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Psychological Barriers to Pro-climatic Action in Portugal

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PSYCHOLOGICAL BARRIERS TO PRO-CLIMATIC ACTION IN PORTUGAL

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RESUMO

Cada vez mais se destaca a importância da mudança comportamental individual no combate às alterações climáticas. Contudo, a preocupação com os problemas climáticos e a perceção da importância da ação individual para os combater podem não ser suficientes para que haja uma maior aderência a um estilo de vida mais sustentável. Neste projeto, examinamos fatores psicológicos como (1) a falta de conhecimentos; (2) objetivos em conflito; (3) influências sociais; (4) achar a mudança desnecessária; e (5) o tokenismo, que podem atuar como barreiras para uma ação mais pró-climática em indivíduos preocupados e conscientes sobre os problemas climáticos. Uma amostra de respondentes portugueses (N = 937) revelou que na generalidade existe uma consciência elevada quanto ao impacto humano nocivo nas alterações climáticas e uma preocupação relacionada com os impactos que os problemas climáticos podem ter na natureza e nos humanos. Esses fatores mostram-se relacionados em diversos graus com uma maior frequência de ação em domínios de ação ambiental como a reutilização, a poupança de água ou energia, o uso do avião e a redução de consumo de produtos animais, sendo que esta relação é negativamente moderada pela presença de barreiras psicológicas em todos os comportamentos exceto naqueles relacionados com o hábito de voo. Entender a forma como fatores psicológicos interagem com diferentes tipos de comportamentos pro-ambientais permitirá uma intervenção mais focalizada.

Palavras-chave: Alterações Climáticas, Barreiras Psicológicas, Atitudes, Sustentabilidade

ABSTRACT

The importance of individual behavioural change has been increasingly recognized for combating climate change. However, being concerned about climate problems and knowing the importance of individual actions in combating them may not be enough for greater adherence to a more sustainable lifestyle. In this project, we examine psychological factors such as (1) lack of knowledge; (2) conflicting goals; (3) social influences; (4) finding the change unnecessary; and (5) tokenism, that can act as barriers to more pro-climate action in individuals concerned and aware of climate issues. A sample of Portuguese respondents (N = 937) revealed that, in general, there is high awareness about the harmful human impact on climate change and concerns related to the impacts that climate problems can have on nature and humans. These factors are shown to be related, within varying degrees, to a greater frequency of environmental action in areas such as reusing, water and energy conservation, airplane use, and reduced consumption of animal products. This relationship is negatively moderated by psychological barriers in all behaviors except those related to flying. Understanding how psychological factors interact with different pro-environmental behaviors will allow for more focused intervention.

Keywords: Climate Change, Psychological Barriers, Attitudes, Sustainability

RESUME

L'importance du changement de comportement individuel est de plus en plus reconnue pour lutter contre le changement climatique. Cependant, le fait de se sentir concerné par les problèmes climatiques et de connaître l'importance des actions individuelles pour les combattre peut ne pas suffire à susciter une plus grande adhésion à un mode de vie plus durable. Dans ce projet, nous examinons les facteurs psychologiques tels que (1) le manque de connaissances; (2) les objectifs contradictoires; (3) les influences sociales; (5) le fait de trouver le changement inutile; et (6) le symbolisme, qui peuvent agir comme des barrières à une action plus pro-climat chez les individus concernés et conscients des problèmes climatiques. Un échantillon de répondants portugais (N = 937) a révélé qu'en général, il existe une forte sensibilisation à l'impact nuisible de l'homme sur le changement climatique et des préoccupations liées aux impacts que les problèmes climatiques peuvent avoir sur la nature et les humains. Ces facteurs sont liés, à des degrés divers, à une plus grande fréquence des actions environnementales dans des domaines tels que la réutilisation, la conservation de l'eau et de l'énergie, l'utilisation de l'avion et la réduction de la consommation de produits animaux. Cette relation est modérée par les barrières psychologiques dans tous les comportements, sauf ceux liés à l'avion. Comprendre comment les facteurs psychologiques interagissent avec les différents comportements pro-environnementaux permettra de mieux cibler les interventions.

Mots-clés : Changement climatique, Barrières psychologiques, Attitudes, Durabilité

Table of Contents

Introduction 1
1. Climate Change and Household Behaviour 2
2. The Psychology of Pro-Environmental Action 3
3. The Value-Action Gap 5
4. Psychological Barriers to Pro-Environmental Action 6
5. The Current Study 9
Methods 10
1. Open Science Practices 10
2. Participants 10
3. Materials 11
3.1. Environmental Concerns 11
3.2. Climate Change Beliefs 12
3.3. General Ecological Behaviour 12
3.4. Psychological Barriers to Pro-Environmental Behaviour 12
4. Procedure 13
5. Data Analysis 14
Results 15
1. Personal Norms 15
1.1. Environmental Concerns 15
1.2. Climate Change Beliefs 17
1.3. The Personal Norms Model 20
2. Pro-Climate Behavior 20
3. Personal Norms and Environmental Action 23
4. Psychological Barriers 25
5. Moderator Effect of Psychological Barriers 28
Discussion 30
1. The Structure of Personal Norms 31
2. Pro-environmental Behavior 32
3. Psychological Barriers 33
4. Relations Between Personal Norms, Behavior, and Psychological Barriers 34
5. Limitations and Future Research 35
References 37
Appendix 48
Appendix A 49

Appendix B 50
Appendix C 51
Appendix D 54
Appendix E 57
Appendix F 58

Figures List

Figure 1. Individual Ratings (Small Jittered Dots) and Sample Mean (Large Black Dots) for Each Item of the Environmental Concern Scale……15

Figure 2. Final Three-Factor Model for Environmental Concerns Obtained in our Sample (*N* = 937)…….17

Figure 3. Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for each Item in the Climate Change Belief Scale……18

Figure 4. One-Factor Model for Climate Change Beliefs obtained in our Sample (*N* = 937)…….19

Figure 5. Second-Order Model for Personal Norms obtained in our Sample (*N* = 937)…….20

Figure 6. Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for Each Item of the Pro-Environmental Behavior Scale……21

Figure 7. One-factor Model for Pro-environmental Behaviors and Standardized Parameter obtained in our Sample (*N* = 937)……24

Figure 8. Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for each Item of the Dragons of Inaction Psychological Barrier Scale……25

Figure 9. *One-Factor Model for Pro-environmental Behaviors and Standardized Parameter in our Sample (N = 937*)……...…..…..27

Tables List

Table 1. Descriptive Statistics and Reliability Scores for Environmental Concern items.....16

Table 2 - Descriptive Statistics for Climate Change Belief Scale and Reliability Scores for all Items……...19

Table 3. Descriptive Statistics and Reliability Scores for the Pro-Environmental Scale Subscales and all Items……22

Table 4. Descriptive Statistics for the Dragons of Inaction Psychological Barrier Scale Items and Reliability Scores for all Items and Items Included in the Final Model…….26

Table 5. Model Fit Indices of each Environmental Behavior independently……29

Table 6. Regression model results for each pro-environmental behavior……..29

Introduction

Climate Change is an ever-growing important issue. Global temperature has steadily increased over the past decades, with 2020 being one of the hottest years on record (NOAA, 2020). The leading cause for these and other climate-related changes has been the emission of anthropogenic greenhouse gases (Meyer et al., 2014), which have been causing negative impacts in both human and natural systems (Clayton, 2020; DeFries et al., 2019; Kim et al., 2014). Hence, it's paramount to stop or at least ameliorate the progress of climate change for the safety of our ecosystems and societies. Furthermore, since individual behaviours significantly impact these greenhouse gas emissions (Ivanova et al., 2016), adherence to a more sustainable lifestyle is essential for preventing future worsening.

In Portugal, there are not many studies in environmental psychology regarding climate change. According to recent survey data from the Eurobarometer 2019, Portuguese individuals are aware and preoccupied about climate change, yet the Portuguese Climate Change Performance Index in the same period shows that the country has one of the lowest performance in greenhouse gases emission compared to other European nations (Guerra et al., 2020). Furthermore, Portuguese citizens have a limited engagement with pro-environmental behaviour (Cabecinhas et al., 2009). To better understand what are the factors that hinder the engagement in pro-climate behaviour in Portugal, this study will use psychological instruments to collect data about personal norms, the frequency of engagement in pro-environmental behaviour, and the psychological barriers that might widen the gap between favourable norms and actual behaviour.

In the following, we will first review the importance of addressing individual behaviours to fight climate change. Next, we will explain the current models of ecological behaviour and address the gap between positive attitudes and behaviour in ecological models; then, we will discuss the importance of psychological barriers. Finally, we will delineate the specific research questions and hypotheses addressed in the present study, and the study design to test them.

1. Climate Change and Household Behaviour

Global warming, driven mainly by greenhouse gas emissions from human activities (IPCC, 2021), has caused widespread adverse impacts to nature and people (IPCC, 2022). Global climatology changes have been responsible for decreases in physical (Kim et al., 2014; Rocque et al., 2021) and mental health (Cianconi et al., 2020; Clayton, 2020; Palinkas & Wong, 2020), and elevated economic expenses related to structural destruction, relocation of population, water security and food production (DeFries et al., 2019; Tol, 2018). Hence, while some of its impacts are inevitable, it's paramount to at least ameliorate the progress of anthropogenic climate change to reduce risk and damages to our natural and human systems (IPCC, 2022).

To face these challenges, technological progress and demographic control appear to be effective in the long run, but their slowness calls for faster lifestyle changes (De Matteis, 2019)**,** since modern economic growth and high-consumption behaviours are behind the increasing levels greenhouse gas emissions (Roy & Pal, 2009)**.** This means that even though technology and economic incentives are crucial, behavioural change must also be included as a centrepiece for policymakers.

A large percentage (65%) of global greenhouse gas emissions can be directly or indirectly linked to household consumption, especially in high-income countries like the ones within Europe, Australia, and North America (Ivanova et al., 2016). Hence behavioral change presents itself as an opportunity to mitigate the negative effects of anthropogenic climate change (Dubois et al., 2019; Ivanova et al., 2020). Mobility (air and land) and food choices (consumption of meat) are the main contributors to the household carbon footprint, followed by household appliances, refurbishment, heat, and electricity provision (Dubois et al., 2019; Ivanova et al., 2020). Reducing meat consumption and adopting a plant-based diet is especially important to reduce individual carbon footprint and acquire an healthier life style (González et al., 2020; Schiermeier, 2019). The same can be said about shifting travel habits to less car and plain use (Chapman, 2007; Timperley, 2020).

One recent evidence of the effect of massive behavioural changes on greenhouse gas emissions was the Covid-19 pandemic. The first quarter of 2020 saw a significant drop in global carbon dioxide (CO2) emissions that could be traced to the restrictions imposed by the pandemic, surpassing any previous declines recorded (International Energy Agency, 2020) Nevertheless, Forster et al. (2020) pointed that the short-term dynamics of the

pandemic likely have a negligible effect on temperature decreased if lasting measures are not taken. This means that while behaviour changes are essential and valuable, to have an actual long-lasting impact on climate indices, interventions must result in durable lifestyle changes and not just momentary behavioural shifts.

2. The Psychology of Pro-Environmental Action

Changing behaviours requires an understanding of how they work. Environmental behaviours can be broadly defined as all types of behaviour that change the availability of materials or energy from the environment or alter the structure and dynamics of ecosystems or the biosphere (Stern 2000 cited in Steg & Vlek, 2009). The goal is to decrease damaging behaviour and increase the frequency of pro-environmental behaviours that benefit the environment or harms it as little as possible. This is one of the topics studied by Environmental Psychology (American Psychological Association, 2014).

