

## Pro-environmental behaviors and well-being in everyday life

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## **Abstract**

Individual and household behaviors are key targets for climate change mitigation efforts and studies suggest that people who enact more pro-environmental behaviors tend to experience higher levels of well-being. Yet these studies have typically used coarse-grained, retrospective reports that offer limited insight into the immediate impacts of specific behaviors. In three studies (total  $N = 8,522$  observations,  $N = 1,353$  US and UK participants) we adopted a highly fine-grained approach. Using the day reconstruction method, we zoomed in on particular moments in everyday life to examine links between specific behaviors and different aspects of well-being. This revealed generally positive associations, but also substantial variation. Pro-environmental behaviors are more closely and consistently associated with positive and especially “eudaimonic” dimensions of well-being, and more active, effortful, and social behaviors tended to show stronger positive associations. Although the relationships between pro-environmental behaviors and well-being are considerably more complex than prior research has indicated, these findings continue to suggest that ecological and individual well-being can be pursued in tandem.

Keywords: sustainability; happiness; meaning in life; well-being; day reconstruction method

## 1 Introduction

Wealthy countries are responsible for an outsized share of global carbon emissions (Ritchie, 2023) and international authorities predict that it will not be possible to meet emissions goals without substantial changes in household behavior in such countries (IPCC, 2019). Yet many people in countries like the United States and the United Kingdom live far less sustainably than they could (Tyson et al., 2021). This may be, in part, because pro-environmental behaviors (PEBs) are thought to be burdensome and self-sacrificial (Atkin, 2019; Maniates & Meyer, 2010; Milloy, 2009). In popular media, environmentalists are praised for their “sacrifices” (Nisa & Bélanger, 2019), whereas others are criticized as being too “selfish” to do anything for the environment (Walsch, 2013).

Contrary to this popular perception, past research has found that people who engage in PEBs more frequently tend to experience higher levels of well-being – encompassing feelings of happiness and meaning in life (Zawadzki et al., 2020). This suggests that environmentally friendly lifestyle changes need not entail reductions in individuals’ well-being. However, existing research on the association between PEB and well-being suffers from both methodological and conceptual limitations. First, with only a few exceptions (Bissing-Olson et al., 2013; Prinzing, 2024; Wray-Lake et al., 2019), past studies have employed global, retrospective reports – survey measures that ask research participants about their behaviors and feelings over long periods of time or “in general.” Such measures are subject to recall and social desirability biases (Robinson & Clore, 2002; Stone et al., 1999). In fact, because global, retrospective reports are often thought to reflect a person’s self-conception more than their actual behavior, some have argued

that the association between self-reports of PEB and well-being reflects the impact of a “green self-image,” rather than beneficial effects of the behaviors themselves (Binder & Blankenberg, 2017).

In addition to this methodological limitation, past research has also tended to be conceptually limited by the practice of grouping PEBs together into a single index. Although useful for simplifying analyses, the category of PEB includes a range of heterogeneous behaviors, from conserving electricity at home to eating vegetarian meals to carpooling or cycling (Larson et al., 2015). Such behaviors differ in theoretically important respects, such as perceived convenience and costs and whether they are social or solitary. For this reason, a single correlation coefficient may conceal substantial variability in the relationships between specific PEBs and well-being.

We aimed to address these limitations by focusing on individuals’ experiences during the very moments in which they are engaged in a variety of PEBs. By zooming in on moments in everyday life, we obtain more accurate data about individuals’ behaviors and feelings than could be obtained from global, retrospective reports (Hektner et al., 2007; Shiffman et al., 2008). And by distinguishing among many different forms of PEB, we can examine unique patterns of association that may be concealed when PEBs are aggregated into a single index. For similar reasons, we also differentiate between different aspects of well-being. Within well-being research, it is common to contrast “hedonic” well-being, which refers to the presence of pleasant feelings and the absence of unpleasant feelings, with “eudaimonic” well-being, which refers to a sense of meaning, value, and purpose in life (Deci & Ryan, 2008). Although interrelated, these are distinct outcomes and past work suggests that (at least in global, retrospective reports) PEBs may be more

strongly associated with eudaimonic well-being than with hedonic well-being (Zawadzki et al., 2020). Hence, just as the association between PEB and well-being may depend on the specific behavior in question, it may also depend on the dimension of well-being in question.

## **2 The Present Studies**

We conducted three studies examining the links between PEBs and hedonic and eudaimonic well-being in everyday life. Study 1 used a community-based sample of undergraduate and graduate students in the United States. Study 2 used an online sample of adults from across the United Kingdom. These studies were planned independently, and different authors collected the data without knowledge of the others' efforts. However, after becoming aware of each other's work and recognizing the complementary nature of the studies, we decided to collaborate. In the spirit of multi-lab collaborations – a recommended tool for improving replicability in scientific research (Klein et al., 2014) – we present both studies together. The studies employed similar designs and we adopted a common analytic approach. Yet they used somewhat different procedures and sampled from distinct populations. Hence, Study 3 was a collaboratively designed, preregistered replication that enabled us to examine possible sources of inter-study variation in results.

All three studies employed the day reconstruction method, or DRM, (Kahneman et al., 2004), which was designed to increase the accuracy of individuals' reports of their behaviors and feelings in everyday life. In DRM surveys, participants fill out diaries for the past day, breaking up the day into a series of episodes. Participants are asked to mentally relive each episode, recalling what they did and how they felt before answering episode-

specific survey questions. In the present studies, for each episode participants reported on their hedonic and eudaimonic well-being and whether they engaged in various PEBs.

We examined PEBs spanning a range of environmentally impactful actions. Some related to dietary choices, given the ecological impact of animal proteins on the one hand, and local and organic foods on the other (Hayek et al., 2021; Niggli, 2015). We assessed behaviors pertaining to the conservation of household resources, including both electricity and water, as household energy use is a significant contributor to greenhouse gas emissions and water shortages are driven partly by excessive household consumption (Goldstein et al., 2020; Savelli et al., 2023). We also assessed shopping and consumption-related behaviors and waste-reducing behaviors, each of which involve minimizing the consumption of consumer goods and thereby reducing emissions required for their production (Cooper & Gutowski, 2017; Gutowski et al., 2013). Given that emissions from transportation make up a large share of total greenhouse gases (EPA, 2022), we assessed transportation-related behaviors, such as carpooling, walking, and cycling rather than driving. In Studies 2-3 we also assessed behaviors that do not directly impact the environment, but that increase awareness about environmental issues and challenges (e.g., talking with others about environmental issues).

Sample sizes were determined *a priori* and based on available resources. The data, materials, and analytic code for all studies are available online: [https://osf.io/3jma4/?view\\_only=8dbbed7222ef44c19776652d7085433c](https://osf.io/3jma4/?view_only=8dbbed7222ef44c19776652d7085433c).

### **3 Study 1**

This study examined the associations between nine forms of PEB and three well-being outcomes in a sample of students living in the United States. In this section, we

present the study's methods and results. A combined discussion of Studies 1-2 is presented in Section 4.3.

