16_2. The information about the environmental aspects of this product is confusing. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 25 [Redundancy perceptions]

The product you just saw had the following labels and logos. You may find all information useful to evaluate the product. You may also find some or even all information redundant. According to you, is there any information that can be removed from the package because you think it is redundant?

Scripter: Display following pictures (2):

If X1 = 11 & X2 = 1, then display "W_V11_FULL.jpg" on the left, and "organic.jpg" on the right

If X1 = 11 & X2 = 2, then display "P_V11_FULL.jpg" on the left, and "ecolabel.jpg" on the right

If X1 = 11 & X2 = 3, then display "D_V11_FULL.jpg" on the left, and "ecolabel.jpg" on the right

If X1 = 12 & X2 = 1, then display "W_V12_FULL.jpg" on the left, and "organic.jpg" on the right

If X1 = 12 & X2 = 2, then display "P_V12_FULL.jpg" on the left, and "ecolabel.jpg" on the right

If X1 = 12 & X2 = 3, then display "D_V12_FULL.jpg" on the left, and "ecolabel.jpg" on the right

- 1 The information on the left can be removed
- 2 The information on the right can be removed
- 3 All information can be removed
- 4 None of the information can be removed

Screen 26 [Trust in Environmental Footprint label]

If X1 < 16:

Please indicate to what extent each of the statements about this label applies to you.

If X1 = 2 & X2 = 1, then display "W_V2_FULL.jpg"

If X1 = 2 & X2 = 2, then display "P_V2_FULL.jpg"

If X1 = 2 & X2 = 3, then display "D_V2_FULL.jpg"

If X1 = 3 & X2 = 1, then display "W_V3_FULL.jpg"

If X1 = 3 & X2 = 2, then display "P_V3_FULL.jpg"

If X1 = 3 & X2 = 3, then display "D_V3_FULL.jpg"

If X1 = 4 & X2 = 1, then display "W_V4_FULL.jpg"

If X1 = 4 & X2 = 2, then display "P_V4_FULL.jpg"

If X1 = 4 & X2 = 3, then display "D_V4_FULL.jpg"

Etc.

| | Not at all | | | | | | Very much so |
|---|------------|---|---|---|---|---|--------------|
| Q19_1. I trust the information on this label to be correct. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q19_2. I trust that this label provides accurate information about the environmental friendliness of products. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 27 [Trust in ecolabel/organic label]

X1 = 11 OR X1 = 12:

Please indicate to what extent each of the statements about this label applies to you.

If X2 = 1, then display "organic.jpg"

If X2 = 2 OR X2 = 3, then display "ecolabel.jpg"

| | | | | | | | |
|---|------------|---|---|---|---|---|--------------|
| | Not at all | | | | | | Very much so |
| Q20_1. I trust this label. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q20_2. I trust that this label only appears on products that are actually [<i>if X2 = 1; then organic; if X2 > 1; then environmentally friendly</i>]. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 28 [Usage intentions]

If X1 = 2 OR X1 = 8 OR X1 = 9 OR X1 = 16:

In the first part of this questionnaire, you were asked to make choices among products. One of these concerned a choice for a laundry detergent. Below, you see the laundry detergent of your choice:

Display "chosendetergent.jpg"

Q21. Imagine that you are now at home, and want to use it for washing your laundry. Please indicate below how much detergent you would put in the washing machine:

Display:

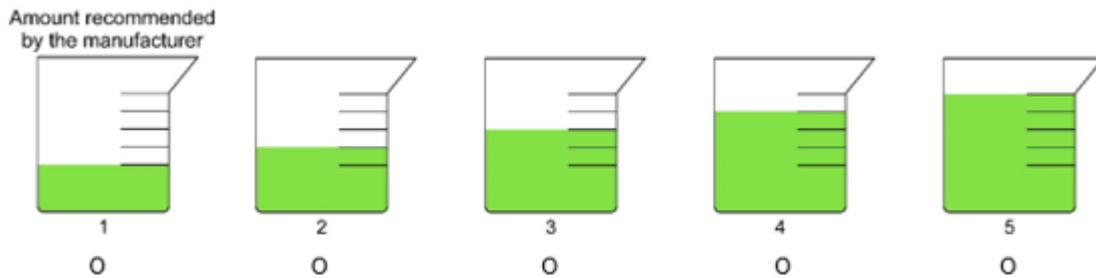
"XX_detergentamount1.jpg" (country-specific image)

"detergentamount2.jpg"

"detergentamount3.jpg"

"detergentamount4.jpg"

"detergentamount5.jpg"



Q22. Please indicate below at what temperature you would wash your coloured laundry:

1 30°C (temperature recommended by the manufacturer)

2 40°C

3 50°C

4 60°C

5 90°C

Screen 29 [Responsibility perceptions, adapted from Kim & Choi, 2005]

If X1 = 2 OR X1 = 8 OR X1 = 9 OR X1 = 16:

Please indicate to what extent you agree or disagree with the following statements.

| | | | | | | | |
|---|---------------------|---|---|---|---|---|------------------|
| | Completely disagree | | | | | | Completely agree |
| Q23_1. I think using less detergent makes no difference for the environment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q23_2. I can help the environment by using less detergent. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

PART 4. BACKGROUND INFORMATION

Screen 30

All respondents:

Finally, we would like to ask you a few general questions.

