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## Article

# Breath, Love, Walk? The Impact of Mindfulness Interventions on Climate Policy Support and Environmental Attitudes

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**Abstract:** Mindfulness practices have the potential to induce the cognitive and behavioral changes needed to foster pro-environmental behavior and increase support toward sustainable and climate-oriented policies. However, the empirical evidence of the effectiveness of meditation on sustainable behavior is limited and mostly confined to correlational studies, often based on the same type of mindfulness interventions. In this paper, we report the results of an online experiment ( $n = 1000$ ) comparing the impact of three different short-term mindfulness interventions on various (self-reported and incentivized) measures of mindfulness state and sustainable behavior. While only one of our interventions is found to impact environmental attitude and climate policy support directly, we show that the three meditation practices indirectly foster sustainable behavior through preidentified mediators. These results are relevant for organizations and policymakers who seek to foster climate policy support and environmental attitudes in their stakeholders.

**Keywords:** mindfulness; pro-environmental behavior; interventions; meditation; climate policy support



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## 1. Introduction

### 1.1. Background

It is now widely acknowledged that changes required to limit climate change must occur at multiple levels [1,2] and that citizen engagement is essential in this process [3–5]. This is why the Intergovernmental Panel on Climate Change (IPCC) has encouraged psychologists to become part of the discussion on sustainable issues [6,7]. Recent studies have highlighted human beings' limited attentional capabilities and pointed out possible connections between these limitations and the lack of more meaningful considerations and actions toward climate among the general public [8,9]. The global COVID crisis and post-COVID period may provide the impetus for a global system change [10–13] leading individuals to become more aware of their environment and to seek to contribute more actively to counteracting the climate change phenomenon [14,15].

In the psychological literature, behavior is generally explained by the Theory of Planned Behavior which states that attitudes are considered to be the antecedents to intentions which in turn impact behaviors [16–18]. However, a discrepancy may exist between a positive attitude toward action and the level of engagement toward it [19], leading to the so-called 'intention–behavior gap' or 'green gap' as a recurring issue. Despite environmental-friendly attitudes, intentions, and willingness to engage on behalf of the environment, relatively few individuals actually engage in sustainable behavior [20,21]. While various factors such as motivation, awareness, values, emotions, and demographics may act as gateways toward potential solutions, none have found a definitive answer [22].

One possible way to reduce the ‘intention–behavior’ gap is via mindfulness. Mindfulness is a practice rooted in Buddhist psychology defined as intentional and non-judgmental attentiveness to the present moment [23]. Mindfulness practices have recently been highlighted as potentially fostering the needed cultural shift toward sustainability [24]. Recent studies have, for example, explored how mindfulness may foster cognitive and behavioral attitude changes toward climate change [25,26]. It has been shown that people cultivating mindfulness reflect more skillfully on their unconscious behaviors and opt for measures allowing them to reduce their cognitive dissonance [27,28]. Mindfulness may also foster individuals’ awareness of internal and external events, which may help overcome common psychological barriers, such as limited cognition of the problem, perceived risks of change, and discredence of facts, that hinder motivation to confront environmental challenges [29,30] and promote collaboration [31] and creativity [32]. Overall, a mindful disposition may thus serve to foster proactive climate actions [33].

While several studies have explored the mechanisms at play linking mindfulness and sustainable behavior [34,35], they typically rely on self-reported indicators and are thus unable to assess the impact on actual behaviors [14,36].

### *1.2. The Sustainability–Mindfulness Link*

The notion of the inner transformation of individuals through heightened consciousness has recently been highlighted as a pathway to address climate change and the attitude–behavior gap in the sustainability field [35,37]. Existing studies have highlighted positive correlations between levels of mindfulness and sustainable behavior, measured as increases in climate change belief [38], environmental attitude [15,33], pro-environmental behavior [39,40], and climate policy support [27].

Yet, the existing literature exploring the sustainability–mindfulness link typically presents some significant limitations. First, most of the existing studies are correlational and focus on measuring individual trait mindfulness through surveys and self-reported measures [15,27,33,38], whereas sustainable behavior is typically measured through intention-based concepts [34,35]. However, the ‘intention–behavior’ gap in the sustainability field is even more prevalent, as most respondents generally manifest a worry and willingness to act in favor of the environment but very few do behave according to their intention [21,29,41,42]. Second, existing studies that have used mindfulness-based interventions (MBI) to explore the impact of mindfulness on sustainable behavior are typically based on the 8 to 10-week MBSR (mindfulness-based stress reduction) programs [39,40,43]. As these formats require a rigorous time commitment from participants, their main drawback is that they can negatively impact expected results and create attrition [44–46]. Consequently, it is often difficult for these studies to attribute changes in sustainable behavior to mindfulness practice alone [39,47]. Third, most studies focus on a single type of intervention and do not compare the differences between distinct mindfulness practices on perceptions and behaviors toward the environment [15,27]. However, distinct mindfulness modules focusing on compassion, breathing, or specific elements of contemplative practices empirically show medium-term differentiated effects on the brain and body [48].

### *1.3. The Current Study*

This study seeks to assess the role of mindfulness in the reduction of the intention–behavior gap in sustainability. Specifically, our first goal is to investigate whether more mindful individuals are more likely to support policies to mitigate climate change and are willing to adopt more sustainable behavior. Second, this study seeks to investigate in more detail the mediators between mindfulness and sustainable behavior [49]. Mindfulness has indeed been found to cultivate sustainable attitudes and behaviors through a plurality of mediators, among which are compassion, openness to new experiences, and connectedness with Nature [14,27]. The intention is to contribute to the needed paradigm shift whereby individuals transform heightened awareness into climate action.

Using a systematic and comparative approach, we explore the causality links between mindfulness and sustainability and address the following question: Among the three most commonly practiced mindfulness interventions (breath, LKM, walking), which is the most likely to foster pro-environmental behavior (PEB), and through which mediating mechanisms?

## 2. Research Design

### 2.1. Mindfulness and Sustainability

The objective of this study is to investigate whether the practice of mindfulness meditation may lead to improvements in sustainable awareness and behavior. The first general hypothesis thus concerns the causal relationship between mindfulness practice and behavior. It can be summarized as follows.

**Hypothesis 1 (H1).** *Mindfulness meditation positively affects sustainable behavior.*

Behind this general pattern, several pathways have been proposed to explain the link between mindfulness and sustainability [14]. A particular aspect of this research design is that three different types of mindfulness meditations and three different mediators are considered. Thiermann and Sheate (2020) [14] encouraged researchers to explore the relationship between mindfulness and sustainable behavior through six potential mediators. This study focused on three of them.

Connectedness with Nature has been largely studied as a variable linking mindfulness and sustainability concepts but there is a clear lack of experimental studies exploring this connection [14].

Compassion has been identified as a significant antecedent to pro-social behavior by several studies [50]. Yet, in the sustainability field, studies have either established this relationship using solely self-reported levels of general mindfulness and compassion (without any mindfulness intervention) [27] or using a very specific sample group [51].

Openness to new experiences could be a substantial mediator when linking mindfulness to PEB [14,52,53]. However this pathway has seldom been explored in this research field connecting mindfulness with sustainable behaviors [14].

In order to elicit the appropriate feelings corresponding to the mediators, three different meditations were chosen and paired with a specific mediator. The breath and loving-kindness meditations have been used frequently in the sustainability–mindfulness research field [35]. The walking meditation, an integral part of historical Buddhist meditation practices [54], has only been the object of one study (to our knowledge), where scientists explored the effects of nature on connectedness with Nature and found robust evidence showing that mindfulness cues coupled with a walk in nature elicited stronger connectedness with Nature and less negative affect than other conditions [55]. In what follows, the focus is on critical arguments to establish the relationship between each pair of meditation and mediator. Focusing on the differentiated effect of distinct types of meditations, more precise hypotheses linking mindfulness to sustainable behavior are developed.

### 2.2. Loving-Kindness Meditation, Compassion, and Sustainability

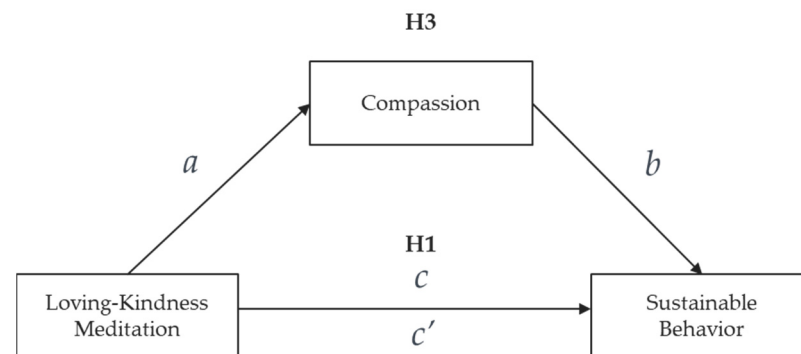
Compassion or pro-sociality may act as a pathway between mindfulness and sustainability, and it may be fostered through a particular kind of meditation called loving-kindness meditation (LKM) [50,56]. LKM is a meditation technique and contemplative practice originating from Buddhist tradition [57–59]. It differs from regular mindfulness practice in that one is invited to repeat phrases of kindness directed to oneself and numerous others, such as ‘may I be happy and at ease’ or ‘may all beings be safe and free from suffering.’ This systematic technique cultivates compassion for oneself, loved ones, and even for all sentient beings [49].

