Neuro-marketing Tools for Assessing the Communication Effectiveness of Life Cycle Based Environmental Labelling—Procedure and Methodology

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Abstract The paper presents a procedure and a methodology of research which aimed at assessing and comparing the effectiveness of different variants of labels in communicating life cycle based environmental information (EU ecolabel, draft PEF labels). Based on a survey, an electroencephalography (EEG) and an eye-tracking, the information regarding consumers’ ecological awareness, their neurological reaction and a visual attention is gathered and used for identifying the ecolabels’ elements with the highest communication potential. A potential target audience of the project is not limited to the specialists in the environmental labelling, but includes also the readers involved in green marketing, Product Environmental Footprint and Life Cycle Assessment practitioners.

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1 Introduction

Information regarding the environmental performance of products or organisations plays a more and more important role in consumers’ decisions. There are different communication vehicles and many strategies of green marketing which allow incorporating environmental information into the communication between various stakeholders representing both sides of the market (supply and demand). A way of performing this incorporation has come a long way from disclosing general, qualitative, unverified and single-issue information (“bio”, “eco”, “eco-friendly”) to move toward verified, quantitative, specific and multi-issue statements. Sustainability has become an integral aspect of product quality and organisation image and it goes beyond a single environmental dimension. Today the products don’t need to be declared as green, they just need to be green [1]. Consumers differ considerably in their sense of sustainability and ecological awareness. Some of them are not susceptible to greenwashing. They have a tendency to use verified product-related information taken not only from informal sources, but also from professionals and trusted third parties [2]. Green consumers—as early adopters and leaders—influence purchasing behaviour [1]. Also, the role of authorities and idols (e.g. celebrities) in the popularisation of “sustainable everyday” [3] can be significant [4]. From this perspective, an interesting issue is to ask about the importance of life cycle thinking (LCT) in communication between producers and consumers. Of among twenty new rules of green marketing listed by Ottman [1], at least seven can be directly or indirectly linked with life cycle thinking (LCT) and Life Cycle Assessment (LCA). However, the above question should not be limited to a potential role of LCA in marketing communication, but it should also address the issue of measuring the effectiveness of this communication. While papers on the former issue can be found in the literature, only single examples of work on the latter were found. Moreover, no information was found about the research on using neuroscience to measure the effectiveness of communication based on the results of LCA. For this reason, a core goal of this paper is to present a procedure and a methodology aimed at estimating the human neurological reaction as a result of exposure to life cycle based environmental labels and advertisements.

2 Life Cycle Based Environmental Information as Part of Product-Related Communication

A relationship between eco-design or LCA and green marketing has been discussed in literature. In 1993, Bhat [5] talked about the general strategies of eco-design (e.g. Design for Disassembly, Design for Recycling, and Design for Durability) as a basis for formulating marketing strategies. While there are many publications about eco-labelling and green marketing, only a few works can be found regarding a discussion narrowed to a role of LCA [6–10]. Some authors discussed this issue
more generally by presenting good practice in communicating LCA results [11–13]. The discussion has been dominated by positive opinions, showing that eco-design and LCA are good fundaments for marketing claims. However, there are also some voices advising caution when using LCA results in marketing communications. The scepticism doesn’t relate to the LCA as a method, but rather to its subjectivity and, especially, a high flexibility in formulating the initial assumptions [14, 15].

Besides being discussed in the literature, LCA is more and more present in business practices and communication. LCA results are usually released as a part of organisation-related sustainability report or product-related communication. The results can be disclosed in comprehensive, quantitative and third party verified forms (EPD declarations, the environmental certificates), but can also include more general content of advertising spots, brochures and websites. Some recent examples of using LCA in product advertising can be found. Life cycle based advertising video spots are published on mainstream media channels, for example, the ads published on YouTube by Beiersdorf AG (Nivea creams) [16], Toyota Motor Corporation (Toyota Prius) [17] and W. L. Gore & Associates (Gore-tex® footwear) [18]. In these cases, the spots are based on a presentation of general information about life cycle thinking and LCA results.

A question regarding life cycle based communication is pivotal, not only because of an increase in the number of LCA-based ads, but also because of the European Commission Initiative on Product and Organization Environmental Footprints. PEFs and OEFs are intended for estimating and communicating the life cycle environmental performance of products and organisations [19]. The verification and assessment of various communication vehicles are currently important subjects for the European Commission and for related pilot working groups. Different variants of PEF labels, as one of the communication vehicles, are under consideration. A few years ago, in 2012, a study entitled “Different options for Communicating Environmental Information for Products” was launched by the European Commission—DG Environment. The aim of this study was to review and analyse the existing knowledge about different ways of providing final consumers with multi-criteria environmental information related to products [20].