Screen 31 [Awareness of consequences; adapted from Wall et al., 2007]

All respondents:

Please indicate to what extent you agree or disagree with the following statements.

| | Completely disagree | | | | | | Completely agree |
|---|---------------------|---|---|---|---|---|------------------|
| Q24_1. By making sensible product choices people can help to solve environmental problems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q24_2. People have an impact on the environment through the product choices they make. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q24_3. The way a product is made has a negligible impact on the environment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q24_4. The way a product is used has a negligible impact on the environment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 32 [Other questions]

All respondents:

Q25. What is the highest level of education you have attained?

- 1 Elementary (primary) school or less
- 2 Some high (secondary) school
- 3 Graduation from high (secondary) school
- 4 Graduation from college, university or other third-level institute
- 5 Post-graduate degree (Masters, PhD)
- 6 Other qualification
- 7 Prefer not to answer

Q26. Thinking about your household’s financial situation, would you say that making ends meet every month is:

- 1 Very difficult
- 2 Fairly difficult
- 3 Neither easy nor difficult
- 4 Fairly easy
- 5 Very easy

Q27. Which of the following best describes where you live?

- 1 A city
- 2 A town
- 3 A village
- 4 The countryside

Q28. Which type of device did you use when completing this questionnaire?

- 1 Tablet
- 2 Laptop
- 3 Personal computer
- 4 Other, namely

Screen 33 [Pro-environmental behaviour task; inspired on Lange, Steinke & Dewitte, 2018]

All respondents:

Thank you for completing the first study. Now, you will proceed to the second study, which is about choices related to transport. It takes only a few minutes to complete.

Screen 34 [Instructions - continued]

All respondents:

Imagine that you have just been on a holiday and you are on your flight back home. After landing, you pick up your bags at the baggage claim. Now, you need to take a taxi to get home. At the information counter, you find out that there are two taxi companies: Blue Taxi and GreenCab. All taxis from Blue Taxi are petrol-fuelled. All taxis from GreenCab are electric.

Indeed, walking out of the airport, you can see a taxi from Blue Taxi and a taxi from GreenCab waiting. The taxi drivers are there too. You speak to both drivers to get more information.

Screen 35 [PEB task 1]

All respondents:

Imagine that both taxi companies charge the same for the trip home and the amount of time to get home will be the same.

However, the taxi driver from Blue Taxi tells you he can bring you immediately. The taxi driver from GreenCab tells you he has to take a brief mandatory break first, and can take you home after that. He also tells you when he will be back.

Q29. What would you do?

1. I would go with Blue Taxi.
2. I would go with GreenCab if the waiting time is [*drop-down menu: 1 – 60*] minutes maximum.

Screen 36 [PEB task 2]

All respondents:

Now, imagine a different situation. Again, you just returned from your holiday and are at the airport looking for a taxi to take you home. You find out about the two taxi companies. All taxis from Blue Taxi are petrol-fuelled. All taxis from GreenCab are electric. Again, you can see taxi drivers from Blue Taxi and GreenCab waiting in their cars.

Now, both taxi drivers can take you home immediately. However, you find out that they charge different rates. The taxi ride from Blue taxi costs 20 euro. The taxi ride from GreenCab costs more.

Q30. What would you do?

1. I would go with Blue Taxi.
2. I would go with GreenCab if the ride costs [*drop-down menu: 21 – 40 euros*] [*depending on country: euros / zloty / Bulgarian lev / Swedish Krona*] maximum.

Screen 37 [PEB task 3]

All respondents:

Finally, imagine another situation. Again, you just returned from your holiday and are at the airport looking for a way to get home. You know that there are two bus companies: Blue Bus and GreenCoach. The buses from Blue Bus are petrol-fuelled. The buses from GreenCoach are electric.

Buses from both companies depart from the airport and stop at the same bus stop near your house. The amount of time to get home as well as the costs are the same for the two buses.

Both buses – Blue Bus and GreenCoach – leave in half an hour. For both, you need to buy a ticket at a ticket machine. There is a queue in front of the GreenCoach ticket machine. So, to buy a GreenCoach ticket, you would have to wait for your turn. Because Blue Bus has more ticket machines, there is no queue and you can buy a ticket for Blue Bus right away. Once it is someone's turn, buying a ticket takes about a minute.

Q31. What would you do?

1. I would buy a ticket for Blue Bus.
2. I would buy a ticket for GreenCoach if there are [*drop-down menu: 1 – 30*] people in the queue maximum.