Compassion is a motivational state characterized by feelings of love and concern for others which helps drive behavior and promote others’ welfare [60,61]. Various studies have investigated the existence of correlations between compassion, prosocial behavior,

and mindfulness [35,62]. For example, Pandey et al. (2018) found that mindfulness training increased levels of compassion and allowed one to overcome egocentric bias, which in turn increased moral reasoning and diminished the need for immediate gratification, which itself correlates positively with sustainable behavior [63,64]. Similarly, Lu and Schuldt (2016) have shown that higher levels of compassion lead to greater climate policy support as follows: increased levels of compassion lead to a higher likelihood that people think that human activities cause a natural catastrophe, and thus the more likely they will be to support policies to mitigate such catastrophes, since people perceive human-made catastrophes as preventable [65]. More recently, Engel et al. (2020) found that exposing entrepreneurs to a brief LKM meditation led to a higher level of compassion and, in turn, increased the likelihood of making more sustainable decisions [51].

Based on these previous findings, the following theoretical hypothesis is developed and illustrated in Figure 1.

**Hypothesis 2 (H2).** *Increased feelings of compassion from LKM act as a mediator to foster greater sustainable behavior.*



**Figure 1.** Conceptual model illustrating Hypothesis 2.

### 2.3. Breath Meditation, Openness to New Experiences, and Sustainability

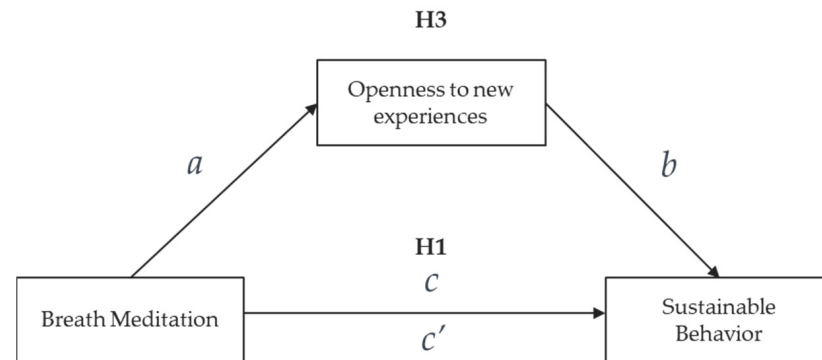
Breath meditation is the most widely used mindfulness technique with which to reach a state of mindfulness [66,67]. Such meditation involves experiential processing of internal and external stimuli (body sensations, emotions, thoughts, see [68]) and fosters a decentering where stimuli are observed within a broader context of awareness [66]. The most common operationalization of breath meditation practice has been through the MBSR program developed by John Kabat-Zinn (2003) or adaptations of this program [69]. Mindfulness taps into a unique quality of consciousness that is positively associated with, among other variables, openness to new experiences [70–72].

Openness to new experiences is the ability to open up to new ideas and change behaviors combined with a non-judgemental attitude [52]. Openness to new experiences has been highlighted as an essential mediator linking trait mindfulness with more sustainable practices or attitudes [14,52,73] and with attitudes toward climate change [33]. For example, openness to new experiences and novelty-seeking, which are often attributed to mindful people, allow individuals to be attentive to new products and experiences that may be potentially more sustainable [26].

Most studies investigating the links between mindfulness, openness to new experiences, and sustainability have focused on self-reported measures rather than actual behavior [74]. For example, Ray et al. (2021) found that participants who underwent a mindful breathing exercise presented increased levels of mindfulness, connectedness with Nature, and self-reported measures of engagement in more PEB [75]. Along the same line, Frank et al. (2019) revealed that a short MBI program, including “Breathing Observation” exercises, allowed people to develop competencies crucial to curbing climate change [39].

Based on the existing literature, it is hypothesized that, through practicing breath meditation and the openness to new experiences it generates, subjects can enhance their sustainable behavior (see Figure 2).

**Hypothesis 3 (H3).** *Increased feelings of openness to new experiences from mindfulness breath meditation act as a mediator to foster greater sustainable behavior.*



**Figure 2.** Conceptual model illustrating Hypothesis 3.

#### 2.4. Walking Meditation, Connectedness with Nature, and Sustainability

Walking meditation is the third type of meditation considered. It is an integral part of meditative practices coming from the Zen tradition. The practice of walking meditation has been developed as an essential component of the mindful living practices instituted, for instance, by the teachings of the Vietnamese Buddhist monk Thich Nhat Hanh (1987) [76]. Through attention to the placement of one's feet on the ground and the use of soothing phrases about the interconnectedness between our feet and planet earth, walking meditation may foster an increased connectedness with Nature (CWN) [77].

CWN may be defined as a 'stable state of consciousness comprising symbiotic cognitive, affective, and experiential traits that reflect, through consistent attitudes and behaviors, a sustained awareness of the interrelatedness between oneself and the rest of nature' [78]. CWN has been found to be significantly related to mindfulness [19]. For example, using a 4-week mindfulness meditation intervention, Ray et al. (2021) demonstrated that mindfulness practice may increase CWN and confirmed how a nature experience combined with mindfulness heightens CWN even more compared to a regular mindfulness intervention [75] (see also [79,80]). While walking meditations have rarely been used to link mindfulness and CWN, Nisbet et al. (2019) found robust evidence that a walk outdoors in Nature with mindfulness instructions elicited stronger CWN and less negative affect than a regular walk outdoors in Nature or a walk indoors [55].

CWN has also been found to be correlated with and a good predictor of PEB [28,74,78,81]. In particular, a meta-analysis of 37 studies confirmed that feeling a positive connection with Nature significantly increased PEB. Additionally, Sato et al. (2021) [82] found that a greater CWN increases the value one attributes to Nature and thus increases the propensity to sacrifice personal financial gains to help preserve Nature. Such results indicate the importance of willingness to sacrifice wealth to engage in PEB [64,82,83].

Based on the previous literature, it is posited that walking meditation may foster an increased CWN, which may, in turn, increase sustainable behavior (see Figure 3).

**Hypothesis 4 (H4).** *Increased feelings of connectedness with Nature from walking meditation will act as a mediator to foster greater sustainable behavior.*



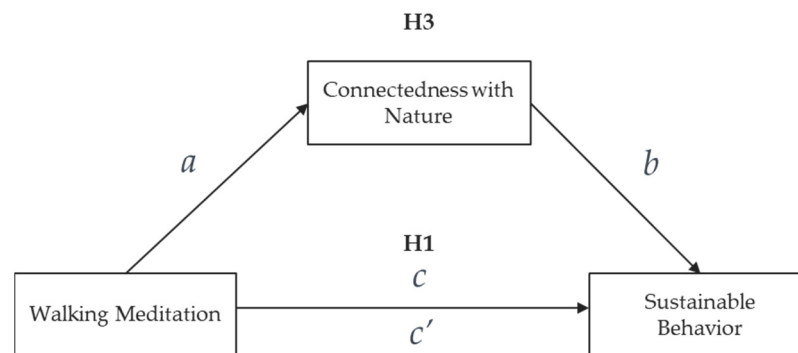


Figure 3. Conceptual model illustrating Hypothesis 4.

### 3. Materials and Methods

We ran a large-scale online experiment with 1000 participants proposing different MBI types. Specifically, we confronted different groups of subjects with three types of 10-min guided meditation (plus an active control group) and measured the meditations' effect on (i) beliefs and intentions to act toward the environment, (ii) support for climate policy, and (iii) engagement in PEB. We then study the role of three mediating mechanisms (compassion, connectedness with Nature, and openness to new experiences) in explaining how such a short intervention may foster sustainable behavior.

#### 3.1. Participants and Procedures

1000 participants were recruited to take part in an online experiment via Prolific. Prolific (<https://prolific.co/>) is an established platform for online subject recruitment for social and economic science experiments, which explicitly caters to researchers [84]. An advantage of Prolific, compared to other platforms such as MTurk, is the wider geographical locations of participants and their degree of trust and honesty (which are ensured by the strong processes put in place) [85]. The study was certified to conform with the ethical rules and regulations of the CNRS research laboratory LEM, and informed consent was obtained from all participants. Participants were recruited over five consecutive days. In order to take part in our experiment, participants had to be registered with the recruitment service and have at least a 95% jobs approval rating. Participants received a fixed £2 for completing the 22-min questionnaire, representing an hourly wage of £5.45 (i.e., £0.45 above the minimum wage imposed by Prolific). Participants also had the opportunity to earn up to a £1 bonus, thus potentially increasing their participations earnings to £8.2/hour. The mean sample age was 27.8 (SD = 9.47), and 42.8% were female. Most participants came from Europe (82.5%). Others came from North America (5.8%), Africa (5%), South America (3.1%), Asia (2.6%), and the Middle East (1%).

