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Understanding the Environmental Attitude-Behaviour Gap: The Moderating Role of Dispositional Mindfulness

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Abstract: Great scientific effort has been devoted to understanding what drives pro-environmental behaviour, yet the question of the environmental attitude–behaviour gap remains unanswered. Studies have indicated that self-regulation and executive functions may reduce such a gap by increasing individuals' ability to maintain attention on present actions and to resist goal-conflicting temptations. Given the inherent association of self-regulation and executive functions with dispositional mindfulness, we carried out a cross-sectional study to test the hypothesis of the role of dispositional mindfulness in explaining the phenomenon. Our results showed that higher levels of dispositional mindfulness, measured via the Five Facets Mindfulness Questionnaire (FFMQ), are related to a higher tendency to perform pro-environmental behaviour, and that the observing facet of the construct would predict higher pro-environmental behaviour scores. Interestingly, we also found the acting with awareness and nonjudging factors to be moderators of the relationship between pro-environmental attitudes and behaviours, suggesting that enhanced awareness of the present moment may favour higher congruence between attitudes and behaviours, and that higher acceptance may favour more adaptive coping strategies to the climate challenge. Our findings provide a novel contribution to the understanding of the relationship between mindfulness and pro-environmental behaviour and support the perspective that self-regulation skills would contribute to reducing the environmental attitude–behaviour gap.

Keywords: dispositional mindfulness; pro-environmental behaviour; attitude–behaviour gap; self-regulation; executive functions

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1. Introduction

A great deal of scientific effort has been devoted to understanding what drives individuals to engage in pro-environmental behaviours, i.e., behaviours that seek to minimize the negative impact of one's actions on the ecosystem [1]. Multiple intra- and inter-individual factors have been identified as influencing individuals' propensity to engage in pro-environmental behaviours, such as socio-demographics, environmental knowledge, and socio-psychological factors (e.g., attitudes, values, norms, cognitive abilities, and dispositional traits), highlighting that the nature of pro-environmental decision-making would entail a high degree of complexity [2–4].

However, such complexity does not appear fully represented in the two most applied models of pro-environmental decision-making, which are, respectively, based on Ajzen's theory of planned behaviour [5] and on Stern's Value–Belief–Norm theory [6]. Both models have, indeed, been criticised for failing to explain actual pro-environmental behaviours while instead illustrating behavioural intentions, which are not always nor entirely reflected in actual pro-environmental behaviour [7–9]. This phenomenon, referred to as the "environmental attitude–behaviour gap", has been extensively investigated in scientific literature [4,9–15], though its causes remain unclear [4,15].

1.1. Literature Review

Recent studies have suggested that individuals' ability to implement their pro-environmental intentions would be modulated by both executive functions and self-regulation skills [15–19]. Accordingly, an increased ability of individuals to maintain focus on their own behaviours, and to resist both hedonistic and egoistic temptations, would allow individuals to stick to their pro-environmental intentions, even when acting in favour of the environment requires overcoming habits or sacrificing short-term personal gratification [18,20–22]. Recent neuroscience studies support this view, showing a relation between pro-environmental behaviours and the brain regions involved in self-regulation processes and executive functions, such as the dorsolateral prefrontal cortex (involved in inhibitory processes) and the ventromedial prefrontal cortex (involved in perspective thinking) [23–25].

In parallel with this, researchers investigating the mechanisms of the relationship between mindfulness and pro-environmental behaviour have suggested that mindfulness could also play a role in reducing the environmental attitude–behaviour gap [26,27]. Mindfulness, as a psychological trait, has been defined as the capacity of paying and maintaining attention to the present moment with awareness and a non-judgmental attitude [28–32]. Accordingly, dispositional mindfulness would entail a higher individual ability to regulate one's own behaviours and emotions, suggesting that self-regulation and executive functioning would be inherent attributes of dispositional mindfulness [33–38]. Studies have, indeed, reported a positive correlation of dispositional mindfulness with both cognitive flexibility and inhibitory control [31,34,37]. Furthermore, individuals with higher levels of dispositional mindfulness have been found to be better able to detect behaviours carried out automatically [38] and less prone to impulsive behaviour [39] due to higher self-regulation abilities.