Interventions for behavioural change are generally superior when they are systematically planned, implemented, and evaluated (Steg & Vlek, 2009). The same authors address four key issues: the identification of the behaviours to be changed, examination of the main factors underlying those behaviours, application of interventions, and previous evaluation. The examination of which behaviours with a high potential for impact should be targeted for change belongs mainly to the domain of environmental sciences (Nielsen et al., 2021). Behaviour measurement and understanding, however, belongs to the realm of Environmental Psychology. This field has produced several methodologies that focus on different behaviours and populations (Lange & Dewitte, 2019) .

After recognizing which behaviours to target, an effective intervention aims to identify the critical antecedents of the appropriate behaviour and remove barriers to action (Grilli & Curtis, 2021; Steg & Vlek, 2009). Therefore, understanding which factors promote or inhibit environmental behaviour is crucial. Many lines of research have come up with theoretical models that try to explain the antecedents of ecological behaviour. Klöckner, (2013a) presents the theoretical background of the most used models on the psychology of environmental behaviour: namely, *The Theory of Planned Behaviour*, the *Norm-Activation-Theory*, and the *Value-Belief-Norm.* They also propose a *Comprehensive Action-Determination Model* of environmental behaviour that integrates the main tenets of these

theories. All four theories share a similar behaviour model, one where an internal predisposition to action leads to an intention or behaviour.

The *Theory of Planned Behavior* (Ajzen, 1991) assumes that behavioural intentions are determined by favourable attitudes, social norms, and perceived behavioural control. In general terms, this theory predicts that people perform a pro-environmental behaviour if they hold a positive attitude toward that behaviour, if this behaviour is socially expected and supported, and if they perceive themselves as being able to carry it out (Klöckner, 2013).

The *Norm-Activation Theory* focuses more on personal moral norms as main determinant of behaviour, that is what the person believes is right or wrong. Main behavioural determinants in this theory are awareness of the adverse consequences of not acting, followed by feelings of responsibility for the negative consequences of not acting (Steg & de Groot, 2010).

The *Value-Belief-Norm* model expand from the norm-activation theory and proposes that the activation of personal norms results from an interaction between stable values orientation and ecological beliefs (Stern, 2000). Values serve as guiding principles towards what is essential to the person and what they are considering when making decisions, with some common examples being self-transcendent and self-enhancement values (Schwartz & Bilsky, 1987; Steg & de Groot, 2010). Beliefs about climate change in this model relate to the general knowledge that human activity endangers the natural equilibrium (Klöckner, 2013) which includes the awareness of problems and ascription of responsibility from Norm-Activation-Theory and the New Ecological Paradigm (Dunlap, 2008), that measure the endorsement of a "pro-ecological" worldview.

Finally, the *Comprehensive Action-Determination Model* attempts to integrate all previous models where behaviour is directedly predicted by intention to act, habits and perceived behavioural control. Intentions is predicted by personal norms and attitudes related to the specific behaviour; while personal norms, much like the Value-Behavior-Norm is predicted by beliefs (awareness of problem, ascription of responsibility and the New Environmental Paradigm) and values (self-transcendent and self-enhancement).

These models tend to suggest that at the basis of environmental behaviour the interaction between what is valued and what is believed about the problematic activates each individual personal norms which in turn predict environmental intention and action.

Nevertheless, beliefs about climate change, self-transcending values, and positive attitudes do not always relate to pro-environmental behaviour.

3. The Value-Action Gap

The extensive literature about social attitudes concerning environmental matters reveals a discrepancy between the expressed support for environmental matters and the commitment to alter behaviours (Geiger et al., 2019; Masud et al., 2015). This gap has been loosely named the "*value-action gap*", although terms such as "*belief-action gap*", "*knowledge-action gap*", and "*attitude behaviour inconsistency*" have been also employed (Grandin et al., 2021). This variety in terms are generally used to describe the inconsistency between the presence of elements that should positively predict behaviour and its lack of occurrence.

Studies in Great Britain revealed that knowing information about climate change did not correlate with personal action. For example, in the case of some specific behaviours like driving cars and flying in aeroplanes, negative attitudes and awareness about the detrimental impact of these behaviours did not lead to less adherence to them (Flynn et al., 2009). These findings contested initial behaviour models that directedly related beliefs to action, and called for more appropriate models that include the different factors that interfere with that connection. Grandin et al. (2021) explain the complexity of ecological behaviours and why attitudes and beliefs don't have such a strong relationship on them by dividing their complexity into three domains: Measurement issues, information deficit, and structural barriers and psychological factors.

First, measurement tools may not be sophisticated enough to evaluate the "attitude-action" relation. Very often, researchers measure overall environmental concern and try to match it with specific behaviours. Yet, stronger relations between attitudes and behaviour can only be found on compatible levels of generality or specificity (Ajzen, 2005). This means that general measurements of attitudes should better relate to general measurements of behaviour. Furthermore, social desirability in self-reported measurements and temporal gaps between the collection of attitudinal and behavioural data can also moderate the relation between these two variables.

Second, the author points that lack of information can be a potential factor beyond inadequate measurement. Basic knowledge about climate change and its consequences, and even general knowledge – e.g., crystallized intelligence - are necessary for people to be concerned and adopt pro-environmental behaviour (Geiger et al., 2019; Masud et al., 2015). Still, even when general awareness about climate change is high, people might lack knowledge about what to do and the impact of their actions.

But then what happens when there is an overall knowledge about climate change and the appropriate pro-environmental actions? There are still factors that can "get in the way". Structural and psychological factors can hinder action. Regarding structural challenges: Lack of access to adequate infrastructures like public transports and recycling facilities; socioeconomic status; the price of some more environmentally friendly products; and lack of time due to professional occupation or children, were reviewed as significant structural and situational barriers to consider when accessing pro-environmental behaviour (Grandin et al., 2021).

Regarding the psychological factors, the complexity of the human mind comes into play. Perceived conflicting beliefs and attitudes; sense of agency; the importance we put on social norms, and being recognized contribute to less pro-environmental behaviour or to the adoption of "tokenistic" green actions that are easier to perform but have less impact (Grandin et al., 2021). For this study, we are especially interested in the psychological factors that contribute to the intention-action gap.

4. Psychological Barriers to Pro-Environmental Action

Environmental Psychologists have been studying the extent of the relation of psychological barriers to pro-environmental behaviour. Gifford (2011) reviewed what he called "*The Dragons of Inaction*", an enumeration and explanation of 29 different psychological factors that impede the adherence to climate change mitigation behaviours. These "dragons" were then categorized into 7 different groups: Limited Cognition; Ideologies; Comparison with others; Sunk costs; Discredence; Perceived Risks, and Limited Behaviour.

Limited Cognition refers to flaws in human reasoning like having an ancient brain that is still more adapted to the immediate dangers and resources and not so well adapted to

deal with distant and slow coming dangers. We tend to make a judgmental discounting about climate change**,** believing that environmental conditions are worse in other places than our own. Nonetheless, humans can think about the future to some extent. Still, there is ignorance about specific actions and their impact, along with possible uncertainty about climate change scientific information. Attentional limitations can also contribute to a sort of environmental numbness**,** whether by climate change being considered a phenomenon outside of immediate attention because it is not causing any immediate difficulties or by overstimulation of information about the environment and climate change. Other cognitive factors exposed in the limited cognition category are an excessive optimism bias and low perceived behaviour control.

Some belief systems or ideologies may clash with climate-change mitigation and other forms of pro-environmental action. Particularly some worldviews are not compatible with adopting mitigative behaviours. Furthermore, a conviction in superhuman entities, whose influence is superior to humans, or in the capability of technology to alone solve all problems associated with climate change are ideologies that remove responsibility from humans. The last "dragon" in the category of ideologies is system justification, a tendency to defend the current state of affair (societal status quo).

As mentioned before, social norms and the social comparisons that people routinely make are instrumental in determining the adoption of pro-environmental behaviours. For example, the search for equality and justice can make perceived inequality in the distribution of environmental action a justification for nonaction.

Sunk costs, as described by Gifford (2011), include financial costs and investments that, while not the most environmentally friendly (e.g., buying a new gas car), are complicated to give up on for more friendly alternatives (walking or taking the bus). They also include the effect of habits or behavioural momentum**,** and the interactions between values and aspirations that conflict with environmental attitudes and pro-environmental behaviour.

Discrendence is a category of psychological barriers that is related to lack of trust. Mistrust in the government, policymakers, or science is a potential barrier to pro-environmental behaviour. Another form of discrendence is related to perceived program inadequacy. Since most climate-related programs are voluntary, people can choose not to participate if they think the program is inadequate. Uncertainty, mistrust, and suck costs can

easily lead to active denial of a problem, in this case, denial that climate change is real. Finally, lack of trust in those who set policies can lead to a chain reactance or opposition against those entities.

Changing behaviours might also encompass potential risks that can make those choices difficult. In Gifford (2011), six kinds of risks were set forward as barriers: functional risk – *"Is it going to work?"* ; physical risk – *"Is it safe?"* ; financial risk – *"Is it going to cost too much?"* ; social risk – *"Are others going to think well of me?"* ; psychological risk – *"Is there going to be any damage to my self-esteem or confidence?"* ; and temporal risk – *"Is the time spent worth it?"*.

The final category proposed by Gifford (2011) is Limited Behaviour. In this category, two behavioural tendencies emerge. Tokenism a tendency to adopt easier behaviours that have less impact on greenhouse gas emissions. And a rebound effect where after adopting some mitigation effort, the gains achieve may be diminished or erased by subsequent action. For example, when someone buys fuel-efficient vehicles but drives farther and more often than before.

This extensive list of psychological factors served as a theoretical foundation for the creation of scales. Iglesias et al. (2014) adapted a scale based on "The Dragons of Inaction", the *Individuals' Obstacles to Proenvironmental Behaviour*, to investigate psychological barriers for the responsible and ecological consumption in a Brazilian context. The participants choose an ecological behaviour to serve as a reference while answering the scale. Overall, three categories of behaviour emerged as dominant: garbage production, energy use, and transportation. As for the psychological barriers, the factorial analysis revealed a bidimensional model composed of *negation of environmental problems* whose items were related to uncertainty, descredence and ignorance, and *different priorities* whose items were related to habits, conflicting goals, and social norms. Different priorities scores were overall higher than negation of environmental problems for all main categories of behaviour.

Lacroix et al. (2019) developed a valid, reliable measure of the psychological barriers to pro-environmental behaviour for a Canadian population, one that could be applied across multiple domains of environmental behaviour. They did three different studies to create the *Dragons of Inaction Psychological Barriers (DIPB)* scale. The first was an exploratory factorial analysis from a preliminary list of 65 items which resulted in a 24-item scale with

five factors (Change Unnecessary; Conflicting Goals and Aspirations; Interpersonal relationships; Lacking Knowledge; Tokenism). The second study was done on a different sample and showed that the five-factor model extracted in Study 1 outperformed a seven-factor model that aligned with the Gifford proposal, and a unidimensional model. The third and final study resulted in a 22 item five-factor scale with good reliability and model fit, and adequate for different domains of environmental behaviour. For this study six dimensions of behaviour where considered: food, transportation, energy, water, purchasing, and waste. The Interpersonal Relation barrier was the strongest for food (e.g., eating less meat), the Conflicting Goals and Aspirations barrier was stronger for transportation (e.g., driving less), and the Lacking Knowledge barrier was the strongest for purchase (e.g., buying green). Tokenism did not differ across behaviours.