The online survey consisted of five parts. In Part 1, participants were asked to sit comfortably, pay attention and listen to a 10-min audio track without interruption. Before accessing the audio track, participants were told that they could not take breaks after having listened to the 10-min audio and should return their submission if they were not able to commit to this requirement. Additionally, at the end of track recording, participants were asked to confirm that they indeed listened to the audio completely. They were not able to proceed with the questionnaire if this was not the case and were asked to return their submission to Prolific. In total, 118 persons returned their submission. These persons are not counted as participants. Participants were randomly assigned to one of the three treatment conditions (i.e., three different guided meditations) or the active control condition (i.e., the recording of a reading of an article from the Huffington post). Part 2 contained a battery of state measures and manipulation check questions. It took place directly after participants listened to the audio recordings. Part 3 included questions on participants' environmental attitudes and included self-reported measures of (1) beliefs and intentions to act and (2) climate policy support, as well as an economically incentivized

question measuring (3) pro-environmental behavior through the possibility of donating to an international non-governmental organization. In Part 4, participants answered questions about the potential mediators we identified: compassion, openness to new experiences, and connectedness to Nature. Finally, in Part 5, participants were asked to report their political views and prior meditation experience and fill in their demographic information. All participants completed the survey in the same order. Answers were timed to ensure reliability of answers. Appendix A presents the survey materials.

### 3.2. Measures

#### 3.2.1. Treatment and Control Conditions

The experimental condition consisted of an audio segment with either one of the four following treatments: (1) a loving-kindness guided meditation (LKM); (2) a standard guided breath meditation; (3) a walking guided meditation; or (4) an active control consisting in a recording of a reading of a news article. All recordings were precisely the same length (10 min) and narrated by the same person (a certified MBSR instructor and long-time mindfulness practitioner).

Participants in the LKM treatment were guided through an audio clip focused on developing feelings of love and kindness for themselves, loved ones, and strangers (see Logie and Frewen, 2015 [86], for a similar procedure). This treatment was chosen to evoke in participants feelings of compassion and sympathy toward themselves and others [50,51,87]. Participants in the breathing treatment were guided through mindful breathing and attention meditation. As mentioned earlier, such an intervention has been shown to increase openness to new experiences significantly [88,89]. In the walking meditation treatment, participants were instructed to focus on the bodily sensations of walking. Special attention was given to the relationship between the body and the Earth through repeated guided affirmations such as “Caressing the earth” or “Touching the earth” to foster a feeling of Connectedness With Nature. Finally, participants in the active control group were not instructed to meditate but instead listened to a reading of an article from the Huffington Post about the author of the Grinch (see Appendix B for full transcripts of audio scripts). The objective was to provide participants with a closely matched intervention in terms of form but not content.

#### 3.2.2. Sustainable Behavior

Participants’ sustainable behavior was measured along three distinct dimensions. First, their beliefs and intentions toward the environment (with a focus on climate change) were measured using the Climate Change Attitude Survey (CCAS) [90]. While a distinction is sometimes made between “beliefs and intentions” and “behavior”, for the sake of exposition, we here adopt a broad definition of behavior, which encompasses the notion of beliefs. These two elements are, in general, very strongly correlated with other elements of sustainable behavior and are considered to be a substantial precedent [33,91,92]. The survey comprises 15 Likert-type attitudinal items rated on a 5-point scale from 1 = Strongly Disagree to 5 = Strongly Agree. Two main themes are represented among the items: beliefs (10 items, such as “I believe there is evidence of global climate change”) and intentions (5 items, such as “I can do my part to make the world a better place for future generations”).

Second, climate policy support was measured using different types of questions. For example, we used a “ranking” item in which participants were asked to rank ten different World issues from 1 to 10. The list of issues is adapted from the European Social Survey 2016 [93], to which we added the issue “Technology failure (cybersecurity failure, IT infrastructure breakdown, . . . )” taken from The Global Risks Report 2021 [94]. As any of these global issues may be crucial to mitigating climate change [95], the support for unilateral climate and push/pull policies was assessed using a 5-point Likert-scale from 1 = Strongly Disagree to 5 = Strongly Agree. Specifically, we use one item from Bernauer and Gampfer (2015) [96], which uncovers supports from citizens for unilateral climate policies and four items from Rhodes et al. (2017) [95], which connect bio-spheric



values with acceptance of policies increasing personal taxes compared to softer policies giving subsidies and encouraging change in regulations.

For the first two dimensions measured, an introductory phrase was included with cues such as “Right now” and “in this present moment” to ensure as much as possible that participants answered from the mindful state they were in after the meditation and not from old habitual thought patterns.

Finally, a direct, incentivized measure of PEB was introduced by eliciting the amount of money given to a non-governmental organization whose mission is to protect the environment and tackle climate change (i.e., WWF). To do so, participants were endowed with a £1 bonus and told that they could donate any portion they wished to the WWF (whose actions to protect the environment were shortly described). Contrary to most existing studies using self-reported measures of PEB, such a real monetary incentive question, widely used in experimental economics, enables us to obtain a reliable measure of behavior while simultaneously controlling for experimental conditions [97].

### 3.2.3. Compassion, Openness to New Experiences, and Connectedness with Nature

Following Engel et al. (2020) [51], Oveis et al.’s (2010) [98] measure of state compassion was used, in which participants were asked to report how they felt after listening to the audio recording. A 5-point Likert scale (1 = did not experience at all; 5 = strongly experienced) was used to measure the extent to which participants had felt the following: “compassion toward themselves,” “compassion toward others,” “sympathy toward others,” “moved.”

The “Mini marker” subset of Saucier (1994) [99] was used to measure openness to new experiences. It consists of a brief version of Goldberg’s (1992) [100] Big-Five markers to assess phenotypic personality traits, asking participants to rate the extent to which 40 different adjectives describe them well (eight adjectives per personality trait). In this study, participants were asked to answer a 5-point Likert scale (1 = very inaccurate; 5 = very accurate) on the eight items corresponding to the trait “openness” (adjectives are: complex, creative, imaginative, intellectual, philosophical, deep, uncreative, unintellectual).

Finally, following Kleespies et al. (2021) [101], the shortened 5-item state version of the Connectedness to Nature Scale (CNS, which consists of 14 items) of Mayer and Frantz (2004) [102] was used to measure the affective connection with Nature. The CNS is considered a suitable instrument for investigating the connection with Nature [103]. It has been used in numerous studies, and its reliability is repeatedly confirmed [104]. A 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) with statements such as “At the moment, I can imagine myself as part of the larger cyclical process of living” was used. The three measures of openness to new experiences, compassion, and CWN were assessed through a composite of ratings of the different items described.

In addition, cues in the wording were introduced to help participants answer based on how they felt at the moment.

### 3.2.4. Manipulation Check and Control Variables

The Toronto-Mindfulness-Scale (TMS) was used as a manipulation check to compare the effects of the different meditations [50]. The TMS is a widely used 13-item scale to assess the level of state mindfulness after a mindfulness intervention [105,106]. It has been implemented as a manipulation check in previous studies examining the effects of short mindfulness interventions [107]. Participants were asked, directly after the audio recording, to rate, on a 5-point Likert scale (1 = not at all, 5 = very much), the extent to which they had experienced levels of curiosity and decentering (ability to be aware of one’s experience with some distance and disidentification rather than being carried away by one’s thoughts and feelings”, see [53]). Both measures of state mindfulness (curiosity and decentering) were assessed through a composite of ratings of the corresponding items.

To ensure that potential confounds are properly randomized across the experimental groups (and thus that groups are comparable), participants’ differences in age, gender, and cultural background were controlled for, along with more specific individual measures such

as trait mindfulness, political views, and prior meditation experience. Specifically, because of its relationship with sustainability concerns [33,108], potential differences between groups on trait mindfulness were controlled for, using the adapted Mindful Attention Awareness Scale (MAAS, [72]) by Osman et al. (2015) [109], which consists of a validated 5-item short version of the MAAS that evaluates how often an individual experiences mindfulness states (on a 5-point Likert scale, 1 = strongly disagree; 5 = strongly agree). As the inner dimensions of the respondents are also essential when dealing with mindfulness and sustainable behavior/attitudes [15,33], a measure of political ideology was introduced using the left-right scale [15,110] (Note that this scale has been criticized for presenting conceptual views of political affiliations that can be interpreted differently depending on the individuals [111,112]). To reduce the weight of subjective interpretation, we introduce common political views based on the Manifesto Research Group (MRG) associated with the right and left affiliation [113]). Studies relating mindfulness to environmental attitudes often fail to incorporate meditation practice and experience assessment [14,35]. To overcome this potential problem, prior meditation experience was controlled for by asking participants if and for how long they have been practicing meditation and at which frequency.

## 4. Results

### 4.1. Descriptive Statistics

Table 1 shows that none of the control variables presents significant differences between the groups. This indicates that the groups are balanced and that randomization is correctly ensured. In contrast, significant differences between the means for the manipulation checks under different conditions are observed. In particular, the state mindfulness variables (curiosity and decentering) are higher after a meditation intervention than under the control treatment (U-test,  $p < 0.001$ , for all), indicating that our experimental conditions worked as intended.