Several studies have also reported a relationship between dispositional mindfulness and pro-environmental behaviours [26,27,40–47]. Most of them explain the positive correlation between mindfulness and pro-environmental behaviour in terms of a higher tendency of mindful individuals to feel connected to the natural and social world of which they are a part, resulting in increased concern about the consequences of the environmental crisis on the ecosystem [41,45–47]. However, some studies have highlighted a role of self-regulation in explaining such a correlation. Amel et al. [40], for instance, found a positive correlation between pro-environmental behaviour and the acting with awareness dimension of mindfulness, i.e., the present-moment awareness and the absence of mind wandering. This correlation suggests that mindful individuals would be more likely to perform pro-environmental behaviours because they are less inclined to act by default and are more prone to consider different behavioural options in terms of their environmental impact. Furthermore, Li et al. [44] reported that self-control, i.e., the self-regulation ability to override impulses in order to bring behaviour in line with goals [48], would be a mediator of the relationship between dispositional mindfulness and ethical consumption, intended as a type of pro-environmental behaviour. Despite evidence showing that increased self-regulation could explain the positive relationship between dispositional mindfulness and pro-environmental behaviour, no studies have yet explored whether and how dispositional mindfulness could play a role in modulating the environmental attitude–behaviour gap.

1.2. The Current Study

The purpose of the current study was to deepen the understanding of the dynamics underlying the relationship between mindfulness and pro-environmental behaviour, and to investigate the role played by enhanced self-regulatory abilities in explaining the environmental attitude–behaviour gap. Therefore, consistent with conceptual proposals suggesting that mindfulness would allow for more deliberate behavioural choices [49–51], we argued that dispositional mindfulness would play a role in reducing such a gap through increased awareness of the present moment. Specifically, we assumed that dispositional mindfulness would positively correlate with pro-environmental behaviours (H1). Further-

more, considering that mindfulness has been found to affect pro-environmental behaviours via increased awareness and consideration of the ecosystem, we expected that higher mindfulness would predict an increase in pro-environmental behaviours (H2). Finally, in light of the evidence that self-regulation would promote higher congruence between pro-environmental attitudes and behaviours, and that mindfulness would favour a higher level of self-regulation, we assumed that mindfulness would moderate the relationship between pro-environmental attitudes and behaviours (H3).

2. Materials and Methods

2.1. Participants

Using a power of 0.80 and an alpha level of 0.05, the G*Power statistical tool indicated about 200 participants to detect a regression coefficient with small-to-medium effect size. Considering that we would include the independent variables in the regression models, their interactions, and the control variables, we had a total of ten predictors, which with a sample of at least 200 participants would result in a number of subjects per variable (SPV; ratio between participants and number of predictors) higher than 20. This SPV could be considered sufficient to make the interpretation of our model meaningful. Based on this power analysis, the study was conducted using a random sample that included 228 individuals (138 females; mean age = 40.65; SD = 15.58, range 18–89 years), both Italian (n = 177) and foreign nationals (n = 51). We used a random sampling method as it produces results that are more representative of the overall population, and that can be more easily generalized beyond the tested sample.

2.2. Procedure

The survey was carried out online with Qualtrics software during May and June 2022. First, participants were contacted through mailing lists and social networks. Second, they were asked to provide their written consent to participate in the study and to treat their data, before completing the questionnaires. Third, they completed all the questionnaires and, finally, they were thanked. The survey took on average 20 min to be completed.

No financial compensation was given as a reward to those who completed the survey. All responses were anonymously collected. The ethical approval was given by the Research Ethics Board of the Department of Psychology, Sapienza University of Rome.

2.3. Measures

Pro-environmental attitudes. Pro-environmental attitudes were measured using the New Ecological Paradigm scale [52,53], a revised version of the New Environmental Paradigm scale [54]. The NEP assesses ecological worldviews through 15 items.

Pro-environmental behaviours. Pro-environmental behaviours were assessed using the Pro-Environmental Behaviour Scale [55,56], a 19-item scale measuring engagement in pro-environmental behaviours in four domains (e.g., conservation, environmental citizenship, food, and transportation).

Trait mindfulness. Trait mindfulness was measured using the Five Facet Mindfulness Questionnaire (FFMQ) [57,58], a 39-item standardised measure of mindfulness, based on a 5-point Likert scale, which considers the construct of mindfulness as composed by five facets or factors: observing, describing, acting with awareness, nonreactivity to inner experience, and nonjudging of experience. The first three facets can be related to attention and present-moment awareness dimensions, and the last two facets refer to the acceptance dimension.