Appendix B. Experiment 2: Questionnaire

| Value of X1 | Claim type | Number of products with PEF claim | Number of respondents per country |
|-------------|---------------------|-----------------------------------|-----------------------------------|
| 1 | PEF type 1 | Few | 100 |
| 2 | PEF type 1 | Many | 100 |
| 3 | PEF type 2 | Few | 100 |
| 4 | PEF type 2 | Many | 100 |
| 5 | PEF type 3 | Few | 100 |
| 6 | PEF type 3 | Many | 100 |
| 7 | PEF type 4 | Few | 100 |
| 8 | PEF type 4 | Many | 100 |
| 9 | Non-PEF (control 1) | None | 100 |
| 10 | Absent (control 2) | None | 100 |

| Value of X2 | Product type | Number of respondents per country |
|-------------|------------------|-----------------------------------|
| 1 | TV | ±333 |
| 2 | Sport shoes | ±333 |
| 3 | Chocolate spread | ±333 |

| Value of X3 | Product order | | | | Number of respondents per country |
|-------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------------|
| | Part 1A | Part 1B | Part 1C | Part 2 | |
| 1 | TV (X2 = 1) | Sport shoes (X2 = 2) | Chocolate spread (X2 = 3) | Chocolate spread (X2 = 3) | ±333 |
| 2 | Sport shoes (X2 = 2) | Chocolate spread (X2 = 3) | TV (X2 = 1) | TV (X2 = 1) | ±333 |
| 3 | Chocolate spread (X2 = 3) | TV (X2 = 1) | Sport shoes (X2 = 2) | Sport shoes (X2 = 2) | ±333 |

Scripter: Respondents are **randomly assigned** to the levels of **X1**, and **X3**. Each respondent will be exposed to all product types (all values of **X2**). The order depends on the value of **X3**.

If X3 = 1, then X2 = 1 (PART 1A), X2 = 2 (PART 1B), X2 = 3 (PART 1C and other parts).

If X3 = 2, then X2 = 2 (PART 1A), X2 = 3 (PART 1B), X2 = 1 (PART 1C and other parts).

If X3 = 3, then X2 = 3 (PART 1A), X2 = 1 (PART 1B), X2 = 2 (PART 1C and other parts).

Screen 1 [Socio-demographics]

All respondents:

Q1. What is your gender?

1 Man

2 Woman

Q2. What is your age?

GENERAL INTRODUCTION

Screen 2 [General introduction]

All respondents:

This questionnaire consists of two separate studies.

The first study is about shopping. We are interested in how people form impressions of the products they encounter during a shopping trip, and how they make buying decisions.

After completing the first study, you will automatically proceed to the second study, which is about choices related to transport.

In total, the questionnaire will take about 10 minutes to complete.

PART 1. PRODUCT CHOICE, EVALUATION AND CLAIM CREDIBILITY

For each product type (TX depending on X2) and claim type (VX depending on X1), there are six claims (C) and six products (P). For each product type (TX depending on X2), each participant is exposed to six product alternatives with claims of the same type. The products on which the claims appear are randomized across the six claims within each set (C1-C6). So in total, there are 36 product-claim combinations for each product type (X2) and claim type (X1) (see table below).

Scripter: for each respondent, three product sets are determined, as in this example:

If X1 = 1 AND X2 = 1, then display V1_T1_C1_PX.jpg to V1_T1_C6_PX.jpg. (six images)

If X1 = 2 AND X2 = 3, then display V2_T3_C1_PX.jpg to V2_T3_C6_PX.jpg. (six images)

Etc.

The six products are rotated across the six values of C. Thus, for each participant, each product is randomly assigned to a value of C.

For example:

*Let's say X1 AND X2 = 1 for **participant 1**, then he/she is exposed to the following images (in random order):*

V1_T1_C1_P1.jpg

V1_T1_C2_P3.jpg

V1_T1_C3_P5.jpg

V1_T1_C4_P6.jpg

V1_T1_C5_P2.jpg

V1_T1_C6_P4.jpg

*Let's say X1 AND X2 = 1 for **participant 2**, then he/she is exposed to the following images (in random order):*

V1_T1_C1_P6.jpg

V1_T1_C2_P2.jpg

V1_T1_C3_P5.jpg

V1_T1_C4_P4.jpg

V1_T1_C5_P3.jpg

V1_T1_C6_P1.jpg

Etc.

All images are country-specific, so we will add a country code at the beginning of each image name.

Finally, please randomize the order of the products within each product set (T) and record display order.