### **3.1 Method**

#### **3.1.1 Procedure**

This study was embedded within a larger project that investigated the relationship between social interaction quality and prosocial tendencies. Participants completed a baseline survey with demographic questions and measures of several psychological traits. They were then invited to attend an in-person laboratory session, were randomized to one of four experimental conditions, completed a DRM survey on the following day, and were invited to a second laboratory session the day after that. For present purposes, we use data from the DRM survey only. Details regarding the laboratory sessions and experimental intervention are beyond the scope of the present work and are documented elsewhere (REFERENCE REDACTED FOR REVIEW). In the analyses reported below, we controlled for experimental condition but did not test for effects of the intervention.

The DRM survey asked participants to break up the past 24 hours into a series of episodes (maximum of 20), delineating episodes in whatever way seemed most meaningful to them. They wrote a few sentences about each to remind themselves of what they did and how they felt. Then, they answered some questions about each episode. For reasons related to the larger project within which this study was embedded, participants were asked to indicate whether they interacted with anyone during each episode. If a participant reported a social interaction, then they were asked to indicate with whom they interacted and how (i.e., face-to-face, on the phone, over video, etc.), and complete a 3-item measure of the quality of that social interaction. For all episodes,

participants completed measures of well-being and PEB. These measures were presented after the social interaction questions, with the PEB questions presented last.

### **3.1.2 Participants**

Participants were recruited from the local community using email listservs, social media advertisements, and flyers. Eligibility required that one be a student aged between 18 and 35. The DRM survey received  $N = 324$  responses with an average of 10.58 episodes per participant ( $SD = 4.84$ ), totaling 3,428 observations. Participants reported an average age of 20.04 ( $SD = 2.61$ ). Of these, 75% identified as female, 21% as male, 1.5% as “other,” and 2.5% did not state; 24% of participants identified as Asian, 5% as Black or African American, 5% as Hispanic or Latinx, 50% as White, 3% as “other,” and 2% did not state.

### **3.1.3 Measures**

We asked participants to, “Think about whether or not you felt any pleasant or unpleasant emotions” and used Likert scales (1 = “Not at all”, 5 = “Extremely”) to indicate the extent to which they experienced such states. We gave examples of pleasant emotions (amusement, awe, joy, gratitude, hope, inspiration, interest, love, pride, compassion, and contentment) as well as unpleasant emotions (anxiety, anger, shame, fear, hate, disgust, embarrassment, guilt, sadness, and stress). We also included a measure of eudaimonic well-being that used the same response scale: “During this episode, to what extent did you feel that you were doing something meaningful?” We z-scored these single-item measures. Additionally, participants used a checklist to report



whether or not they had engaged in 9 specific PEBs during the episode (see Table 1). The response options were “Yes” (coded as 1) or “No” (coded as 0).<sup>1</sup>

### **3.1.4 Analysis Plan**

We tested for associations between PEBs and each aspect of well-being using mixed-effects regressions with random effects of participant and experimental condition (random intercepts only). Past research has found that people experience different levels of well-being depending on the time of day and day of the week (Choi et al., 2017; Stone et al., 2012). We therefore controlled for each (time of day was coded as either morning, afternoon, or evening).

In the initial stage of the analysis, we examined the links between each aspect of well-being (pleasant emotions, unpleasant emotions, and eudaimonia) and a PEB index. This index was computed by summing across specific behaviors and taking the z-score. Then, in a second stage of analysis, we regressed the well-being outcomes on each PEB individually (i.e., 27 separate regressions). In these models, the comparison group can be thought of as the typical levels of well-being that a person experiences when they are not engaged in a given PEB. Because this analytic approach involves a large number of tests, we used the Benjamini-Hochberg (1995) procedure to prevent an inflated false positive rate.

## **3.2 Results**

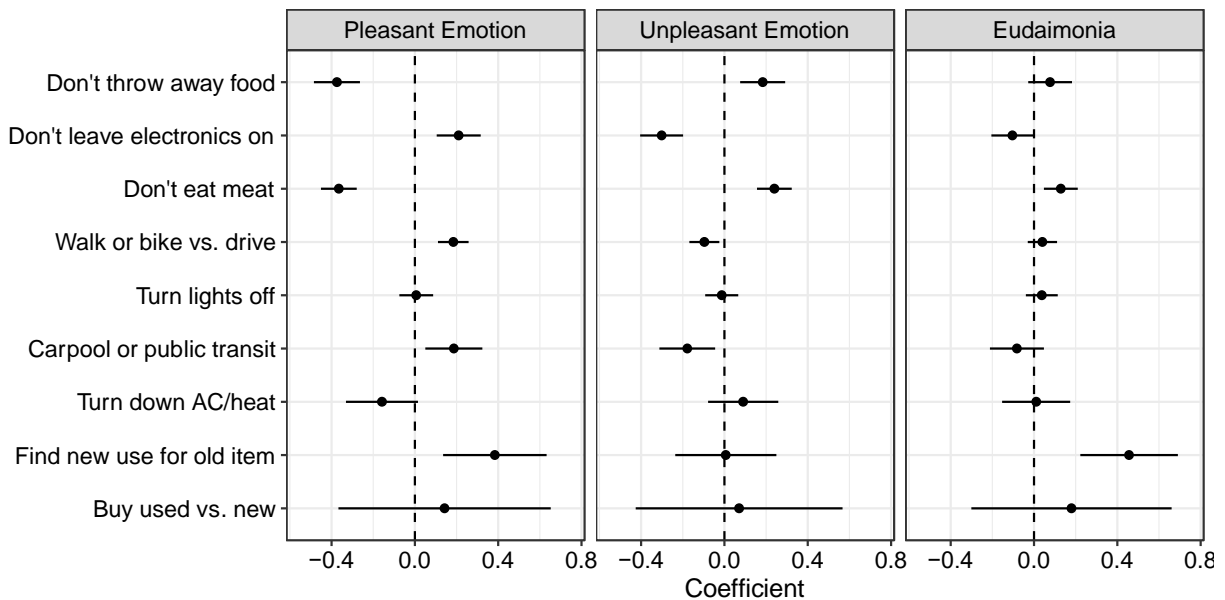
The PEB index was not significantly associated with pleasant emotions,  $b = -0.02$ , 95% CI: [-0.06, 0.02],  $p = .331$ , or unpleasant emotions,  $b = -0.01$ , 95% CI: [-0.04, 0.02],

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<sup>1</sup> Supporting the idea that PEB constitutes a heterogeneous category, we found that the person means for these 9 behaviors were generally weakly correlated, and in some cases even negatively correlated ( $-.34 \leq r_s \leq .26$ ;  $M = .03$ ,  $SD = .12$ ). See Section 1 of the Supplementary Material for these results, and parallel results for Studies 2-3.

$p = .704$ . However, it was significantly, albeit modestly, associated with eudaimonia,  $b = .04$ , 95% CI: [0.01, 0.07],  $p = .021$ .