The DIPB scale was also adapted to the Colombian population by Gutiérrez and Sofía (2020). They utilized the same five-factor structure and 22 item scale as Lacroix et al. (2019). They did not, however, compared the effect of barriers across different behaviours.

One goal of the present study was to adapt the DIPB scale to the Portuguese population to assess what barriers prevent concerned individual from taking action to fight climate change in Portugal.

5. The Current Study

The goal of this study is to understand the extent to which climate change attitudes addressed by measuring self-orienting values and general beliefs about climate change diverge from actual general pro-environmental behaviour and what role do psychological barriers have in that relation. This assessment will eventually bring better insights for intervening within the Portuguese population to facilitate the adherence to more environmentally friendly household behaviour.

First, we measured climate change beliefs and self-orienting values, two factors that appear as relevant in the various behavioural models (Karp, 1996; Klöckner, 2013; Kollmuss & Agyeman, 2002), to examine their relation with actual engagement in general ecological behaviour. The belief measurement included the assessment of beliefs about climate change, its negative consequences, and anthropogenic responsibility (Christensen & Knezek, 2015). The measurement of values was composed of questions about altruist, egoistic, and

biospheric concerns which were directly related to self-transcendent and self-enhancement values (Schultz, 2001). The general ecological scale collected self-report data on the frequency of pro-environmental behaviour in the following domains: Conservation of Energy and Water; Food; Transportation; and Waste. We expected to find a weak relation between favourable personal norms and the frequency of pro-environmental behaviour, especially for behaviours that are of high difficulty, but which are also more impactful in fighting climate change (Ivanova et al., 2020) like food and transportation.

The second main goal of this study was to adapt and validate the DIPB scale to the Portuguese population and to assess how and which psychological barriers intervene in the belief/value-action relation. Based on previous studies (Gutiérrez & Sofía, 2020; Iglesias et al., 2014; Lacroix et al., 2019), we assumed that the psychological barriers would partially explain the gap between beliefs/values and pro-environmental behaviours.

Methods

1. Open Science Practices

All the materials, data and analysis scripts used in this research are available at the project page of the project at the Open Science Framework: https://osf.io/ygw89/?view_only=81214022e99c4c65bc669bca47301f8f

2. Participants

The sample consisted of 937 participants living in Portugal, of which 645 identified themselves as females (69.21%), 280 as males, and seven as other/no response. The mean age of the sample was 37 (min = 18 and max = 83), most lived in Porto (42%), Lisbon (14.6%), Braga (6.8%) and Aveiro (6.7%), while the rest were distributed around the other regions of Portugal. Regarding education, 372 had a bachelor's degree (40%), 183 had a masters' degree (19.6%), 70 had a PhD (7.5%), and 289 a High School diploma (30.9%).

About 26.6% was engaged in some sort of environmental activism or organization, and 73.3% weren't.

The study consisted of a 15-min online survey. Participants completed an informed consent form in the beginning of the study and were debriefed at the end. The Ethics committee of the Faculty of Psychology and Education Sciences approved the research protocol (Ref.ª 2021/09-08). The study link was advertised in the mailing list of the University of Porto, and in various online groups. We reached 438 people with this strategy. Afterwards, Facebook and Instagram pages were created to publicise the study using the paid promotion feature to reach individuals over 18 years old from all around Portugal. We reached the remaining 499 people with this method.

According to recommendations for complex structural equation modelling, sample-size should be at a minimum of 10 cases per parameter (Wolf et al., 2013). Our final sample of 937 satisfies these recommendations.

3. Materials

The online questionnaire was created using Lab.js (Henninger et al., 2019) https://lab.js.org/ which is an online builder for programming experiments using JavaScript and HTML. The questionnaire included items about environmental concerns, general climate change beliefs, frequency of environmental action, psychological barriers to pro-environmental behaviour and participants' sociodemographic information.

For each instrument, the original authors were informed and authorised the use of their intellectual property. The scales were translated from English to Portuguese by the researchers, who were native speakers of the target language with in-depth knowledge of the culture, had experience in test development principles, and had high English levels (Bartram et al., 2018). The final translated items were evaluated by a graduate student in Environmental Sciences for comprehensibility and correctness of terminology.

3.1. Environmental Concerns

We used the Environmental Concern Items from Schultz (2001). It comprises 12 items, divided into four altruistic (e.g., "All people"), four egoistic (e.g., "My lifestyle), and four biospheric (e.g., "Animals") concerns. The participant rated the 12 items using a scale

from 1 (not important) to 7 (supreme importance) in response to the question "*I am concerned about the environmental problems because of the consequences for….*". The instrument has good reliability, and it has been correlated with other measures of environmental attitude, self-reported pro-environmental behaviour, empathy, and social value orientation (Schultz, 2001). The original and translated items appear in Appendix A.

3.2. Climate Change Beliefs

Climate-change related beliefs were measured using items from *The Climate Change Attitude Survey* scale (Christensen & Knezek, 2015). The original scale was divided into two parts: beliefs and intentions. In this study, only the first part related to beliefs was used. The sub-scale used was composed of 9 items rated on Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). One example of an item is: "*Human activities cause global climate change*". The original and translated items are presented in Appendix B.

3.3. General Ecological Behaviour

To measure the self-reported frequency of ecological behaviour, we adapted some of the items from the *Pro-Environmental Behaviour Scale* (Markle, 2013) related to transportation, energy, and water conservation. One example of an item is: "*Walk or cycle instead of driving*". We added items concerning long distant flights due to their impact on the carbon footprint (Ivanova et al., 2020), for example: "*Avoid long-distance flights (lasting six hours or more)*"; included a part for waste-related behaviours based on the Special Eurobarometer report on Climate Change (European Commission, 2019), for example: "*Cut down on your consumption of disposal items (e.g., plastic bags from the supermarket)*" , and items about sustainable purchases (Lee, 2009), for example: "*Buy products that are against animal testing*". The set of 21 items covers five domains of environmental action: transportation, food, energy, water, waste, and purchase. Each item was rated on a Likert scale from 1 (rarely) to 5 (very often). The participants rated their frequency of behaviour currently and before the Covid-19 pandemic. The survey was completed between November 2021 and March 2022. The final scale and items are presented in English and Portuguese on Appendix C.

3.4. Psychological Barriers to Pro-Environmental Behaviour

We used the Dragons of Inaction Psychological Barriers Scale (Lacroix et al., 2019). It assesses the following psychological barriers: (a) Change Unnecessary, (b) Conflicting Goals and Aspirations; (c) Interpersonal Relation, (d) Lacking knowledge, and (e) Tokenism. The original Canadian scale had good reliability and model fit: (1) Change Unnecessary: $\alpha = 0.85$; (2) Conflicting Goals and Aspirations: $\alpha = 0.82$; (3) Interpersonal Relationship: $\alpha = 0.80$; (4) Lacking Knowledge: $\alpha = 0.73$; (5) Tokenism: $\alpha = 0.77$. It was also found to be good at distinguishing high difficulty from low difficulty behaviours as it is adapted for different domains of environmental behaviour.

We used the original 22-items and two extra items concerning the government that, while not used in the final Canadian version of the DIPB case, were recommended in contexts where governments play an essential role. Since the Portuguese people tend to attribute to local and national government a high (larger than the European Union average) responsibility in fighting Climate Change (Guerra et al., 2020) we included these items to assess if they would bring relevant information to the measurement of psychological barriers.

Participants first had to choose from a list of five behaviours[1] covering important domains of ecological behaviour: purchase, water, waste, food, transportation. They were asked to choose a behaviour they believed should be done to help the environment but which they were not doing now or were not doing often enough. Afterwards, they were presented items from the scale (for example: "*These problems are so far in the future, so there is no need to act.*") and were asked to rate each statement on a 7-point Likert scale, ranging from *"strongly disagree"* to *"strongly agree"*. The original scale and translated items are presented in Appendix D.

4. Procedure

The online survey was shared via email, Facebook, and Instagram. The participants were told that the survey takes ca. 15 minutes, and all answers would be stored anonymously. The first page of the survey was an informed consent stating the study goals and the participation criteria (Portuguese language, living in Portugal, and being over 18 years old).

[1] Originally it should have been six domains, however, due to a coding error we included only five domains on the online questionnaire. The domain of saving energy was not included.

After they answered to our selected scales, the participants completed a sociodemographic questionnaire and receive a debriefing of the study's research questions where there was a space to leave their contact voluntarily if they wished to receive information about the study results. The Informed Consent and Debriefing in Portuguese are presented in Appendix E.

5. Data Analysis

The data analysis was performed using R. 4.1.3 (R Core Team, 2022). We used the "*lavaan*" package (Yves Rosseel, 2012) for the confirmatory factor analysis, the package "*psych*" (Revelle, 2022) for the exploratory factor analyses, and "*ltm*" package (Rizopoulos, 2006) to compute the reliability of our measures (Cronbach's alpha). We analysed our data in three steps. First, we evaluated the descriptive statistics of the responses to all scales. Second, we assessed the structure of the scales. We ran an exploratory factor analysis to describe the data of the frequency of ecological behaviour. For the remaining scales, we used the model that was specified in the literature with some adjustments. Third, we assessed the relation between the measured constructs, namely between personal norms, pro-environmental behaviour, and psychological barriers.

We assessed model fit adequacy with the chi-square goodness-of-fit statistic, the root mean square error of approximation (RMSEA), the Bentler's comparative fit index (CFI), and the standardized root-mean-square residual (SRMR) (Schermelleh-Engel et al., 2003). For $\chi 2$, a small, non-significant value indicates good fit. However, $\chi 2$ is known to be affected by sample-size. RSMEA smaller than 0.06 indicates a good fit, and of 0.08 or less, a reasonable fit. For the CFI, values higher than 0.95 indicate good fit, and values between 0.90 and 0.95 an adequate fit. Finally, for the SRMR, a value below 0.08 indicates an acceptable fit (Hu & Bentler, 1999). Note that these cutoff criteria are not static and should be weighted in light of the data since the index values can be influenced by sample size, the number of variables analyzed, and missing data (Peugh & Feldon, 2020).

A second-order factor model was created where the latent factors for climate change beliefs and environmental concerns were loaded onto a factor we named "Personal Norms". Then, we executed a regression analysis between personal norms as an independent variable and frequency of environmental behaviour as the dependent variable. This allowed us to assess the degree in which personal norms predicted action.

Finally, we used a moderation analysis to understand how the relationship between personal norms and the frequency of pro-environmental behaviour depended on the perception of psychological barriers.

Results

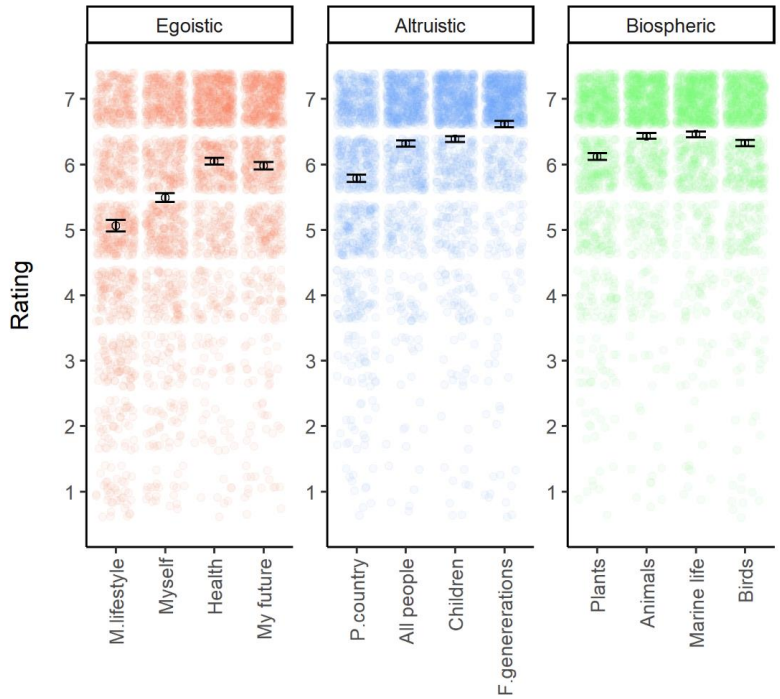
1. Personal Norms

1.1. Environmental Concerns

Figure 1 presents the individual and average ratings for each item in the environmental concerns scale, separately for each of the three domains proposed by Schultz (2001). Descriptive statistics and reliability indices for each item and subscale are presented in Table 1.