For VX = 1, ..., 10 (depending on X1) AND TX = 1, 2, 3 (depending on X2):

| Image name | C (claim variant) | P (product) |
|-----------------|-------------------|-------------|
| VX_TX_C1_P1.jpg | 1 | 1 |
| VX_TX_C1_P2.jpg | 1 | 2 |
| VX_TX_C1_P3.jpg | 1 | 3 |
| VX_TX_C1_P4.jpg | 1 | 4 |
| VX_TX_C1_P5.jpg | 1 | 5 |
| VX_TX_C1_P6.jpg | 1 | 6 |
| VX_TX_C2_P1.jpg | 2 | 1 |
| VX_TX_C2_P2.jpg | 2 | 2 |
| VX_TX_C2_P3.jpg | 2 | 3 |
| VX_TX_C2_P4.jpg | 2 | 4 |
| VX_TX_C2_P5.jpg | 2 | 5 |
| VX_TX_C2_P6.jpg | 2 | 6 |
| VX_TX_C3_P1.jpg | 3 | 1 |
| VX_TX_C3_P2.jpg | 3 | 2 |
| VX_TX_C3_P3.jpg | 3 | 3 |
| VX_TX_C3_P4.jpg | 3 | 4 |
| VX_TX_C3_P5.jpg | 3 | 5 |
| VX_TX_C3_P6.jpg | 3 | 6 |
| VX_TX_C4_P1.jpg | 4 | 1 |
| VX_TX_C4_P2.jpg | 4 | 2 |
| VX_TX_C4_P3.jpg | 4 | 3 |
| VX_TX_C4_P4.jpg | 4 | 4 |
| VX_TX_C4_P5.jpg | 4 | 5 |
| VX_TX_C4_P6.jpg | 4 | 6 |
| VX_TX_C5_P1.jpg | 5 | 1 |
| VX_TX_C5_P2.jpg | 5 | 2 |
| VX_TX_C5_P3.jpg | 5 | 3 |
| VX_TX_C5_P4.jpg | 5 | 4 |
| VX_TX_C5_P5.jpg | 5 | 5 |
| VX_TX_C5_P6.jpg | 5 | 6 |
| VX_TX_C6_P1.jpg | 6 | 1 |
| VX_TX_C6_P2.jpg | 6 | 2 |
| VX_TX_C6_P3.jpg | 6 | 3 |
| VX_TX_C6_P4.jpg | 6 | 4 |
| VX_TX_C6_P5.jpg | 6 | 5 |
| VX_TX_C6_P6.jpg | 6 | 6 |

Scripter: display product sets as follows:



Part 1A

Screen 3 [Introduction choice task]

All respondents:

Imagine that you are going to a shopping mall. You plan to buy a new TV at the electronics store and sport shoes at the shoe store. You also need to buy some groceries at the supermarket in the mall.

On the next screens, you will see various choice options. Please imagine seeing these options in a real store and make choices as you would in reality.

Screen 4 [Product choice: first product set]

All respondents:

First, you are visiting [if $X2 = 1$, then the store that sells electronics; if $X2 = 2$, then the shoe store; if $X2 = 3$, then the supermarket]. You are looking for [if $X2 = 1$, then a new TV; if $X2 = 2$, then new sport shoes; if $X2 = 3$, then chocolate spread, amongst other things]. Imagine that you consider buying one of the six [if $X2 = 1$, then TVs; if $X2 = 2$, then shoes; if $X2 = 3$, then jars of chocolate spread] on the next screen.

Screen 5 [Product choice: first product set]

All respondents:

Q3. If you had to make a choice, which of these [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] would you choose?

On the left side of the screen you can see the six [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg" to "VX_T1_C6_PX.jpg"

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg" to "VX_T2_C6_PX.jpg"

If X2 = 3 (chocolate spread), then display "VX_T3_C1_PX.jpg" to "VX_T3_C6_PX.jpg"

VX depends on X1. For example:

If X1 = 1 AND X2 = 1, then display "V1_T1_C1_PX.jpg" to "V1_T1_C6_PX.jpg" (six images)

If X1 = 2 AND X2 = 3, then display "V2_T3_C1_PX.jpg" to "V2_T3_C6_PX.jpg" (six images)

Etc.

PX is random within the set (as explained above).

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Part 1B

Screen 6 [Product choice: second product set]

All respondents:

Now, you are visiting [if X2 = 1, then the store that sells electronics; if X2 = 2, then the shoe store; if X2 = 3, then the supermarket]. You are looking for [if X2 = 1, then a new TV; if X2 = 2, then new sport shoes; if X2 = 3, then chocolate spread, amongst other things]. Imagine that you consider buying one of the six [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] on the next screen.

Screen 7 [Product choice: second product set]

All respondents:

Q4. If you had to make a choice, which of these [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] would you choose?

On the left side of the screen you can see the six [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg" to "VX_T1_C6_PX.jpg"

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg" to "VX_T2_C6_PX.jpg"

If X2 = 3 (chocolate spread), then display "VX_T3_C1_PX.jpg" to "VX_T3_C6_PX.jpg"

VX depends on X1. For example:

If X1 = 1 AND X2 = 1, then display "V1_T1_C1_PX.jpg" to "V1_T1_C6_PX.jpg" (six images)

If X1 = 2 AND X2 = 3, then display "V2_T3_C1_PX.jpg" to "V2_T3_C6_PX.jpg" (six images)

Etc.