Control variables. In our analyses, we controlled for participants' sex (0 = male, 1 = female), age, education (in years), number of children, meditation expertise (0 = non-meditator, 1 = meditator), and political orientation (from 1 = completely left/liberal to 7 = completely right/conservative). All these variables were measured through a socio-demographic form.

2.4. Data Analysis

First, to assess the general relationship pattern between the variables considered, Pearson's bivariate correlation analysis was performed. The aim of this analysis was to reveal the pattern of relationships between socio-demographic variables, mindfulness skills, pro-environmental attitudes, and pro-environmental behaviours. To further investigate the role of mindfulness skills (FFMQ) in influencing the environmental attitude-behaviour gap, i.e., the relationship between the pro-environmental attitudes (NEP) and pro-environmental behaviours (PEBS) scores, we then ran a series of moderation analysis.

Moderation analysis was performed with hierarchical regression. The first step model included only the control variables and the NEP score. In the second step, one of the FFMQ facets at a time was added, i.e., either observing, describing, acting with awareness, nonreacting, or nonjudging, and in the third and last step, the interaction term between the NEP score and the FFMQ facet included at step two was added. When a significant moderation was found, it would be probed with simple slope analysis. The moderation was probed at 16th, 50th, and 84th percentiles as suggested by Hayes [59], corresponding to a standard deviation below the mean, the mean, and a standard deviation above the mean of the observed distribution. Moreover, the Johnson-Neyman technique was applied, individuating the region of significance of the conditional effect. We mean-centred both predictor and moderator variables and reported the unstandardised coefficients (indicated as b) and their 95% confidence intervals along with the standardised ones (indicated as β).

Considering all predictors, their interactions, and the control variables included in the hierarchical model, we had a total of nine independent variables (IV). This resulted in a number of subjects per variable (SPV) higher than 20, computed as the ratio between participants and number of IV. This SPV could be considered as sufficient to make the interpretation of our global model meaningful [60].

Data analysis was carried out with the statistical software Jamovi, version 2.3 [61], and R, version 4.1 [62].

3. Results

Firstly, we conducted correlation analysis between the investigated variables. For the sake of clarity, we reported the correlation analysis in two bunches. The first included the correlations between socio-demographic variables and psychological ones, while the second included the correlations between the psychological variables only, i.e., mindfulness skills, environmental attitude, and pro-environmental behaviours.

The correlations between socio-demographic and psychological variables were reported in Table 1. As shown, PEBS positively correlated with age, female sex, education, and meditation experience, and negatively correlated with political orientation. NEP score showed a similar pattern of correlations, with a positive relationship with the female sex, education, and meditation experience, and a negative relationship with political orientation. Overall, this pattern of results indicated that being female, educated, and oriented towards a progressive political position is correlated with increased pro-environmental behaviours and environmental attitudes. Therefore, we controlled for the effect of these sociodemographic variables in the subsequent analyses. Regarding mindfulness, acting with awareness and nonjudging facets of mindfulness were positively correlated to age, number of children, and education. Being a meditator was instead positively correlated to all mindfulness facets, except acting with awareness.

Table 1. Pearson's correlations between sociodemographic and psychological variables.

	Age	Sex	Number of Children	Education (in years)	Political Orientation	Meditation Experience
PEBS	0.18 **	0.19 **	0.07	0.23 ***	−0.36 ***	0.19 **
NEP	−0.06	0.17 **	−0.06	0.14 *	−0.14 *	0.22 ***
Observing	0.00	0.13	−0.09	0.10	−0.11	0.33 ***
Describing	0.08	0.13	0.00	0.27 ***	−0.12	0.23 ***
Acting with awareness	0.24 ***	−0.10	0.23 ***	0.20 **	0.08	0.01
Nonjudging	0.21 **	−0.02	0.17 *	0.22 ***	0.01	0.14 *
Nonreacting	0.08	−0.10	−0.02	0.10	0.00	0.20 **

Note. Sex is coded as 0 = male, 1 = female. Political orientation is coded in the range 1–7, with 1 = completely progressive, and 7 = completely conservative. Meditation experience is coded as 0 = no, 1 = yes. PEBS = Pro-environmental Behaviour Scale. NEP = New Ecological Paradigm scale. Significance level is marked as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The second bunch of correlations was aimed at assessing the relationship pattern between psychological variables, i.e., mindfulness facets, environmental attitude, and pro-environmental behaviours. This analysis is summarized in Table 2. As reported, NEP and PEBS scores were positively correlated. The mindfulness facet of observing was positively correlated with both NEP and PEBS scores, as well as the describing facet. Among the others, only the nonreacting facet was positively and weakly correlated with the PEBS score. All the mindfulness facets were positively correlated with each other, except for the negative but weak correlation between observing and nonjudging, and the non-significant correlation between observing and acting with awareness.