**Table 1.** Means, standard deviations and statistical differences between treatments.

| Variable                       | Mean (SD)                    |                          |                             |                              | Test Statistic            |
|--------------------------------|------------------------------|--------------------------|-----------------------------|------------------------------|---------------------------|
|                                | Control<br>( <i>n</i> = 250) | LKM<br>( <i>n</i> = 250) | Breath<br>( <i>n</i> = 250) | Walking<br>( <i>n</i> = 250) |                           |
| Sustainable behavior           |                              |                          |                             |                              |                           |
| Beliefs and intentions to act  | 4.31 (0.53)                  | 4.34 (0.49)              | 4.33 (0.52)                 | 4.40 (0.45)                  | $\chi^2(3) = 3.70$        |
| Climate policy support         | 4.16 (0.64)                  | 4.19 (0.61)              | 4.18 (0.63)                 | 4.26 (0.50)                  | $\chi^2(3) = 1.54$        |
| Money given to an NGO (in £)   | 0.47 (0.41)                  | 0.49 (0.41)              | 0.51 (0.40)                 | 0.50 (0.40)                  | $F(3, 996) = 0.5$         |
| Mediators                      |                              |                          |                             |                              |                           |
| Compassion                     | 3.39 (0.05)                  | 3.74 (0.05)              | 3.49 (0.06)                 | 3.60 (0.05)                  | $\chi^2(3) = 30.17^{***}$ |
| Openness to new experiences    | 3.55 (0.62)                  | 3.61 (0.64)              | 3.74 (0.52)                 | 3.73 (0.59)                  | $\chi^2(3) = 14.50^{**}$  |
| Connectedness with Nature      | 3.52 (0.85)                  | 3.71 (0.86)              | 3.59 (0.84)                 | 3.73 (0.77)                  | $\chi^2(3) = 11.27^*$     |
| Manipulation checks            |                              |                          |                             |                              |                           |
| State mindfulness: curiosity   | 2.99 (0.93)                  | 3.33 (0.95)              | 3.39 (0.88)                 | 3.46 (0.77)                  | $\chi^2(3) = 34.80^{***}$ |
| State mindfulness: decentering | 2.91 (0.72)                  | 3.09 (0.72)              | 3.11 (0.67)                 | 3.24 (0.64)                  | $\chi^2(3) = 26.05^{***}$ |
| Controls                       |                              |                          |                             |                              |                           |
| Age                            | 27.88 (8.58)                 | 28.15 (9.52)             | 27.59 (9.82)                | 27.73 (9.96)                 | $F(3, 996) = 0.162$       |
| Gender                         | 1.43 (0.52)                  | 1.48 (0.53)              | 1.48 (0.52)                 | 1.43 (0.52)                  | $\chi^2(6) = 1.98$        |
| Trait mindfulness              | 3.16 (0.94)                  | 3.02 (0.95)              | 3.07 (0.93)                 | 3.00 (0.95)                  | $\chi^2(3) = 4.586$       |
| Prior meditation experience    | 1.03 (3.24)                  | 0.81 (2.13)              | 0.82 (2.20)                 | 1.32 (3.60)                  | $F(3, 996) = 1.70$        |
| Political ideology             | 2.50 (1.10)                  | 2.58 (1.03)              | 2.44 (1.02)                 | 2.52 (1.10)                  | $\chi^2(3) = 1.875$       |

Notes: Gender is coded into three categories with 0 = women, 1 = men, and 3 = third gender; Prior meditation experience is measured through numerical variables in years ranging from 0 to 30; political ideology is measured in five ordinal categories from 1 = left to 5 = right. Test statistic refers to either the Kruskal-Wallis test or the one-way ANOVA test depending on the nature of the variable in question. \*\*\* significant at 0.001, \*\* significant at 0.01, \* significant at 0.05.

Turning to sustainable behavior variables, the different meditation interventions seem to have, on average, no direct effect on beliefs and intentions to act, nor on climate policy

support. While a short meditation intervention seems to increase the amount of money given to support climate action, this effect is not significantly higher than for the control group ( $t$ -test,  $p = 0.875$ ,  $p = 0.294$ , and  $p = 0.203$ , for LKM, breath, and walking, respectively). In contrast, significant differences are observed between the means for the mediating variables under different conditions. In particular, compassion is higher after a short LKM than in the control group ( $t$ -test,  $p < 0.001$ ), openness to new experiences is higher in the breathing group than in the control group ( $t$ -test,  $p < 0.001$ ), and walking meditation significantly increase CWN compared to the control conditions ( $t$ -test,  $p = 0.004$ ).

The correlations between our variables measuring sustainable behavior and the potential mechanisms through which the effect of meditation is transmitted to them (mediators) are then observed. The Spearman correlation coefficients are presented in Table 2. It is observed that, in general, CWN is the mediator that has the strongest correlations with sustainable behavior ( $p < 0.01$  for all). The correlations between the mediators and the actual (incentivized) measure of PEB are lower than with the other variables (beliefs and intention to act and climate policy support). More specifically, one can see that openness to new experiences and compassion are, respectively, not ( $p = 0.059$ ,  $p = 0.062$ ) and only weakly ( $p = 0.065$ ,  $p = 0.041$ ) correlated with the amount given to an NGO.

**Table 2.** Spearman correlation coefficients between sustainable behavior and mediators.

|                             | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-----------------------------|-------------------------------|------------------------|----------------------------|
| Compassion                  | 0.179 ***                     | 0.157 ***              | 0.065 *                    |
| Openness to new experiences | 0.222 ***                     | 0.178 ***              | 0.059                      |
| Connectedness with Nature   | 0.313 ***                     | 0.300 ***              | 0.159 ***                  |

Notes: \*\*\* significant at 0.001, \* significant at 0.05. The tests are based on  $t$ -tests.

#### 4.2. Regression Analysis

Before testing the mediation hypotheses, an initial multivariate multiple regression is conducted to determine the effect of meditation on sustainable behavior (Hypothesis 1). Dummy variables are used as indicators of the different treatment conditions and the measures of sustainable behavior as dependent variables. Three individual regressions were subsequently run, one for each dependent variable.

Table 3 reports the regression results. All the regressions include participants' gender, age, trait mindfulness, prior meditation experience, and political ideology as covariates. One can observe that walking meditation is the only treatment that significantly impacts sustainable behavior compared to the control condition ( $b = 0.089$ ,  $p = 0.014$  for beliefs and intention to act, and  $b = 0.079$ ,  $p = 0.031$  for climate policy support). In contrast, none of the meditation conditions could significantly predict actual PEB as measured through the donation to an NGO, generally confirming the preliminary results of the previous section.

**Table 3.** Multiple Regressions.

|                         | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-------------------------|-------------------------------|------------------------|----------------------------|
| LKM                     | 0.032 (0.042)                 | 0.033 (0.050)          | 0.024 (0.035)              |
| Breath                  | 0.009 (0.042)                 | 0.021 (0.050)          | 0.042 (0.035)              |
| Walking                 | 0.089 * (0.042)               | 0.079 * (0.050)        | 0.039 (0.035)              |
| Constant                | 4.345 *** (0.087)             | 4.407 *** (0.105)      | 0.353 *** (0.074)          |
| Adjusted R <sup>2</sup> | 0.134                         | 0.116                  | 0.035                      |
| Observations            | 1000                          | 1000                   | 1000                       |

Notes: Standardized regression coefficients; Dependent variable: sustainable behavior. Method: OLS. Experimental conditions: LKM (0–1), Breathing (0–1), Walking (0–1). Standard errors are in parentheses. \*\*\* significant at 0.001, \* significant at 0.05.

### 4.3. Mediation Analysis

As the direct impact of the experimental conditions on sustainable behavior is significant in the case of the walking meditation only, the indirect effects [114] of different mindfulness interventions on our environmental variables through different mediators are calculated. The mediation analyses are conducted using a bootstrap resampling procedure consisting of taking 5000 random samples of the original sample size and computing the indirect effect ( $a \times b$  product) for each mediator in each sample. The point estimate of the indirect effect is the mean of the  $ab$  product over those 5000 samples. The procedure yields a 95% bias-corrected confidence interval.

#### 4.3.1. Compassion Mediation

First, Hypothesis 2 is investigated, stating that compassion mediates the effects of LKM on sustainable behavior. It is established that a higher compassion score in the LKM group is attributable to the experimental condition. To do so, it is ensured that group differences cannot be attributed to factors such as trait mindfulness (U-test between LKM and control groups,  $p = 0.092$ ), prior meditation experience (U-test,  $p = 0.948$ ), or political ideology (U-test,  $p = 0.411$ ). Then, it is verified that individuals in the LKM condition reported significantly higher compassion scores than those in the control condition (U-test,  $p < 0.001$ ).

As observed in Table 4, the LKM significantly impacts the compassion felt by participants. Compassion is also a significant predictor of beliefs and intentions to act and of climate policy support. The indirect mediation between the meditation and environmental attitudes through the compassion felt by participants is positive and significant for these two measures (beliefs and intentions to act, and climate policy support). Regarding the incentivized measure of PEB, compassion does not impact WWF donations, so there is no indirect relationship between LKM and the amount of money given to an environmental NGO.