PX is random within the set (as explained above).

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Part 1C

Screen 8 [Product choice: third product set]

All respondents:

Finally, you are visiting [if X2 = 1, then the store that sells electronics; if X2 = 2, then the shoe store; if X2 = 3, then the supermarket]. You are looking for [if X2 = 1, then a new TV; if X2 = 2, then new sport shoes; if X2 = 3, then chocolate spread, amongst other things]. Imagine that you consider buying one of the following [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread].

Screen 9 [Product choice: third product set]

All respondents:

Q5. If you had to make a choice, which of these [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] would you choose?

On the left side of the screen you can see the six [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] you can choose from. If you click on a product, you will see that product in large format on the right side of the screen. By clicking on that larger image, a square "magnifying glass" appears. This allows you to inspect the product in detail by moving your mouse cursor over the product.

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg" to "VX_T1_C6_PX.jpg"

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg" to "VX_T2_C6_PX.jpg"

If X2 = 3 (chocolate spread), then display "VX_T3_C1_PX.jpg" to "VX_T3_C6_PX.jpg"

VX depends on X1. For example:

If X1 = 1 AND X2 = 1, then display "V1_T1_C1_PX.jpg" to "V1_T1_C6_PX.jpg" (six images)

If X1 = 2 AND X2 = 3, then display "V2_T3_C1_PX.jpg" to "V2_T3_C6_PX.jpg" (six images)

Etc.

PX is random within the set (as explained above).

Scripter: Please randomize the order of the six images.

Scripter: Respondents should be able to zoom in on each product image.

Scripter: Respondents should be able to select one of the six products. Please record their choice.

Screen 10 [Product evaluation: product type 3]

All respondents:

On the next screen, the [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread] you just saw will be shown again. Now, please indicate how attractive or unattractive you consider each product.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Screen 11 [Product evaluation: product type 3]

All respondents:

Q6. Please indicate how attractive or unattractive you find each product. Provide your answer on a scale from 1 to 7, where **1 = unattractive** and **7 = attractive**.

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg to VX_T1_C6_PX.jpg", same set and order as in Q5.

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg to VX_T2_C6_PX.jpg", same set and order as in Q5.

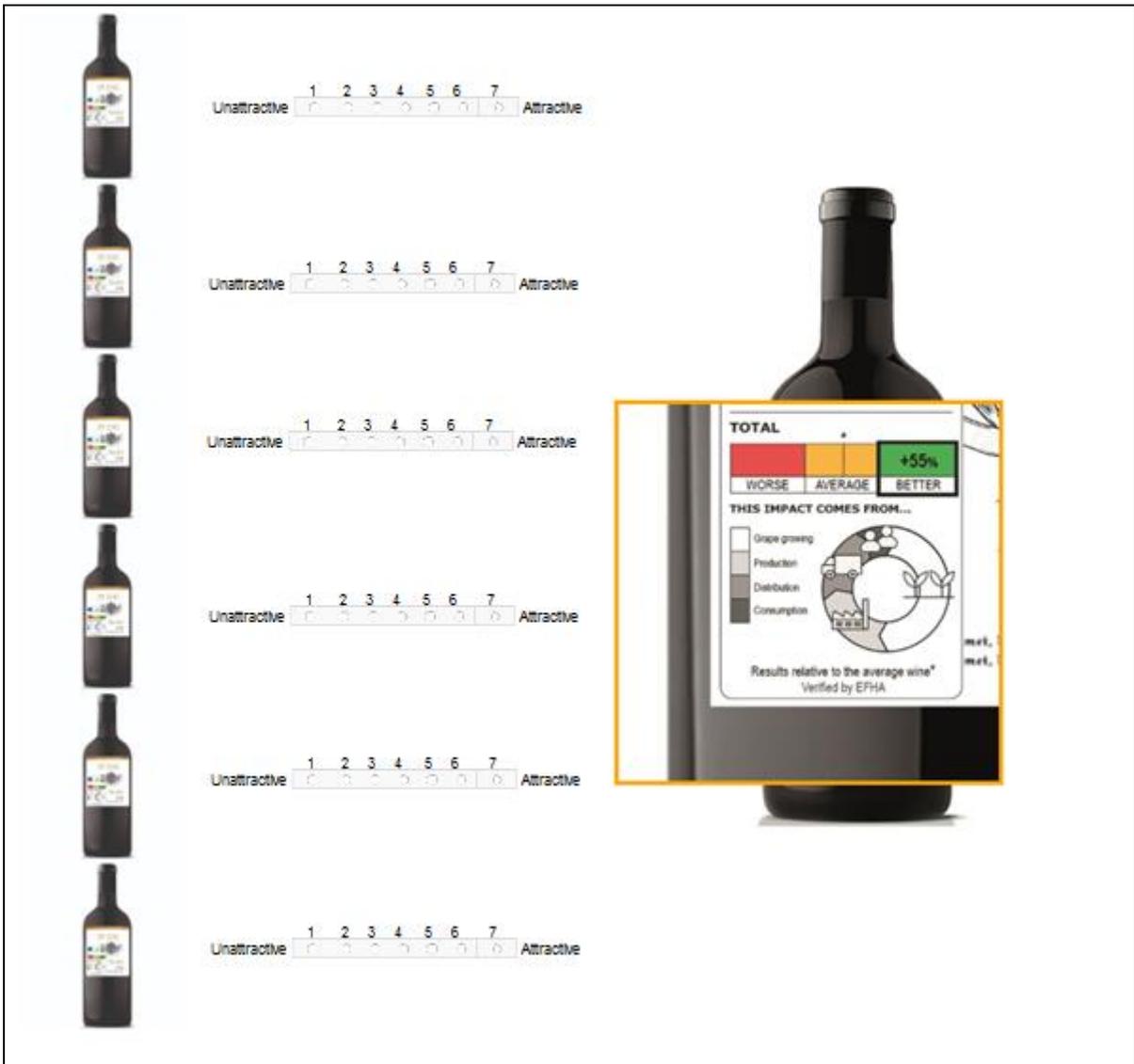
If $X2 = 3$ (chocolate spread), then display "VX_T3_C1_PX.jpg to VX_T3_C6_PX.jpg", same set and order as in Q5.