As mentioned above, the papers about using LCA results as content of marketing communications can be found. However, no information was discovered in the literature about using neuroscience to verify the effectiveness of this kind of communication. In order to fill this gap, an initiative has been undertaken by the authors to use neuromarketing tools to assess the human reaction to products labelled with life cycle based environmental labels and to ads with life cycle environmental information included. Our project aims at answering the following questions:

(1) What, if any, are the differences in the neurological responses of consumers as a result of exposure to eco-labelled and non-eco-labelled products?
(2) Which elements of environmental labels and the eco-labelled products attract the visual attention most?
(3) Is there any correlation between consumers’ ecological awareness and their response?
(4) What kind of neurological response (in terms of activated brain regions and response time) follows the exposure to environmental information?
(5) Are the selected ecolabels convincing enough for consumers to persuade them to select the eco-labelled products?

3 Project Procedure and Methodology

The project consists of three parts intended to be performed independently: a survey, monitoring of purchasing behaviour (in a shopLAB) and monitoring of psychophysiological reactions (in an EEG laboratory). A description of the parts in terms of placing, tools, key elements and their relationship with the project goals (questions to be answered) is presented in Table 1. A first part—the survey—is aimed at identifying the types of participants involved, in terms of their environmental awareness and tendency to practice the principles of sustainable development in daily life. This survey is assumed to play a supplementary role for the whole project. The methodology and the consumer typology assessment tool have been described in [21]. The main purpose of the survey is to analyse the relationship between consumer types (Voluntary Simplifiers, Beginner Voluntary Simplifiers, Accidental Simplifiers, Non-Voluntary Simplifiers) [21, 22] and their reaction to environmental labels and environmentally labelled products. Attensee Software [23] is intended to be used to verify the visual attention of the surveyed participants. The international scope of the survey provides a chance to compare results obtained in different countries from the perspective of cultural and international differences. The same consumer assessment tool is intended to be used in the EEG laboratory. However, in this case, only Polish respondents will be involved and the focus is on finding a relationship between consumer types and their reaction which will be measured by electroencephalograph (EEG) and the eye-tracker. More detailed information regarding the research in EEG lab can be found in a Sect. 4.

Another part of the project is to analyse consumer behaviour in a shopping environment. This task is performed in a shopLAB—a laboratory where real shopping conditions are reflected. The research procedure is as follows: the products with and without environmental labels are placed on the shelves and the participants—equipped with an eyetracker—make decisions about selecting products. The participants are divided into three groups. All of them are provided with the same shopping list on which the products to buy are listed. The members of the first group are fully free in their decision making (the only condition is to follow the shopping list). The second group is recommended to buy only green products. They make decisions based only on their current knowledge and experience, without any prior training. The members of the third group take, before shopping, a short course...
on LCA and environmental labels. From this, the effect and role of an information campaign can be noticed.

Four product categories have been selected for the research in all parts of the project: red meat, t-shirt, liquid detergent and TV-set. There were two criteria for selecting these product categories:

- they represent various modes of purchasing decision-making (meat—purchased emotionally with low commitment; t-shirt—purchased emotionally with high commitment; household detergent—purchased rationally with low commitment and TV-set—purchased rationally with high commitment),
- they have been included in a PEF pilot phase and a draft version of the PEFCR document is available and/or the EU ecolabel criteria exist.

| Table 1 | A description of the project parts |
|---------|-----------------------------------|
| **Project parts** | **Survey** | **Monitoring of purchasing behaviour** | **Monitoring of neurological reaction and visual attention** |
| **Placing** | A remote survey via internet scoped internationally (respondents from various countries included) | The shopLAB reflecting real shopping conditions (shelves with products, check out) (Poznan, Poland) | The laboratory equipped with devices for measuring the human body’s psychophysiological reactions (EEG, GSR, OG) (Poznan, Poland) |
| **Tools** | ● Consumer typology assessment tool  
● Attensee Software | ● Questionnaire  
● Consumer typology assessment tool  
● Eyetracker | ● EEG  
● Eyetracker  
● Consumer typology assessment tool  
● Questionnaire |
| **Key research elements** | ● Consumer types  
● Environmental awareness of the analysed consumers  
● Visual attention | ● Consumer types  
● Purchasing decision-making  
● Purchase intention  
● Visual attention | ● Consumer types  
● Visual attention  
● The regions of the brain activated |
| **Research objects** | ● Environmental labels  
● Environmentally labelled products | ● Environmental labels  
● Environmentally labelled products | ● Environmental labels  
● Environmentally labelled products  
● Print and video advertising |
| **Exposition mode** | Via computer screen (only sight involved) | Full and direct exposition (sight, hearing and touch involved) | Via computer screen (sight and hearing involved) |
| **Number of participants** | ca. 400 | ca. 100 | ca. 90 |
| **Questions to be answered** | Q3 | Q1, Q5 | Q1, Q2, Q3, Q4 |
Two sorts of environmental labels are within the scope of the research: draft variants of PEF labels (own proposals inspired by Lewandowska et al. [20, 24]) and the EU ecolabel [25]. Additionally, ads with life cycle based environmental information are prepared.