Breaking apart PEB into individual behaviors revealed a far more complex pattern of results. Most PEBs were significantly associated with pleasant emotions and unpleasant emotions, and two were significantly associated with eudaimonia (see Figure 1 and Table 1). Specifically, finding new uses for old items, carpooling, walking or biking rather than driving, and turning off electronics were all positively associated with pleasant emotions, whereas not eating meat and not throwing away food were each negatively associated with pleasant emotions. With the exception of finding a new use for an old item, each of these behaviors showed the opposite association with unpleasant emotions. Finding a new use for an old item and abstaining from eating animal products were significantly and positively associated with eudaimonic well-being.



**Figure 1: Associations between pro-environmental behaviors and well-being in Study 1.** Points and error bars indicate coefficients and 95% confidence intervals. Dependent variables are z-scored; independent variables are dichotomous.

Behavior	%	Coefficient		
		<i>Pleasant Emotion</i>	<i>Unpleasant Emotion</i>	<i>Eudaimonia</i>
Throw away food <sup>†</sup>	91%	<b>-0.37***</b> [-0.48, -0.26]	<b>0.18***</b> [0.08, 0.29]	0.08 [-0.03, 0.18]
Leave electronic devices (e.g., TV or computer) on while not using them <sup>†</sup>	89%	<b>0.21***</b> [0.10, 0.32]	<b>-0.30***</b> [-0.40, -0.20]	-0.10* [-0.20, 0.00]
Eat meat or other animal products <sup>†</sup>	84%	<b>-0.36***</b> [-0.45, -0.28]	<b>0.24***</b> [0.16, 0.32]	<b>0.13**</b> [0.05, 0.21]
Walk, ride a bicycle, etc. rather than drive (your own or another's car)	29%	<b>0.18***</b> [0.11, 0.26]	<b>-0.10**</b> [-0.17, -0.02]	0.04 [-0.03, 0.11]
Turn off the lights whenever you left a room	21%	0.01 [-0.07, 0.09]	-0.01 [-0.09, 0.07]	0.04 [-0.04, 0.11]
Carpool or take public transportation rather than drive by yourself	5%	<b>0.19**</b> [0.05, 0.32]	<b>-0.18**</b> [-0.31, -0.04]	-0.08 [-0.21, 0.05]
Turn down the heat or air conditioner to save power	4%	-0.16 [-0.33, 0.01]	0.09 [-0.08, 0.26]	0.01 [-0.15, 0.17]
Find a new use for an old item	2%	<b>0.38**</b> [0.14, 0.63]	0.01 [-0.24, 0.25]	<b>0.46***</b> [0.22, 0.69]
Buy something used rather than new	< 1%	0.14 [-0.37, 0.65]	0.07 [-0.43, 0.57]	0.18 [-0.30, 0.66]

**Table 1: Results of behavior-specific analyses in Study 1.** The table presents the text of each item, the percentage of episodes in which behaviors were reported, and association between behaviors and well-being obtained from separate regressions. Dependent variables are z-scored; independent variables are dichotomous. Behaviors marked with a † were reverse-scored (i.e., percentages indicate the proportion of episodes in which the behavior was *not* reported). \* indicates an unadjusted  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Brackets indicate 95% confidence intervals. Coefficients that remain significant after Benjamini-Hochberg adjustment are bolded.

## 4 Study 2

Whereas Study 1 examined nine PEBs in a sample of college students in the United States, Study 2 examined twenty PEBs in a sample of adults from across the United Kingdom.

### 4.1 Method

#### 4.1.1 Procedure

Participants completed a two-part survey. In Part 1, they completed measures of economic preferences, including individual differences in risk taking, delayed gratification, present bias, reciprocity, altruism, and trust (Falk et al., 2018). These measures were included to test a set of independent research questions. Details regarding those

measures and the results of corresponding analyses are published elsewhere (REFERENCE REDACTED FOR REVIEW). Participants were then informed that the first part of the study was over and that they were moving on to Part 2. This part consisted of a DRM survey in which participants broke up their day into three episodes: morning (defined as “from the time you woke up until lunch”), afternoon (“from lunch to 6:00 pm”), and evening (“from 6:00 pm until you went to bed”). They wrote a few sentences about each to remind themselves of what they did and how they felt and then completed measures of PEB and well-being for each episode.

#### **4.1.2 Participants**

Participants were recruited through Prolific, an online research platform. Eligibility required being at least 18 years old and resident of the United Kingdom. The survey received  $N = 360$  responses. Because each participant reported on three episodes, this yielded a total of 1,080 observations. Participants reported an average age of 37.15 (SD = 12.98). Of these, 63.3% of participants identified as female, 36.1% as male, < 1% other or did not state; 5.6% identified as Asian, 2.5% Black, 82.5% White, 2.8% mixed race/ethnicity, < 1% other race/ethnicity, and 5.8% did not state. 63.3% reported having a college degree. Median reported income was between £200 and £500 per month.

#### **4.1.3 Measures**

Participants completed a 12-item measure of well-being drawn from previous DRM studies (White & Dolan, 2009). Participants were asked how they felt during the episode, indicating whether they felt happy, nervous/anxious, sad/depressed, content/relaxed, frustrated, impatient, focused, engaged, and competent/able. The response scale ranged from 1 = “Not at all” to 7 = “Very much.” Participants were also asked how much they

agreed (1 = “Strongly disagree”, 7 = “Strongly agree”) with the statements that the episode “was worthwhile and meaningful”, that they were “useful to other people” during the episode, and that the episode helped them to “achieve important goals.” We computed a “pleasant emotion” variable by averaging the happy and content items. This index showed good internal reliability (within-/between-person  $\omega = .76/.93$ ). We computed an “unpleasant emotion” variable by averaging the nervous/anxious, sad/depressed, frustrated, and impatient items (within-/between-person  $\omega = .75/.93$ ). Finally, we computed a eudaimonic well-being variable by averaging the focused, engaged, and competent items, along with the statements about doing something meaningful, useful to others, and achieving important goals (within-/between-person  $\omega = .81/.95$ ).

Participants also used a checklist to report whether or not they had engaged in 20 PEBs (see Table 2). The response options were, “Yes,” “No, but I could have,” and “Not applicable or can’t recall.” For parity with Study 1, we scored the first option as 1 and the other two as 0.