1 = unattractive

7 = attractive

| | | | | | | | | |
|--|---|---|---|---|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|--|---|---|---|---|---|---|---|--|

Scripter: Please show the response scale with each product in the product set for VX_TX_C1_PX.jpg to VX_TX_C6_PX.jpg without losing the hover zoom option, for example like this:



Respondents should be able to zoom in on each product image.

Screen 12 [Perceived environmental friendliness]

All respondents:

Products can be more or less environmentally friendly. On the next screen, you see the six [if $X2 = 1$, then TVs; if $X2 = 2$, then sport shoes; if $X2 = 3$, then jars of chocolate spread] once more. Please indicate how good or bad you think each [if $X2 = 1$, then TV; if $X2 = 2$, then pair of shoes; if $X2 = 3$, then chocolate spread] is for the environment. If you have no idea how good or bad a certain product is for the environment, you can also indicate that.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Screen 13 [Perceived environmental friendliness]

All respondents:

Q7. Please indicate how good or bad for the environment you think each [if X2 = 1, then TV; if X2 = 2, then pair of shoes; if X2 = 3, then jar of chocolate spread] is, compared to other [if X2 = 1, then TVs; if X2 = 2, then shoes; if X2 = 3, then jars of chocolate spread]. Provide your answer on a scale from 1 to 7, where **1 = bad for the environment** and **7 = good for the environment**.

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg" to "VX_T1_C6_PX.jpg", same set and order as in Q5.

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg" to "VX_T2_C6_PX.jpg", same set and order as in Q5.

If X2 = 3 (chocolate spread), then display "VX_T3_C1_PX.jpg" to "VX_T3_C6_PX.jpg", same set and order as in Q5.

1 = bad for the environment

7 = good for the environment

| | | | | | | | | |
|--|---|---|---|---|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| + additional response option: Don't know | | | | | | | | |

Scripter: Please show the response scale with each product in the product set for "VX_TX_C1_PX.jpg" to "VX_TX_C6_PX.jpg", without losing the hover zoom option, as in Q9.

Screen 14 [Attention to the claims]

If X1 < 10:

Q8. You just saw several products: TVs, sport shoes, and jars of chocolate spread. Some of these products had a sticker or label with information on the product's impact on the environment. Did you look at this information for at least some of these products?

1 Yes, I studied it in detail

2 Yes, I briefly looked at it

3 No, I did not look at it at all

Screen 15 [Claim credibility - instruction]

If X1 < 10:

On the next screen, you will see the products once more. Some of the products have a sticker or label with information on the product's impact on the environment. Please indicate, for these products, how credible you find this environmental information.

Again, you can click on each product to see it in larger format on the right side of the screen. By clicking on the larger image, a square "magnifying glass" appears which allows you to inspect the product in detail.

Screen 16 [Claim credibility]

If X1 < 10:

Q9. Please indicate, for each product, how credible you find the information on the product's impact on the environment. Provide your answer on a scale from 1 to 7, where **1 = not credible** and **7 = credible**.

If X1 < 10:

If X2 = 1 (TV), then display "VX_T1_C1_PX.jpg" to "VX_T1_C6_PX.jpg", same set and order as in Q5.

If X2 = 2 (sport shoes), then display "VX_T2_C1_PX.jpg" to "VX_T2_C6_PX.jpg", same set and order as in Q5.