Figure 1

Individual Ratings (Small Jittered Dots) and Sample Mean (Large Black Dots) for Each Item of the Environmental Concern Scale.



Note. Error-bars represent 95% within-subjects confidence intervals.

We performed a confirmatory factor analysis (CFA) to verify if the data of our sample would be well-described by the three-factorial model proposed by Schultz (2001), consisting of the Egoistic (M = 5.56, SD = 1.15), Altruistic (M = 6.26, SD = 1.11), and

Biospheric (*M* = 6.33, *SD* = 1.52) concerns. Model fit was not acceptable by defined standards due to a high RMSEA, χ^2 (51) = 932.566, CFI = 0.906, RMSEA = 0.136 [CI: 0.128, 0.144], SRMR = 0.058. With the goal of improving model fit, we took two approaches. First, we examined modification indices suggested by *lavaan*. Second, we removed items that were loading on more than one factor as suggested by the modification indices function.

Table 1

Descriptive Statistics and Reliability Scores for Environmental Concern Items.

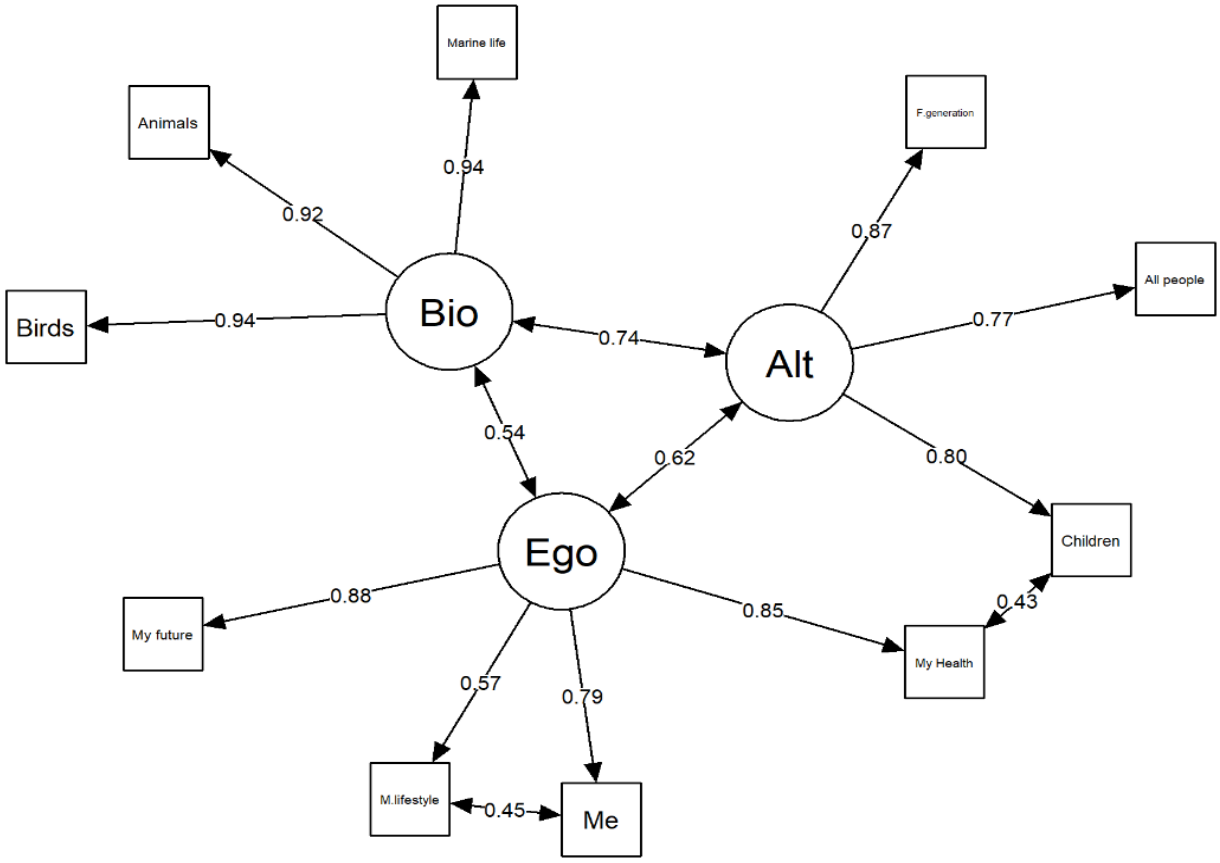
Domain	Item	Mean	SD	Cronbach's α if item deleted
Egoistic (α= .87)				
	My lifestyle	5.06	1.68	.92
	Me	5.49	1.53	.91
	My health	6.05	1.27	.91
	My future	5.98	1.31	.91
Altruistic (α= .85)				
	P. country [a]	5.79	1.33	.85
	All people	6.32	1.05	.79
	Children	6.39	1.08	.80
	F. Generations	6.62	0.94	.81
Biospheric (α= .94)				
	Plants [a]	6.12	1.23	.95
	Animals	6.43	1.02	.92
	Marine life	6.46	1.02	.92
	Birds	6.33	1.13	.91

Note. [a] These items where removed from the final model.

We inspected the highest modification values and selected two suggestions that had some theoretical grounding. We included in the model the estimation of residual correlations between *lifestyle* and *me* and between *health* and *children.* We then removed two items that were suggested by the modification indices to load on more than one factor: *plants* and *country.* The final resulting model had an acceptable fit: χ^2 (30) = 196.964, CFI = 0.978, RMSEA = 0.077 [0.067, 0.087], SRMR = 0.028. The final model structure with standardized loadings is presented in Figure 2. The final model had good reliability (see Table 1).

Figure 2

Final Three-Factor Model for Environmental Concerns Obtained in our Sample (N = 937).



Note. Ego = Egoistic; Alt = Altruistic; Bio = Biospheric.

1.2. Climate Change Beliefs

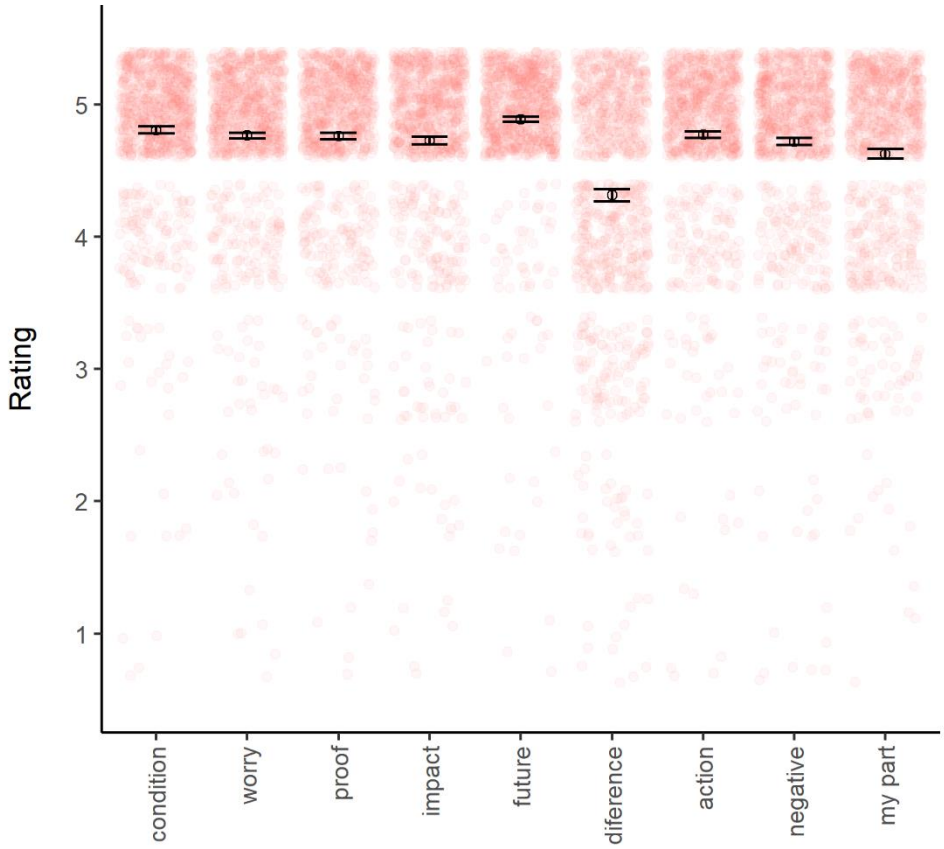
Our climate change belief items were taken from the Climate Change Attitude Survey (Christensen & Knezek, 2015). In this study, an exploratory factor analysis suggested that the data was explained by two factors: climate change beliefs and intentions to make a difference. We used nine items assumed to measure climate change beliefs. Figure 3 presents the individual and average ratings for each item. Table 2 presents descriptive statistics and reliability scores.

We conducted a CFA on the data using the one-factor structure assumed in the literature, however the model fit was poor: $\chi^2(27) = 591.856$, CFI = 0.872, RMSEA = 0.149 [0.139, 0.160], SRMR = 0.079. We then evaluated the suggested modification indices, which pointed towards the inclusion of residual covariations between the items *difference* and *my part*, both related to the importance of individual contribution in fighting climate change,

and between *condition* and *proof*, items about the factual existence of climate change. With the inclusion of these residual covariations, model fit became acceptable: χ^2 (25) = 158.392, CFI = 0.970, RMSEA = 0.075 [0.064, 0.087], SRMR = 0.035. The model structure is presented in Figure 4.

Figure 3

Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for each Item in the Climate Change Belief Scale.



Note. Error-bars represent 95% within-subjects confidence intervals.