Table 2. Pearson's correlations between psychological variables.

	PEBS	NEP	Observing	Describing	Acting with Awareness	Nonjudging
NEP	0.21 **					
Observing	0.31 ***	0.32 ***				
Describing	0.23 ***	0.18 **	0.30 ***			
Acting with awareness	0.10	−0.11	−0.02	0.35 ***		
Nonjudging	0.01	−0.08	−0.15 *	0.33 ***	0.51 ***	
Nonreacting	0.13 *	0.07	0.37 ***	0.26 ***	0.18 **	0.22 **

Note. PEBS = Pro-Environmental Behaviour Scale. NEP = New Ecological Paradigm scale. The significance level is marked as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

After the correlation analysis, we conducted a series of hierarchical regression analysis in order to assess the predictive effects of NEP and FFMQ facets on PEBS score, while controlling for the covariates of age, sex, education, political orientation, and mediation experience. The first step of the hierarchical regression analysis was the same for all the models, so we called it a basic model. At step 2, each model included one of the FFMQ facets as a predictor, and then, at step 3, the conditional or moderated effect as the interaction between NEP score and the same FFMQ facet. The results of these models were summarized in Table 3. In the basic model (Step 1), female sex was related to increased pro-environmental behaviours, as was the education level. Conversely, a conservative political orientation was related to a decreased PEBS score. The NEP score positively predicted the PEBS score, i.e., the environmental attitude was significantly related to pro-environmental behaviour. Subsequently, we added each FFMQ facet (at step 2) and its interaction with the NEP (at step 3) in a different regression model.

Table 3. Hierarchical linear regression models with PEBS as dependent variable.

Basic Model								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 1	Intercept	3.048	2.677	3.418	<0.001	-	0.228 **	-
	Age	0.006	0.014	0.011	0.011	0.155		
	Sex	0.121	−0.029	0.272	0.113	0.097		
	Education (in years)	0.081	0.010	0.151	0.025	0.141		
	Political orientation	−0.154	−0.214	−0.094	<0.001	−0.307		
	Meditation experience	0.094	−0.079	0.267	0.283	0.067		
	NEP	0.078	0.005	0.151	0.041	0.128		
Model with Observing								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 2	Observing	0.130	0.057	0.213	<0.001	0.220	0.268 **	0.040 **
Step 3	NEP × Observing	−0.035	−0.100	0.034	0.296	−0.058	0.272 **	0.004
Model with Describing								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 2	Describing	0.061	−0.020	0.142	0.118	0.099	0.237 **	0.009
Step 3	NEP × Describing	−0.004	−0.081	0.073	0.914	−0.007	0.237 **	0.001
Model with Acting with Awareness								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 2	Acting with awareness	0.062	−0.020	0.134	0.153	0.090	0.235 **	0.007
Step 3	NEP × Acting with awareness	0.074	0.003	0.150	0.048	0.121	0.249 **	0.014 *
Model with Nonjudging								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 2	Nonjudging	−0.038	−0.113	0.042	0.359	−0.057	0.231 **	0.003
Step 3	NEP × Nonjudging	0.059	−0.005	0.130	0.093	0.097	0.241 **	0.010 +
Model with Nonreacting								
	Predictor	*b*	*CI lower*	*CI upper*	*p*	*β*	R^2	ΔR^2
Step 2	Nonreacting	0.059	−0.003	0.132	0.108	0.098	0.237 **	0.009
Step 3	NEP × Nonreacting	−0.008	−0.078	0.059	0.846	−0.012	0.237 **	0.001

* PEBS = Pro-Environmental Behaviour Scale. NEP = New Ecological Paradigm scale. b represents the unstandardized coefficients and β represents the standardized coefficients. CI lower and CI upper represent the limits of the 95% confidence intervals of the unstandardized coefficients. The significance level is marked as follows: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

