

# Eco-Label Effects in the Built Environment: Does Labeling a Light Source Environmentally Friendly Influence Performance and Judgment?

SAGE Open  
April-June 2018: 1–8  
© The Author(s) 2018  
DOI: 10.1177/2158244018766977  
journals.sagepub.com/home/sgo  


Andreas Haga<sup>1</sup>

## Abstract

Built environments with objects that are labeled “environmentally friendly” appear to change people’s behavior. For example, one study has shown that labeling a desktop lamp “environmentally friendly” can enhance color discrimination, in comparison with when the lamp is labeled “conventional,” even though there is no physical difference between the two lamps. This article explored the generalizability and replicability of this label effect by asking participants to conduct a proofreading task on a desk lit up by a desktop lamp that was either labeled “environmentally friendly” or “conventional”; in reality, the two lamps were identical. Participants high in environmental concern performed better when the lamp was labeled “environmentally friendly.” Moreover, the light from the lamp labeled “environmentally friendly” was rated as more comfortable. Taken together, the results seem to suggest that people’s beliefs about the source (an environmentally friendly or a conventional lamp) from which the light originates change both rating of comfort and performance. Theoretical explanations and applied implications of these effects are discussed.

## Keywords

eco-label effect, environmentally friendly, lamp, label, environmental concern

## Introduction

Product judgment is influenced by various sources of extrinsic cues (e.g., labeling, packaging, the location where the product is sold; Piqueras-Fiszman & Spence, 2015). For example, coffee (Sörqvist et al., 2013) and other consumable products (Sörqvist, Haga, Langeborg, et al., 2015) appear to taste better when they are labeled “eco-friendly,” in comparison with other alternatives labeled “conventional,” even when the “eco-friendly” and the “conventional” products are actually identical. This *eco-label effect* is a specific example, within the environmental realm, among many similar label effects. Another example is fair-trade labels. People believe that chocolate claimed to be fair trade is healthier (Schuldt, Muller, & Schwartz, 2012), and they perceive better taste in chocolate labeled fair trade (Lotz, Chrisandl, & Fetchenhauer, 2013), in comparison with chocolate claimed to be nonlabeled or “conventional.”

Label effects on judgment have been extensively studied in the context of food and edible products (Piqueras-Fiszman & Spence, 2015), while relatively few studies have investigated label effects in other contexts, such as the labeling of objects in the built environment. Scientific investigation into “green” buildings (Zuo & Zhao, 2014) and environmentally

friendly objects (e.g., light sources; Mayr, Köpper, & Buchner, 2013) is increasing, but relatively little is known about their psychological effects. For example, environmentally friendly light sources may have psychological benefits or potential drawbacks (Mayr et al., 2013), but it is still unclear to what extent these effects are underpinned by the psychological associations with the “environmentally friendly” label. A recent experiment from our laboratory found that people tend to prefer the light from a light source labeled “eco-friendly,” and also perform better on a color discrimination task when the task was lit up that same light source, in comparison with a light source labeled “conventional,” even when the two lamps were actually identical (Sörqvist, Haga, Holmgren, & Hansla, 2015). The purpose of the experiment reported here was to contribute to this relatively small but growing literature on label effects in the built environment by exploring the generalizability and

<sup>1</sup>University of Gävle, Sweden

## Corresponding Author:

Andreas Haga, Department of Building, Energy and Environmental Engineering, University of Gävle, Kungsbäcksvägen 47, SE-801 76 Gävle, Sweden.  
Email: andreas.haga@hig.se



replicability of the eco-label effect. Specifically, the current experiment tested whether eco-labeling of a light source can change behavior on a vision-dependent task other than color discrimination.

### *Mechanisms Underpinning Behavioral Change by Eco-Labeling*

People have the capacity to mobilize resources when situations so demand. Motivation is on factors, influencing the mind-set and can change people's behavior (e.g., Geers, Weiland, Kosbab, Landry, & Helfer, 2005). Just believing you have been exposed to something that can influence the behavior seems to be enough to enhance performance. Arbitrary information about sleep (Draganich & Erdal, 2014), and bogus priming boosting confident in knowledge (Weger & Loughan, 2013), can enhance cognitive performance. This phenomenon is similar to the placebo effect (an outcome that is not attributed to a specific treatment but rather to an individual's mind-set). There are different explanations for this effect, some link the effects to desire, motivation, and expectations, while other effects can be better explained with regard to classical conditioning and response biases (Price et al., 2008).

One possibility is that the effects of eco-labels on performance are underpinned by a (conscious or subconscious) change in motivation and effort. For instance, participants could have been more motivated to perform well when the light source in Sörqvist, Haga, Holmgren, and Hansla's (2015) study was labeled "environmentally friendly." This assumption is reinforced by the finding that the eco-label effect on task performance was greater among participants high in environmental concern—that is, participants who were worried about the consequences of environmental change (Sörqvist, Haga, Holmgren, & Hansla, 2015). People with high environmental concern probably have higher expectations in the potential benefits of eco-friendly products or for other reasons tend to try harder when they believe the light source is environmentally friendly, and therefore also perform better.