**Table 4.** The effects of LKM on sustainable behavior as mediated by compassion (path coefficients and bias-corrected confidence intervals (CJs)).

| Coefficient                   | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-------------------------------|-------------------------------|------------------------|----------------------------|
| a                             | 0.339 *** (0.074)             | 0.339 *** (0.074)      | 0.339 *** (0.074)          |
| b                             | 0.111 *** (0.018)             | 0.137 *** (0.021)      | 0.029 (0.015)              |
| c'                            | −0.001 (0.041)                | −0.001 (0.050)         | 0.013 (0.036)              |
| c                             | 0.037 (0.042)                 | 0.045 (0.050)          | 0.023 (0.035)              |
| 95% CI of the indirect effect | [0.020, 0.061]                | [0.024, 0.073]         | [−0.001, 0.022]            |

Notes: Experimental condition was coded as 1 (LKM) or 0 (control).  $a$  denotes the effect of experimental condition on compassion score;  $b$  denotes the effect of compassion on sustainable behavior (dependent variables);  $c'$  denotes the direct effect of experimental condition on sustainable behavior, and  $c$  denotes the total effect of experimental condition. Participants' gender, age, trait mindfulness, prior meditation experience, and political ideology are included as covariates. Standard errors are in parentheses. \*\*\* significant at 0.001.

#### 4.3.2. Openness to New Experiences Mediation

Turning to Hypothesis 3, the objective is to understand whether openness to new experiences mediates the effect of a regular breath meditation on participants' sustainable behavior. To establish that group differences in environmental attitudes are not attributable to trait mindfulness, the difference in the mean of the trait mindfulness scores for the breath meditation and the control condition is tested. No significant difference between the groups (U-test,  $p = 0.256$ ) is found. However, as predicted, subjects in the breath condition reported significantly higher openness to new experiences (U-test,  $p = 0.011$ ) than subjects in the control condition. As one can also confidently reject prior meditation experience, political ideology, and other demographic variables as alternative explanations for the differences observed between the groups, the higher score in openness to new experiences observed in the breathing group can be attributed to the experimental condition.

Table 5 reports the mediation analysis results through openness to new experiences. One finds that breath meditation is a significant predictor of openness to new experiences, and openness to new experiences is a significant predictor of two out of three sustainable behaviors (beliefs and intention to act and climate policy support). Overall, the results are consistent with Hypothesis 3: a significant positive indirect effect of breath meditation on environmental attitudes through openness to new experiences is found. Supporting this idea, one can also observe that breath meditation no longer predicts sustainable behavior when controlling for openness to new experiences.

**Table 5.** The effects of breath meditation on sustainable behavior as mediated by openness to new experiences (path coefficients and bias-corrected confidence intervals (CJs)).

| Coefficient                   | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-------------------------------|-------------------------------|------------------------|----------------------------|
| a                             | 0.190 *** (0.053)             | 0.190 *** (0.053)      | 0.190 *** (0.053)          |
| b                             | 0.166 *** (0.025)             | 0.184 *** (0.030)      | 0.044 (0.021)              |
| c'                            | −0.021 (0.041)                | −0.007 (0.049)         | 0.031 (0.036)              |
| c                             | 0.010 (0.042)                 | 0.028 (0.050)          | 0.039 (0.035)              |
| 95% CI of the indirect effect | [0.014, 0.052]                | [0.015, 0.059]         | [0.000, 0.019]             |

Notes: Experimental condition was coded as 1 (breath meditation) or 0 (control). *a* denotes the effect of experimental condition on openness to new experiences score; *b* denotes the effect of openness to new experiences on sustainable behavior (dependent variables); *c'* denotes the direct effect of experimental condition on sustainable behavior, and *c* denotes the total effect of experimental condition. Participants' gender, age, trait mindfulness, prior meditation experience, and political ideology are included as covariates. Standard errors are in parentheses. \*\*\* significant at 0.001.

#### 4.3.3. Connectedness with Nature Mediation

Finally, the mediating role of connectedness with Nature is observed when investigating the relationship between walking meditation and sustainable behavior (Hypothesis 4). First, the effects of the walking meditation on connectedness with Nature and sustainable behavior is isolated. While trait mindfulness changes (U-test,  $p = 0.051$ ) are marginally significant, prior meditation experience (U-test,  $p = 0.163$ ), political ideology (U-test,  $p = 0.833$ ), and other demographic variables are rejected as an alternative explanation for any differences observed between the treated group and the control group. It is verified that the walking condition indeed leads to a higher score in connectedness with Nature (U-test,  $p = 0.006$ ) than the control group (note that this treatment is the only one having such an effect, which may be explained by the fact that elements of Nature were only approached in the walking meditation).

Table 6 presents the results of the mediation analysis. One observes that the walking meditation is a significant predictor of connectedness with Nature and that connectedness with Nature has a significant positive effect on the three measures of sustainable behavior. Consistent with Hypothesis 4, one finds a significant positive indirect effect of walking meditation on sustainable behavior through connectedness with Nature. Supporting the hypothesis that connectedness with Nature transmits the effect of walking meditation on sustainable behavior, one finds that walking is no longer a significant predictor after controlling for the mediator.

**Table 6.** The effects of walking meditation on sustainable behavior as mediated by connectedness with Nature (path coefficients and bias-corrected confidence intervals (CJs)).

| Coefficient | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-------------|-------------------------------|------------------------|----------------------------|
| a           | 0.204 ** (0.073)              | 0.204 ** (0.073)       | 0.204 ** (0.073)           |
| b           | 0.183 *** (0.017)             | 0.219 *** (0.021)      | 0.073 *** (0.015)          |
| c'          | 0.065 (0.040)                 | 0.064 (0.048)          | 0.022 (0.035)              |



**Table 6.** *Cont.*

| Coefficient                   | Beliefs and Intentions to Act | Climate Policy Support | PEB: Money Given to an NGO |
|-------------------------------|-------------------------------|------------------------|----------------------------|
| c                             | 0.103 * (0.042)               | 0.108 * (0.050)        | 0.037 (0.035)              |
| 95% CI of the indirect effect | [0.011, 0.064]                | [0.014, 0.079]         | [0.004, 0.028]             |

Notes: Experimental condition was coded as 1 (walking meditation) or 0 (control). *a* denotes the effect of experimental condition on connectedness to Nature score; *b* denotes the effect of CWN on sustainable behavior (dependent variables); *c'* denotes the direct effect of experimental condition on sustainable behavior, and *c* denotes the total effect of experimental condition. Participants' gender, age, trait mindfulness, prior meditation experience, and political ideology are included as covariates. Standard errors are in parentheses. \*\*\* significant at 0.001, \*\* significant at 0.01, \* significant at 0.05.

## 5. Discussion

This study explores how mindfulness may be a pathway for individuals to embark on a paradigm shift to help curb climate change on multiple levels, assuming that individual and collective action are inextricably linked [115,116]. As individuals become more aware, they will seek to contribute to counteracting the dire phenomenon of climate change [14,15]. Starting from the idea that mindfulness-arising interventions may shift consciousness and self-awareness levels so as to reduce cognitive dissonance between intention and action, it was explored how such shifts could lead to a reassessment of beliefs and values to ultimately alter not only intention to act, but also behavior toward climate change.

Our results may be summarized as follows. First, we show that more mindful individuals are more supportive of policies to mitigate climate change and, thus, more willing to enact more sustainable behavior. Second, we find that it is through walking meditation that individuals are most likely to take actual environmental action (in this study, through a donation to an NGO). Third, our study unravels the mechanisms by which mindfulness interventions are most likely to foster pro-environmental behavior: compassion, connectedness with Nature (CWN), and openness to new experiences. In particular, our findings shed light on the critical role of CWN as a mediating mechanism, even more important than compassion or openness to new experiences.

### 5.1. Contribution

Overall, this study makes several contributions to the literature on mindfulness and sustainability. First, to our knowledge, this study is the first large-scale experiment that uses an MBI to explore the causality links between mindfulness and sustainability. By doing so, the methodological limitations of previous sustainability–mindfulness correlational studies, which approach and assess individual trait mindfulness through short surveys and self-reported measures subject to identification issues such as reverse causality, are overcome. As such, this study contributes to the recent literature on short-mindfulness interventions and shows that a short 10-min meditation intervention is sufficient to foster a mindfulness state and impact PEB indirectly. Such results are encouraging, given the need for quick behavior change to address the urgency of the climate crisis. It is important to note, however, that the effects of short mindfulness interventions are only temporary [44] and that such short-term interventions, to be most beneficial, should be part of a regular practice. This is reflected in this study, where approximately 40% of participants in the high-state mindfulness group had already meditated, compared to only 27% of people in the low-state mindfulness group. This highlights the importance of long-term sustained mindfulness practice to effectively enter a high state of mindfulness that will foster PEB.

Second, by proposing an incentivized measure of PEB, the approach taken tackles the intention–behavior gap issues in the sustainability literature. Using a method widely used in experimental economics, where subjects could donate an amount of money they had received to an environmental organization, one can measure people's actual behavior toward sustainability and not just their intentions. This is relevant given that many studies use the term behavior when their scale is intention-based [35]. Most self-reported intention-based scales lack validity and are heterogeneous [36].



Third, this study is the first large-scale mindfulness–sustainability study to compare how different types of meditation (breath, LKM, walking) may impact sustainable behavior. To the best of our knowledge, the sustainability–mindfulness literature has not explored these three different types of meditations in the same experimental study. This study unpacks how these three short meditation practices lead to participants’ feelings of openness to new experiences, compassion, and connectedness with Nature and how some of these mediating variables are more or less powerful in fostering sustainable behavior in participants. Findings show that each of the three meditation conditions indirectly predicts, in a significant manner, sustainable behavior, such as climate policy support and positive environmental attitudes, through its respective mediator (compassion, openness to new experiences, and connectedness with Nature).