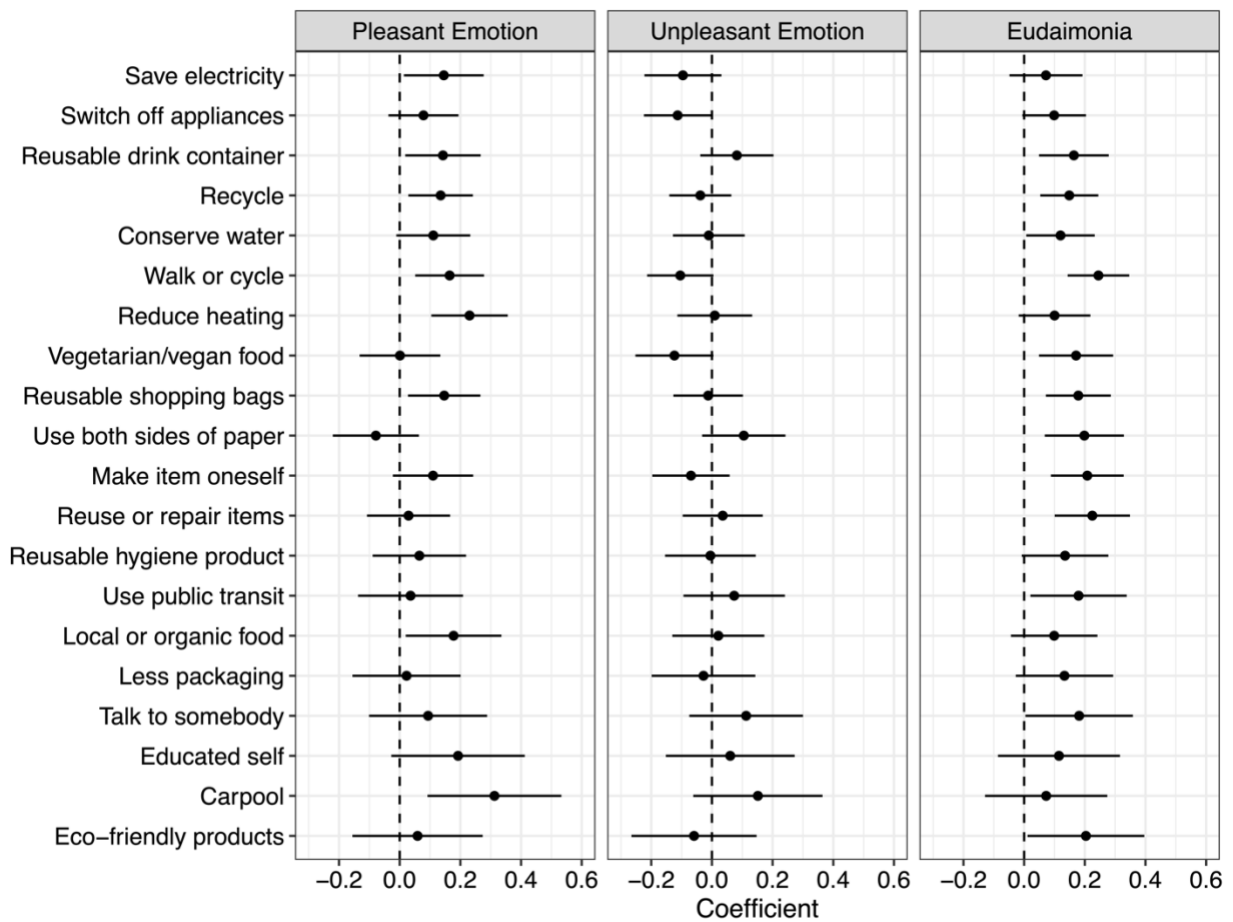
## 4.2 Results

The analyses in this study are parallel to those used in Study 1 (see Section 3.1.4).

As in Study 1, we examined links between each aspect of well-being and a PEB index (the z-scored sum of behaviors reported in each episode). This PEB index was significantly, positively associated with pleasant emotions,  $b = 0.12$ , 95% CI: [0.06, 0.19],  $p < .001$ , and eudaimonia,  $b = 0.18$ , 95% CI: [0.13, 0.24],  $p < .001$ , but not with unpleasant emotions,  $b = -0.02$ , 95% CI: [-0.08, 0.04],  $p = .526$ .

Turning to behavior-specific analyses (see Figure 2 and Table 2), we found that carpooling, walking or cycling, and turning down the heating were each positively

associated with pleasant emotions. Although none of the PEBs showed significant links with unpleasant emotions, eight out of twenty were significantly and positively associated with eudaimonia. These were: reusing or repairing items, using both sides of paper, bringing reusable bags for shopping, recycling, carrying reusable drinking containers, walking or cycling, making items oneself, and eating vegetarian or vegan food. In fact, when considering eudaimonic well-being, although not all coefficients were significant, every coefficient was positive.



**Figure 2: Associations between pro-environmental behaviors and well-being in Study 2.** Points indicate mixed-effects regression coefficients and error bars indicate 95% confidence intervals. Dependent variables are z-scored; independent variables are dichotomous.

Behavior	%	Coefficient		
		<i>Pleasant Emotion</i>	<i>Unpleasant Emotion</i>	<i>Eudaimonia</i>
Saved electricity in the house (e.g., turned off lights)	75%	0.15* [0.01, 0.28]	-0.10 [-0.22, 0.03]	0.07 [-0.05, 0.19]
Switched off electrical appliances	64%	0.08 [-0.04, 0.19]	-0.11* [-0.22, 0.00]	0.10 [-0.01, 0.20]
Used a reusable cup/container for drinking	60%	0.14* [0.02, 0.27]	0.08 [-0.04, 0.20]	<b>0.16**</b> <b>[0.05, 0.28]</b>
Recycled	59%	0.13* [0.03, 0.24]	-0.04 [-0.14, 0.06]	<b>0.15**</b> <b>[0.05, 0.24]</b>
Conserved water when it was not directly needed (e.g., when washing dishes)	55%	0.11 [-0.01, 0.23]	-0.01 [-0.13, 0.11]	0.12* [0.01, 0.23]
Walked or cycled for more than 5 minutes	47%	<b>0.16**</b> <b>[0.05, 0.28]</b>	-0.10 [-0.21, 0.00]	<b>0.24***</b> <b>[0.14, 0.35]</b>
Reduced heating	44%	<b>0.23***</b> <b>[0.10, 0.36]</b>	0.01 [-0.11, 0.13]	0.10 [-0.02, 0.22]
Ate vegetarian/vegan food	28%	0.00 [-0.13, 0.13]	-0.12 [-0.25, 0.00]	<b>0.17**</b> <b>[0.05, 0.29]</b>
Used reusable bags when shopping	28%	0.15* [0.03, 0.27]	-0.01 [-0.13, 0.10]	<b>0.18**</b> <b>[0.07, 0.29]</b>
Used both sides of the paper when drawing or printing	24%	-0.08 [-0.22, 0.06]	0.11 [-0.03, 0.24]	<b>0.20**</b> <b>[0.07, 0.33]</b>
Made/produced a product myself	23%	0.11 [-0.02, 0.24]	-0.07 [-0.20, 0.06]	<b>0.21***</b> <b>[0.09, 0.33]</b>
Reused or repaired items	22%	0.03 [-0.11, 0.17]	0.04 [-0.10, 0.17]	<b>0.22***</b> <b>[0.10, 0.35]</b>
Used reusable hygiene products (e.g., washable wipes)	20%	0.06 [-0.09, 0.22]	-0.01 [-0.15, 0.14]	0.13 [-0.01, 0.28]
Used public transport	14%	0.04 [-0.14, 0.21]	0.07 [-0.09, 0.24]	0.18* [0.02, 0.34]
Bought seasonal, organic, and/or local food	13%	0.18* [0.02, 0.34]	0.02 [-0.13, 0.17]	0.10 [-0.04, 0.24]
Bought products with less packaging	10%	0.02 [-0.16, 0.20]	-0.03 [-0.2, 0.14]	0.13 [-0.03, 0.29]
Talked to somebody about environmental issues	9%	0.09 [-0.10, 0.29]	0.11 [-0.07, 0.30]	0.18* [0.00, 0.36]
Educated myself about the environment	7%	0.19 [-0.03, 0.41]	0.06 [-0.15, 0.27]	0.11 [-0.09, 0.32]
Car-pooled	7%	<b>0.31**</b> <b>[0.09, 0.53]</b>	0.15 [-0.06, 0.36]	0.07 [-0.13, 0.27]
Bought environmentally-friendly products (e.g., eco-friendly cleaners)	7%	0.06 [-0.16, 0.27]	-0.06 [-0.27, 0.15]	0.20* [0.01, 0.40]

**Table 2: Results of behavior-specific analyses in Study 2.** This table presents the item texts, percentage of episodes in which each was reported, and associations between each behavior and each aspect of well-being from separate regressions. Dependent variables are z-scored; independent variables are dichotomous. \* indicates an unadjusted  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Brackets indicate 95% confidence intervals. Coefficients that remain significant after Benjamini-Hochberg adjustment are bolded.