The relation between the magnitude of the eco-label effect and environmental concern appears to arise for a specific dimension of environmental concern (Sörqvist, Haga, Holmgren, & Hansla, 2015). Environmental concern can be classified as different dimensions of value orientations (Stern & Dietz, 1994). The biospheric value type is driven by an inherent care for nature. If the foundation for an individual's attitude to the environment was solely based on biospheric values, the individual would only act on moral principles regarding nature itself (e.g., de Groot & Steg, 2008; Hansla, 2011; Joireman, Lasane, Bennett, Richard, & Solaimani, 2001; Steg, de Groot, Dreijerink, Abrahamse, & Siero, 2011; Steg, Dreijerink, & Abrahamse, 2005; Steg, Perlaviciute, Van der Werff, & Lurvink, 2014; Thøgersen & Ölander,

2002; Van der Werff, Steg, & Keizer, 2013, 2014). People with an altruistic value-orientation are (or might be) slightly different in such a way that they put more emphasis on the concern for other human beings, rather than for nature specifically. A person with a pure altruistic value-orientation would only engage in pro-environmental behavior if doing so would be beneficial (e.g., protective) for others (Black, Stern, & Elsworth, 1985; Hopper & Nielsen, 1991; Stern, Dietz, & Black, 1986). The difference between biospheric and altruistic orientations is seldom clear-cut, however. Some researchers view the two dimensions as closely intertwined and even undistinguishable (Bardi & Schwartz, 2003; Nordlund & Garvill, 2002; Stern & Dietz, 1994; but see de Groot & Steg, 2008), as reflected in strong positive correlations between the two dimensions (e.g., Sörqvist, Haga, Holmgren, & Hansla, 2015). A third dimension, typically negatively correlated with the biospheric and the altruistic dimensions, is the egoistic value-orientation that predisposes individuals to safeguard environmental features if there is some self-interest in doing so. People with an egoistic value-orientation prefer protecting the environment if doing so would lead to benefits for themselves and if the benefits would outweigh the costs of the pro-environmental action (de Groot & Steg, 2008, 2010). Previous studies have shown interactions between environmental values and behavior in other domains than performance. For example, people higher in environmental concern showed stronger preference for eco-friendly products, in particular, stronger purchase intentions and taste preferences (Hahnel et al., 2015; Sörqvist et al., 2013).

A related mechanism that may also underpin the magnitude of the eco-label effect is reactance. According to reactance theory, when interpersonal threats, for example, when freedom to act, are threatened by some external factors, a nudge toward a specific action can backfire; in other words, a pressure toward change from an influential agent may induce a person to do just the opposite (Brehm, 1966). Reactance theory has led to an extensive amount of research and some particularly on behavior and freedom of attitudes (Clee & Wicklund, 1980). It appears as if threat of freedom to choose as one likes is important, in particular, in cases that involve social influence; reactance arises when an influence brings up feelings of pressure toward change. When freedom is threatened, a person will be increasingly interested in behaviors or attitudes that can release the pressure, and simultaneously incurs a decreased interest in behaviors or attitudes that are forced upon that person. Moreover, when social influence is the starting point of reactance, an individual tends to move his or her behavior in the direction opposite from the influence effort. This change in direction of the behavior is described as a "boomerang effect" in the literature and refers to attitudes. More specifically, it means that when one perceives a threat to a specific and expected freedom, one will experience an increased motivation (effort) to engage in liberating behavior (Clee & Wicklund, 1980).

This is consistent with previous findings, showing that performance on cognitive demanding task decreases linearly with self-reported environmental concern.

### *Purpose and Hypotheses*

The purpose of the current study was to test whether eco-labeling of light sources can change behavior on a vision-dependent task other than color discrimination. If the effect does generalize to other tasks, such as proofreading, the results would align with the assumption that changes in motivation and effort underpin the eco-label effect, because motivation and effort should, arguably, influence performance on most (if not all) tasks. If the effect does not generalize to proofreading, however, the findings would suggest that the effect acts specifically on color discrimination and the effect of effort may not be one of the underlying mechanisms for the effects on task performance. In the current study, participants were expected to perform better on a proofreading task in the “environmentally friendly” lamp label condition compared with the “conventional” lamp label condition (Hypothesis 1 [H1]). Here, performance refers to the number of errors participants would fail to detect across the part of the proofreading task they managed to cover within the time limit. Hence, it was expected that participants would miss fewer text-related errors in the “environmentally friendly” lamp label condition compared with the “conventional” lamp label condition. As altruistic and biospheric environmental concern is hard to distinguish in the sense that these value types exert similar effects in environmentally friendly behavior, either one or the other or both of these values were expected to be associated with the difference between the two conditions (Hypothesis 2 [H2]). Specifically, the magnitude of the eco-label effect was expected to be bigger among participants with higher altruistic/biospheric environmental concern. And the magnitude of the eco-label effect refers to the size of the difference between the two label conditions. Furthermore, it was expected that participants would perceive the light from the “environmentally friendly” labeled lamp to be more comfortable than the light from the lamp labeled “conventional” (Hypothesis 3 [H3]). The magnitude of the eco-label effect on comfort ratings was also expected to be positively associated with individual differences in either altruistic or biospheric values, or both of these two values (Hypothesis 4 [H4]).