In the first model, adding the observing score significantly increased the model fit at step 2 but not at step 3. In fact, observing was a significant predictor of the PEBS score, but the interaction term NEP × observing was not. In the second model, we added the describing score of the FFMQ to the basic model. Adding both the unconditional effect of describing, at step 2, and the interaction term NEP × describing did not significantly increment the model fit in terms of R2. In the third model, adding acting with awareness

did not improve the model fit, as it was not directly related to the PEBS score at step 2, while adding the interaction NEP × acting with awareness significantly increased the model fit. In fact, the interaction term significantly predicted the PEBS score. In the fourth model, we did not obtain a significant direct effect of the nonjudging score on the PEBS score, whereas the interaction term NEP × nonjudging showed a trend towards significance. In the last model, the nonreacting facet did not have any unconditional (step 2) or conditional (step 3) effect on the PEBS score. Overall, this analysis revealed that acting with awareness and nonjudging facets of mindfulness interacted with the environmental attitudes in predicting pro-environmental behaviours. To further investigate these effects, we probed these conditional effects by means of simple slope analysis and the Johnson-Neyman technique.

Firstly, we probed the interaction between acting with awareness and NEP score (Figure 1, left panel). In the simple slope analysis, NEP was a significant predictor of PEBS only when acting with awareness was average (0.080: $p < 0.05$) or high (0.154: $p < 0.001$), but not when it was low (0.006: $p = 0.912$). Johnson–Neyman analysis confirmed that the relationship between NEP and PEBS was significant when acting with awareness and was higher than −0.063 in the observed range of value [−3.178, 2.029].

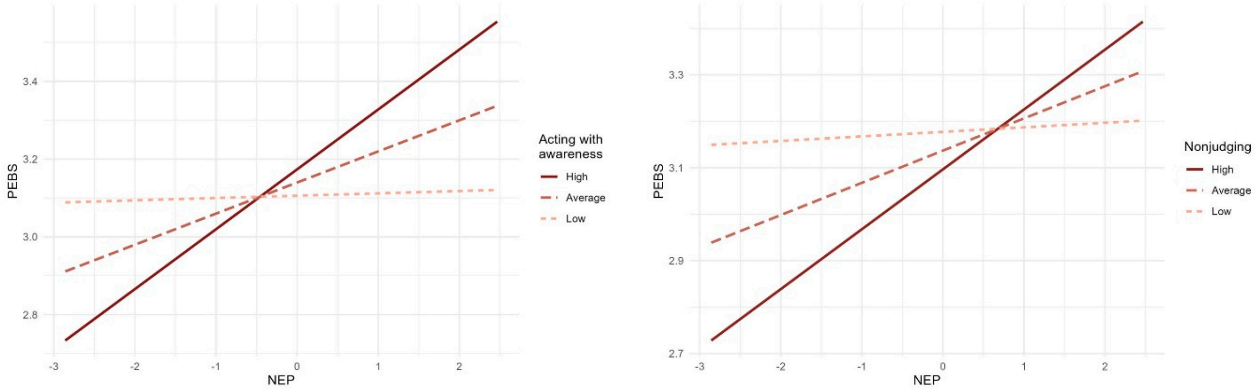

Figure 1. Results of the simple slope analysis for (**left**) the interaction between NEP and Acting with Awareness, and (**right**) the interaction between NEP and Nonjudging.

We then also probed the interaction between nonjudging and NEP score (Figure 1 right panel). In this analysis, the environmental attitudes significantly predicted the pro-environmental behaviours only when nonjudging was high (0.129: $p < 0.05$), whereas this relationship was not significant for average (0.069: $p = 0.072$) and low levels of nonjudging (0.010: $p = 0.857$). Johnson–Neyman analysis confirmed that the relationship between NEP and PEBS was significant when nonjudging was lower than 0.103 in the observed range of value [−2.822, 1.880], i.e., only when nonjudging was higher than average.

4. Discussion

The purpose of the present study was to gain insight into the role of mindfulness in explaining the environmental attitude–behaviour gap. In line with our H1 and with previous research [26,27], we obtained a positive correlation between dispositional mindfulness (specifically, the observing, describing, and nonreacting facets of the construct), and pro-environmental behaviour. Partly supporting H2, dispositional mindfulness predicted PEBS score only in terms of observing, corroborating evidence suggesting that mindfulness would relate to pro-environmental behaviour through increased awareness and concern of the effects of the environmental crisis on the ecosystem [41,45–47]. Although no other dimension of mindfulness was found to be a direct predictor of pro-environmental behaviour, acting with awareness and nonjudging predicted pro-environmental behaviour in interaction with pro-environmental attitudes, supporting the hypothesis of a moderating role of dispositional mindfulness in the relation between pro-environmental attitudes and behaviours (H3).