### 4.3 Discussion

Although designed and conducted separately, Studies 1 and 2 used similar methods to investigate a single research question and, on the whole, the two patterns of results were fairly similar. Both studies indicated a positive association between a PEB index and eudaimonic well-being, and Study 2 identified a similar link with pleasant emotions. However, a more complex pattern emerged when we differentiated among individual PEBs and aspects of wellbeing. For example, walking, biking, and carpooling were positively associated with at least one aspect of well-being in both studies, whereas more effortless behaviors like turning off lights around the house were not. That said, there were some notable differences between the results of these two studies. (See Section 2 of the Supplementary Materials for a comprehensive side-by-side comparison.)

The most striking difference relates to the consumption of meat or other animal products. Abstaining from animal products was associated higher eudaimonic well-being in both studies. But, whereas Study 1 suggested that it is also associated with *lower* hedonic well-being, Study 2 did not. We speculate that this difference results from subtle differences in the phrasing of the survey items. In Study 1, participants were asked whether they had eaten any animal products. Hence, this question contrasts episodes in which the participant ate animal products and episodes in which they either ate vegetarian foods *or* did not eat at all. In Study 2, participants were asked whether they had eaten a vegetarian/vegan meal, establishing a contrast between episodes in which participants ate a vegetarian/vegan meal and episodes in which they either ate meat or ate nothing. For this reason, the results are different but not inconsistent. It seems likely that, in Study 1, some of the apparent hedonic impact of eating meat might come simply from eating a



meal rather than eating animal products specifically. Hence, the question used in Study 1 would seem to be a less valid measure than the question used in Study 2.

There were also a couple of other minor differences between studies in the patterns of association. In Study 1, carpooling or taking public transit (assessed with a single question) were each negatively associated with unpleasant emotions. Yet, in Study 2, neither of these behaviors (assessed separately) were associated with unpleasant emotion. This could have to do with differences in the places to which participants were travelling. For example, the UK adults (Study 2) may have been more likely to be travelling to and from work, whereas the US students (Study 1) may have been more likely to be travelling to less stressful locations. Additionally, turning down household heating and cooling was positively associated with pleasant emotions among the UK adults, but not the US undergraduates. Interestingly, there was also a substantial difference in the frequency with which this behavior was reported (4% of episodes in Study 1 versus 44% in Study 2). It's possible that the undergraduates had less autonomy over the heating and air-conditioning in their homes (e.g., because they were living in dormitories or with multiple roommates). This might reduce both the frequency with which they adjusted their thermostats and their emotional reactions to doing so.

A final difference in the patterns of results is more general. Looking across behaviors, the associations with eudaimonic well-being tended to be stronger in Study 2 than in Study 1. This could reflect different implications of PEBs for the two different populations sampled (US students and UK adults). Some groups may tend to find PEBs enjoyable but not especially meaningful or valuable, whereas others may find PEBs meaningful and valuable but not especially enjoyable. Then again, it is also possible that

this discrepancy in results reflects a methodological difference between studies. Study 1 participants divided their days into about 10 episodes on average. Study 2 participants, by contrast, divided their days into three episodes (morning, afternoon, and evening). This means that Study 2 participants were reporting on substantially longer periods of time. It's possible that people assess the value and meaning of their activities somewhat differently when considering those activities over longer or shorter periods. If so, then this could explain the stronger links between PEBs and eudaimonia in Study 2.

In sum, although the results of these two studies are broadly consistent, there are some discrepancies. These could reflect differences across contexts or populations but could also reflect methodological inconsistencies. We investigated these possibilities in a third study.

## **5 Study 3**

This preregistered study tested whether the patterns of association between PEBs and well-being differ between the US or UK populations and/or when people report on longer or shorter periods of time. To address the former, we recruited nationally representative samples of the general adult populations of the UK and US. We therefore expected that any remaining differences in participants' backgrounds can be attributed to meaningful societal differences rather than sampling variability. Regarding the latter, we experimentally varied the length of the episodes on which participants reported. This enabled us to test whether the observed associations differ depending on whether people are reporting on short versus long episodes (e.g., because they conceptualize their activities differently on these different timescales).

## **5.1 Method**

The preregistration form for this study is available online:

[https://osf.io/arxj3?view\\_only=8dbbed7222ef44c19776652d7085433c](https://osf.io/arxj3?view_only=8dbbed7222ef44c19776652d7085433c).

### **5.1.1 Procedure and Measures**

All participants completed a DRM survey, reporting on their PEBs and well-being during three episodes. However, we randomly assigned participants to either a “long episodes” condition or a “short episodes” condition. The procedure in the long episodes condition was identical to Study 2. Participants reported on the morning, afternoon, and evening, with each period defined in the same way as in Study 2. In the short episodes condition, by contrast, participants reported on only one randomly selected period. That is, they broke up either the morning, the afternoon, or the evening into three shorter episodes making the lengths of the episodes similar to those in Study 1. Thus, although the duration of the episodes differed, all participants reported on the same number of episodes, and the number of observations from the morning, afternoon, and evening was balanced between those reporting on long and short episodes.

The measures were identical to those used in Study 2. Again, the pleasant emotions, unpleasant emotions, and eudaimonic well-being measures displayed good internal reliability (within-/between-person  $\omega$ s = .75/.95, .75/.94, and .85/.92, respectively). The presentation order for these measures was randomized.

### **5.1.2 Participants**

Using Prolific, we recruited nationally representative samples of adults from the US and UK. We originally intended to collect 300 responses per sample. However, we also aimed to spread data collection across one week and to collect similar numbers of

responses each day. To that end, we paused data collection each day, attempting to do so after receiving about 40-50 responses. However, manually pausing data collection in this way proved challenging and resulted in a somewhat larger overall sample size than originally intended.

In the US sample, we received 350 complete responses. As preregistered, we excluded ( $n = 26$ ) participants for failing an attention check, leaving an analysis sample of  $N = 324$  participants ( $n = 158$  in the short episodes condition,  $n = 166$  in the long episodes condition), reporting on 972 episodes. Participants reported an average age of 46.43 ( $SD = 16.15$ ). In this sample, 50% of participants identified as female, 48% as male, 2% other or declined to state a sex; 6% identified as Asian, 13% Black, 67% White, 1% Native American or Alaska Native, 4% other race, 7% mixed race, and 1% declined to state a race. Most participants (58%) reported having a college degree, and the median reported income was \$25,000-\$49,999 per year.