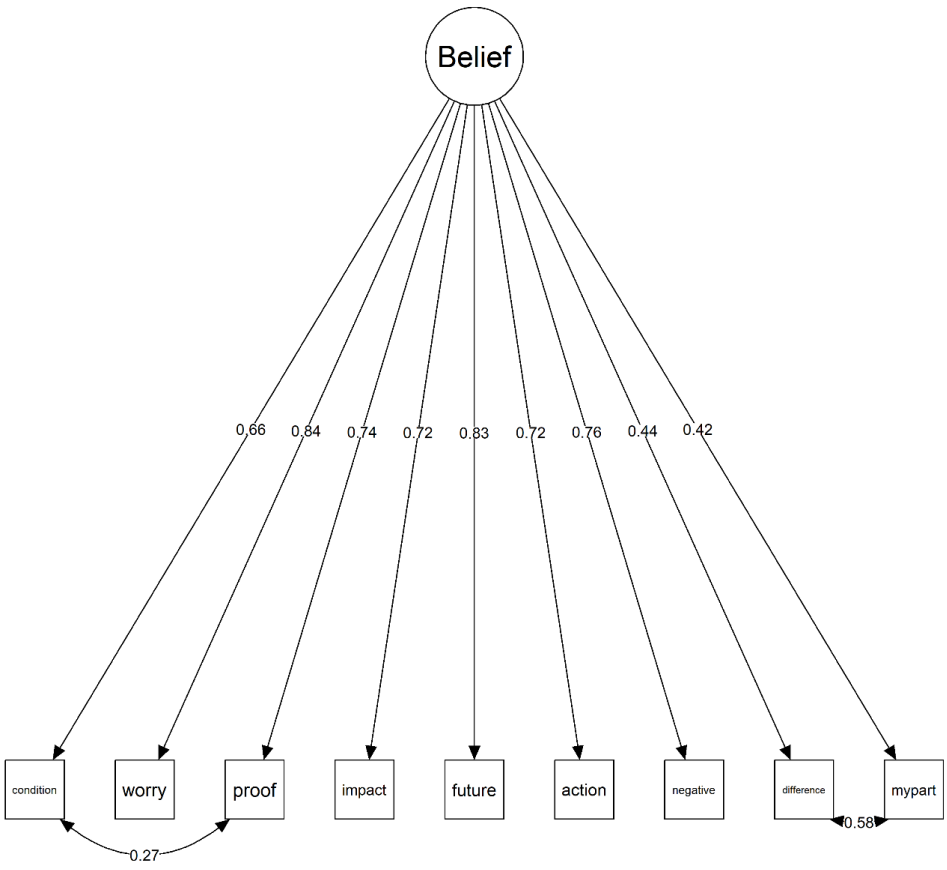
Table 2

Descriptive Statistics for Climate Change Belief Scale and Reliability Scores for all Items.

Item	Mean	SD	Cronbach's α if item deleted
condition	4.81	0.53	.87
worry	4.77	0.60	.85
proof	4.76	0.59	.86
impact	4.73	0.66	.86
future	4.89	0.47	.86
difference	4.31	0.88	.89
action	4.77	0.59	.86
negative	4.72	0.65	.86
my part	4.63	0.67	.88
Total	4.71	0.64	.88

Figure 4

One-Factor Model for Climate Change Beliefs obtained in our Sample (N = 937).

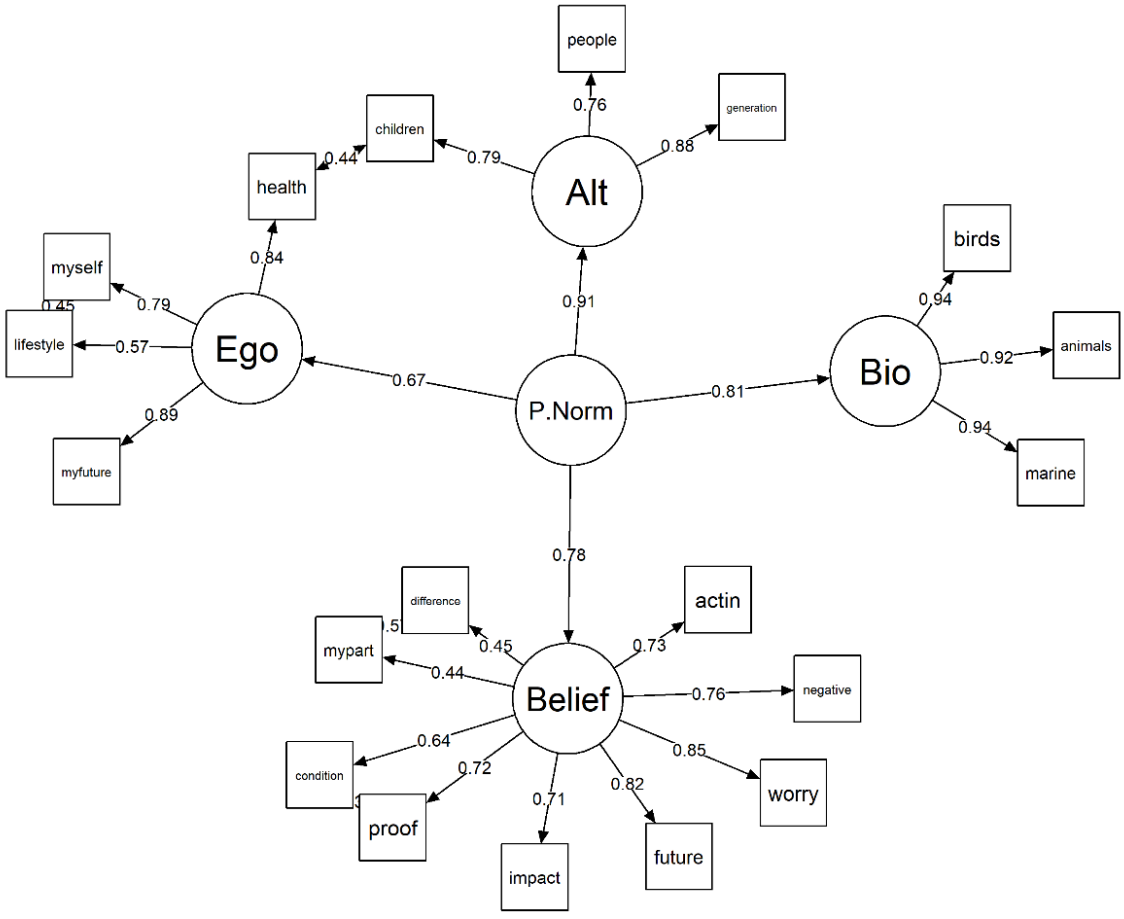


1.3. The Personal Norms Model

Following the more commonly used environmental behavior models (Klöckner, 2013), we operationalized personal norms as being activated by climate-change related beliefs and environmental concerns. To test this model, we utilized a second-order CFA model, in which Personal Norms was a second order factor where the factors of Egoistic, Altruistic, and Biospheric values, on the one hand, and Beliefs, on the other hand, loaded. The model had an acceptable fit: χ^2 (144) = 662.339, CFI = 0.959, RMSEA = 0.062 [0.057, 0.067], SRMR = 0.051. Figure 5 presents the model and the loadings of the latent variables in the second order factor.

Figure 5

Second-Order Model for Personal Norms Obtained in our Sample (N = 937).



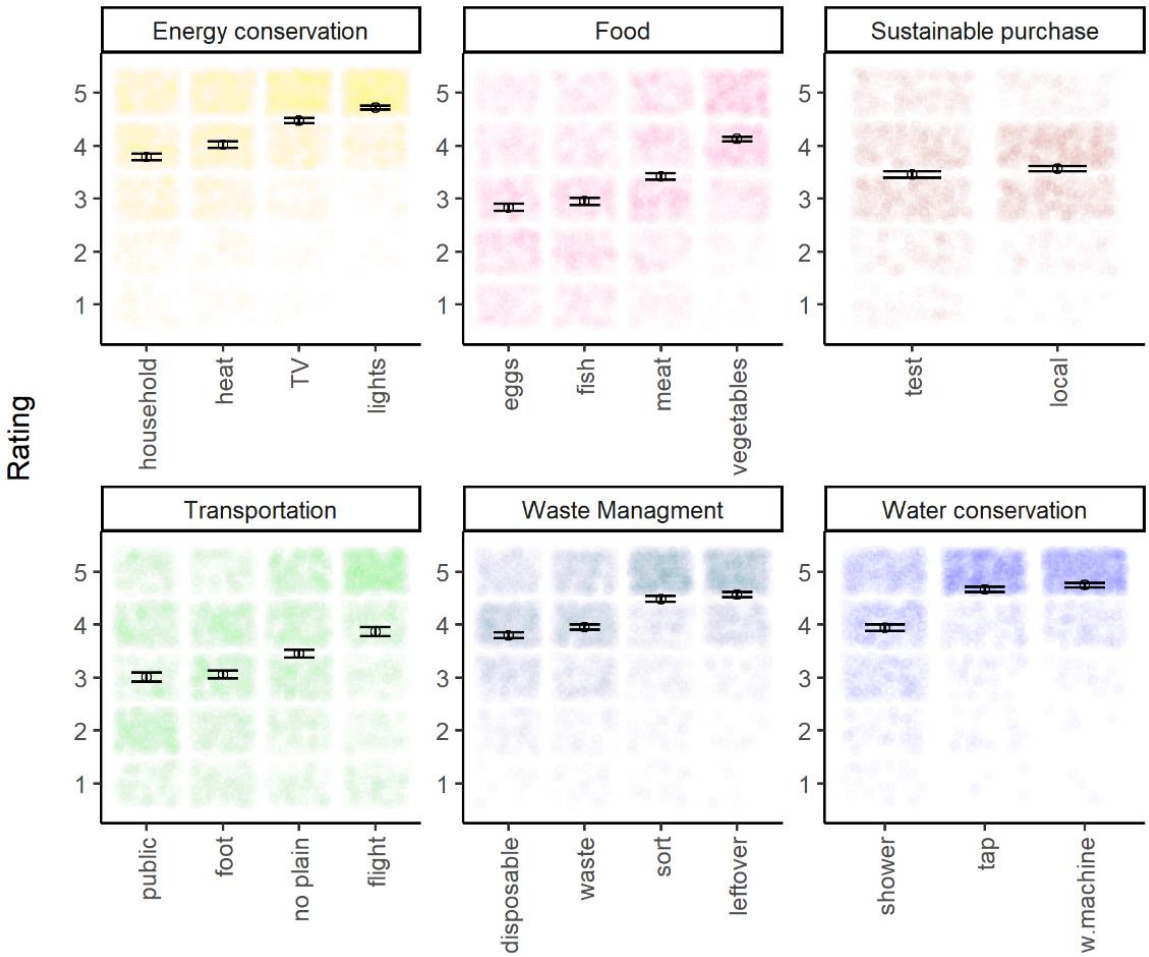
2. Pro-Climate Behavior

We assessed the self-reported frequency of environmental behaviors in six domains: energy conservation, food, sustainable purchase, transportation, waste management, and water conservation. We asked participants to judge the frequency of these behaviors before

the COVID pandemic and currently (which was during the pandemic: end of 2021 to the first months of 2022). For the current analysis, we selected only the frequency of current behaviors. Figure 6 displays individual and averages ratings for the items in each of the six domains of environmental behavior. Table 3 presents descriptive statistics and reliability measures.

Figure 6

Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for Each Item of the Pro-Environmental Behavior Scale.



Note. Error-bars represent 95% within-subjects confidence intervals.

Behaviors related to transportation (M = 3.34, SD = 1.35), food (M = 3.33, SD = 1.28), and sustainable purchases (M = 3.51, SD = 0.96) were less frequent than behaviors related to waste management (M = 4.20, SD = 0.96), energy (M = 4.25, SD = 0.98) and water conservation (M = 4.45, SD = 0.88).

Table 3

Descriptive Statistics and Reliability Scores for the Pro-Environmental Scale Items.

Domain	Item	Mean	SD	Cronbach's α if item deleted
Energy Conservation (α= .47)		4.25	0.98	
	household[a]	3.79	1.13	.36
	heat[a]	4.02	1.02	.48
	TV	4.48	0.83	.38
	lights	4.72	0.55	.40
Food (α= .79)		3.33	1.28	
	eggs	2.83	1.27	.73
	fish	2.95	1.28	.73
	meat	3.42	1.22	.70
	vegetables[a]	4.12	0.91	.80
Sustainable Purchase (α= .37)		3.51	0.96	
	test[a]	3.46	1.10	.33
	local	3.57	0.79	.17
Transportation (α= .54)		3.34	1.35	
	public	3.01	1.30	.52
	foot	3.06	1.24	.47
	no plain	3.45	1.29	.50
	flight	3.87	1.41	.37
Waste Management (α= .63)		4.20	0.96	
	disposable	3.80	0.92	.56
	waste	3.95	0.98	.44
	sort	4.48	0.95	.56
	leftover[a]	4.57	0.72	.64
Water Conservation (α= .38)		4.45	0.88	
	shower[a]	3.94	1.02	.24
	tap	4.66	0.74	.30
	w. machine[a]	4.74	0.58	.30

Note. [a] These items where removed from the final model.