Overall, while all three meditation conditions indirectly foster sustainable behavior, the walking meditation stands out from the others as the only meditation to impact environmental attitude and climate policy support directly. In addition, one finds that the level of donations to an NGO was only impacted by the walking meditation through connectedness with Nature, but not by the LKM or breath meditation. These findings highlight the potential of walking meditation as a powerful pathway for sustainable behavior and bring additional support to existing studies on the triptych walking meditation–CWN–sustainable behavior [55,82]. Of course, it is worth noting that the walking meditation was the only meditation directly alluding to Nature in its instructions to participants and the only one actively inducing bodily movement. Perhaps incorporating natural elements in one’s mindfulness practice may help foster a mindset needed to engage in sustainable behavior and reduce the attitude–behavior gap. Further studies must tease which walking meditation aspects are critical to fostering sustainable behavior (nature sounds, references, or movement).

### 5.2. Limitations and Future Research

While this study offers several contributions, it also comes with some limitations. First, it is implicitly assumed that individual-level mindfulness and individual sustainable behavior are important steps toward transformation at the organizational and societal levels. While this study demonstrates that more mindful individuals will be more supportive of policies to mitigate climate change and thus more willing to enact more sustainable behavior, further research should replicate these findings in a natural workplace setting to take into account group-level processes which may impact how well sustainability behavior actually ‘sticks’ and acts as a lever of organizational transformation both within and beyond the immediate boundaries of the organization. Various literature reviews of mindfulness in the workplace [66] or in the corporate context [117] point to the lack of empirical studies exploring the dynamics of mindfulness in situ [118]. Several recent case studies of politicians relating the policy implications of mindfulness training for UK parliamentary members [119,120] and pilot studies [121] exploring the multi-level interactive effects of mindfulness at the individual, group, organizational and societal level are promising and point to the need for further more wide scale studies exploring further the multilevel effects of mindfulness. In the corporate ecosystem, Patel & Holm (2018) [122] created a model in which mindfulness and PEB at work were indirectly related through values of i) connectedness with Nature, ii) non-materialism and iii) openness to change, and advised future studies to test their model. Our study contributes to such a call, using similar pathways.

Second, like most of the commonly used studies in the mindfulness and sustainability literature, this study is cross-sectional. Consequently, one cannot entirely rule out lifestyle factors and other unknown variables that could impact the relationship between mindfulness and climate policy support or sustainable behavior. To mitigate as much as possible such limitations, a broad and diverse sample with 1000 participants allocated evenly into four groups (including one control group) was used. The four groups had the

same statistical portion of women/men, meditators/non-meditators, trait mindfulness levels, left/right political orientation, and people from different cultures.

Third, a limitation often associated with cross-sectional studies is the use of self-reported scales to measure mindfulness [26], which may foster social desirability bias [26,123]. Egan et al. (2018) [113] explain that there are recurrent misunderstandings of the scales in mindfulness research, which can result in unexpected outcomes. Generally, self-reported measures of mindfulness are often associated with limitations regarding the lack of clarity of the concepts and items, the confusion between the understanding of the concept and actual behavior, and the absence of validation between what is reported and what is felt by the subject [124,125]. Even though this phenomenon is likely to have occurred, it generally does not hold statistically, and the effects are rarely significant [26,72,81]. Explicit cues were added to have all participants tackle the scales most authentically depending on their experience at the moment. Additionally, checking for outliers and having a large sample size enabled only significant results with a strong enough magnitude to be detected [126].

A fourth limitation pertains to the potential impact of participants' cultural background on the results. Aware that culture may influence participants' intention and behavior towards climate change [127,128], it was investigated whether participants' cultural backgrounds impacted the propensity to engage in sustainable behaviour. After conducting two different analyses, it was found that some cultures had a higher propensity to engage in sustainable behaviour than others. Secondly, it was uncovered that, once in a high mindfulness state, no difference in willingness to engage in sustainable behavior was detected between cultures. However, these analyses presented methodological caveats, as our sample was not homogenous, with some sub-groups being under-represented, thus preventing any general conclusion. Future studies should further explore how cultural background may impact sustainable behaviour.

A final potential limitation of this study concerns the short aspect of the mindfulness intervention. Short one-time meditations foster short-lived effects and need to be supported by long-term studies [44,129–131]. Future studies on long-term meditation practice in a controlled experiment could substantially impact the sustainable and mindfulness research field [43].

Despite these limitations, the present study is expected to bring novel and significant results to the literature, and to answer some of the questions raised by Thiermann and Sheate (2020) [14]. The current study went beyond self-reported levels of mindfulness and PEB by engaging participants in meditation and using a laboratory experiment method.

While findings lead to conclude that integrating elements of Nature as part of mindfulness practice may positively impact environment-related variables, future research will be needed to unravel further the effect of walking meditation, elements of Nature, and connectedness with Nature. For example, comparing different types of meditation with walking conditions would allow understanding of whether allusions to Nature increase environmental attitudes, climate policy support, or general PEB more effectively than a regular breath meditation. It would also allow for better control and understanding of whether walking itself and being in "motion" explains the more robust results. Including qualitative measures such as interviews or diaries would also answer calls from the literature to incorporate such measurements [74] in order to help further unpack and clarify the relationship between mindfulness and climate policy support [27,34,132]. Overall, these results are relevant for organizations and policymakers who seek to foster climate policy support and environmental attitudes in their stakeholders.

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**Institutional Review Board Statement:** The study was conducted in conformity with the ethical rules and regulations of the CNRS Research Center Lille Economie et Management.

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## Appendix A. Questionnaire

### Block 1:

We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement.

Below each statement are five choices: “not at all,” “a little,” “moderately,” “quite a bit,” and “very much.”

Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?

1. I experienced myself as separate from my changing thoughts and feelings.
2. I was more concerned with being open to my experiences than controlling or changing them.
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings, or sensations.
4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things ‘really’ are.
5. I was curious to see what my mind was up to from moment to moment.
6. I was curious about each of the thoughts and feelings that I was having.
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.
9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.
10. I remained curious about the Nature of each experience as it arose.
11. I was aware of my thoughts and feelings without overidentifying with them.
12. I was curious about my reactions to things.
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.

### Block 2:

Right now, how do you feel about the following statements? (1 = Strongly disagree; 5 = Strongly agree)

1. I believe our climate is changing.
2. I am concerned about global climate change.
3. I believe there is evidence of global climate change.
4. Global climate change will impact our environment in the next 10 years.
5. Global climate change will impact future generations.
6. The actions of individuals can make a positive difference in global climate change.
7. Human activities cause global climate change.
8. Climate change has a negative effect on our lives.

9. We cannot do anything to stop global climate change.
10. I can do my part to make the world a better place for future generations.
11. Knowing about environmental problems and issues is important to me.
12. I think most of the concerns about environmental problems have been exaggerated.
13. Things I do have no effect on the quality of the environment.
14. It is a waste of time to work to solve environmental problems.
15. There is not much I can do that will help solve environmental problems.

### Block 3:

The following questions are about government policies and global warming.

1. Which of the following do you consider to be the most serious problems facing the world as a whole (rank the elements from 1 to 10)?

Climate Change

International terrorism

Poverty, hunger and lack of drinking water

The economic situation

Proliferation of nuclear weapons

Armed conflicts

The increasing global population

Technology failure (cybersecurity failure, IT infrastructure breakdown . . . )

Pandemics (COVID-19...)

Other

Right now, in this present moment, can you say to which extent you oppose or support the following statements: (1 = Strongly oppose; 5 = Strongly support)

2. How much would you oppose or support a tax on greenhouse gas emissions, such as carbon emissions from burning gasoline or driving polluting cars? The tax will apply to all households and businesses contributing to climate change/global warming.
3. How much would you oppose or support providing subsidies (such as tax rebates) to households/businesses that purchase energy efficient appliances/equipment, fuel efficient vehicles, or use solar and wind energy?
4. How much would you oppose or support regulations that require new buildings, appliances, and equipment to be more energy efficient?
5. How much would you oppose or support the government funding more research into clean energy sources, such as hydro, solar, or wind?
6. How important will a candidate's views on global warming be in determining your vote for President/Government Officials? Will it be the single most important issue, one of several important issues, or not important in determining your vote? (1/the single most important issue; 2/one of the several important issues; 3/not an important issue).

People hold different views on whether their country should reduce their carbon dioxide emissions on their own or reduce their emissions only if other countries do so as well.

7. How do you feel toward this statement?

My country should reduce its carbon dioxide emissions regardless of what other countries do.

Coronavirus questions (1 = Strongly disagree; 5 = Strongly agree)

Given what you know, the part of the Coronavirus Recovery Plan allocated to the fight against climate change should be... (1 = significantly lower; 5 = significantly higher)

8. In your country?
9. Internationally?

Some economists argue that developing countries need help to recover from the COVID-19 crisis in order to integrate climate actions and drive sustainable, resilient and inclusive economic growth.

To what extent do you agree with the following statement?

