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An eco-label effect in the built environment: Performance and comfort effects of labeling a light source environmentally friendly

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ABSTRACT

People tend to idealize eco-labeled products, but can eco-labeling have consequences for performance? To address this question, 48 university students were asked to undertake a color discrimination task adjacent to a desktop lamp that was either labeled "environmentally friendly" or "conventional" (although they were identical). The light of the lamp labeled "environmentally friendly" was rated as more comfortable. Notably, task performance was also better when the lamp was labeled "environmentally friendly". Individual differences in environmental concern, but not pro-environmental consumer behavior and social desirability indexes, were related to the magnitude of the eco-label effect on performance. Whilst some previous studies have shown similar placebo-like effects of eco-labels on subjective ratings, this is the first study to show an eco-label effect for artifacts in the built environment on performance, and the first study to relate this effect to environmental concern. Psychological mechanisms that may underpin the eco-label effects are discussed.

1. Introduction

Environmentally friendly and organic products tend to be idealized and receive more positive evaluations than conventional (or more environmentally harmful) alternatives. For example, people tend to prefer the taste of coffee they believe is "eco-friendly" over the taste of another cup of coffee they believe is "conventional", even if the two cups of coffee are actually identical (Sörqvist et al., 2013). This preference bias for eco-labeled products has been termed *the eco-label effect*. The effect has been found for subjective sensory ratings (i.e., taste evaluations) across a range of different products including bread (Annett, Muralidharan, Boxall, Cash, & Wismer, 2008), banana (Sörqvist et al., 2015), wine (Wiedmann, Hennigs, Behrens, & Klarmann, 2014), potato chips (Lee, Shimizu, Kniffin, & Wansink, 2013), and tomatoes (Ekelund, Fernqvist, & Tjärnebo, 2007), and for emotion ratings in eco-labeled electricity choice (Nilsson, Hansla, & Biel, 2014). It has also been found for other judgmental dimensions including willingness to pay, calorific contents and potential mental performance benefits (Sörqvist et al., 2015). In this paper, we seek to investigate whether an eco-label effect can also be found for performance measures or whether the effect is restricted to self-reported judgments only.

Arbitrary information about how well one has slept (Draganich & Erdal, 2014), and bogus priming that makes people more confident in their knowledge (Weger & Loughnan, 2013), can influence cognitive performance. These placebo-like effects (an outcome that is not attributed to a specific treatment but rather to an individual's mindset; Price, Finniss, & Benedetti, 2008) suggest that performance measures can be influenced by simply telling the participants something they believe could potentially have facilitating effects on performance. In our attempt to find placebo effects of eco-labeling on performance, we compared performance on a color discrimination test previously shown to be sensitive to variations in lighting (Mayr, Köpper, & Buchner, 2013) under two conditions: One condition wherein the light source was labeled "environmentally friendly" and one condition wherein the exact same light source was labeled "conventional".

The mechanism underpinning the eco-label effect was also examined in the context of individual difference analyses. The eco-

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label effect on sensory ratings is larger in magnitude amongst people who often purchase eco-labeled products in the grocery store (Sörqvist et al., 2013) or otherwise engage in pro-environmental behavior (Lee, Shimizu, et al., 2013). Therefore, environmental concern could perhaps make people more susceptible to the eco-label effect (but see Schuldt & Hannahan, 2013). Environmental concern describes an attitude (i.e. affective or cognitive evaluation of an object) towards environmental protection and environmental problems (Fransson & Gärling, 1999; Schultz, Shriver, Tabanico, & Khazian, 2004) and is an influential determinant of pro-environmental choices and behaviors (Bamberg, 2003; Stern, 2000; van der Werff, Steg, & Keizer, 2013, 2014). In previous research (e.g., Schultz, 2001), three types of general environmental concern have been distinguished: biospheric concerns (being worried about adverse consequences for wildlife and nature), altruistic concerns (being worried about adverse consequences for people, including one's family and friends), and egoistic concerns (being worried about consequences for one's own health and wellbeing). Especially biospheric and altruistic environmental concerns have been shown to encourage pro-environmental behavior (Milfont, Duckitt, & Cameron, 2006; Schultz, 2001). In the experiment reported here, we used attitudinal and behavioral indices of environmental concern, thus measuring general biospheric, altruistic and egoistic environmental concerns (Schultz, 2001) and specific pro-environmental consumer behavior (Sörqvist et al., 2013). Then we tested whether these would predict the magnitude of the eco-label effect.