## **Method**

### *Participants*

A total of 59 Swedish students (69.5% women) at the University of Gävle ( $M$  age = 25.28 years,  $SD$  = 5.03) were recruited to participate in the experiment. They all received a small honorarium as gratitude for participation. This study was approved by the Uppsala regional ethical review board

(Dnr 2015/475). Participants gave their written informed consent to participate in the study.

### *Design and Procedure*

A within-participants design was used with lamp label as the independent variable. In one condition, the lamp was labeled “environmentally friendly” and in the other it was labeled “conventional” (although in reality the lamp was identical in the two conditions). Participants learned about the lamp label by being told about the label by the researcher, and also by a written note (white background with black text) attached to the lamp’s foot, which said that the lamp was environmentally friendly or conventional, respectively.

The experiment took place in a laboratory at the University of Gävle. Participants sat at a desk in a small room that was lit only by the desktop lamp in front of them, labeled either “environmentally friendly” or “conventional.” Participants received both oral and written task instructions, and that they would, after a proofreading task, be asked to evaluate the comfortableness of the light from the lamp. Before the proper experiment, participants also participated in a brief proofreading practice session with a text of just a few lines, where they got familiar with the procedure and the type of errors that could be found within the texts. After the practice part, participants were given proofreading tasks, one in each lamp label condition (with a time limit of 2 min respectively). The order between the two lamp label conditions, and the order between the two versions of the proofreading task, was counterbalanced between participants in all four possible combinations. After the first session of proofreading, the experimenter changed the lamp to a lamp with a different label and gave oral information about what type of lamp it was. The participant stayed in the same room throughout the experiment. After the two proofreading tasks, participants filled in a questionnaire.

### *Materials*

**Lamp.** A classic incandescent (Osram Classic ECO Superstar) with 30 W input power was used in this study. The lamp had a D efficiency certification and an E14 screw base.

**Proofreading task.** The pen-and-paper proofreading task was adopted from Halin, Marsh, Haga, Holmgren, and Sörqvist (2014). Two texts from the Swedish reading comprehension portion of the Swedish Aptitude Test for Higher Education were used as proofreading texts in the experiment. Both texts were written in Swedish, 12-point font size in Times New Roman font, with single spacing between lines. One text had 640 words and included 65 errors in total; the other text had 592 words and included 60 errors. There were two types of errors: Semantic/contextual errors consisted of either a function word that was replaced with a content word (e.g., the preposition *WITHIN* with the noun *WATER*) or a content word

**Table 1.** Intercorrelations Between Individual Differences in Environmental Concern and Dependent Measures of Comfort and Performance on Proofreading Task.

Variable	1	2	3	4	5	6	7	8
1. Egoistic	—							
2. Altruistic	.64*	—						
3. Biospheric	.42**	.61**	—					
4. Comfort in the EC	.33*	.36**	.34*	—				
5. Comfort in the CC	.03	-.00	.08	.45**	—			
6. Differences in comfort	.28*	.33**	.24	.49**	-.56**	—		
7. Missed errors in EC	-.03	-.03	-.20	-.29*	-.23	-.05	—	
8. Missed errors in CC	-.06	.02	.02	-.18	-.17	-.00	.74**	—
9. Differences in missed errors	.03	-.07	-.31**	-.19	-.11	-.07	.49**	-.22

Note. The table shows correlations ( $N = 59$ ) between three environmental concern dimensions (egoistic, altruistic, and biospheric); comfort ratings in EC and in the CC; the difference score for the difference between comfort in EC and comfort in CC; missed errors in the proofreading task in both EC and CC, respectively; and the difference score for the difference between missed errors in EC and missed errors in CC. EC = eco-friendly lamp label condition; CC = conventional lamp label condition.

\* $p < .05$ . \*\* $p < .001$ .

that was replaced with another content word (e.g., the noun *BRAIN* with the noun *TRAIN*). The other type of error was visual/spelling errors, which consisted of words with either missing letters or substituted letters (e.g., such as the letter “c” instead of “e” in the word “text” to create “text”). Half of the errors in each category were function words and the other half were content words. Participants had a time limit of 2 min in each condition. Within this time limit, no participant could proofread the entire text. Before starting the test, instructions told participants to place a mark after each line they had completed proofreading within the text. By obtaining these markings, it was possible to calculate the number of errors participants had failed to detect in the lines that they had read. The dependent variable was calculated by dividing the number of errors that the participant had failed to detect (within the lines they had marked as completely read) with the total number of errors within the lines they had marked as completely read. This dependent measure is hereafter called “errors missed.” The marking procedure also served an additional purpose: to encourage participants to read from top to bottom, instead of jumping from place to place in the text.