We performed an exploratory factor analysis (EFA) to find a potential factorial structure describing the frequency of environmental behaviors. We used principal axis factor analysis to extract factors for its relative tolerance of nonnormality, and a Promax rotation since the factors are assumed to be correlated (Watkins, 2018). A scree-plot (see Appendix

F) indicated that five factors should be retained accordingly to the guidelines by Williams et al. (2010). Items were assigned to the factors where they had the strongest loadings - items with loadings below 0.4 were removed. This led to the removal of the following items: *heat, household, vegetables, test, shower, w. machine*. After the removal, no loadings were salient on more than one factor (see Appendix F).

Items coded *waste, sort, disposable* and *local* were loaded on Factor 1, which we called "Reuse" since they were related to sustainable waste management and investment in local products. Items *public* and *foot* where load on Factor 2, called "Driving" since they refer to the reduction of driving habits. Items *no plain* and *flight* loaded on Factor 3, "Flying", because they mentioned reducing flying distances or choose other transports instead of flying. Items *lights, TV* and *tap* loaded on Factor 4, called "Saving" due to their relation to actions that save water or electricity. Finally, items *meat, fish* and *eggs* loaded on Factor 5, called "Food", because they were items about changes in food choices (see Appendix C for the respective items). We ran a CFA to test how the model obtain by the EFA would fit our data. Model fit was acceptable, χ^2 (71) = 257.818, CFI = 0.923, RMSEA = 0.053 [0.046,0.60], SRMR = 0.062. The obtained factor structure with standardized loadings is presented in Figure 7. Cronbach's alpha reliability scores for the final scale where the following: Reuse (α= .65), Saving (α=.49), Food (α=.80), Flying (α= .62), Driving (α= .52).

3. Personal Norms and Environmental Action

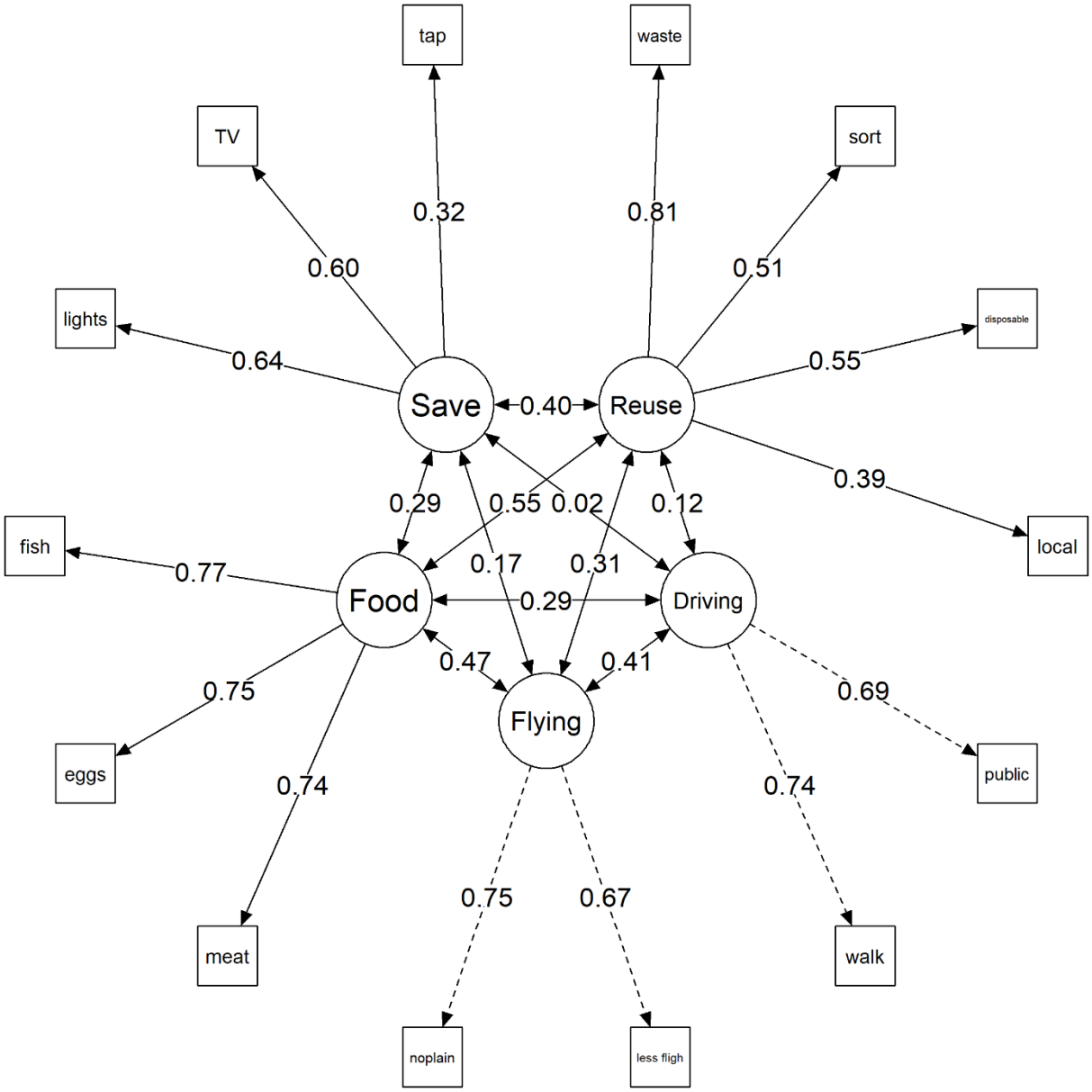
To assess the relationship between personal norms and pro-environmental behaviors, we computed a linear regression where the latent frequency of each type of pro-environmental behavior was predicted by personal norms. To capture only the effect of personal norms on each of the behaviors, we set the pro-environmental behavior factors to be uncorrelated to each other. The model had a good fit: χ^2 (486) = 1729.214, CFI = 0.920, RMSEA = 0.052 [0.050,0.55], SRMR = 0.063.

There was a significant positive effect of personal norms on the frequency of Reuse (β = .48, z = 10.64, p < 0.001, R^2 = .23), Driving (β = .10, z = 2.42, p = .015, R^2 = .01), Flying (β = .33, z = 8.04, p < 0.001, R^2 = .11), Saving (β = .30, z = 6.21, p < 0.001, R^2 = .09), and Food (β = .42, z = 10.22, p < 0.001, R^2 = .17). We compared the size of the beta-regression weights for the different behaviors, reflecting the impact of the personal norms on the behavior frequency. The highest beta was for Reuse which had a significantly higher

beta than Saving (p = .001) and Flying (p = .003), but not compared to Food (p = .224). Beta values for Food did not significantly differ from Flying (p = .06) and Saving (p = .027). Flying and Saving did not significantly differ from each other (p = .617). The Beta for Driving was significantly lower than that of all the others' behaviors.

Figure 7

One-Factor Model for Pro-environmental Behaviors and Standardized Parameter in our Sample (N = 937).

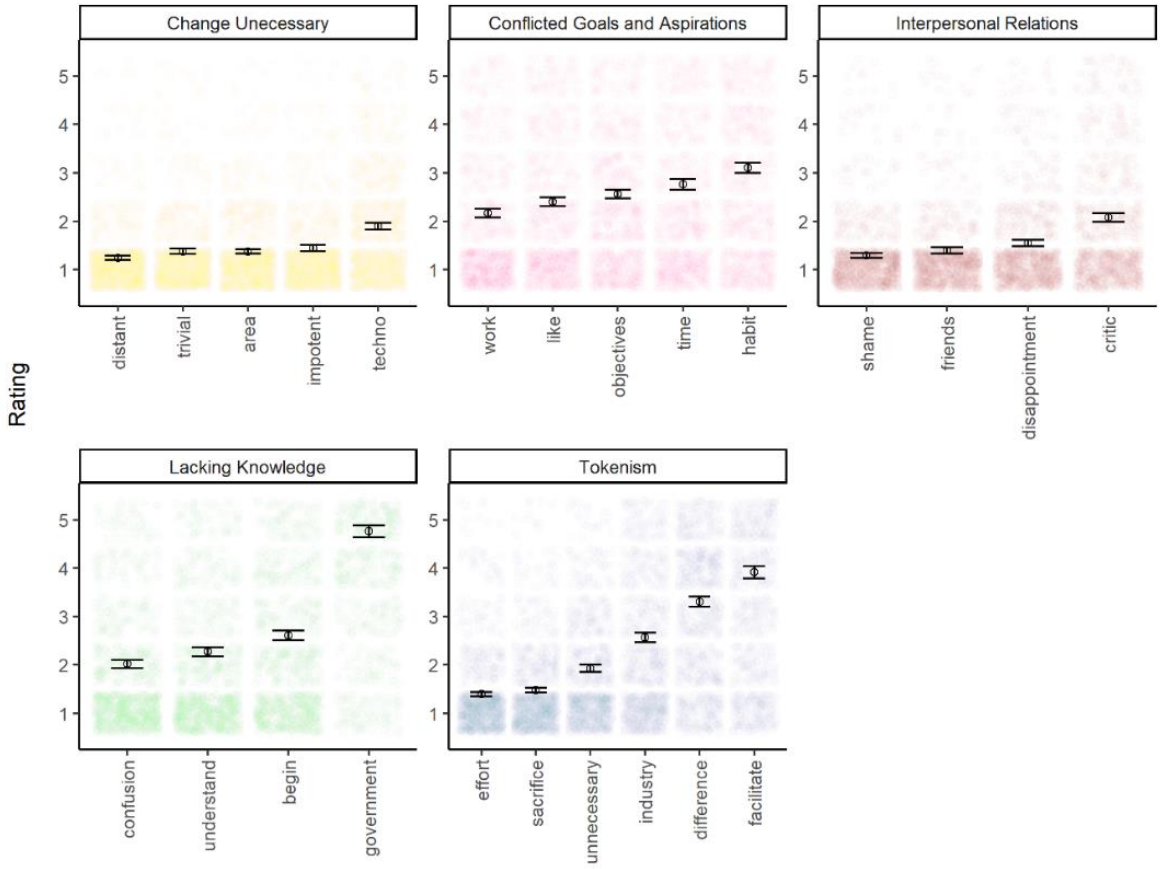


4. Psychological Barriers

We performed a CFA to assess if the data of our sample would fit Lacroix et al. (2019) proposed five-factor structure for the Dragons of Inaction Psychological Barriers Scale. In our scale, we included two extra items (government in Lacking Knowledge and facilitate in Tokenism) that were not part of the final factorial model of Lacroix et al. (2019) but were recommended to be used when the government plays an important part in climate-change mitigation. The five factors were *Change Unnecessary* (*M* = 1.47, *SD* = 1.01), *Conflicting Goals and Aspirations* (*M* = 2.60, *SD* = 1.79), *Interpersonal Relations* (*M* = 1.58, *SD* = 1.24) *Lacking Knowledge* (*M* = 2.92, *SD* = 2.07), and *Tokenism* (*M* = 2.43, *SD* = 1.81). Figure 8 presents individual and group average ratings for each item in each of the five originally proposed barriers. Table 4 presents descriptive statistics and reliability scores.