Our findings suggest that different aspects of dispositional mindfulness would affect pro-environmental behaviours through different paths. Observing would contribute to increased engagement in pro-environmental behaviour by enabling stronger human–nature bonds and increased concern for the environmental crisis, in line with findings of previous studies [41,45,47,63]. Acting with awareness and nonjudging would affect pro-environmental behaviour by modulating, through increased self-regulation abilities, the effect of pro-environmental attitudes on behaviours. On the one hand, the enhanced awareness of the present experience entailed in the acting with awareness dimension of mindfulness would make individuals more skilled at detecting discrepancies between their pro-environmental attitudes and behaviours, as suggested by Rosenberg [51] and Bahl et al. [49], and more capable of aligning actual behaviours with intentions, as indicated by Li et al. [44]. This appears in line with findings indicating that, by making alternative behavioural choices more salient, heightened awareness would allow individuals to inhibit automatic behavioural responses [64,65]. On the other hand, nonjudging could improve individual coping strategies when faced with the environmental crisis and prevent negative emotions from interfering with behaviours aimed at addressing the environmental threat, which is in line with findings indicating fear and helplessness as major barriers to adopting pro-environmental behaviour [66–68].

In general, our findings have important implications for interventions aimed at mobilising individuals to face the climate challenge, as they suggest that increasing the knowledge and concern of individuals about climate change may not be sufficient to bring about relevant behavioural change, and that self-regulation abilities should also be addressed. Moreover, if we consider that trait mindfulness could be increased by mindfulness practice [69–71], our findings suggest that mindfulness-based interventions could be effectively used to promote individual engagement in front of the climate crisis, in parallel to awareness campaigns.

The current study is not without limitations. First, results have been collected using a relatively small random sample, potentially hindering the generalisability of our results as well as the replicability of the study. However, the study was designed to include the measurement of potential confounding variables (e.g., age, gender, family status, place of residence, and political orientation) in order to reduce eventual bias related to our sample. Moreover, the power analysis indicated that our sample size was large enough to consider our findings as reliable. We advocate for future research to test our hypothesis on a different sample and with different controlling variables, to increase the reliability of our conclusions and to further reduce the effects of potential confounders. Second, our study uses self-report measures, which may be subject to assessment bias and social desirability bias. In particular, self-reported pro-environmental behaviour measures have sometimes been criticised for failing to align with behaviour observed in real life and in laboratory tasks [72]. When it comes to pro-environmental attitudes, it is also worth noting that whilst the New Ecological Paradigm scale [52] administered in our study has been widely used to measure pro-environmental attitudes, it has been designed to assess endorsement of ecological worldviews (e.g., an eco-centred view of the relationship between nature and human, in which humans are considered part of nature rather than dominating it). In this perspective, though the NEP certainly measures attitudes towards the relationship between humans and the environment, it might actually only partly capture attitudes towards the importance of acting in front of the climate crisis. Whilst the aforementioned limits of the self-report measures used in our assessment might slightly affect the internal validity of our study, it is important to point out that such tools were selected because of their good internal validity and reliability in measuring the assessed constructs. Future research should seek to use different measurement tools to assess mindfulness, pro-environmental attitudes, and pro-environmental behaviours when trying to replicate our findings. Finally, the correlational nature of our study prevents us from making any inference regarding causal effects of mindfulness on pro-environmental behaviour, hindering the applicability of our findings to environmental policies. We call for the use of an experimental design in

future research to assess whether increasing mindfulness levels (though mindfulness-based practice and interventions) could result in lower discrepancy between pro-environmental attitudes and behaviours.

5. Conclusions

Despite its limitations, our study adds to the broader literature on the relationship between mindfulness and pro-environmental behaviour. Consistent with findings indicating a relationship between mindfulness and pro-environmental behaviour, and a role of self-regulation in explaining the attitude behaviour gap, we found that the observing facet of mindfulness was a predictor of pro-environmental behaviour, and the acting with awareness and nonjudging facets acted as moderators of the relationship between pro-environmental attitudes and behaviours. Therefore, our findings provide a novel contribution to the understanding of the relationship between mindfulness and pro-environmental behaviour, and they support the perspective that self-regulation skills would contribute to reducing the environmental attitude–behaviour gap.

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