If X2 = 3 (chocolate spread), then display "VX_T3_C1_PX.jpg" to "VX_T3_C6_PX.jpg", same set and order as in Q5.

1 = not credible

7 = credible

| | | | | | | | | |
|--|---|---|---|---|---|---|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|--|---|---|---|---|---|---|---|--|

Scripter: Please show the response scale with each product in the product set for "VX_TX_C1_PX.jpg" to "VX_TX_C5_PX.jpg", but **NOT** "VX_TX_C6_PX.jpg", without losing the hover zoom option, as in Q9.

PART 2. CLAIM UNDERSTANDING AND EVALUATION

Images to be presented in this part:

| X2 = 1 (TVs) | X2 = 2 (sport shoes) | X2 = 3 (chocolate spread) |
|----------------|----------------------|---------------------------|
| T_V1_FULLL.jpg | S_V1_FULLL.jpg | C_V1_FULLL.jpg |
| T_V2_FULLL.jpg | S_V2_FULLL.jpg | C_V2_FULLL.jpg |
| T_V3_FULLL.jpg | S_V3_FULLL.jpg | C_V3_FULLL.jpg |
| T_V4_FULLL.jpg | S_V4_FULLL.jpg | C_V4_FULLL.jpg |
| T_V9_FULLL.jpg | S_V9_FULLL.jpg | C_V9_FULLL.jpg |

Screen 17 [Claim understanding]

If X1 < 10:

Now imagine seeing [if X2 = 1, then a TV; if X2 = 2, then sport shoes; if X2 = 3, then a jar of chocolate spread] with this label on the packaging. Please indicate what you think of the information on the label.

If (X1 = 1 OR X1 = 2) & X2 = 1, then display "T_V1_FULLL.jpg"

If (X1 = 1 OR X1 = 2) & X2 = 2, then display "S_V1_FULLL.jpg"

If (X1 = 1 OR X1 = 2) & X2 = 3, then display "C_V1_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 1, then display "T_V2_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 2, then display "S_V2_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 3, then display "C_V2_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 1, then display "T_V3_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 2, then display "S_V3_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 3, then display "C_V3_FULLL.jpg"

If (X1 = 7 OR X1 = 8) & X2 = 1, then display "T_V4_FULLL.jpg"

If (X1 = 7 OR X1 = 8) & X2 = 2, then display "S_V4_FULLL.jpg"

If (X1 = 7 OR X1 = 8) & X2 = 3, then display "C_V4_FULLL.jpg"

If (X1 = 9) & X2 = 1, then display "T_V9_FULLL.jpg"

If (X1 = 9) & X2 = 2, then display "S_V9_FULLL.jpg"

If (X1 = 9) & X2 = 3, then display "C_V9_FULLL.jpg"

[Understanding]

Q10. This information is...

| | | | | | | | | |
|--------------------------------------|---|---|---|---|---|---|---|---------------------------------|
| Difficult to understand | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Easy to understand |
| Unclear | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Clear |
| Difficult to compare across products | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Easy to compare across products |

Screen 18 [Claim evaluation]

If X1 < 10:

If (X1 = 1 OR X1 = 2) & X2 = 1, then display "T_V1_FULLL.jpg"

If (X1 = 1 OR X1 = 2) & X2 = 2, then display "S_V1_FULLL.jpg"

If (X1 = 1 OR X1 = 2) & X2 = 3, then display "C_V1_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 1, then display "T_V2_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 2, then display "S_V2_FULLL.jpg"

If (X1 = 3 OR X1 = 4) & X2 = 3, then display "C_V2_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 1, then display "T_V3_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 2, then display "S_V3_FULLL.jpg"

If (X1 = 5 OR X1 = 6) & X2 = 3, then display "C_V3_FULLL.jpg"
 If (X1 = 7 OR X1 = 8) & X2 = 1, then display "T_V4_FULLL.jpg"
 If (X1 = 7 OR X1 = 8) & X2 = 2, then display "S_V4_FULLL.jpg"
 If (X1 = 7 OR X1 = 8) & X2 = 3, then display "C_V4_FULLL.jpg"
 If (X1 = 9) & X2 = 1, then display "T_V9_FULLL.jpg"
 If (X1 = 9) & X2 = 2, then display "S_V9_FULLL.jpg"
 If (X1 = 9) & X2 = 3, then display "C_V9_FULLL.jpg"

[Evaluation]

Q11. This information is...

| | | | | | | | | |
|---------------|---|---|---|---|---|---|---|-----------|
| Not credible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Credible |
| Not useful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Useful |
| Not important | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |

PART 3. ENVIRONMENTAL AWARENESS

Screen 19

All respondents:

Finally, we would like to ask you a few general questions.