Another potential mechanism underpinning the eco-label effect is social desirability. To behave pro-environmentally is socially desirable (Félonneau & Becker, 2008; Milfont, 2009) and, because of this, one suspicion is that the preference bias for eco-friendly alternatives seen in previous studies (Lee, Shimizu, et al., 2013; Sörqvist et al., 2015) is a result of participants judging the products in ways that they believe is approved by others (e.g., the researcher). To control for this possibility, we used a social desirability scale designed to identify respondents who are susceptible to the influence of social desirability (Rudmin, 1999). If the magnitude of the eco-label effect is underpinned by those individual difference measures, it should be revealed in correlation analyses.

In summary, the experiment reported here was designed to find an eco-label effect on performance by having participants conduct a color discrimination task by comparing performance when the light source was labeled “environmentally friendly” with when the light source was instead labeled “conventional”. The participants were also asked to rate how comfortable it was to work with the “eco-labeled” and the “conventional” light source respectively. These self-reported comfort ratings were collected to compare the eco-label effect on subjective ratings with the eco-label effect on performance. Finally, the mechanisms underpinning the eco-label effect was investigated by testing whether individual differences in environmental concern or social desirability indices would predict the magnitude of the eco-label effect.

2. Method

2.1. Participants

A total of 48 Swedish students (63% women) at the University of Gävle (mean age = 24.31 years, *SD* = 4.02) were recruited to participate in the experiment. They all received a cinema ticket as a gratitude for participation.

2.2. Materials

2.2.1. Lamp

A classic incandescent lamp (Osram Classic P) with 40 W input power was used in this study. The lamp had an E efficiency certification and an E14 screw base.

2.2.2. Color discrimination test

The Farnsworth-Munsell 100 Hue Test was used to assess color discrimination performance (Mayr et al., 2013). The participants were faced with trays of colored caps and their assignment was to arrange the randomly placed color caps into a proper sequence of gradual color transition (e.g., from red to yellow).

2.2.3. Questionnaire

The participants rated on a scale ranging from 1 (not at all comfortable) to 11 (very comfortable) how comfortable it was to work under the illumination of each of the two light sources respectively. Thereafter the participants responded to three different scales. The pro-environment consumer scale consisted of the following 3 questions: “How often do you purchase eco-friendly alternatives?”, “Do you feel guilt when you don't purchase eco-friendly alternatives?”, and “Is environmentally friendly or conventional products better in terms of quality, generally?”. Questions were answered using scales ranging from 1 (never/definitely environmentally friendly) to 11 (always/definitely conventional) with endpoints labeled. The third question was reversely coded, and the average was then calculated across the three questions to create an index of pro-environment consumer behavior ($M = 5.45$, $SD = 1.22$). A short version of the Marlow–Crown Social Desirability Scale was used to assess individual differences in tendencies to act is ways that are socially desirable (Rudmin, 1999). The test consisted of 10 questions (e.g., “Have you ever been angry with someone?”) to which the participants responded “yes” or “no”. The “yes” response was the socially desirable alternative for half of the questions, whilst the “no” response was the socially desirable response to the other questions. The total score was used to create an index of social desirability response behavior ($M = 4.60$, $SD = 2.01$). Finally, biospheric, altruistic, and egoistic environmental concerns were assessed with the following question (Schultz, 2001; Swedish version adapted from Hansla, Gamble, Juliusson, & Gärling, 2008): “*How concerned are you that today's environmental problems will affect … ?*” The participants responded to each of 12 consequences on a seven-point scale ranging from 1 (not concerned) to 7 (very concerned). Reliable measures were obtained by averaging ratings of egoistic consequences (“myself”, “my lifestyle”, “my health” “my future”, $M = 4.51$, $SD = 1.15$, Cronbach's $\alpha = .82$), altruistic consequences (“all human beings”, “people close to me”, “future generations”, and “my children”, $M = 5.28$, $SD = 1.26$, Cronbach's $\alpha = .79$), and biospheric consequences (“all living things”, “plants”, “animals”, and “life at sea”, $M = 5.52$, $SD = 1.19$, Cronbach's $\alpha = .88$).

2.3. 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). The lamp label was communicated to the participants by the researcher orally and with a written note that was attached to the lamp.

The experiment took place in a laboratory at the University of Gävle. The participants sat at an ordinary desk in a small room that was lit only by the desktop lamp in front of them, labeled either "environmentally friendly" or "conventional", and a similar light source behind them. They began by reading the first page of the questionnaire so that they knew that they were going to evaluate how comfortable it would be to work under the illumination of the two lamps respectively. Thereafter, they completed one tray from the Farnsworth-Munsell 100 Hue Test in each experimental condition (the time limit was 2 min for each condition) and later filled in the questionnaire. The order of the two lamp label conditions ("environmentally friendly" versus "conventional"), the color trays in the color discrimination task, and the order in which the two lamps were evaluated in the questionnaire were counterbalanced between participants.

2.4. Statistics

Normality of the distribution of observations was confirmed by visual inspection wherever suitable. Consequently, parametric tests (paired samples *t*-tests, Pearson's product–moment correlation analyses, and regression analyses) were conducted.

3. Results

As can be seen in Fig. 1, working under the lamp that was labeled "environmentally friendly" was rated as more comfortable in comparison with working under the lamp that was labeled "conventional". This result was statistically significant as shown with a paired samples *t*-test for within-participant design of the difference in comfort ratings ($M_{diff} = 1.04$, $SD_{diff} = 2.11$) in the "environmentally friendly" lamp label condition ($M = 7.15$, $SD = 1.60$) and the "conventional" lamp label condition ($M = 6.10$, $SD = 1.34$), $t(47) = 3.42$, $p = .001$, Cohen's $d = 0.49$. Moreover, the participants performed better on the color discrimination task when working under the lamp that was labeled "environmentally friendly" (Fig. 2). This result was statistically significant as shown with a paired samples *t*-test for within-participant design of the difference in color-discrimination task scores ($M_{diff} = -11.49$, $SD_{diff} = 16.66$) in the "environmentally friendly" lamp label condition ($M = 10.38$, $SD = 11.51$) and the "conventional" lamp label condition ($M = 21.87$, $SD = 13.63$), $t(47) = 4.78$, $p < .001$, Cohen's $d = 0.69$. As the eco-label effect on a performance measure is novel, we controlled whether this is due to the influence of outliers. When four extreme outliers (above/below 2.5 *SD* from the means) were removed, the statistical reliability of the difference increased, $t(43) = 5.78$, $p < .001$.

To test whether the eco-label effect on subjective ratings and that on performance are underpinned by a similar mechanism, the relationships between comfort ratings and errors on the performance test were analyzed. In a first step, difference scores (ratings in the "environmentally friendly" condition subtracted from ratings in the "conventional" condition) for the comfort ratings ($M = 1.04$, $SD = 2.11$) and for the error scores ($M = -11.49$, $SD = 16.66$) were calculated, respectively. More positive comfort ratings represent a more favorable evaluation of the lamp labeled "environmentally friendly". More negative error scores represent a greater eco-label effect on performance (i.e., a greater error in the "conventional" lamp label condition). In a second step, the Pearson product–moment correlation coefficient for the relationship between the difference scores was tested. The correlation was not significant, $r(46) = .02$, $p = .900$. This was not a result of outliers suppressing the relationship, as the correlation was still not significant when two extreme outliers were removed from the analysis, $r(44) = .03$, $p = .822$.

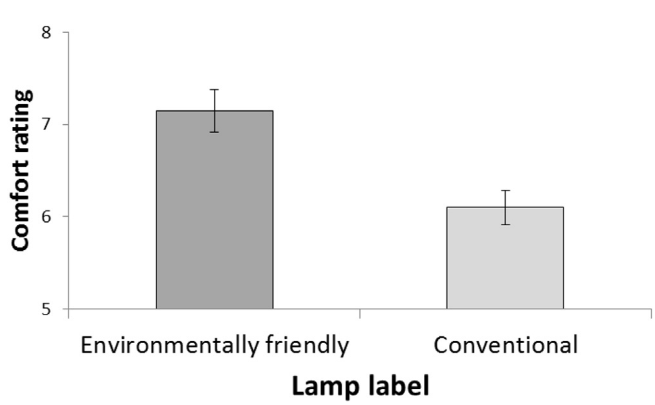

Fig. 1. Mean comfort ratings assigned to the light from a classic, not environmentally friendly light source that was either labeled "environmentally friendly" or "conventional". Error bars represent standard error of means.

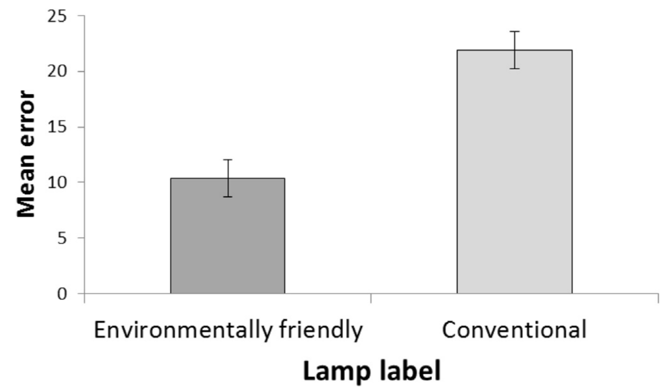

Fig. 2. Mean error on a color discrimination task performed adjacent to a classic, not environmentally friendly light source that was either labeled "environmentally friendly" or "conventional". Error bars represent standard error of means.

Correlation coefficients amongst the predictor variables are reported in Table 1. A multiple regression analysis was conducted to have the five individual difference variables compete as predictors of the eco-label effects. In a first analysis, the difference scores for the comfort ratings were selected as dependent variable and the five predictor variables were selected as independent variables. The variance explained by each predictor variable, respectively, was far from significant, and the model did not reach statistical significance, $R^2 = .06$, $F(5, 42) = 0.53$, $p = .753$. In a second analysis, the difference scores for errors on the performance test were selected as dependent variable and the five predictor variables were selected as independent variables. In this model, lacking overall significance, $R^2 = .14$, $F(5, 42) = 1.40$, $p = .243$, altruistic environmental concern was a significant predictor, $\beta = -.46$, $t = -2.15$, $p = .037$. Higher altruistic environmental concern was associated with a tendency to make fewer errors in the "environmentally friendly" lamp label condition compared to the "conventional" lamp label condition (Fig. 3).

Table 1
Intercorrelations (Pearson r's) amongst the predictor variables.

Variable	1.	2.	3.	4.
1. Egoistic environmental concern	–			
2. Altruistic environmental concern	.66*	–		
3. Biospheric environmental concern	.48*	.61*	–	
4. Social desirability scale	.09	.17	.17	–
5. Pro-environment consumer scale	.18	.16	.15	–.18

Note: $N = 48$.
*$p < .001$.

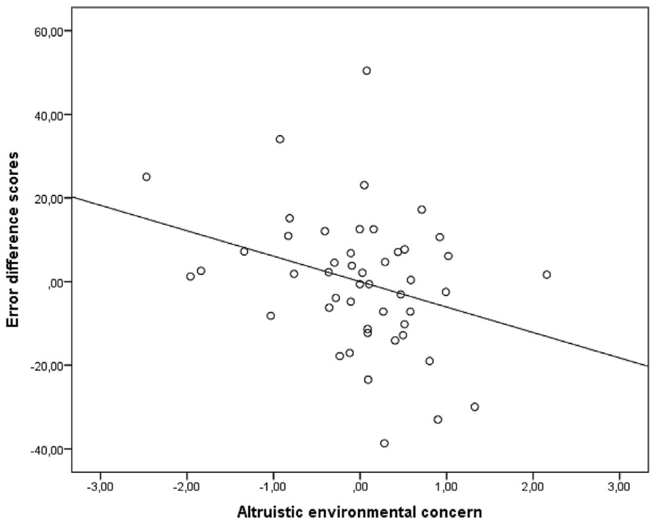

Fig. 3. The figure shows the partial relationship between error difference scores on the color discrimination test (errors in the "environmentally friendly" lamp label condition subtracted with errors in the "conventional" lamp label condition) and altruistic environmental concern. Higher altruistic values are associated with a greater eco-label effect; a tendency to perform better (make fewer errors) in the "environmentally friendly" lamp label condition compared with the "conventional" lamp label condition.

4. Discussion

Whilst previous research has shown that eco-labeled food products are idealized in subjective evaluations and, in particular, receive higher taste ratings than conventional consumables even if the two products are identical (Lee, Shimizu, et al., 2013; Sörqvist et al., 2013), the experiment reported here is the first to demonstrate a similar phenomenon for artifacts in the built environment. The light from a light source that is labeled "environmentally friendly" feels more comfortable than the light from a light source labeled "conventional", even if the two light sources are identical. This eco-label effect was also found in the context of a performance measure: The participants made fewer errors on a color discrimination task when the lamp was labeled "environmentally friendly" in comparison with when the lamp was labeled "conventional".