**Questionnaire.** Participants rated how comfortable it was to work under the illumination of each of the two light sources respectively on a scale ranging from 1 (*not at all comfortable*) to 11 (*very comfortable*). Thereafter, participants responded to a scale that measured biospheric, altruistic, and egoistic environmental concern (Schultz, 2001; Swedish version adapted from Hansla, Gamble, Juliusson, & Gärling, 2008) with the following questions: “How concerned are you that today’s environmental problems will affect . . . ?” Participants responded to each of 12 consequences on a 7-point scale ranging from 1 (*not concerned*) to 7 (*very concerned*). Reliable measures were obtained by averaging ratings of egoistic principles (“myself,” “my lifestyle,” “my health,” “my future,”  $M = 5.04$ ,  $SD = 0.91$ , Cronbach’s  $\alpha =$

.73), altruistic principles (“all human beings,” “people close to me,” “future generations,” and “my children,”  $M = 5.89$ ,  $SD = 0.81$ , Cronbach’s  $\alpha = .73$ ), and biospheric principles (“all living things,” “plants,” “animals,” and “life at sea,”  $M = 5.75$ ,  $SD = 0.91$ , Cronbach’s  $\alpha = .85$ ).

## Results

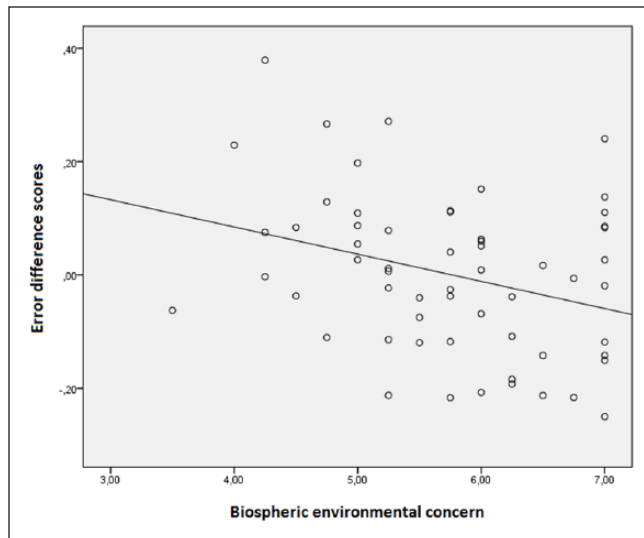
The intercorrelations between the key variables are reported in Table 1.

### Errors Missed in the Proofreading Task

The analysis of proofreading performance is based on the proportion of missed errors per lines that each participant covered. For example, a participant who covered 10 lines of text and found all mistakes in these lines would obtain a perfect score, so would also another participant who found all mistakes but covered 20 lines. Because of this, it is important to begin with a test of whether there was a difference between the two conditions with regard to the number of lines covered. The number of lines read in the “environmentally friendly” lamp label condition ( $M = 17.93$ ,  $SD = 5.75$ ) did not significantly differ from lines read in the “conventional” lamp label condition ( $M = 18.49$ ,  $SD = 6.36$ ),  $t(58) = -0.90$ ,  $p = .373$ .

In the next step, the difference in proportion of missed errors between the two conditions was analyzed. The mean difference scores (i.e., scores in the eco-labeled condition minus scores in the conventional labeled condition; where positive difference scores mean that more errors were detected in the eco-labeled lamp condition) were  $M_{\text{diff}} = 0.00$  ( $SD = 0.14$ ). Proportion of missed errors in the “environmentally friendly” lamp label condition ( $M = 0.37$ ,  $SD = 0.20$ ) did not significantly differ from proportion of missed errors in the “conventional” lamp labeled condition ( $M = 0.37$ ,  $SD = 0.18$ ),  $t(58) = 0.05$ ,  $p = .961$ , the lack of significance suggesting no support for H1.





**Figure 1.** The figure shows the relationship between biospheric environmental concern and the number of errors the participants failed to detect in the proofreading task.

Note. Specifically, the y-axis shows the difference scores between the two experimental lamp label conditions, for errors missed among the text lines the participants managed to read. Higher biospheric values are associated with a greater eco-label effect, a tendency to fail to detect fewer errors in the “environmentally friendly” lamp label condition compared with the “conventional” lamp label condition (i.e., values below 0 on the y-axis). The figure also illustrates a reversed pattern, lower biospheric values are associated with a tendency to miss more errors in the “environmentally friendly” lamp label condition compared with the “conventional” lamp label condition (i.e., values above 0 on the y-axis).