Screen 20 [Awareness of consequences; adapted from Wall et al. 2007]

All respondents:

Please indicate to what extent you agree or disagree with the following statements.

| | Completely disagree | | | | | | Completely agree |
|---|---------------------|---|---|---|---|---|------------------|
| Q12_1. By making sensible product choices people can help to solve environmental problems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q12_2. People have an impact on the environment through the product choices they make. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q12_3. The way a product is made has a negligible impact on the environment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q12_4. The way a product is used has a negligible impact on the environment. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Screen 21 [Other questions]

All respondents:

Q13. What is the highest level of education you have attained?

- 1 Elementary (primary) school or less
- 2 Some high (secondary) school
- 3 Graduation from high (secondary) school
- 4 Graduation from college, university or other third-level institute
- 5 Post-graduate degree (Masters, PhD)
- 6 Other qualification
- 7 Prefer not to answer

Q14. Thinking about your household's financial situation, would you say that making ends meet every month is...

- 1 Very difficult
- 2 Fairly difficult
- 3 Neither easy nor difficult
- 4 Fairly easy
- 5 Very easy

Q15. Which of the following best describes where you live?

- 1 A city
- 2 A town
- 3 A village
- 4 The countryside

Q16. Which type of device did you use when completing this questionnaire?

- 1 Tablet
- 2 Laptop
- 3 Personal computer
- 4 Other, namely

Screen 22 [Pro-environmental behaviour task; inspired on Lange, Steinke & Dewitte, 2018]

All respondents:

Thank you for completing the first study. Now, you will proceed to the second study, which is about choices related to transport. It takes only a few minutes to complete.

Screen 23 [Instructions - continued]

All respondents:

Imagine that you have just been on a holiday and you are on your flight back home. After landing, you pick up your bags at the baggage claim. Now, you need to take a taxi to get home. At the information counter, you find out that there are two taxi companies: Blue Taxi and GreenCab. All taxis from Blue Taxi are petrol-fuelled. All taxis from GreenCab are electric.

Indeed, walking out of the airport, you can see a taxi from Blue Taxi and a taxi from GreenCab waiting. The taxi drivers are there too. You speak to both drivers to get more information.

Screen 24 [PEB task 1]

All respondents:

Imagine that both taxi companies charge the same for the trip home and the amount of time to get home will be the same.

However, the taxi driver from Blue Taxi tells you he can bring you immediately. The taxi driver from GreenCab tells you he has to take a brief mandatory break first, and can take you home after that. He also tells you when he will be back.

Q17. What would you do?

1. I would go with Blue Taxi.
2. I would go with GreenCab if the waiting time is [*drop-down menu: 1 – 60*] minutes maximum.

Screen 25 [PEB task 2]

All respondents:

Now, imagine a different situation. Again, you just returned from your holiday and are at the airport looking for a taxi to take you home. You find out about the two taxi companies. All taxis from Blue Taxi are petrol-fuelled. All taxis from GreenCab are electric. Again, you can see taxi drivers from Blue Taxi and GreenCab waiting in their cars.

Now, both taxi drivers can take you home immediately. However, you find out that they charge different rates. The taxi ride from Blue taxi costs 20 euro. The taxi ride from GreenCab costs more.

Q18. What would you do?

1. I would go with Blue Taxi.

2. I would go with GreenCab if the ride costs [drop-down menu: 21 – 40] [depending on country: euros / zloty / Bulgarian lev / Swedish Krona] maximum.

Screen 26 [PEB task 3]

All respondents:

Finally, imagine another situation. Again, you just returned from your holiday and are at the airport looking for a way to get home. You know that there are two bus companies: Blue Bus and GreenCoach. The buses from Blue Bus are petrol-fuelled. The buses from GreenCoach are electric.

Buses from both companies depart from the airport and stop at the same bus stop near your house. The amount of time to get home as well as the costs are the same for the two buses.

Both buses – Blue Bus and GreenCoach – leave in half an hour. For both, you need to buy a ticket at a ticket machine. There is a queue in front of the GreenCoach ticket machine. So, to buy a GreenCoach ticket, you would have to wait for your turn. Because Blue Bus has more ticket machines, there is no queue and you can buy a ticket for Blue Bus right away. Once it is someone’s turn, buying a ticket takes about a minute.

Q19. What would you do?

1. I would buy a ticket for Blue Bus.
2. I would buy a ticket for GreenCoach if there are [drop-down menu: 1 – 30] people in the queue maximum.

Screen 27 [Pro-environmental self-identity; Van der Werff, Steg & Keizer, 2013]

All respondents:

Finally, we would like to ask you some questions regarding how you see yourself.

Please indicate to what extent you agree or disagree with the following statements.

| | Completely disagree | | | | | | Completely agree |
|---|---------------------|---|---|---|---|---|------------------|
| Q20_1. Acting in an environmentally-friendly way is an important part of who I am. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q20_2. I am the type of person who acts in an environmentally-friendly way. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Q20_3. I see myself as an environmentally-friendly person. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |