Proenvironmental Behavior Increases Subjective Well-Being: Evidence From an Experience-Sampling Study and a Randomized Experiment

Michael Prinzing
Department of Psychology and Neuroscience, Baylor University

Abstract

Two preregistered studies investigated whether engaging in proenvironmental behavior increases a person's well-being. A 10-day experience-sampling study (7,161 observations from 181 adults in 14 countries, primarily the United States) revealed positive within-person and between-person associations, and a randomized controlled experiment ($N = 545$ U.S. undergraduates) found that incorporating proenvironmental behavior into individuals' daily activities increased their experiences of happiness and meaning in life. Indeed, the effect was comparable to incorporating activities selected specifically to elicit such positive states, though these results may be affected by demand characteristics. The studies also offered some tentative preliminary evidence about why such an effect might emerge. There was some support for the hypothesis that proenvironmental behavior affects well-being by creating a "warm glow." But overall the findings align more closely with the hypothesis that proenvironmental behavior helps to satisfy individuals' basic psychological needs.

Ecologically sustainable lifestyles are widely thought to reduce well-being. In popular media, environmental activists are praised for forgoing "comfortable lifestyles" (Nisa & Bélanger, 2019), whereas others are said to be "too selfish to endure present pain to avert future climate change" (Walsch, 2013). Figures on the political right often portray sustainability initiatives as requiring people to give up their comforts and freedoms (Wilkie, 2019). As one conservative pundit wrote, "going green" necessitates "living on a smaller, more inconvenient, more uncomfortable, more expensive, less enjoyable, and less hopeful scale" (Milloy, 2009). Yet similar ideas are found on the political left (Atkin, 2019), and in psychological research it is also commonly assumed that proenvironmental behavior is inimical to individual well-being (Bilandzic et al., 2017; Thaller et al., 2020).

This unfavorable perception of proenvironmental behavior is strikingly out of step with philosophical theory and psychological science. Philosophers from East and West have long argued that virtue is the most reliable route to well-being (Aristotle, 2000; Confucius, 2007); that is, people flourish when they strive to be good and do good in the world. Empirical findings generally support this theory. Morality and social contribution are central to ordinary conceptions of happiness and a meaningful life (Huang & Yang, 2022; Prinzing et al., 2022), and acting prosocially increases individuals' experiences of happiness and meaning, or *subjective well-being* (SWB; Hui et al., 2020). The question arises, therefore, whether acting proenvironmentally might do the same. If proenvironmental behavior involves doing something good for the Earth, then—contrary to popular perceptions—might it improve SWB?

Prior work has found that prosocial and proenvironmental values are positively correlated (Boer & Fischer,

Corresponding Author:
Michael Prinzing, Baylor University, Department of Psychology and Neuroscience
Email: michael_prinzing@baylor.edu

2013; Kaiser & Byrka, 2011), and that proenvironmental behavior predicts SWB even after controlling for environmental concern and a range of sociodemographic factors (Welsch & Kühling, 2010). Indeed, a recent meta-analysis concluded that, although the correlation between proenvironmental behavior and SWB is not especially large ($r = .24$), it is remarkably robust (Zawadzki et al., 2020). Yet this body of research has two fundamental limitations. First, because these studies have been exclusively observational, and almost exclusively cross-sectional (cf. Bissing-Olson et al., 2013; Wray-Lake et al., 2019), the possibilities for causal inference are limited. Second, past studies have relied heavily on global self-reports, which ask participants to report on their proenvironmental behavior over long periods of time (e.g., in general, or in the past year). Global self-reports suffer from recall and social-desirability biases and tend to reflect a person's self-conception more than actual behavior (Grimm, 2010; Stone et al., 1999). Recent meta-analytic evidence suggests that social-desirability bias is only very modestly associated with reports of proenvironmental behavior (Vesely & Klöckner, 2020). Yet some researchers argue that SWB is associated with having a "green self-image" rather than actually acting proenvironmentally (Binder & Blankenberg, 2017; Venhoeven et al., 2016). The aim of this article is to overcome these limitations.

How Might Proenvironmental Behavior Increase Subjective Well-Being?

Our primary research question is whether proenvironmental behavior increases SWB. Yet an affirmative answer to that question would naturally invite the further question of *how* exactly proenvironmental behavior affects SWB. One hypothesis is that doing something good for the environment makes people feel good about themselves, thereby producing a pleasant feeling sometimes called a "warm glow" (Binder & Blankenberg, 2017; van der Linden, 2018; Venhoeven et al., 2016). The precise details of this hypothesis could be elaborated in several ways: A warm glow might arise from the belief that proenvironmental behavior is morally good, from the expectation of others' approval, or from a perceived alignment between proenvironmental behavior and one's identity. But the core idea is that engaging in proenvironmental behavior might increase SWB because it makes people feel good about themselves.

A second hypothesis is that proenvironmental behaviors often satisfy individuals' basic psychological needs. This hypothesis is based in *self-determination theory* (Ryan & Deci, 2000), which posits that, just as physical health and well-being depend on the satisfaction of

Statement of Relevance

Global climate change is a pressing problem, requiring action at many levels. In addition to government and corporate policies, individuals' habits and lifestyle choices have an important role to play. Unfortunately, in both popular culture and scientific literature, proenvironmental behavior is often seen as unpleasant and as diminishing individuals' well-being. Yet this perception is at odds with philosophical theory and psychological science, each of which suggest that human well-being depends crucially on doing good in the world beyond the self. The studies reported here align with that work, indicating that proenvironmental behaviors improve a person's well-being. Hence, these findings contradict popular perceptions and highlight a novel strategy for motivating climate action.

biological needs, mental health and well-being depend on the satisfaction of psychological needs. These are thought to include needs for competence (i.e., to be capable of achieving goals), autonomy (i.e., to be free to choose), and relatedness (i.e., to be close and connected with others). Many forms of proenvironmental behavior appear well-suited to satisfying such needs (Kasser, 2009). To illustrate, certain proenvironmental behaviors are inherently social and may therefore help satisfy the need for relatedness. Carpooling and living with other people each reduce per-person energy use (Underwood & Zahran, 2015) and also involve spending time with others.

One approach to testing the warm-glow and need-satisfaction hypotheses would be to assess each construct and test for statistical mediation, yet such an analysis would likely be confounded. Because a host of unobserved variables might influence both SWB and these mediators, such an approach is liable to falsely demonstrate an indirect effect (Bullock & Green, 2021). Fortunately, there is another way to test these two hypotheses. Although the warm-glow and need-satisfaction hypotheses are claims about how proenvironmental behavior affects SWB, they also make distinctive predictions about who will experience this effect and how strongly. Hence, one way to evaluate the hypotheses is by testing those predictions, rather than testing for statistical mediation.

For example, people who care more about environmental issues should regard proenvironmental behavior as more morally good. Similarly, because environmental

concern and proenvironmental behavior are more normative for those on the political left (Hornsey et al., 2016), the more right-leaning people are, the less their group members will tend to commend proenvironmental behavior. Thus, the warm-glow hypothesis predicts that individual differences in environmental values and political orientation will moderate the effect of proenvironmental behavior on SWB. The need-satisfaction hypothesis, by contrast, does not predict this. If actions like carpooling or conserving electricity contribute to the satisfaction of a basic psychological need, then they should improve a person's SWB regardless of the person's concern about environmental issues or whether their community commends proenvironmental behavior.

Thus, if proenvironmental behavior increases SWB among environmentalists and people on the left, but the effect dwindles and disappears as one moves across these continua, then this would be evidence against the need-satisfaction hypothesis and in favor of the warm-glow hypothesis. By contrast, if proenvironmental behavior increases SWB regardless of such individual differences, then this would be evidence against the warm-glow hypothesis and in favor of the need-satisfaction hypothesis. Finally, if the effect is larger among environmentalists and people on the left, but emerges across the board, then this would support both hypotheses.

The Present Studies

We investigated the relationship between proenvironmental behavior and SWB in two studies, avoiding global self-reports and seeking insight into potential causal relations. Study 1 was a 10-day experience-sampling study. In addition to minimizing recall and social-desirability biases (Hektner et al., 2007), this design enabled us to disaggregate between-person and within-person associations. This is useful insofar as a causal relationship between proenvironmental behavior and SWB would involve a within-person process. Study 2 was a randomized, controlled experiment that tested whether incorporating proenvironmental behavior into individuals' daily routines increases their SWB. In both studies, we compared the predictions of the warm-glow and need-satisfaction hypotheses.

Study 1

Method

Study 1 is a preregistered reanalysis of data originally collected between October 2017 and April 2018 by Kimberly Doell and colleagues (2021). Methods were approved by the ethics committee at the University of Geneva. The data and codebook for the original study are publicly available (https://osf.io/7kmp8/). The preregistration form, materials, data, and R scripts for the present study are also available online (https://osf.io/hpvsu/).

Participants. Participants were recruited primarily through Amazon's Mechanical Turk, but also a politically diverse range of Facebook and Reddit pages. To be eligible, participants were required to be at least 18 years old and have a smartphone with a data plan. Participants were excluded if they did not successfully answer attention checks in the baseline survey and respond to at least half of the experience-sampling messages. For further details on the data-cleaning procedure, see Doell et al. (2021).

The final analysis sample included 181 adults from 14 countries, who together provided a total of 7,161 observations (M = 39.56 observations per participant, SD = 7.48). Most participants were from the United States (n = 131). However, some were from the United Kingdom (n = 19) and other European countries (n = 19 from Belgium, Croatia, France, Germany, Italy, Spain, and Switzerland), as well as other countries in the Americas (n = 8 from Brazil, Canada, and Mexico), India (n = 2), and Nigeria (n = 2). Ages ranged from 18 to 76 (M = 33.48, SD = 11.87). A majority of participants (61%) identified as female, 38% identified as male, and < 1% identified as "other" or declined to respond. Race and ethnicity data were not collected. A majority (66%) reported that they had earned a college degree and that they were at least "slightly liberal" (59%; M = 3.08, SD = 1.69; 1 = *very liberal*, 4 = *moderate*, 7 = *very conservative*).

According to a recent meta-analysis (Zawadzki et al., 2020), the correlation between proenvironmental behavior and SWB is r = .24. This sample yields over 90% power (at = α .05) to detect such a correlation.

Procedure. Participants first completed a baseline survey with demographic questions and trait measures, including measures of environmental values and social-desirability bias. For the following 10 days, they were sent text messages with hyperlinks to the experience-sampling surveys, which included questions about their activities in the past hour and their current mood. Participants received five such messages each day at random intervals between 9:00 a.m. and 10:00 p.m. Participants who did not respond to the survey within 15 min were sent reminder messages. The links expired 1 hr after being sent.

Measures. In the baseline survey, participants completed a version of the Schwartz Values Survey (Schwartz, 2009), which asks about the extent to which different values serve as "guiding principles" in individuals' lives. This study used a version of the scale that was modified
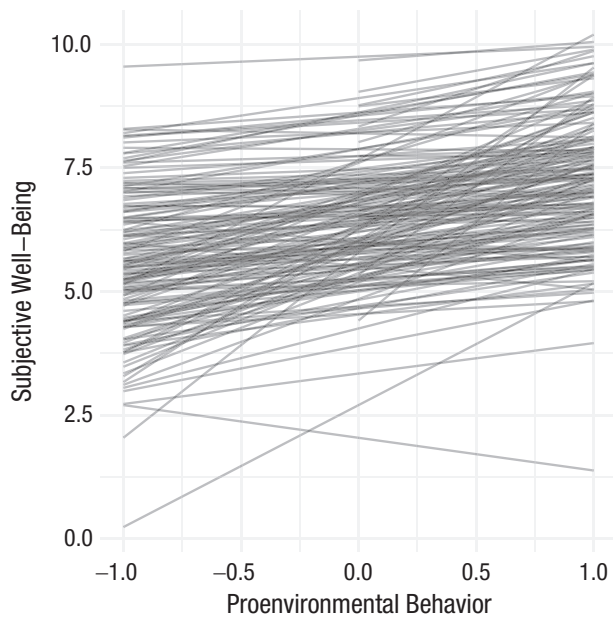
Fig. 1. Associations between proenvironmental behavior and subjective well–being in Study 1. Each line illustrates the association for a specific participant.

by De Groot and Steg (2008) to include four items about "biospheric" values. Specifically, these items asked participants about the extent to which they valued "respecting the earth," "preventing pollution," "unity with nature," and "protecting the environment." The response scale was a 9-point Likert scale, ranging from −1 (*opposite to my values*) to 0 (*not at all important*) to 7 (*of supreme importance*). As stated in the user's manual for this measure (Schwartz, 2009), environmental values scores were calculated by centering each item on participants' mean response across all items (59 in total), and then averaging the four biospheric values items. The rationale for this scoring procedure is based in Schwartz's *theory of human values* (Schwartz et al., 2012), according to which values function as systems and can be understood only in comparative terms (i.e., people only value something if they prioritize it over other potentially competing, interests). In this sample, environmental values scores ranged from −4.07 to 3.93 ($M = 0.24$, $SD = 1.42$); 43% of the sample ($n = 77$) had a negative score, indicating that environmental issues were not a priority for them.

In the baseline survey, participants also completed the Social Desirability Scale–Short Form (Reynolds, 1982). This scale includes 13 statements like "I'm always willing to admit it when I make a mistake" and "I am always courteous, even to people who are disagreeable." Participants were asked to indicate whether each statement was true (coded as 1) or false (coded as 0). Social-desirability bias scores were computed by summing the number of socially desirable but likely untruthful answers ($M = 5.49$, $SD = 3.21$).

In the experience-sampling surveys, participants were asked whether they had observed or enacted any environmentally relevant behaviors in the past hour. If so, they indicated whether the behavior was environmentally beneficial or harmful and whether they had enacted the behavior personally or witnessed someone else enact it. We computed a 3-point proenvironmental behavior scale ($M_{grand} = 0.21$, $SD_{grand} = 0.69$) by scoring environmentally harmful behaviors enacted by the participant as −1 ($n = 1{,}102$ episodes), environmentally beneficial behaviors enacted by the participant as 1 ($n = 2{,}609$ episodes), and all other responses as 0 ($n = 3{,}450$ episodes). Finally, as a measure of momentary SWB, participants indicated their current mood on an 11-point scale ranging from *very negative* (scored as 0) to *very positive* (scored as 10; $M_{grand} = 6.62$, $SD_{grand} = 2.15$).

Preregistered analysis plan. We used multilevel regression models with repeated observations nested within days and days within individuals. To test for within- and between-person associations between proenvironmental behavior and SWB, we included grand-mean-centered person means and deviations from person means as separate predictors. The former indicates the between-person association, whereas the latter indicates the within-person association (Curran & Bauer, 2011). If these links emerged as significant, we planned to test whether they remained so after controlling for social-desirability bias, which might plausibly influence reports of both proenvironmental behavior and SWB. Finally, we planned to test whether the links between proenvironmental behavior and SWB were moderated by individual differences in environmental values by testing for each of the two-way interactions.

Results

Proenvironmental behavior was significantly and positively associated with SWB, both between-persons, $b = 1.64$ (95% confidence interval, or CI = [0.82, 2.46]), $\beta = 0.17$ (95% CI = [0.08, 0.25]), $p < .001$, and within-persons, $b = 0.77$ (95% CI = [0.64, 0.91]), $\beta = 0.23$ (95% CI = [0.19, 0.28]), $p < .001$ (see Fig. 1). That is, people who engage in proenvironmental behavior more often than others also tend to experience higher levels of SWB than others. Moreover, in the specific moments when people engage in proenvironmental behavior more than they typically do, they also tend to experience greater SWB than they typically do.

Adding social-desirability bias to this model revealed that it was also significantly associated with SWB, $b = 0.06$ (95% CI = [0.01, 0.12]), $\beta = 0.09$ (95% CI = [0.01, 0.18]), $p = .032$, suggesting that self-reports of one's current SWB are (very modestly) inflated by a bias toward socially desirable responding. However, the

Table 1. Test for Moderation by Environmental Values in Study 1

Predictor	b	β	p
PEB between-person	1.45 [0.58, 2.32]	0.15 [0.07, 0.24]	.001
PEB within-person	0.75 [0.61, 0.89]	0.24 [0.20, 0.28]	< .001
Social-desirability bias	0.06 [0.01, 0.12]	0.09 [0.01, 0.18]	.032
Environmental values	−0.01 [−0.14, 0.13]	0.00 [−0.09, 0.09]	.942
PEB between-person × environmental values	0.10 [−0.59, 0.80]	0.01 [−0.09, 0.12]	.774
PEB within-person × environmental values	0.10 [0.01, 0.19]	0.04 [0.00, 0.08]	.041

Note: The dependent variable is momentary subjective well-being, unstandardized coefficients are indicated by *b*, and standardized coefficients are indicated by β. Bracketed ranges represent 95% confidence intervals. PEB = proenvironmental behavior.

addition of this covariate did not affect the initial pattern of results. Proenvironmental behavior was significantly associated with SWB both between-persons, $b = 1.48$ (95% CI = [0.65, 2.30]), β = 0.15 (95% CI = [0.07, 0.24]), $p < .001$, and within-persons, $b = 0.77$ (95% CI = [0.64, 0.91]), β = 0.23 (95% CI = [0.19, 0.28]), $p < .001$. Thus, the links between proenvironmental behavior and SWB hold independently of social-desirability bias.

Finally, we tested for interactions with individual differences in environmental values. Results of this model are presented in Table 1. Environmental values did not moderate the between-person link but did moderate the within-person link. That is, the more a participant reported valuing environmental protection, the stronger the association between proenvironmental behavior and SWB for that individual. Figure S1 in the Supplemental Material available online illustrates this interaction. The Johnson-Neyman technique indicated that the slope of the within-person association between proenvironmental behavior and SWB was significant until environmental values dropped below −3.65 (2.73 *SDs* below the mean). There was only 1 participant below that threshold. Moreover, the coefficient remained positive until environmental values fell below −7.55, which is below the lowest possible score on the measure.[1]

In sum, these results suggest that the within-person association between proenvironmental behavior and SWB may be amplified by proenvironmental values, offering some support for the warm-glow hypothesis. However, the association appears to emerge even among individuals who are very low in environmental values, suggesting that a warm-glow effect does not fully explain the association. Thus, the results also offer some support for the need-satisfaction hypothesis.

Study 2

Method

Study 2 was a preregistered randomized experiment. The method was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill (#22-0124). The preregistration form, materials, data, and R scripts are available online (https://osf.io/hpvsu/).

Participants. We recruited participants through a departmental participant pool, comprised of students taking introductory courses in psychology (though not necessarily students in the same section of a single course) at a public university in the southeastern United States. To keep participants from becoming aware of key details about experimental designs, students in the pool are discouraged from discussing ongoing studies with each other.

Originally, we preregistered a plan to stop collecting data when we reached 500 observations or at the end of the spring 2022 semester, whichever came first. However, because of delays at the IRB office, we were not able to begin data collection until late into the semester, resulting in a far smaller sample than originally intended ($n = 215$). Hence, we decided not to analyze the data at that point and instead modified the preregistration. The revised stopping rule was to end data collection at the end of the fall 2022 semester (December 9, 2022). This resulted in 582 responses. As preregistered, we excluded participants who responded to open-ended questions with nothing or garbled text or who clearly indicated a lack of engagement ($n = 37$). This left an analysis sample of 545, which offered over 80% power (at $\alpha = .05$) to detect main effects as small as $f = .15$.

Ages ranged from 18 to 43 ($M = 19.20$, $SD = 1.69$). A majority (70%) identified as women, 29% identified as men, and 1% identified as "other" or declined to state their gender; 15% identified as Asian or Asian American, 8% as Black or African American, 5% as Hispanic or Latinx, 54% as White or European American, 14% as mixed race, and 3% as "other"; 1% declined to answer.

Procedure. Participants completed a baseline survey and a follow-up two days later. In the consent document, we informed participants that the purpose of the study was "to investigate how daily activities are related to

happiness and well-being." All participants were told that, in addition to completing two surveys, they would be asked to make a small change to their normal behavior. At baseline, participants provided demographic information and completed measures of SWB, environmental concern, environmental self-image, and political orientation. They were then randomly assigned to one of three conditions: *proenvironmental behavior*, *fun*, or *control*.

Participants in the control condition were given a neutral task: "Tomorrow, we would like you to keep track of your activities. You do not need to remember who you were with or how you were feeling during that time. Instead, just try to remember factual information about what you are doing. Do not alter your routine. Simply keep track of what you do." Participants in the proenvironmental behavior condition received the following instructions: "In our daily lives, we all make choices that affect the environment. Tomorrow, your task is to do three good things for the planet, all three in one day." We gave a list of example behaviors, including some that would be easy for young adults to implement on any particular day (e.g., "Walk, bike, or take public transportation instead of driving" or "Find a new recipe that uses vegetarian or locally produced ingredients"), and others that highlight the wide range of possible proenvironmental behaviors (e.g., "See if your power company has renewable energy options" and "Contact your political representatives"). We told participants that they could choose whichever actions they liked but encouraged them to select behaviors that were both impactful and appropriate for their circumstances. The fun condition was included to benchmark the anticipated effect of proenvironmental behavior against a more straightforward SWB intervention. Participants in the fun condition received the following instructions: "In our daily lives, we all perform acts of kindness for others, but we often neglect to do nice things for ourselves. Tomorrow, your task is to do three good things for yourself, all three in one day." We again gave examples (e.g., "Relax in a bath or hot tub" and "Spend some time on a hobby") and told participants that, although they could do whatever they liked, they should choose activities that they would not typically do for themselves. To encourage participants in the proenvironmental behavior and fun conditions to comply with the requested behavior change, we asked them to construct implementation intentions or "if-then" plans (Gollwitzer & Sheeran, 2006). We explained if-then plans and asked participants to enter three of them into text-entry boxes.

Two days later, participants returned for follow-up. They first completed SWB measures and afterward described in their own words what they had done on the previous day. We content-coded the responses to the open-ended question in order to catalog the kinds of proenvironmental behaviors that participants chose to engage in.

Measures. We used two SWB measures to assess experiences of happiness and meaning in life. The 12-item Scale of Positive and Negative Experience (Diener et al., 2010) asks participants to indicate how often they experience positive affective states (e.g., "happy") and negative affective states (e.g., "sad"). We scored each subscale separately. In the baseline survey, participants indicated their feelings "during the past month" ($M = 3.72$, $SD = 0.61$ for positive affect; $M = 2.71$, $SD = 0.68$ for negative affect). In the follow-up survey, they indicated their feelings "yesterday" ($M = 3.77$, $SD = 0.71$ for positive affect; $M = 2.11$, $SD = 0.76$ for negative affect). Participants also completed a six-item version of the Perceived Personal Meaning Scale (Wong, 1998). This measure asked participants to indicate their agreement with statements like, "At present, I find my life very meaningful" ($M = 5.06$, $SD = 1.19$). In the follow-up, participants were instructed to respond to these statements as descriptions of how they felt "yesterday" ($M = 5.30$, $SD = 1.17$). All measures displayed good internal reliability (coefficient ωs $\geq$ .84).

In the baseline survey, we assessed environmental concern, environmental self-image, and political orientation using single-item measures with slider response scales. The environmental concern item was copied from the United States General Social Survey: "Generally speaking, how concerned are you about environmental issues?" ($0 = $ *not at all*, $100 = $ *extremely;* $M = 61.42$, $SD = 23.21$; see Fig. S6 in the Supplemental Material for a comparison with the 2021 sample of the General Social Survey). We assessed environmental self-image using an ad hoc item, "In your daily life, how much effort do you typically put towards minimizing your environmental impact?" ($0 = $ *none at all*, $100 = $ *a great deal;* $M = 42.81$, $SD = 20.30$). Finally, alongside other demographic questions, we asked participants, "What is your political orientation?" ($0 = $ *extremely progressive*, $100 = $ *extremely conservative;* $M = 37.99$, $SD = 23.21$).

In the follow-up survey, we included two open-ended questions: "Could you please explain the task you received in the first part of this study?" and "Regarding that task, could you please tell us what you did yesterday?" We used responses to these questions to assess data quality (see above). Additionally, we content-coded responses to the second question to examine the kinds of activities that participants in the proenvironmental behavior and fun conditions chose to engage in. Participants in the former condition mentioned 12 distinct kinds of proenvironmental behavior: walking or biking instead of driving; taking public transit instead of driving; carpooling; reducing household
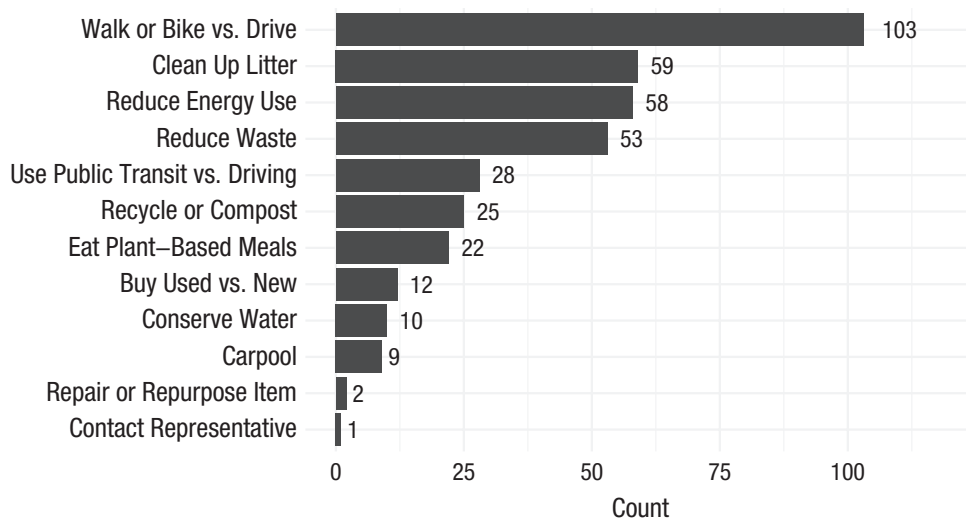
Fig. 2. Frequencies of reported proenvironmental behaviors in Study 2. This figure indicates the number of participants in the proenvironmental behavior condition who reported each kind of behavior.

energy use (e.g., turning the air conditioner down); conserving water (e.g., taking shorter showers); reducing waste (e.g., using reusable grocery bags); recycling or composing waste; cleaning up litter; eating plant-based meals; buying items used rather than new; repairing or repurposing old items; and contacting a political representative about climate change. (We also coded the responses from participants in the fun condition. See Fig. S4 in the Supplemental Material.)

Preregistered analysis plan. We used a confirmatory factor analysis to construct a SWB measurement model in which pleasant affect, unpleasant affect, and perceived meaning in life each indicated SWB latent variables at baseline and follow-up (see Fig. S3 in the Supplemental Material). We extracted the factor scores from this model for use in subsequent analyses. To test for effects of experimental condition, we used an analysis of covariance (ANCOVA) with SWB at follow-up as the dependent variable and condition and baseline SWB as independent variables. For pairwise comparisons of the three experimental conditions, we used estimated marginal means and Tukey-adjusted p values. Finally, we preregistered a plan to conduct exploratory analyses using three additional ANCOVAs to test for interactions between experimental condition and environmental concern, environmental self-image, and political orientation.

Results

Participants in the proenvironmental-behavior condition ($n = 182$) reported between 0 and 4 proenvironmental behaviors, with a mean of 2.11 ($SD = 0.98$, $Mdn = 2$). For comparison, participants in the fun condition ($n = 176$) reported between 0 and 6 fun activities, with a mean of 2.30 ($SD = 1.09$, $Mdn = 2$). This is indicative of imperfect but reasonably good adherence to each of these interventions. Figure 2 illustrates the frequency with which participants reported each kind of proenvironmental behavior. The most common behavior was walking or biking rather than driving. This may be because it is a relatively easy behavior for young adults to implement and was likely independently attractive for reasons of physical fitness. The next most common behaviors were cleaning up litter, reducing energy use (e.g., by turning off electronics or adjusting the thermostat), and reducing waste (e.g., by bringing reusable bags on shopping trips or reusable containers for food and drinks). These too would have been straightforward to integrate into participants' ordinary activities, especially by comparison with the less frequently reported behaviors (e.g., repairing or repurposing an item or contacting a political representative).

We observed a significant effect of experimental condition on SWB at follow-up, $F(2, 541) = 7.12$, $p < .001$, while controlling for baseline SWB, which was also significant, $F(1, 541) = 1,264.56$, $p < .001$ (see Fig. 3). Pairwise comparisons revealed that participants experienced greater SWB in the proenvironmental behavior condition than in the control condition, $p = .003$, $d = 0.34$ (95% CI = [0.14, 0.55]). Participants in the fun condition also experienced greater SWB than those in the control condition, $p = .004$, $d = 0.34$ (95% CI = [0.13, 0.55]). However, the proenvironmental behavior condition and the fun condition did not differ from each other, $p = 1.000$, $d = 0.001$ (95% CI = [−0.21, 0.21]).
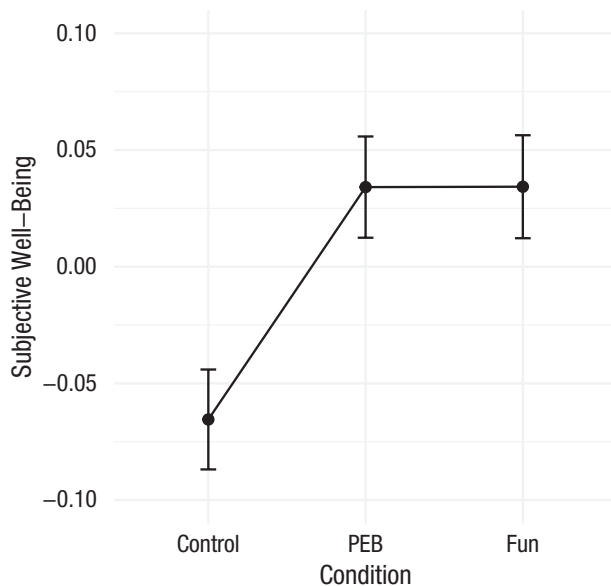
Fig. 3. Effects of experimental interventions on subjective well–being in Study 2. Points and error bars represent condition means and standard errors. PEB = proenvironmental behavior.

In addition to the main effects of experimental condition, we also tested for interactions predicted by the warm-glow hypothesis. We found no significant interactions between experimental condition and environmental concern, environmental self-image, or political orientation. Results of these models are presented in Table 2.[2]

Discussion

The results of these two studies present a clear and striking picture: Proenvironmental behavior appears to increase SWB. Study 1 revealed positive between- and within-person associations between proenvironmental behavior and SWB. Study 2 indicated that these links are causal. Incorporating proenvironmental behavior into individuals' daily activities increases their SWB. In fact, the effect of such behavior on feelings of happiness and meaning in life was equivalent to the effect of behaviors chosen specifically to elicit these positive states of mind.

The findings also provide some preliminary evidence regarding the further question of why this effect emerges. According to the warm-glow hypothesis, proenvironmental behavior increases SWB by making people feel good about themselves. This implies that the effects of proenvironmental behavior will depend on individual differences in the degree to which a person cares about environmental protection and whether proenvironmental behavior is normative in their social group. Study 1 offered some support for this prediction, but also indicated that proenvironmental values only amplify an effect that emerges independently. Moreover, in Study 2, the effect of the experimental intervention did not vary depending on individuals' concern about environmental issues, environmentalist self-perceptions, or political orientation. It is possible that there are such interaction effects but they are too small to be detected (see Fig. S5 in the Supplemental Material for power analyses). Yet, if so, this would further support our conclusion from Study 1: Proenvironmental behavior might boost SWB partly through a warm-glow effect, but this is not the sole, or even the primary, mechanism. Overall, the findings are more in line with the hypothesis that proenvironmental behaviors help to satisfy individuals' basic psychological needs (e.g., for competence, autonomy, and relatedness).

Two key limitations are worth noting. First, the evidence concerning mechanisms is preliminary and tentative. Because our approach to evaluating the warm-glow and need-satisfaction hypotheses involved testing for moderation, it required that participants span a sufficient range on the individual difference variables. Our samples did not appear to be unusually high in environmental values, though they did lean somewhat toward the political left.[3] One interesting avenue for future research might be to oversample conservatives or nonenvironmentalists. This might afford a more

Table 2. Tests for Moderation of Experimental Effects in Study 2

	Environmental concern		Environmental self-image		Political orientation	
Predictor	*F*	*p*	*F*	*p*	*F*	*p*
Baseline SWB	1,269.08	< .001	1,249.24	< .001	1,239.05	< .001
Condition	6.93	.001	7.12	< .001	7.60	< .001
Moderator	6.66	.010	0.26	.612	0.00	.977
Condition × Moderator	0.59	.557	0.16	.849	2.38	.094

Note: The dependent variable is subjective well-being (SWB) at follow-up. In the predictor column, "moderator" refers to the candidate moderating variable indicated at the top of the column. "Baseline SWB" refers to SWB scores from the baseline survey.

robust test of the warm-glow hypothesis. Another possibility is that the warm-glow effect of proenvironmental behavior depends less on individuals' own values and more on their perceptions of others' values. People who expect their peers to approve of proenvironmental behavior might experience a warm glow from that behavior even if they do not personally hold proenvironmental values. Future research might explore this possibility.

A second limitation concerns the risk of demand characteristics in Study 2. If participants in the proenvironmental behavior condition believed that their assigned activity was supposed to improve well-being, then this could have created a researcher demand effect. Naturally, this concern applies to the fun condition as well. Because the effect sizes for the proenvironmental behavior and fun interventions were equivalent, one possibility is that neither intervention affected participants' SWB beyond such demand effects. We investigated this possibility in exploratory analyses (see Fig. S7). At the end of the study, participants explained the instructions they had initially received. After content-coding the responses, we found that only a minority of participants in the proenvironmental-behavior condition (21%; $n = 38$) appeared to believe that their assigned activity was a well-being intervention. Moreover, the effect of the intervention remained after accounting for the effect of this belief. This suggests that, although demand characteristics may have influenced the results, the key finding is robust to this influence. Nevertheless, future studies could rule out demand effects more decisively by using sham interventions, in which a neutral activity is presented to control participants as if it were a well-being intervention.

Stepping back to take a broader perspective, these findings stand in stark contrast to popular perceptions. Sustainability is often portrayed as onerous and unpleasant (Atkin, 2019; Milloy, 2009; Nisa & Bélanger, 2019; Walsch, 2013), whereas these studies support the opposite conclusion. Yet our findings are very much in line with a long tradition of philosophical theory (Aristotle, 2000; Frankl, 1966) and a growing body of scientific evidence (Huang & Yang, 2022; Hui et al., 2020; Prinzing et al., 2022), each of which suggests that being good is conducive to being well: That is, people flourish when they seek to cultivate virtue and do good in the world. These results are fully consistent with that theory, and they also highlight a novel strategy for encouraging people to engage in proenvironmental behavior. Learning that PEBs are often good both for individuals and for the environment could help motivate people to engage in PEB. That is, the message that "going green is good for you" could be a powerful tool for helping people to overcome an all-too-common barrier to sustainability.

ORCID iD

Michael Prinzing 🔟 https://orcid.org/0000-0002-7879-7131

Notes

1. We also tested whether political orientation, social-desirability bias, or altruistic values moderated the links between proenvironmental behavior and SWB and whether the results differed for U.S. versus non-U.S. residents. No significant interactions emerged in any case (see Tables S1 and S2 in the Supplemental Material). Finally, we examined the association between social-desirability bias and reports of proenvironmental behavior (see Fig. S2). A modest positive association emerged, consistent with a recent meta-analysis (Vesely & Klöckner, 2020). These analyses were exploratory and not preregistered.

2. Given these null results, we conducted additional (not preregistered) analyses to further explore potential interactions (see Tables S3 and S4). Specifically, we created a latent variable from environmental concern, environmental self-image, and political orientation and tested whether this moderated the effect of condition. We also attempted to disentangle potential interactions between this latent factor and the proenvironmental behavior intervention versus the fun intervention. Still, we found no evidence of moderation. Finally, we conducted power analyses to assess the likelihood that this study would have detected theoretically or practically significant interaction effects (see Fig. S5). Results continued to support the conclusion that, although

it is possible that a warm-glow effect plays some role, proenvironmental behavior seems to increase well-being independently of such an effect.

3. Mean political orientation was below the scale midpoint (i.e., closer to liberal or progressive than conservative) in Study 1, $t(178) = -7.27$, $p < .001$, and Study 2, $t(539) = -12.02$, $p < .001$.

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