Figure 8

Individual Ratings (Small Jittered Dots) and Group Average (Large Black Dots) for each Item of the Dragons of Inaction Psychological Barrier Scale.



Note. Error-bars represent 95% within-subjects confidence intervals.

Table 4

Descriptive Statistics for the Dragons of Inaction Psychological Barrier Scale Items and Reliability Scores for all Items and Items Included in the Final Model.

Domain	Item	Mean	SD	Cronbach's α if item is deleted
Change Unnecessary (α= .80)		1.47	1.01	
	distant	1.24	0.72	.75
	trivial	1.37	0.96	.73
	area	1.38	0.86	.75
	impotent	1.45	1.07	.78
	techno	1.90	1.25	.83
Conflicting Goals and Aspirations		2.60	1.78	
(α= .79)	work	2.17	1.65	.73
	like	2.40	1.68	.74
	objectives	2.56	1.64	.73
	time	2.77	1.91	.78
	habit	3.11	1.91	.76
Interpersonal Relations (α= .72)		1.58	1.24	
	shame	1.30	0.83	.69
	friends	1.40	1.08	.69
	disappointment	1.55	1.14	.57
	critic	2.08	1.61	.67
Lacking Knowledge (α= .62)		2.92	2.07	
	confusion	2.02	1.53	.51
	understand	2.27	1.70	.39
	begin	2.61	1.80	.43
	government[a]	4.76	2.00	.80
Tokenism (α= .65)		2.43	1.81	
	effort	1.40	1.08	.60
	sacrifice	1.48	0.97	.58
	unnecessary	1.93	1.37	.60
	industry	2.57	1.79	.59
	difference	3.31	1.75	.63
	facilitate[a]	3.92	2.13	.66

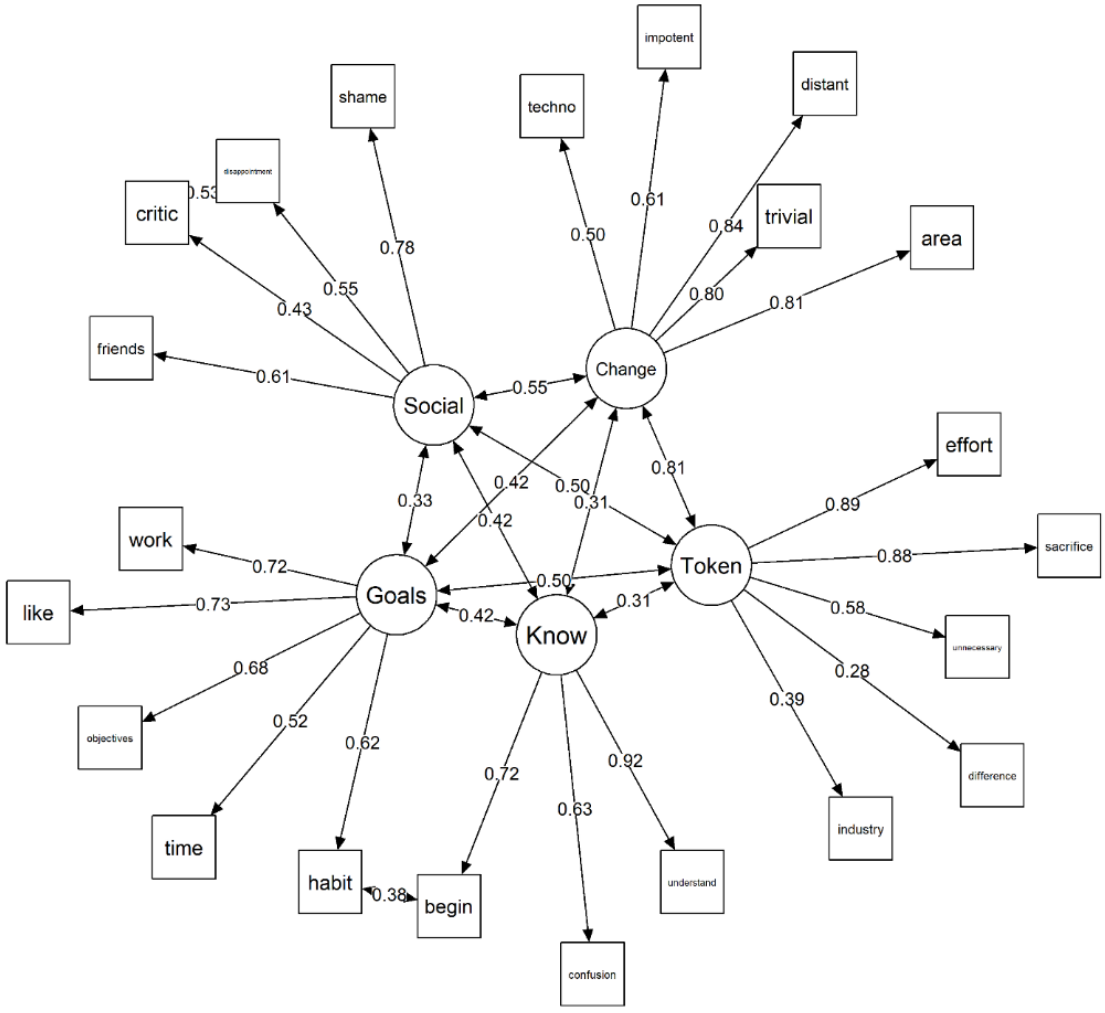
Note. [a] These items where removed from the final model.

Model fit was not acceptable, χ^2 (242) = 2075.777, CFI = 0.803, RMSEA = 0.090 [0.086, 0.94], SRMR = 0.082. To improve model fit, we first removed items with low loadings, and then added some of the suggested residual correlations identified by the modification index's function. The two government-related extra items had very low loadings (*government* = 0.15 and *facilitate* = 0.30) and did not seem to fit with the categories

allocated by Lacroix et al. (2019), hence they were removed. We then included residual correlations between the item's *critics* and *disappointment* and between *habits* and *beginning*. These modifications produced a model with an acceptable fit: χ^2 (197) = 978.974, CFI = 0.909, RMSEA = 0.065 [0.061,0.69], SRMR = 0.061). Figure 9 displays the structure of the Psychological Barrier model in our sample.

Figure 9

Five-Factor Structure of the Psychological Barriers in our Sample (N=937).



Before answering the scale, participants had to choose one of five environmental behaviors belonging to the main domains of environmental action. Of the 937 participants, 205 chose "*taking public transport or cycling, rather than driving*"; 239 chose "*eating less meat*"; 246 chose "*making more eco-friendly purchases*"; 125 chose "*recycling all items*

permitted by their local programs"; and 122 chose "*reducing water use (e.g., taking shorter showers, repairing leaks*". Unfortunately, due to a coding mistake, the "*wearing a sweater rather than turning up the heat in the winter*" used by Lacroix et al. (2019) was not included in the questionnaire. The chosen behaviors that were important but infrequent align with the reported frequency of environmental behaviors from our pro-environmental behaviors scale and also with the ones observed in Lacroix et al. (2019).

5. Moderator Effect of Psychological Barriers

Finally, our last aim was to assess if the Psychological Barriers described above moderated the influence of personal norms on the frequency of environmental behaviors. For this, we performed a latent moderation analysis using a factor score procedure (Pieters et al., 2022). Although this approach neglects measurement error, given our sample size (N = 937) estimation error for the correlations in our sample should be low (Schönbrodt & Perugini, 2013). Pieters et al. (2022) simulations also show that this method performs relatively well compared to latent product method even under sub-optimal conditions such as with reliabilities lower than 1, null to medium correlations between the predictor and the moderator, and unequal factor loadings.

The factor scores analysis involves three steps. First, we estimated the individual latent scores for a model of each environmental behavior separately. These latent scores served as our latent dependent variable in the moderation analysis. Fit indices for each model are in Table 5. We did not include the Driving factor in this analysis due to poor model fit. Second, we estimated individual factor scores for our latent predictors, namely personal norms and psychological barriers, in a single model in which we allowed them to correlate. The later model had reasonable fit, χ^2 (1360) = 4335.150, CFI = 0.881, RMSEA = 0.048 [0.047,0.050], SRMR = 0.070. The correlation estimate between personal norms and psychological barriers was r = – 0.603.

We entered the factor scores in a linear regression model of the following form:

$$Y(Behavior) = X(Personal\ Norms) + Z\ (Barriers) + XZ$$

Table 6 contains the statistics for each regression model. Psychological Barriers was found to be a significant moderator for the relation between personal norms and the frequency of behaviors related to Reuse, Food, and Saving. Psychological Barriers did not significantly moderate the relation between personal norms and the frequency of behaviors related to Flying.

Table 5

Model Fit Indices of each Environmental Behavior independently.

Indices	Reuse	Saving	Food	Flying	Driving
χ^2	6.097	0	0	7.384	44.223
df	2	0	0	1	1
CFI	0.922	1	1	0.969	0.641
RMSEA	0.47	0	0	0.083	0.215
SRMR	0.016	0	0	0.071	0.185

Table 6

Regression model results for each pro-environmental behavior.

Effect	Estimate	*SE*	t	*p*
Reuse				
Intercept	- .030	.028	- 1.056	.291
Personal Norms	.395	.046	8.638	< .001
Psychological Barriers	- .039	.040	- 0.994	.320
Moderation	- .051	.016	-3.099	.002
Food				
Intercept	- .031	.029	-1.075	.282
Personal Norms	.328	.047	6.923	<.001
Psychological Barriers	-.126	.041	-3.056	.002
Moderation	-.053	.017	-3.154	.002
Flying				
Intercept	-.003	.026	- 0.123	.901
Personal Norms	.272	.042	6.426	<.001
Psychological Barriers	.064	.037	1.740	.082
Moderation	-.005	.015	-0.362	.718
Saving				
Intercept	-.026	.025	-1.020	.308
Personal Norms	.214	.047	5.260	<.001
Psychological Barriers	- .022	.035	- 0.621	.534
Moderation	-.043	.014	-2.994	.003

Discussion

The purpose of this study was, first, to gain a better understanding of environmental concerns and climate change beliefs, engagement in different domains of environmental action, and finally psychological barriers to pro-environmental action in Portugal. For that, we translated and adapted several scales to Portuguese and assessed the factorial structure of these constructs. Second, we conceived a model where environment-related personal norms were a latent construct activated by climate change beliefs and environmental concerns. We used this model to assess if environmentally favorable personal norms – i.e., high environmental concerns and belief in anthropogenic climate change - would relate to higher frequency of environmental action. Finally, we examined if psychological barriers moderated the relation between personal norms and behavior frequency in each domain.

We observed high levels of both environmental concerns and climate change beliefs. Regarding behaviors, there was a distinction in the frequency of action between behaviors related to transportation (e.g., walking or taking the bus instead of driving), food (e.g., eating less meat), and sustainable purchase (e.g., buy local products) which were reportedly done less frequently than behaviors related to water conservation (e.g., closing the tap while brushing my teeth), waste management (e.g., separate the various types of garbage for recycling), and energy conservation (e.g., turning off the lights when leaving the room). As for the psychological barriers, generally conflicting goals and aspirations (e.g., concerns that the change would take much time), lacking knowledge (e.g., not understating enough of the detail on how to make the change), and tokenism (e.g., current pro-environmental efforts make further change unnecessary) presented higher scores than change unnecessary (e.g., environmental problems are far in the future, so there is no need to act) and interpersonal relations (e.g., worried about friends disapproval if the change was made).