10. My country should fund other developing countries' COVID-19 recovery plans so that these nations can keep investing in their climate protection actions (1 = Strongly disagree; 5 = Strongly agree)

Several countries are considering implementing a Carbon Border Tax that will tax countries from which they import un-taxed polluting goods and energies. This tax should motivate companies and people to switch to greener energies. However, it could increase the price you pay in your country for goods coming from the countries that have implemented such Carbon Border Tax.

11. To what extent would you support paying more for imported goods coming from countries actively engaging in reducing climate change compared to countries keeping on polluting? (1 = Strongly oppose; 5 = Strongly support)

#### Block 4:

The WWF (Worldwide Fund for Nature) is an international non-governmental organization with the mission to conserve Nature and reduce the most pressing threats to the diversity of life on Earth. One of their main goals is to create a climate-resilient and zero-carbon world, powered by renewable energy.

For your participation in the current study, you will receive an additional 1£ at the end of the questionnaire.

You now have the possibility to donate a part or the totality of this amount to the WWF.

Note: To certify that the money you donated was indeed sent to the WWF, we will send you a certificate with the total amount transferred to this non-profit organization on our behalf after the completion of our research.

1. What is the amount of money you would like to give to the WWF (between 0 and 1, ex: 0.15)?

#### Block 5:

Think of how you feel right now after having listened to the audio: (1 = Strongly disagree; 5 = Strongly agree)

1. Right now I'm feeling a sense of oneness with the natural world around me.
2. At the moment, I'm feeling that the natural world is a community to which I belong.
3. At the moment, I can imagine myself as part of the larger cyclical process of living.
4. Right now, I feel as though I belong to the Earth just as much as it belongs to me.
5. Presently, I feel like I am part of the web of life.

#### Block 6:

After having listened to the audio, describe to what extent you feel: (1 = Did not experience at all; 5 = Strongly experienced)

1. Compassion toward yourself
2. Compassion toward others
3. Sympathy toward others
4. Moved

#### Block 7:

Please use the list of adjectives below to describe yourself how you feel right now after having listened to the audio, not as you were before in the past or as you wish to be in the future. (1 = Very inaccurate; 5 = Very accurate)

1. Complex
2. Creative

3. Imaginative
4. Intellectual
5. Philosophical
6. Deep
7. Uncreative
8. Unintellectual

**Block 8:**

Now, think of how you usually are and behave in your daily life: (1 = Strongly disagree; 5 = Strongly agree)

1. It seems I am 'running on automatic' without much awareness.
2. I run through activities without being really attentive to them.
3. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.
4. I do jobs or tasks automatically, without being aware of what I'm doing.
5. I find myself doing things without paying attention.

**Block 9:**

1. Do you practice meditation? (yes/no)

If yes:

2. How many hours do you practice per week? . . . hours
3. How long have you been meditating for? . . . years

**Block 10:**

1. Position yourself on the scale below so that you can best represent your political ideology: (1 = left; 5 = right)

To help you in making this choice, you can look at the list below of political standpoints connected to right or left ideologies:

Left: Military Negative, Peace, Internationalism Positive, Market Regulation, Controlled Economy, Nationalization, Welfare State Expansion

Right: Military Positive, Constitutionalism Positive, Political Authority, Free Enterprise, Welfare State Limitation, Law and Order, Traditional Morality Positive

**Block 11:**

1. How old are you?...years
2. How would you identify your gender? (Male/female/Non-binary or third gender)
3. Which country (ies) would you identify the most in terms of cultural background? (It can be the country in which you were born, where you live or lived)

Thank you again for your time and participation! If you wish to receive the results of our study on the impact of meditation on sustainability adoption, please let us know and we will be happy to send you the results of our study.

**Appendix B. Transcripts of Guided Meditations and Guided Audio**

All guided meditations and audios were recited by one of the co-authors of this study, Julie Bayle-Cordier who is a certified mindfulness practitioner (MBSR level 1, Brown University, USA).

**Loving Kindness Meditation (LKM) transcript**

Source: Julie Bayle-Cordier's class instructions for Mindfulness & Management course, IESEG School of Management and inspiration from John Kabat-Zinn's MBSR program and Sharon Salzberg Loving Kindness meditation, Joanna Macy's Loving Kindness meditation (World as Lover, World as Self) and from The Five Earth Touchings, excerpt from "Creating True Peace" by Thich Nhat Hanh.



Begin by finding a comfortable sitting position on a cushion or on a chair. Allow your breath to be natural. No need to change anything. Your breath is fine the way it is. We're choosing, as an object of awareness, the silent repetition of certain phrases with ourselves as the first recipient.

You can use any variation of the phrases: may I be safe, be happy, be healthy, live with ease.

Repeat these phrases over and over with enough space and silence to create a rhythm that's pleasing to you.

Now think of someone you care about deeply, someone who has often been there for you. Someone who makes you smile. It can be a friend, family member.

May you be safe, may you be happy, may you live with ease.

Now extend this loving kindness to any acquaintances you may have, the cashier in a store.

May you be safe, may you be happy, may you live with ease. May you be free from suffering.

Now to someone you know who's been less fortunate than you. Someone who you know has suffered a lot.

May you be safe, may you be happy, may you live with ease. May you be free from suffering.

Now to all sentient beings on this planet and in the universe.

May you be safe, may you be happy, may you live with ease. May you be free from suffering.

Now visualize our planet earth. This little sphere floating in space. Green blue brown white. There it is, our planet. In the vastness of space. Let your loving kindness extend and flow out to surround the earth. You may imagine in your mind's eye forests, lakes, flowers, fields that you know and love.

May you be safe, may you be at ease. May you be protected and free from suffering.

Now as you are zooming in on planet earth, its fields, flowers, let the face of the person you know best in the world appear. It is your own face. You may call your own name: "X"

May I be free from suffering, may I be at ease, may I be happy.

Gently coming back to the breath. In and out. Gently wiggling your fingers/hands and moving your feet and gently opening your eyes at your own pace, coming back to the room and your surroundings.

### **Breath Meditation transcript**

Source: This 10 min Breath Meditation is taken from Jon Kabat-Zinn's Guided Mindfulness Meditation, Series 2 audio CDS.

### **Bell sound.**

When practicing sitting meditation, it is helpful to bring to the sitting posture itself, a sense of dignity with your head, neck and back erect but not rigid, with the shoulders relaxed and your hands comfortably placed on your lap or on your knees.

Follow along with my instructions as best you can and then use the stretch of silence to practice on your own. It's fine to sit on a chair or on the floor.

As best you can commit yourself to simply being fully awake, fully present for these moments. If you feel comfortable with it, allowing your eyes to simply close.

Otherwise, letting your gaze fall unfocused on the floor or on a wall and just tuning into the feeling of the breath moving in and out of your body, focusing on the sensation of the breath moving past the nostrils, or alternatively on the feeling of your belly expanding gently on each in breath and receding gently with each out breath. And allowing yourself to just dwell here, moment by moment. Following the breath as it comes in and as it goes out.

And bringing your attention back to the nostrils or to the belly or anywhere else you've decided to focus on each time you've noticed that your mind has gone off somewhere else.

Wherever that may be. And if the mind wanders off a thousand times, you simply bring it back a thousand times.

Intentionally cultivating an attitude of patience and gentleness towards yourself. This means choosing as best you can not to react to or judge your thoughts or feelings, impulses or perceptions. Reminding yourself instead that in this work of mindfulness absolutely anything that comes into the field of awareness is ok. We simply sit with it and breathe with it and observe it, staying open and awake in the present moment. Right here, right now.

A continual process of seeing and letting be. Seeing and letting go. Rejecting nothing. Pursuing nothing. Dwelling in stillness and in calmness as the breath moves in and out.

#### **Quiet (2 min SILENCE)**

Just riding the waves of your own breathing, moment by moment, breath by breath.

#### **Quiet (2 min SILENCE)**

And as the tape comes to an end, staying centered for a moment or two more in the sitting posture as the sound of the bell recedes. Experiencing the sound and the wakefulness it invites. And before getting up, you might find it of value to commit yourself right here and now to carrying this wakefulness with you throughout your day, remembering that you can touch base with your breathing in any moment and thereby bring some mindfulness and calmness and clarity into that moment of your life, when and wherever it is, as it is unfolding. And affirming as well the importance of regular, formal practice. If possible every day. Either using a tape for guidance or simply practicing on your own.

#### **Bell sounds (3)**

**30 s of silence.**

#### **Walking Meditation transcript**

Source: Julie Bayle-Cordier's class instructions for Mindfulness & Management course at IESEG School of Management and inspiration from The Five Earth Touchings, excerpt from "Creating True Peace" by Thich Nhat Hanh, Sharon Salzberg Loving Kindness meditation, Tara Brach Walking meditation and Joanna Macy's Loving Kindness meditation (World as Lover, World as Self).

Begin by choosing a place—an indoor or outside walking path about 10-30 paces long.

Start by standing still and sensing the weight of your body at your feet, feeling your muscles supporting and stabilizing you. You may shift the weight of the body from one side to the other. Beginning with shifting the weight to the right foot and noticing how this feels. Then switching the weight to the left foot.

As you begin walking, start at a slower pace than usual, paying particular attention to the sensations in your feet and legs: heaviness, lightness, pressure, tingling, energy, even pain if it's present.