In the UK sample, we received 369 complete responses and excluded ( $n = 24$ ) for failing an attention check, leaving an analysis sample of  $N = 345$  participants ( $n = 169$  in the short episodes condition,  $n = 176$  in the long episodes condition), reporting on 1,035 episodes. Participants reported an average age of 48.57 ( $SD = 17.74$ ). In this sample, 52% of participants identified as female, 47% as male, 1% declined to state a sex; 3% identified as Black, African, or Caribbean, 84% White, 1% another ethnicity, 11% mixed ethnicity, and  $< 1\%$  declined to state an ethnicity. Most participants (59%) reported having a college degree, and the median reported income was £40,000-59,999 per year.

In the combined analysis sample, we had  $N = 669$  participants reporting on 2,007 episodes ( $n = 681$  morning episodes;  $n = 669$  afternoon episodes;  $n = 657$  evening episodes).

### **5.1.3 Preregistered Analysis Plan**

The pre-registered analysis plan mirrored the analyses in Studies 1-2. Additionally, we tested whether the associations between the PEB index and each aspect of well-being differed between the US and UK participants and those reporting on short versus long episodes. To do so, we added dummy-coded variables reflecting country (US: 0 = UK, 1 = US) and episode length (short episodes: 0 = long, 1 = short) to the prior models, as well as interaction terms between the PEB index and each of these dummy variables. If significant interactions emerged, we planned to continue testing for such interactions when examining behavior-specific associations. However, if they did not emerge, then we planned to control for country and episode length but not test for interactions.

## **5.2 Results**

When aggregating across PEBs, we found an identical pattern of results to Study 2. That is, the PEB index was significantly, positively associated with pleasant emotions,  $b = 0.14$ , 95% CI: [0.09, 0.19],  $p < .001$ , and eudaimonia,  $b = 0.19$ , 95% CI: [0.14, 0.24],  $p < .001$ , but not associated with unpleasant emotions,  $b = -0.01$ , 95% CI: [-0.06, 0.04],  $p = .715$ .

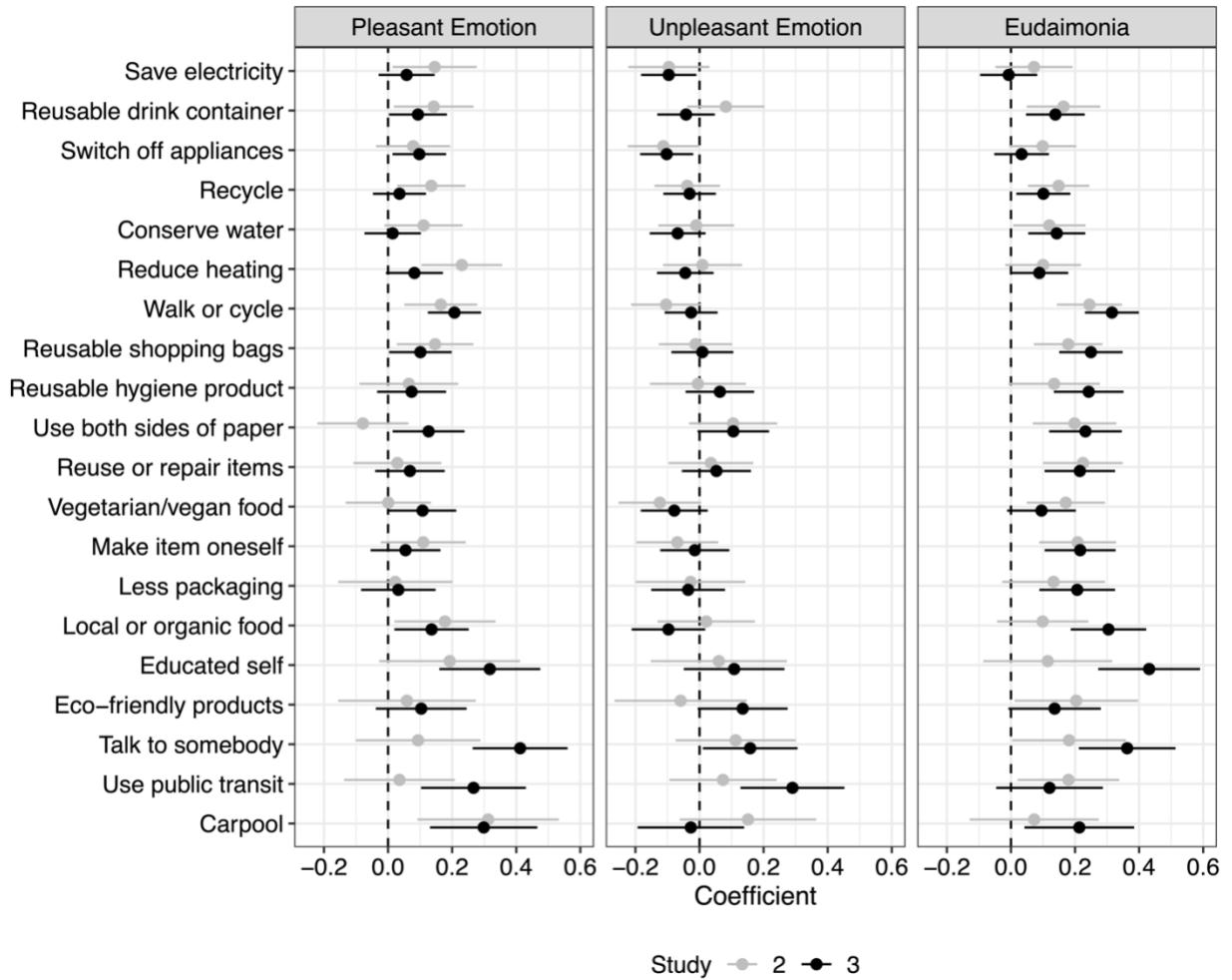
We then added the dummy variables, US and short episodes, and the interaction terms to these models. For pleasant emotions, US was not significant,  $b = 0.07$ , 95% CI: [-0.07, 0.21],  $p = .317$ , short episodes was not significant,  $b = -0.07$ , 95% CI: [-0.19, 0.06],  $p = .307$ , the PEB  $\times$  US interaction was not significant,  $b = 0.07$ , 95% CI: [-0.02, 0.17],  $p$

= .140, and the PEB × short episodes interaction was also not significant,  $b = 0.01$ , 95% CI: [-0.09, 0.11],  $p = .800$ . For unpleasant emotions, again, US was not significant,  $b = 0.06$ , 95% CI: [-0.09, 0.20],  $p = .437$ , short episodes was not significant,  $b = -0.09$ , 95% CI: [-0.22, 0.04],  $p = .169$ , the PEB × US interaction was not significant,  $b = 0.07$ , 95% CI: [-0.03, 0.17],  $p = .180$ , and the PEB × short episodes interaction was also not significant,  $b = -0.01$ , 95% CI: [-0.12, 0.09],  $p = .777$ . Finally, for eudaimonia, US was not significant,  $b = 0.07$ , 95% CI: [-0.06, 0.21],  $p = .279$ , short episodes was significant,  $b = 0.14$ , 95% CI: [0.01, 0.26],  $p = .030$ , but the PEB × US interaction was not significant,  $b = 0.05$ , 95% CI: [-0.05, 0.15],  $p = .339$ , and the PEB × short episodes interaction was also not significant,  $b = -0.06$ , 95% CI: [-0.16, 0.04],  $p = .213$ . Complete results of these models are available in Section 3 of the Supplemental Materials.