4 Measurement of Human Reaction to Environmental Labels and Advertising

A core part of the project is to perform the research in the EEG lab. The neurological reaction of the participants is measured by using electroencephalography (EEG) and the visual attention by applying an eye-tracker. There are some metrics used in neuro-marketing practice, for example, NeuroMetrics developed by NeuroFocus Inc. [26]. Pradeep [26] mentions three primary metrics: an attention, an emotional engagement and a memory retention. The attention (visual and cognitive) and the emotional engagement can be described in terms of reaction location (the regions of the brain activated) and the parameters in the EEG/EOG recordings. For example, emotional engagement can be measured as a frontal asymmetry in the brain which can be used especially as a measure for a motivational direction [27]. Greater left-sided activation at baseline predicts dispositional tendencies toward approach. Greater right-sided asymmetry predicts dispositional tendencies towards avoidance [27, 28]. According to a dimensional model of emotions [27, 29], three emotion-related factors can be distinguished: an emotional valence (positive vs. negative), an emotional intensity (from high arousal to low) and a motivational direction (from approach to avoidance). Environmental information and environmental labels can be considered as minor emotional stimuli, so there is a risk of low emotional arousal as a result of exposure to analysed labels and the environmental information included in the ads. The research is intended to confirm or deny this assumption, also from the perspective of the consumers’ typology. The assumptions related to the labels as an object of emotional stimulation are presented in Fig. 1.

Effective environmental communication (made via ecolabels or ads) occurs when a sensation activated by exposure to a label or information is recognised as interesting and/or easy to understand. As a next step, a sensation must be—for rational and/or emotional reasons—recognised as worth saving in a memory (Fig. 2).

The research participants in the EEG lab, equipped with an eye-tracking glasses and an EEG device, are intended to be exposed (via screen) to the following:

- the impact category names,
- the ecolabels (different draft variants of PEF labels and the EU ecolabel),
- the products (meat, t-shirt, TV-set, detergents) with and without ecolabels,
- the print ads with life cycle based environmental information included,
- the video ads of the eco-labelled products.
Figures 3 and 4 illustrate an example of the results which are expected from the project. Both show the eye-tracking statistics related to the EU ecolabel: displayed solely (Fig. 3) and with a product (Fig. 4). In both cases the perception area has been divided into predefined areas called “Areas Of Interest” (AOIs). Figure 3
includes six AOIs named: an “ecolabel logo” (1), “better for environment” (2), “criteria left” (3), “criteria right” (4), “better for you” (5) and a “white space” as a remaining area (6). Figure 4 presents seven AOIs: a “dark blue label” (1), and the six AOIs previously cited. For each AOI the following information is listed: a sequence (an order of gaze hits into the AOIs), an entry time (average duration from start of the trial to the first hit on an AOI), a dwell time (all fixations and saccades within an AOI for all selected participants), a hit ratio (how many participants out of
the selected ones looked at least once into the AOI), revisits (a number of revisits divided by a number of selected participants with at least one glance), re-visitors, average fixation (the sum of fixation times divided by a number of fixations) and first fixation (average duration of first fixation).

The final phase of research in the EEG lab is to assess the reactions of the participants as a result of their exposure to video advertising. For four selected products, the ads are prepared in two variants: emotional and rational. Additionally, the content of the ads is differentiated in terms of scope and in the way environmental information is presented. Due to the analysis of EEG and EOG recordings, reactions to the different ways of environmental information presentation can be compared.

5 Final Conclusions

The role of ecolabels for a product-related environmental communication and for the consumers’ decision making is well-known and often discussed. A discussion on the same role of LCA and life cycle based environmental information is less evident, although some works on this subject can be also found in the literature. However, in most cases, a survey based on a questionnaire is used as the main way to get knowledge about consumer motivation and preferences. The use of neuro-marketing tools gives more room for interpretation and seems to be more objective than a traditional surveying. The eye-tracking results let follow a glance of the participants and identify these AOIs which attract their visual attention first and for the longest time. At the same time, the elements which are ignored by the participants can be found. It is important as the visual stimulation is a first step for potential activation of higher cognitive processes. From this point of view, a crucial point is to know the sequence and the fixation times for AOIs predefined for the ecolabels, the eco-labelled products and the ads. It can be helpful in designing the ecolabels and the ads in order to display the environmental information in a way which actually attracts the consumers’ visual attention. The preliminary results showed that the elements of ecolabels which attract participants attention most are: EP scale (especially EP class); the words “environmental footprint”, “better”, “improved”, “limited”; EU ecolabel flower; life cycle circle; a final improvement score; the sentence “better for you … better for environment”. The expected results and implications of our project go far beyond the environmental labelling and reach a more broadly scoped life-cycle based communication. It causes that a potential target audience of our project is not limited to the specialists in the environmental labelling, but also the experts in green marketing as well as LCA practitioners and PEF/OEF society.
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