The individual difference analyses reveal some insights into the mechanisms underpinning the eco-label effects. The effects appear to be a result of some other mechanism than social desirability (i.e. that the participants reported higher comfort ratings for the lamp labeled "environmentally friendly" because they wanted to behave in ways they believe are approved by others), as the magnitude of the effects did not correlate with the social desirability scale. This conclusion is consistent with experimental evidence (Sörqvist et al., 2013) and other correlational evidence (Sörqvist et al., 2015) showing that social desirability is not responsible for the eco-label effect found in the context of consumable products. Similarly, it seems unlikely that the effects found here are simply a result of demand characteristics of the experiment (i.e., that the participants deliberately tried harder in the "environmentally friendly" condition because they thought it would help confirm the researcher's hypothesis), because no correlation was found between comfort ratings and performance, and such correlation would be expected if participants simply tried to confirm what they thought was the hypothesis. The magnitude of the eco-label effect on performance was, however, related to attitudinal predispositions in the form of environmental concern. Hence, one mechanism that appears to underpin the eco-label effect (at least the effect on performance) is environmental concern. One possibility is that the eco-label effect arises when people are convinced that eco-labeled artifacts are superior to conventional alternatives, or at least when they hope that the eco-labeled artifacts are superior as that would be to the environment's advantage. Individuals expressing high environmental concern (for altruistic consequences, e.g., people and future generations) may then idealize eco-labeled artifacts to a higher extent than may people expressing low environmental concern for these consequences. This is consistent with the idea that intrinsic—rather than social—desires underpin the eco-label effect (Sörqvist et al., 2013). In previous research, environmental concerns related to self-transcendence values are assumed to reflect such an intrinsic factor (De Groot & Steg, 2007; Schultz et al., 2004). The idealizing process not only enhances subjective evaluations of the artifact, but also stretches into behavioral consequences by means of modulating the magnitude of the placebo-like eco-label effect on performance.

The lack of a correlation between the eco-label effect on comfort ratings and the eco-label effect on performance suggests that the two effects are caused by functionally distinct mechanisms. Placebo effects can have different causes such as desire, expectations, classical conditioning and response biases (Price et al., 2008). One possibility is that the eco-label effect on comfort ratings is a response bias, rather than a difference in the perceptual experience of the light, whereas the eco-label effect on performance is caused by expectation processes whereby the participants' belief in the superiority of environmentally friendly light sources facilitates performance. The functional independence between the two eco-label effects is further reinforced by the correlation analyses with environmental concern. Whilst environmental concern was related to the eco-label effect on performance, it was not related to the eco-label effect on comfort ratings. The placebo-like effect on performance suggests that a "match" between the label and the attitudes held by the person performing the task (e.g., using an environmentally-friendly lamp appealing to altruistic environmental concern) is necessary for performance facilitation, possibly via expectation processes operating to produce a "self-fulfilling prophecy" about positive outcomes. An alternative or complementary explanation could be that a "mismatch" between the lamp label and the person's attitude impedes performance. This alternative appears less likely, however, as the lamp label was rather neutral (i.e., "conventional") as opposed to negative (e.g., "environmentally harmful"). One target for future research is to study the effects of more negative labels.

The results reported here have some applied implications. One is that potential positive behavioral outcomes may promote sales and positive attitudes toward eco-labeled light sources and other products in the built environment. The positive consequences of an (assumed) environmentally friendly lamp shown here, do not contradict previous evidence showing that some people hold negative attitudes related to expectations about worsened illumination of such lamps (Lee, Park, & Han, 2013). At least some people that hold negative attitudes may merely *assume* worse illumination and lack clear-cut experience. Hence, when actually perceiving no adverse consequences of an eco-labeled lamp in a real situation, their reason for opposition would be suppressed and their attitude expression may change in the positive direction. Future research is yet needed to test the eco-label effect in some population-based samples where opposition towards environmental policy may be more wide spread. Another possible applied implication is that "environmentally friendly" light sources may enhance ergonomics in the office environment, simply as a result of a placebo effect arising from user's imagination and expectations. Examining the eco-label effect on performance measures that more closely resemble what office workers are actually doing (e.g., proofreading and word processed writing) is another target for future research. Finally, previous studies on the eco-label effect, as well as the present experiment, have consistently used within-participants design with explicit labels that encourage a comparison between the environmentally friendly alternative and the conventional alternative. This procedure may exaggerate the difference between conditions, and the procedure may have a limited ecological validity because products are typically not labeled "conventional" in the marketplace or in the office environment. Future studies should aim to replicate the eco-label effect in the context of a between subjects design, wherein the participants make absolute estimates of either an eco-labeled or a non-labeled alternative, rather than a comparative estimate.

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