Next, we turned to the behavior-specific analyses. Because no significant interactions emerged at the aggregate level, as preregistered, we controlled for country and episode length but did not continue testing for interaction effects. However, in Section 4 of the Supplemental Materials, we present the coefficients for each behavior across countries and experimental conditions. (We also present the coefficients for males versus females and for younger versus older adults.) Overall, the associations look very similar, supporting the conclusion that these factors do not play an important role in shaping the associations between PEBs and well-being.

Results of the behavior-specific analyses are presented in Figure 3 and Table 3. We found that five PEBs were significantly and positively associated with pleasant emotions: walking or cycling, carpooling, and taking public transportation, as well as learning and talking with others about environmental issues. Thirteen out of twenty PEBs

were significantly (and all positively) associated with eudaimonia: carrying a reusable drinking container, bringing reusable bags when shopping, using reusable hygiene products, buying products with less packaging, conserving water, reusing paper products, making something rather than buying it, reusing or repairing items, walking, cycling or carpooling, eating local and/or organic food, as well as learning and talking about environmental issues. Finally, two PEBs were significantly associated with unpleasant emotions. Whereas switching off electrical appliances was associated with less unpleasant emotion, riding public transportation was associated with more unpleasant emotion. Overall, the results of these behavior-specific analyses are very similar to those observed in Study 2.



**Figure 3: Associations between pro-environmental behaviors and well-being in Studies 2-3.** Points indicate mixed-effects regression coefficients and error bars indicate 95% confidence intervals. Study 2 coefficients are plotted in gray for comparison. Dependent variables are z-scored; independent variables are dichotomous.



Behavior	%	Coefficient		
		<i>Pleasant Emotion</i>	<i>Unpleasant Emotion</i>	<i>Eudaimonia</i>
Save electricity	68%	0.06 [-0.03, 0.15]	-0.10* [-0.18, -0.01]	-0.01 [-0.10, 0.08]
Reusable drink container	61%	0.09* [0.00, 0.18]	-0.04 [-0.13, 0.05]	<b>0.14**</b> <b>[0.05, 0.23]</b>
Switch off appliances	59%	0.10* [0.01, 0.18]	<b>-0.10*</b> <b>[-0.19, -0.02]</b>	0.03 [-0.05, 0.12]
Recycle	53%	0.04 [-0.05, 0.12]	-0.03 [-0.11, 0.05]	0.10* [0.02, 0.19]
Conserve water	49%	0.01 [-0.07, 0.10]	-0.07 [-0.16, 0.02]	<b>0.14**</b> <b>[0.05, 0.23]</b>
Reduce heating	43%	0.08 [-0.01, 0.17]	-0.04 [-0.13, 0.04]	0.09 [0.00, 0.18]
Walk or cycle	36%	<b>0.21***</b> <b>[0.12, 0.29]</b>	-0.03 [-0.11, 0.06]	<b>0.32***</b> <b>[0.23, 0.40]</b>
Reusable shopping bags	22%	0.10* [0.00, 0.2]	0.01 [-0.09, 0.11]	<b>0.25***</b> <b>[0.15, 0.35]</b>
Reusable hygiene product	21%	0.07 [-0.03, 0.18]	0.06 [-0.04, 0.17]	<b>0.24***</b> <b>[0.13, 0.35]</b>
Use both sides of paper	2%	0.13* [0.01, 0.24]	0.11 [-0.01, 0.22]	<b>0.23***</b> <b>[0.12, 0.35]</b>
Reuse or repair items	19%	0.07 [-0.04, 0.18]	0.05 [-0.05, 0.16]	<b>0.21***</b> <b>[0.11, 0.32]</b>
Vegetarian/vegan food	19%	0.11* [0.00, 0.21]	-0.08 [-0.18, 0.03]	0.10 [-0.01, 0.20]
Make item oneself	16%	0.05 [-0.05, 0.16]	-0.01 [-0.12, 0.09]	<b>0.22***</b> <b>[0.11, 0.33]</b>
Less packaging	14%	0.03 [-0.08, 0.15]	-0.04 [-0.15, 0.08]	<b>0.21***</b> <b>[0.09, 0.33]</b>
Local or organic food	13%	0.14* [0.02, 0.25]	-0.10 [-0.21, 0.02]	<b>0.30***</b> <b>[0.19, 0.42]</b>
Educated self	9%	<b>0.32***</b> <b>[0.16, 0.48]</b>	0.11 [-0.05, 0.27]	<b>0.43***</b> <b>[0.27, 0.59]</b>
Eco-friendly products	9%	0.10 [-0.04, 0.25]	0.13 [-0.01, 0.27]	0.14 [-0.01, 0.28]
Talk to somebody	9%	<b>0.41***</b> <b>[0.26, 0.56]</b>	0.16* [0.01, 0.31]	<b>0.36***</b> <b>[0.21, 0.51]</b>
Use public transit	7%	<b>0.27**</b> <b>[0.10, 0.43]</b>	<b>0.29***</b> <b>[0.13, 0.45]</b>	0.12 [-0.05, 0.29]
Carpool	6%	<b>0.30***</b> <b>[0.13, 0.47]</b>	-0.03 [-0.19, 0.14]	<b>0.21*</b> <b>[0.04, 0.38]</b>

**Table 3: Results of behavior-specific analyses in Study 3.** This table presents the item texts, percentage of episodes in which each was reported, and associations between each behavior and each aspect of well-being from separate regressions. Dependent variables are z-scored; independent variables are dichotomous. \* indicates an unadjusted  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Brackets indicate 95% confidence intervals. Coefficients that remain significant after Benjamini-Hochberg adjustment are bolded.

### 5.3 Discussion

The results of this pre-registered study continue to indicate that PEBs are positively associated with pleasant emotions and eudaimonia but not associated with unpleasant emotions. Breaking up this heterogeneous category of behaviors, we found that a handful (all the behaviors related to transportation as well as learning and communicating about the environment) were associated with pleasant emotions. Most of the PEBs were associated with eudaimonia, with some exceptions being turning off lights and appliances and reducing household heating. Finally, two PEBs were associated with unpleasant emotions: switching off electrical appliances was negatively associated, and riding public transportation was positively associated.

Some key questions in this study were whether (a) the observed links between PEB and well-being differ across countries and (b) whether they depend on the length of the period of time on which participants report. We found that they did not: the same overall patterns of association between PEB and well-being emerged for participants in the US and UK, as well as for participants randomly assigned to report on their morning, afternoon, and evening and participants randomly assigned to break up one of these periods into three shorter episodes.