This absence of a difference in missed errors between the two lamp label conditions is expected if the magnitude of the label effect depends on individual differences in environmental concern and the differences scores for participants high versus low in environmental concern cancel each other out. To test whether there was a relationship between environmental concern and the magnitude of the label effect, a multiple regression analysis was conducted with the three environmental concern variables as predictors and the difference scores for proportion of errors missed as the dependent variable. The variance explained by the full model was significant,  $R^2 = .14$ ,  $F(3, 55) = 2.89$ ,  $p = .043$ , wherein biospheric environmental concern was the only significant predictor among the three independent variables, biospheric,  $\beta = -.44$ ,  $t = -2.79$ ,  $p = .007$ ; altruistic,  $\beta = .10$ ,  $t = .55$ ,  $p = .581$ ; and egoistic,  $\beta = .15$ ,  $t = .93$ ,  $p = .357$ . Higher biospheric environmental concern was associated with a tendency to make fewer errors in the “environmentally friendly” lamp label condition compared with the “conventional” lamp label condition (Figure 1). This finding confirms H2. The constant did not reach significance when all three environmental concern factors were included in the analysis,  $B = .17$ ,  $t = 1.22$ ,  $p = .229$ . However, because biospheric environmental concern was the only variable that predicted the effect and the three factors are highly intercorrelated (Table 1), a follow-up analysis was conducted with biospheric as the sole predictor variable. The constant was significant in this analysis,  $B = .28$ ,  $t = 2.47$ ,

$p = .017$ . This finding suggests that there is a difference between the two lamp label conditions for participants high in biospheric values, wherein participants perform better when the lamp is labeled “environmentally friendly,” although this relationship is somewhat weaker when all predictor variables are entered because of the predictor variables’ strong interrelationships.

### Comfort Ratings

Difference scores for judgments of comfort ( $M_{\text{diff}} = 0.78$ ,  $SD = 2.28$ ) were calculated. A  $t$  test for paired samples indicated that participants rated the light in the “environmentally friendly” lamp label condition ( $M = 7.80$ ,  $SD = 2.12$ ) as more comfortable than the light in the “conventional” lamp label condition ( $M = 7.02$ ,  $SD = 2.23$ ), showing a significant difference confirming H3,  $t(58) = 2.63$ ,  $p = .011$ , Cohen’s  $d = 0.36$ . To find out whether individual differences in environmental concern underpin the difference in comfort between the two conditions, a multiple regression analysis was conducted with the difference scores for judgment as dependent variable and individual differences in the three environment concern factors as independent variables. The model was not significant,  $R^2 = .35$ ,  $F(3, 55) = 2.48$ ,  $p = .070$ , and neither egoistic,  $\beta = .26$ ,  $t = 0.62$ ,  $p = .539$ ; altruistic,  $\beta = .65$ ,  $t = 1.24$ ,  $p = .222$ ; nor biospheric,  $\beta = .14$ ,  $t = 0.36$ ,  $p = .722$ , environmental concern were significant predictors. This indicates that H4 is false.

### Discussion

The purpose of the experiment was to explore whether the effects of labeling a light source environmentally friendly is restricted to color discrimination and subjective evaluations of the light from the light source, or whether the effects generalize to other performance measures. The results suggest that the eco-label effect on performance is not restricted to color discrimination, because participants who possess higher biospheric environmental concern performed better on a proofreading task when working under a desktop lamp labeled “environmentally friendly” compared with when the same lamp was labeled “conventional” vis à vis participants with lower biospheric environmental concern. Moreover, without taking individual differences in environmental concern into consideration, participants rated the lamp labeled “eco-friendly” as more comfortable than the lamp labeled “conventional.” In sum, the results show that the eco-label effect on performance, found previously for a color discrimination task (Sörqvist, Haga, Holmgren, & Hansla, 2015), is replicable and that it generalizes to other vision-based tasks.

### Why and When Does the Eco-Label Effect on Performance Arise?

The current study suggests that the eco-label effect on performance is underpinned by a general mechanism capable of

influencing a range of tasks, rather than, for example, being underpinned specifically by a shift in the ability to make color discrimination. One such general mechanism that could influence color discrimination, proofreading, as well as any other cognitive performance measure is effort. The assumption that effort underpins the eco-label effect on performance is reinforced by the finding that people believe that organic consumables (e.g., grapes) are beneficial for their mental performance (Sörqvist, Haga, Langeborg, et al., 2015). This expectation, associated with eco-labels, may operate as a catalyst on people's minds in such a way that they perform better on cognitive tasks by triggering more effort and motivation (Sörqvist, Haga, Holmgren, & Hansla, 2015).