The primary anchor in the standing and walking meditation are the sensations in your body, in your feet as you move and the silent repetition of certain phrases. Let it be a sensory experience. Ease into it. There is no effort to be made. Just enjoy the process.

Notice the sensations of lifting your feet and of placing them back down on the floor or earth. Sense each step fully as you walk in a relaxed and natural way to the end of your chosen path.

During the walking period you might alter your pace, seeking a speed that allows you to be most mindful of your experience. In this way, you'll move back and forth on your pathway, discovering that you are not really going anywhere, but are arriving again and again in the aliveness that is right here.

As you're walking, you may notice that your mind begins to wander, to get lost in thought. This is natural and ok. Whenever this happens, you might mentally pause, perhaps noting inwardly 'thinking', or even where your mind went: planning, worrying, fantasizing, judging. Then, gently return your attention to the sensations in the body, in the feet. No matter how long you've spent lost in thought, you can always come back to the present moment, again and again.

With each step walk as if you are gently caressing the earth with your feet. The walker and that which is walked upon become one. Division between self and other, between self and planet earth dissolve into the sacredness of walking with a peaceful heart.

Now as you are moving each foot you may begin to associate a phrase with each step. You may use any variation of the phrases.

Touching the earth.

Caressing the earth.

Now you may also experiment with associating one silent word with each step.

Caress-Earth

Caress-Earth

Present-Moment

Present Moment—Precious Earth

You may also repeat this phrase to yourself silently: I feel deep gratitude towards the earth, supporting and accepting me.

### **Control audio transcript**

The following recording is a reading of an article from the Huffington Post about the character Mr Grinch.

You're A Keen One, Mr. Grinch. Why we still love the Grinch after more than 60 years. On the day after Christmas in 1956, Ted Geisel looked in the mirror and didn't like what he saw. The 53 years of lines and weather on his face were not, he thought, dignified. They seemed corroded, maybe even corrupt. It was not that he disliked what he did. Or at least, most of it. He wrote picture books for children, and *The New York Times* and *The New Yorker* approved. Sales were sufficient to justify a home in the beachfront San Diego district of La Jolla. Ted liked the sand. He liked the surf. He liked being asked to serve on the board of the San Diego Fine Arts Museum.

Most of all, he liked working with his wife, unofficial editor and creative partner of 30 years, Helen. But his royalties were not quite sufficient to support the medical bills for Helen's mysterious illness. Two years ago, she had retired early from a party citing severe pain in her feet — something more than the ordinary trouble with high heels. Within hours she was paralyzed from the neck down, eventually losing even her ability to speak. The doctors believed Helen's immune system had gone haywire and attacked her neurological system. It was as sound a diagnosis as any, but it hadn't led to a particular treatment, and Helen's recovery had been arduous. Once she was out of the iron lung, Ted spent hours reading letters and literature to her, wheeling her to windows for a good view or whizzing down hospital corridors for thrills. By Christmas 1956 she was walking and talking, complaining only of a persistent pain in her feet that felt, she said, as if she were wearing shoes a few sizes too small. Ted took on some ad work to keep the bills from getting the best of him, drawing billboard pictures for Standard Oil.

The work was much easier than concocting narratives and language lessons for tots, but it left him feeling dry, denuded, ready for a drink. 209 And Ted loved a good cocktail; his excess with alcohol extended back to his college days. His smoking habit, too, had a tendency to accelerate into chain territory when he was working hardest. These chemical indulgences didn't seem to detract from his work. If anything, he was producing the best stuff of his career. But it was taking a toll on his psyche. His passion was becoming a commodity. He was becoming a commodity. His publisher, Random House, had taken to releasing his books in late autumn, timed for the Christmas market. Was he teaching kids to read, or just giving parents something to buy? The whole enterprise was starting to

feel phony. Were his books really any different from his side hustle in highway billboards? Was Christmas itself about anything more than money?

A year and a half earlier, he'd dashed off a 32-line illustrated poem for the magazine *Redbook*, a little morality tale in which a greasy con man convinces a nice, regular guy to buy a piece of string by persuading him it was better than the sun itself. When Ted looked in the mirror on that December morning, he saw the villain of his own creation: the Grinch. By the time Ted and Helen released a full-fledged book on the Grinch in December 1957, his character had transformed from the charlatan of the *Redbook* cartoon into a bona fide hero. "I'm really on the Grinch's side," Ted told journalist Sally Hammond in 1969. "The Grinch is against the commercialization of Christmas, even though he's a mean old so-and-so.... I was cheering for this guy." This account of how the Grinch came to be is mostly compiled from three biographies — Dartmouth English professor Donald E. Pease's "Theodore Seuss Geisel," the intimate portrait "Dr. Seuss and Mr. Geisel" by family friends Judith and Neil Morgan, and Brian Jay Jones' "Becoming Dr. Seuss." Other notes are gleaned from Richard H. Minear's analysis of Geisel's early political cartoons, "Dr. Seuss Goes to War," and various obituaries and news articles. It's difficult for any parent of young children not to identify at least a little with some of the Grinch's gripes. "All the Who girls and boys would wake bright and early. They'd rush for their toys! And then! 210 Oh, the noise! Oh, the Noise! Noise! Noise! Noise!" It's a wonderful thing to see a child entranced by a toy, but it can also be a bit much.

Though the parallels between the Grinch and Charles Dickens' anti-Christmas miser Ebenezer Scrooge are unmistakable, the characters experience very different final acts. Scrooge undergoes an epiphanic reform and decides to reject money in favor of love and family. In the Seuss fable, it is not the Grinch who changes but the world. When the Whos down in Whoville wake up and see their toys are gone, they don't "all cry 'Boo-hoo!'" as predicted — they go outside and hold hands and sing songs anyway. This spirit of community warms the Grinch's heart and persuades him to give back the toys he has stolen. The Grinch can afford to be magnanimous. The toys have become superfluous. The Grinch wins. The green prophet of anti-consumerism is himself an enduring Christmas commodity, his legacy secured not by teachers and churches but by television and, yes, toys. There is an inescapable irony surrounding the Grinch and his status as an American Christmas staple. The green prophet of anti-consumerism is himself an enduring Christmas commodity, his legacy secured not by teachers and churches but by television and, yes, toys. Hollywood has enhanced this Grinchy paradox, but the tension goes all the way back to the book's beginnings. The major Seuss production in 1957 wasn't the Grinch, but "The Cat in the Hat," a book that for 11 months of every subsequent year remains the most iconic offering from the Seuss catalog. Ted dealt with his post-Christmas malaise by working on a book that was extremely wholesome and totally un-Christmasy. Textbook publisher Houghton Mifflin wanted to jump the market for elementary school reading primers.

Educators were taking the laggard U.S. literacy rate seriously — it was a question of national pride during the Cold War — and big pedagogical thinkers of the day had noticed that kids actually seemed to like the Seuss books. The early stages of reading are difficult for children, and the books designed for the youngest readers were extremely dull, filled with bland characters like Dick and Jane who don't really do anything more than "See Spot run." If Dr. Seuss could make reading exciting, even silly, then educators would have a better shot at setting kids up for success. Ted and Helen had been on a roll. Starting in 1954, they'd been producing nonstop classics — "Horton Hears a Who!," the A-B-C book "On Beyond Zebra!" and the fantasy romp "If I Ran the Circus" — adored by

critics, teachers and parents alike. But they operated at a relatively high level for children’s literature. “Horton” swelled to nearly 70 pages, most of them filled with dense blocks of text peppered with words that most children didn’t know and certainly couldn’t read on their own. “The Cat in the Hat” would be different. Houghton Mifflin asked Dr. Seuss to tell this tale with no more than 250 simple words and to make it easy for children to identify the specific objects described, keeping adjectives to a minimum and eliminating the zany nonsense words that were part of the Seuss brand. That was tricky enough, but the hard part was making it fun. “If you drop the charm,” Ted told the Boston Herald American about “The Cat in the Hat,” “you have a dictionary.” The stroke of genius was the Cat himself — a debonair rogue who swashbuckles through a family home pulling stunts and breaking rules. Reading, the book suggested, was edgy and cool — maybe even as cool as a talking cat balancing on a ball while holding a cake. Houghton Mifflin released “The Cat in the Hat” in March 1957, hoping to generate enough buzz to persuade school systems to pick it up for the fall curriculum.

The publisher was so intent on tackling the institutional market that it let Random House — a competitor who had handled all of the previous Seuss material — collect whatever it wanted from sales to retail bookstores. That proved to be a spectacularly bad bet. Schools didn’t bite. Dick and Jane would maintain their hegemony over educational officialdom for decades to come. But “The Cat in the Hat” was a retail smash. “Horton Hatches the Egg,” the first true masterpiece in the Seuss canon, had sold fewer than 6,000 copies when it was released in 1940. “The Cat in the Hat” quickly sold 250,000. Dr. Seuss went from a name that book critics knew to a name that everyone knew. “The Cat in the Hat” changed children’s publishing, demonstrating that selling directly to families could be a bigger and more influential business than selling to school systems. Dr. Seuss may well have been improving American literacy, but what Ted and Helen had created was also unmistakably a retail commodity. The Cat was famous the way movie stars were famous, the product not of public education but of consumer capitalism.

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