Given these new findings, what should we make of the differences between the results of the prior studies? One such difference related to turning down household heating and cooling, which was positively associated with pleasant emotion in Study 2 but not significantly related to pleasant emotion in Study 1. Study 3 also found no association between adjusting the thermostat and pleasant emotion, suggesting that perhaps the Study 2 result might have been a false positive.

Second, in Study 1, we found that carpooling or taking public transit (assessed with a single question) was negatively associated with unpleasant emotions. In Study 2, by contrast, neither behavior was significantly associated with unpleasant emotions. Study 3 supported the result from Study 2, indicating that carpooling is not associated with unpleasant emotions (though, as in Studies 1-2, it was positively associated with pleasant emotions). For taking public transportation, there was a significant, positive association with unpleasant emotions (as well as pleasant emotions). In Study 2, although this coefficient was not significant, it was also positive, which could indicate that the greater statistical power offered by this study ( $N = 2,007$  observations, versus Study 2's  $N = 1,080$ ) was necessary to detect it. Overall, the present evidence suggests that riding public transportation leads to more intense emotions, both pleasant and unpleasant.

Finally, we tended to find stronger links between PEBs and eudaimonic well-being in Study 2 versus Study 1. In this study, these links were quite similar in magnitude to those found in Study 2. (The median coefficient in both Study 2 and Study 3 was  $b = .10$ .) One possibility, therefore, is that the weaker associations in Study 1 reflect the attenuating effect of measurement error (Allen & Yen, 2001). Whereas Study 1 used a single-item measure, Studies 2-3 used a 6-item measure, which should be more reliable.

To summarize, we again found generally positive associations between PEBs and positive and eudaimonic aspects of well-being. The findings helped to explain some of the differences between the results of Studies 1 and 2. They also expanded on those prior results, demonstrating their robustness to methodological choices concerning episode length and that the association between PEB and well-being is similar across populations within two major economies with a large environmental impact.

## 6 General Discussion

In three studies, we examined several aspects of individuals' well-being (pleasant and unpleasant emotions and eudaimonia) during moments when they did and did not enact a range of PEBs. Studies 1 and 2 were conducted independently by subsets of the coauthors and used convenience samples of US students (Study 1) and UK adults (Study 2). The pre-registered Study 3 was then designed and conducted collaboratively. Using nationally representative samples of US and UK adults, we tested whether the relationships between PEBs and well-being differ across countries or depending on the duration of the episodes on which participants report (a methodological difference between Studies 1 and 2). Results indicated no such differences, supporting the generalizability and robustness of the findings.

When aggregating across behaviors, we consistently found that PEB is positively associated with eudaimonia (Studies 1-3) and pleasant emotions (Studies 2-3) but not with unpleasant emotions (Studies 1-3). However, focusing on discrete behaviors revealed a far more complex pattern of associations. PEB is often treated as a monolithic construct. Yet, these behaviors are grouped only by their environmentally-friendly motives and/or consequences, and can therefore differ in numerous important respects (Lange & Dewitte, 2019; Larson et al., 2015). Common examples of PEBs range from restricting animal-based protein consumption to recycling and reusing materials, to limiting energy and water usage. These behaviors vary in theoretically important characteristics, such as costs (including time, money, and/or effort), visibility, social norms, and impact (Binder et al., 2020; Brick et al., 2017). Our results indicate that the associations between different PEBs and well-being also vary in important ways. In line with past work (Schmitt et al.,

2018), the results suggest that behaviors requiring more active engagement and effort show stronger and more consistent associations with well-being. For example, in all three studies, walking or cycling instead of driving and carpooling were each positively associated with well-being, whereas simply turning off lights when one leaves a room was not. Additionally, we find that social behaviors, like carpooling and talking with others about environmental issues, show especially strong links with well-being. Hence, one implication of these findings is that, when researchers use PEB indexes, their results might be influenced by details about the specific behaviors included in the index.

Another important source of variation arises from differences among aspects of well-being. As one example, in Studies 2-3, we found that reusing or repairing items was not associated with pleasant or unpleasant emotions but was positively associated with eudaimonia. Indeed, more generally, we found that most PEBs are associated with eudaimonia, and these links were generally stronger than links with hedonic aspects of well-being. Focusing on the hedonic, few PEBs were associated (whether positively or negatively) with unpleasant emotions, whereas a larger number were associated (all positively) with pleasant emotions. The takeaway, therefore, is that PEBs are more consistently and strongly associated with positive—and especially eudaimonic—aspects of well-being. That is, people sometimes find PEBs enjoyable; but even when they don't, they tend to experience these behaviors as valuable, important, and worthwhile, which could serve as an important justification and source of motivation for PEBs.

## **6.1 Limitations and Implications**

Whereas past research has typically examined a simple bivariate relationship between PEB and well-being, the present studies adopted a more fine-grained approach.

They took advantage of the DRM, which has excellent ecological validity for investigating ordinary life and reduces the recall and social desirability biases that afflict global retrospective reports. Yet, because these studies relied on self-report measures of PEBs and well-being, the observed associations may suffer from a common method bias (Podsakoff et al., 2012). Moreover, because these were not randomized experiments, the findings do not demonstrate that PEBs cause increases in well-being. That said, recent experimental work has found that instructing people to incorporate PEBs into their daily activities increases their well-being (Prinzing, 2024). This finding suggests that the associations observed in the present studies may reflect effects of PEBs on well-being.

That said, a person's well-being may also influence the likelihood that they will engage in PEBs. When people are in a good mood, they tend to act more *prosocially* (Aknin et al., 2018). Perhaps positive states of mind also encourage people to act more *pro-environmentally* (Zelenski & Desrochers, 2021). Recent experiment work has not supported this speculation (Lange & Dewitte, 2020). Yet our findings suggest that effects of well-being on PEB could depend on the specific behavior in question. For example, when a person is feeling especially cheerful or fulfilled, they might be more likely to bike to work or repair something rather than throw it away. But they might also eat more meat or be less attentive to their household energy consumption. Thus, future work on the effect of well-being on PEB would do well to differentiate among behaviors.

## **7 Conclusion**

These three studies provide novel insights into the everyday associations between pro-environmental action and well-being, offering a level of nuance that has previously been missing from the literature. Such details can inform public policy aimed at

encouraging PEBs and assessing their consequences for individual and societal welfare. For example, our findings suggest that many PEBs are experienced as enjoyable and rewarding. Publicizing this result could help to motivate people to incorporate more of these behaviors into their daily routines. Yet other PEBs were not associated with greater well-being and may even be psychologically costly. Hence, other incentives may be required to encourage people to adopt those PEBs. Our findings may also inform public policy that targets well-being rather than (or in addition to) more traditional welfare indicators such as economic growth (Diener & Seligman, 2004; Graham et al., 2018). Although climate policies are often resisted on the grounds that they will curtail individual well-being, the present findings suggest that this is a mistaken assumption. Indeed, it is possible that policies encouraging PEBs could increase well-being. Overall, then, our findings advance understanding of sustainable lifestyles, providing insights that may help to promote, in tandem, ecological and individual well-being.

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