The role of effort and motivation receives further support from the individual difference analyses in the current article. The beneficial effects from the eco-label on proofreading task performance were only found among participants with higher environmental concern. Those participants, arguably, are the ones who associate eco-labeled products and objects with positive feelings and perhaps also desires (i.e., the wish that eco-labeled objects help protect the environment). An opposing disadvantage of eco-labeling was found among participants who were lower in environmental concern. Among them, there was a tendency to detect more errors in the text they covered in the "conventional" lamp label condition. Taken together, these findings are consistent with reactance theory whereby it is assumed that people adjust their behavior to protect their freedom of choices and maintain their attitudes intact. As mentioned in the "Introduction" section, reactance theory suggests that people who perceive a threat to their freedom of choice or who feel forced to behave in a certain way react with a behavior that helps them to regain their sense of freedom (Brehm, 1972; Gniech & Grabitz, 1978). For example, a study by Wicklund, Slattum, and Solomon (1970) showed that if a salesperson puts pressure on a customer to purchase a certain product, the customer may become less (rather than more) willing to make a purchase. Perhaps people who are relatively low in environmental concern respond in a similar way to objects and products that has a label which is there to signal their environmental friendliness. In the particular case under examination in the current article, participants with lower environmental concern could perhaps have reacted negatively toward the eco-friendly lamp (due to its being socially desirable; see Sörqvist, Langeborg, & Marsh, 2016) and adjusted their behavior accordingly. What happens is that instead of acting in a way that is socially desirable, the pressure backfires and participants low in environmental concern perform worse on the proofreading task when the lamp is labeled eco-friendly; they undertake alternative behaviors that release the pressure instead of performing well on the proofreading task, which results in a worse performance in the eco-label condition.

An alternative explanation for the label effect on performance is that some participants intentionally try to confirm what they believe/assume is the research's hypothesis.

However, this "demand characteristics" explanation is difficult to reconcile with a number of findings. Individual differences in environmental concern were related to the magnitude of the eco-label effect on proofreading but not to the magnitude of the eco-label effect on subjective ratings of comfort. However, there was a main effect of lamp label on comfort ratings but not on proofreading; this finding might speak for different mechanisms underpinning the effects of labeling on comfort ratings and performance, respectively. If some participants were deliberately trying to provide the researcher with evidence in favor of the eco-label effect, then these factors should have been related. Instead, the absence of these relationships indicates that the eco-label effect on subjective ratings and the eco-label effect on performance/behavioral measures are underpinned by functionally distinct mechanisms. Placebo effects can have different causes such as desire, expectations, classical conditioning, and response biases (Price et al., 2008). The suggestion here is that the eco-label effect on comfort ratings is a result of response bias and has not to do with actual differences in the sensory experience of the light. On the contrary, the eco-label effect on performance is caused by intrinsic motivation, desires, or expectancies of the superiority of environmentally friendly light sources, which facilitate performance perhaps through effort. Despite what is causing this effect, it is still unknown how long lasting this effect is. It is possible that when, in this case, use of the environmentally friendly lamp becomes habit, the effect may disappear.

### *Reanalysis of Previous Data*

Another way to test whether "demand characteristics" play a part in the eco-label effect is to run an experiment using a between-participants design instead of a within-participants design. A within-participants design has been used in most previous studies on the eco-label effect, including the study by Sörqvist, Haga, Holmgren, and Hansla (2015) where color discrimination were tested in two different conditions (environmentally friendly labeled lamp vs. conventional labeled lamp). This type of design, where participants take part both in an eco-label condition and a conventional label condition, may encourage participants (consciously or unconsciously) to compare the two conditions in ways that may exaggerate the difference between the conditions with regard to the effects of the label on performance. A within-participant design has the advantage of making it possible to calculate a difference score between the two conditions that can be correlated with other individual difference data (such as environmental concern), but testing whether the eco-label effect emerges in the context of a between-participants design might have some advantages because it would suggest that the effect is not dependent on participants comparing the two conditions. To test whether the eco-label effect emerges also in a between-participants design, the data from Sörqvist, Haga, Holmgren, and Hansla (2015) was revisited.

In the new analysis, only data from the first of the two conditions participants took part in were included in the analysis. That is, in this new analysis, the data for the “environmentally friendly” lamp label condition were taken only from participants (half the sample) who had this condition as their first condition, and data for the “conventional” lamp label condition were taken only from participants (other half of the sample) who had this condition as their starting point. A between-participants *t* test, with error rates (high mean values meaning that participants made more errors) on the color discrimination task as dependent variable, showed that participants performed worse when the lamp was labeled “conventional” ( $M = 23.50$ ,  $SD = 13.26$ ) in comparison with when the lamp was labeled “environmentally friendly” ( $M = 11.27$ ,  $SD = 13.12$ ),  $t(46) = 3.21$ ,  $p = .002$ , Cohen’s  $d = 0.93$ . Hence, the eco-label effect appears to be robust enough to emerge both in the context of a between-participants design and a within-participants design. Therefore, this reanalysis confirms that a mental comparison between the conditions by participants is not a prerequisite for the effect to emerge.

### Potential Applied Implications

There are a few applied implications that can be deduced from the results. It seems like eco-friendly objects in the built environment, specifically environmentally friendly light sources, can improve performance in office environments, even if this is a result of the office worker’s preconceptions. For this effect to arise, the user must of course know that the lamp is environmentally friendly, or at least believe it is. The findings reported here illustrate this potential influence from environmentally friendly light sources with a task that is typical of an everyday situation in the office as proofreading. Another potential applied implication is that the beneficial effects of eco-labeling can, possibly, generate and fortify positive attitudes toward eco-labeled light sources and other products and thereby increase the demand for eco-labeled products. Marketing action can change not only consumers’ judgments and the biological processes underlying people’s consumption and purchasing decisions (de Araujo, Edmund, Velazco, Margot, & Cayeux, 2005; Kirk, Skov, Christensen, & Nygaard, 2009; Nitschke et al., 2006), but also the behavioral consequences of these judgments, as indicated by the current article. Understanding these processes (the eco-label effect specifically) reveals the underpinnings of some aspects of human behavior in general, but this understanding may also provide a key to sustainable development. For example, the marketing of organic and eco-friendly products makes consumers enjoy the products more (and perhaps the products’ behavioral consequences with it), which may make consumers more likely to choose environmentally friendly over conventional products in the marketplace.

### Conclusion

In conclusion, the eco-label effect on performance and behavioral outcomes appears to be relatively robust and

replicable. Moreover, the effect on performance generalizes across different task domains, which suggest that the effect on performance is underpinned by a general mechanism. However, a complete explanation of the eco-label effects seems to require a duplex-mechanism account whereby the eco-label effect on subjective ratings and the eco-label effect on performance are underpinned by functionally distinct causes. The results reported here generate a greater understanding of the eco-label effect as it arises in contexts other than with food and consumables, and show some of the potentially important psychological consequences of “green” labeling in the built environment.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

### References

- Bardi, A., & Schwartz, S. H. (2003). Values and behavior: Strength and structure of relations. *Personality and Social Psychology Bulletin*, 29, 1207-1220.
- Benson, H., & Friedman, R. (1996). Harnessing the power of the placebo effect and renaming it “remembered wellness.” *Annual Review of Medicine*, 47, 193-199.
- Black, J. S., Stern, P. C., & Elsworth, J. T. (1985). Personal and contextual influences on household energy adaptations. *Journal of Applied Psychology*, 70, 3-21.
- Brehm, J. W. (1966). *A theory of psychological reactance*. Oxford, UK: Academic Press.
- Brehm, J. W. (1972). *Responses to the loss of freedom: A theory of psychological reactance*. Morristown, NJ: General Learning Press.
- Clee, M. A., & Wicklund, R. A. (1980). Consumer behavior and psychological reactance. *Journal of Consumer Research*, 6, 389-405.
- de Araujo, I. E., Rolls, E. T., Velazco, M. I., Margot, C., & Cayeux, I. (2005). Cognitive modulation of olfactory processing. *Neuron*, 46, 671-679.
- de Groot, J. I. M., & Steg, L. (2008). Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. *Environment and Behavior*, 40, 330-354.
- de Groot, J. I., & Steg, L. (2010). Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *Journal of Environmental Psychology*, 30, 368-378.
- Draganich, C., & Erdal, K. (2014). Placebo sleep affects cognitive functioning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 40, 857-864.
- Geers, A. L., Weiland, P. E., Kosbab, K., Landry, S. J., & Helfer, S. G. (2005). Goal activation, expectations, and the placebo effect. *Journal of Personality and Social Psychology*, 89, 143-159.
- Gniech, G., & Grabitz, H. J. (1978). Freiheitseinsengung und psychologische Reaktanz [Freedom restriction and psychological reactance]. In D. Frey (Ed.), *Kognitive Theorien*



- der Sozialpsychologie (pp. 48-73). Huber Verlag: Bern, Switzerland.
- Hahnel, U. J. J., Arnold, O., Waschto, M., Korcaj, L., Hillmann, K., Roser, D., & Spada, H. (2015). The power of putting a label on it: Green labels weigh heavier than contradicting product information for consumers' purchase decisions and post-purchase behavior. *Frontiers in Psychology*, 6, Article 1392.
- Halin, N., Marsh, J. E., Haga, A., Holmgren, M., & Sörqvist, P. (2014). Effects of speech on proofreading: Can task-engagement manipulations shield against distraction? *Journal of Experimental Psychology: Applied*, 20, 69-80.
- Hansla, A. (2011). Value orientations and framing as determinants of states willingness to pay for eco-labeled electricity. *Energy Efficiency*, 4, 185-192.
- Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). Psychological determinants of attitude towards and willingness to pay for green electricity. *Energy Policy*, 36, 768-774.
- Hopper, J. R., & Nielsen, J. M. (1991). Recycling as altruistic behavior: Normative and behavioral strategies to expand participation in a community recycling program. *Environment and Behavior*, 23, 195-220.
- Joireman, J. A., Lasane, T. P., Bennett, J., Richard, D., & Solaimani, S. (2001). Integrating social value orientation and the consideration of future consequences within the extended norm activation model of proenvironmental behaviour. *British Journal of Social Psychology*, 40, 133-155.
- Kirk, U., Skov, M., Christensen, M. S., & Nygaard, N. (2009). Brain correlates of aesthetic expertise: A parametric fMRI study. *Brain and Cognition*, 69, 306-315.
- Lotz, S., Chrisandl, F., & Fetchenhauer, D. (2013). What is fair is good: Evidence of consumers' taste for fairness. *Food Quality and Preference*, 30, 139-144.
- Mayr, S., Köpper, M., & Buchner, A. (2013). Comparing colour discrimination and proofreading performance under compact fluorescent and halogen lamp lighting. *Ergonomics*, 56, 1418-1429.
- Nitschke, J. B., Dixon, G. E., Sarinopoulos, I., Short, S. J., Cohen, J. D., Smith, E. E., . . . Davidson, R. J. (2006). Altering expectancy dampens neural response to aversive taste in primary taste cortex. *Nature Neuroscience*, 9, 435-442.
- Nordlund, A. M., & Garvill, J. (2002). Value structures behind proenvironmental behavior. *Environment and Behavior*, 34, 740-756.
- Piqueras-Fiszman, B., & Spence, C. (2015). Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Quality and Preference*, 40, 165-179.
- Price, D. D., Finnis, D. G., & Benedetti, F. (2008). A comprehensive review of the placebo effect: Recent advances and current thought. *Annual Review of Psychology*, 59, 565-590.
- Schuldt, J. P., Muller, D., & Schwarz, N. (2012). The "fair trade" effect: Health halos from social ethics claims. *Social Psychological and Personality Science*, 3, 581-589.
- Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, 21, 327-339.
- Sörqvist, P., Haga, A., Holmgren, M., & Hansla, A. (2015). An eco-label effect in the built environment: Performance and comfort effects of labeling a light source environmentally friendly. *Journal of Environmental Psychology*, 42, 123-127.
- Sörqvist, P., Haga, A., Langeborg, L., Holmgren, M., Wallinder, M., Nörtl, A., . . . Marsh, J. E. (2015). The green halo: Mechanisms and limits of the eco-label effect. *Food Quality and Preference*, 43, 1-9.
- Sörqvist, P., Hedblom, D., Holmgren, M., Haga, A., Langeborg, L., Nörtl, A., & Kågström, J. (2013). Who needs cream and sugar when there is eco-labeling? Taste and willingness to pay for "eco-friendly" coffee. *PLoS ONE*, 8, e80719.
- Sörqvist, P., Langeborg, L., & Marsh, J. E. (2016). Social desirability does not underpin the eco-label effect on product judgments. *Food Quality and Preference*, 50, 82-87.
- Steg, L., de Groot, J. I. M., Dreijerink, L., Abrahamse, W., & Siero, F. (2011). General antecedents of personal norms, policy acceptability, and intentions: The role of values, worldviews, and environmental concern. *Society & Natural Resources: An International Journal*, 24, 349-367.
- Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology*, 25, 415-425.
- Steg, L., Perlaviciute, G., Van der Werff, E., & Lurvink, J. (2014). The significance of hedonic values for environmentally relevant attitudes, preferences, and actions. *Environment and Behavior*, 46, 163-192.
- Stern, P. C., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, 50, 65-84.
- Stern, P. C., Dietz, T., & Black, J. S. (1986). Support for environmental protection: The role of moral norms. *Population and Environment*, 8, 204-222.
- Thøgersen, J., & Ölander, F. (2002). Human values and the emergence of a sustainable consumption pattern: A panel study. *Journal of Economic Psychology*, 23, 605-630.
- Van der Werff, E., Steg, L., & Keizer, K. (2013). The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *Journal of Environmental Psychology*, 34, 55-63.
- Van der Werff, E., Steg, L., & Keizer, K. (2014). I am what I am, by looking past the present: The influence of biospheric values and past behavior on environmental self-identity. *Environment and Behavior*, 46, 626-657.
- Weger, W. U., & Loughnan, S. (2013). Mobilizing unused resources: Using the placebo concept to enhance cognitive performance. *Quarterly Journal of Experimental Psychology*, 66, 23-28.
- Wicklund, R. A., Slattum, V., & Solomon, E. (1970). Effects of implied pressure toward commitment on ratings of choice alternatives. *Journal of Experimental Social Psychology*, 6, 449-457.
- Zuo, J., & Zhao, Z. Y. (2014). Green building research—Current status and future agenda: A review. *Renewable and Sustainable Energy Reviews*, 30, 271-281.

## Author Biography

**Andreas Haga** Fil.Dr in environmental psychology at University of Gävle, Sweden. He is an experimental psychologist using conceptually relevant methods with regard to cognitive processing of environment and sustainability-related information.