Whereas past researchers have found the presence of an incongruity between the recognition of environmental problems as a severe threat and the frequency of pro-environmental action (Flynn et al., 2009; Grandin et al., 2021; Kollmuss & Agyeman, 2002), the present study has shown a positive and significant effect of environmentally favorable personal norms on the self-reported frequency of different pro-environmental action domains, whereas the direct effect of psychological barriers was generally not significant. However, these effects differed across different environmental action domains, showing that behavioral antecedents might not be the same for every type of behavior. Contrary to our

hypothesis, we did not observe that the effect of personal norms was significantly weaker for the harder behaviors, except for driving habits.

1. The Structure of Personal Norms

In our study, environmental concerns and climate change beliefs were evaluated as manifestations of personal norms. In this section, we will describe how these two concepts manifested in our sample.

Schultz (2001) proposed that environmental concerns could be distinguished as Egoistic, Altruistic, or Biospheric. In our study, all three types of concerns had high mean scores, with biospheric and altruistic concerns presenting higher mean scores than egoistic ones. According to the literature, biospheric and altruistic concerns have stronger relations to pro-environmental action (Schultz, 2001; Tolppanen & Kang, 2021). However, we did not analyze the effect of each concern separately. Future research on the relation of environmental concerns and personal norms might probe deeper in that subject.

Schultz's (2001) proposed structure for environmental concerns was recently found to still be a valid measure of environmental concerns with many benefits and good model fit (Cruz & Manata, 2020). Similar results were found in our analysis. The structure described relatively well the data of our sample except for the items related to the concern for "*plants*" and for "*all the people in my country*" which had to be removed to obtain a reasonable fit. Evidence shows that people often prefer animals over plants which can reflect greater concern for animals (Balding & Williams, 2016; Wandersee, 1986). Since the other three items in the Biospheric factor related to different types of animals, this may explain why plants do not seem to load well in this factor. The concern for all the people in the country was removed since it related poorly to the altruistic concerns, and further analysis suggested a significant relation to the egoistic concerns. This might be explained by the theory of *Identity Fusion* (Swann et al., 2014), where there is a union between social identity and personal identity.

With regards to beliefs, the one-factor structure for the climate change beliefs subscale employed in the present study was in line with what Christensen and Knezek (2015) proposed. Overall mean scores show little denial about climate change in our sample. However, two items (difference and my part) stood out as having the lowest scores: "*The actions of individuals can make a positive difference in global climate change*" and "*I can*

do my part to make the world a better place for future generations". These items can be related to believing in the capability of the individual to mitigate climate change which might be associated with self-efficacy beliefs. Self-efficacy beliefs were shown before to be related to pro-environmental attitudes and behaviors (Bostrom et al., 2019; Faraz et al., 2021; Tabernero & Hernández, 2011), and our study hinted at a lower presence of said beliefs in our sample, and also that these two items had a covariation that was not explained by its relation to the general belief factor (indicating that they partially measure something additional). Since there seems to be a general acceptance of anthropogenic harmful climate change, future research might continue to invest in studying self-efficacy beliefs to address if they are specifically related to pro-environmental action.

Both environmental concerns and climate change beliefs where found to have a valid association with personal norms akin to what was proposed by Klöckner (2013). Personal norms, seemed to be connected the most to altruistic concerns and the least to egoistic concerns, nonetheless the relation between personal norms and egoistic concerns was not negative as in the *Comprehensive Action-Determination Model (*Klöckner, 2013).

2. Pro-environmental Behavior

To measure the frequency of pro-environmental behaviors in all relevant domains, we had to devise a scale of our own, combining items from different scales and questionnaires. Our frequency of pro-environmental results is consistent with the claim that behavioral action can be divided into high and low difficulty behaviors since the behaviors domains that were reportedly done less frequently were also the ones characterized by Lacroix et al. (2019) as high-difficulty behaviors. These behaviors were: transportation, food, and sustainable purchase.

After performing an exploratory factor analysis, we obtained a model that included five domains: Reuse, Food, Saving, Flying, and Driving. Yet, some items did not load on any factor, and some factors had a low number of items (e.g., flying and driving). Future studies may need to try to measure these domains with more items. Additionally, more specific inquiries to measure pro-environmental behavior with a more continuous measure may be desirable to avoid ceiling effects (e.g., *"how many meals per day include meat on it?"; "when going to work/school, how many times would you drive instead of taking public transportation?"*).

We observed positive intermediary correlations between the latent domains of environmental action. The highest was between Food and Reuse (r = .55) and the lowest between Driving and Saving (r = 0.02). We should note that reliability of most items was relatively low, and hence future work is therefore needed to more robustly measure the frequency of pro-environmental action.

3. Psychological Barriers

The Lacroix et al. (2019) five-factor model for psychological barriers to climate change mitigation was validated for our sample. In our sample Lacking Knowledge, Tokenism and Conflicting Goals where the most prevalent barriers followed by Interpersonal Relations and Change Unnecessary.

The two government-related items had to be removed to attain a good model fit, the same happened in the original study and adaptations (Gutiérrez & Sofía, 2020). Interestingly, these two items which were related to the idea that the government should be the one inciting action had the higher mean scores and, as such, the they represented the largest impeding reported barrier. Yet, they did not seem related to the other psychological barriers nor formed a consistent factor of their own. This may suggest that answers to this question are not well explained by a single factor. An Australian study by Fielding and Head (2012) showed that attributing greater responsibility to the government for environmental protection was related to more negative environmental intentions and behavior than attributing responsibility to the community. Hence, future research is needed to develop more robust ways to study this barrier.

In our model the correlations between the five barriers display were similar to Lacroix et al., (2019) and Gutiérrez & Sofía (2020). In the three studies, Tokenism and Change Unnecessary appear as very correlated; one possible reason could be that Tokenism fundamentally represents a lack of necessity to change (e.g, “I previously have made important effort in this, so there is no need for me to make further changes”). Another recurring aspect is that Lacking Knowledge usually has the lowest relations with all other factors. This may be because, unlike other factors, Lacking Knowledge does not necessarily reflect an unwillingness to change.

Finally, due to time constraints, our analysis did not consider differences between specific behaviors. Lacroix et al. (2019) showed that the relative importance of each barrier

varied across the selected behaviors (i.e., the behavior people had in mind when responding to the scale). For example, the Interpersonal Relations barrier was strongest for eating less meat, the Conflicting Goals and Aspirations barrier for driving less, closely followed by eating less meat, and the Lacking Knowledge barrier is strongest for sustainable purchases. In terms of future research, it would be useful to extend the current findings by examining the specific impact of each barrier for the different pro-environmental behaviors selected.

4. Relations Between Personal Norms, Behavior, and Psychological Barriers

This study was able to validate a model that relates personal norms with frequency of pro-environmental behavior and psychological barriers. Akin to traditional models, we found an association between environmentally favorable personal norms and the frequency of pro-environmental behavior across all our tested domains. We highlight that while this relation was significant and positive in all domains, its strength varied, pointing to the idea that not all forms of environmental action can be explained the same way.This was also hinted by Casaló et al. (2019), which compared waste-related behaviors with energy conservation. We showed that the effect of personal norms was more substantial for behaviors related to reusing and food and the less strong for driving less. These results might point to other stronger motives behind driving habits that are not present in our analysis. For example, Innocenti et al. (2013) found that people are biased against public transportation, preferring to travel by car even when the costs are higher. A possible explanation is that cars and driving symbolize freedom, independence, status, and a pleasurable activity (Steg, 2003). Other factors, such as travel time, which is longer for public transportation, are also crucial when choosing a traveling mode (Liao et al., 2020).

Psychological Barriers moderated the effect on Personal Norms on behavior domains like Reuse, Food, and Saving. The higher the perception of psychological barriers, the smaller the effect of personal norms on pro-environmental behavior. The only domain in which this moderation was not significant was for Flying. Unfortunately, the model for Driving was not adequate for the analysis.

The moderation effects observed here is in line with our predictions that psychological barriers may partly explain the “value-action gap”. Hence future studies should not only focus on increasing positive attitudes towards the environment but also in unlocking the psychological barriers that prevent concerned individuals from acting.

Interestingly, only for Food we observed a direct significant negative prediction of psychological barriers in addition to the moderation effect. Food choices can be considered a high-difficulty behavior (Lacroix et al., 2019) and, as such, be more prone to the negative effect of psychological barriers than other low-difficulty behaviors like Reusing and Saving. Note that this main effect also approached significance for Flying, another high-difficulty behavior.

5. Limitations and Future Research

One of the limitations of this study is that the sample was concentrated mainly in Porto and Lisbon, coastal regions with the highest population density in the country (PORDATA, 2022). Future studies should be focused on reaching a higher diversity of regions, thereby collecting data of a more representative sample.

Collecting data via a survey has its limitation. Self-reported measures of pro-environmental behavior might not entirely reflect authentic environmental action as it may depend on the participant's interpretation of the question and recollection of their activity (Lange & Dewitte, 2019) or be influenced by social desirability (Vesely & Klöckner, 2020). Answers to the other scales could also be influenced by desirability and acquiescence bias, especially the Environmental Concern Items, where there could be a tendency to be highly concerned about every item. A possible solution would be to employ a ranking methodology when collecting data about environmental concerns.

We did not consider other factors that could be important in explaining pro-environmental frequency variabilities, like contextual factors that can minimize the influence of personal norms (Corraliza & Berenguer, 2000), such as lack of infrastructures (Steg & Vlek, 2009) or socioeconomic status (Eom et al., 2018). Even though we collected socioeconomic status data, we did not include them in the analysis due to time constraints.

Before answering the DIPBS, participants had to choose a behavior to serve as a reference, and due to a coding mistake, we did not include the behavior related to energy conservation. Time constraints again did not permit us to employ a multigroup factorial analysis for the psychological barriers and test if the model structure would be the same for all the chosen behaviors. As such, we did not consider those chosen behaviors when measuring the moderating effect of psychological barriers. Instead, we use an aggregated version of all answers.

Conclusion

The present study enhanced our understanding of the relationship between personal norms, psychological barriers, and pro-environmental action in Portugal and how each action domain might be influenced by personal norms and the perception of psychological barriers. This knowledge will help to plan more focused and efficient interventions. Behaviors related to reusing and saving can benefit from an intervention on personal norms, while not ignoring the potential effects of psychological barriers. Incentive changes in diet interventions would need to tackle psychological barriers to be more efficient. Regarding changing flying habits, personal norms appeared to be an important part. Finally, driving seems to be the most resistant of all behaviors being less related to personal norms.

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Appendix

Appendix A

Table S1

Original Environmental Concern Items (Schultz, 2001) and our Translation to Portuguese.

Instructions and items in English	Instruction and items in Portuguese
Please rate each of the following items from 1 (not important) to 7 (supreme importance) in response to the question: I am concerned about environmental problems because of the consequences for…	Indique, por favor, a importância dos itens abaixo numa escala de 1 (nada importante) a 7 (extrema importância), em relação à seguinte afirmação: "Eu preocupo-me com as questões ambientais por causa das suas consequências para…"
Egotistical Concerns	**Preocupações Egoístas**
1.My lifestyle	1.O meu estilo de vida
4.Me	4.A minha pessoa
7.My health	7.A minha saúde
10.My future	10.O meu futuro
Altruistic Concerns	**Preocupações Altruístas**
2.The people in my country	2.As pessoas do meu país
5.All people	5.Todas as pessoas
8.Children	8.As crianças
11.Future Generations	11.As gerações futuras
Biospheric Concerns	**Preocupações Biosféricas**
3.Plants	3.As plantas
6.Animals	6.Os animais
9.Marine Life	9.A vida marinha
12.Birds	12.As aves

Note. The factors highlighted in bold where not revealed to the participants. The numeration behind each item represents the order they appeared on the online questionnaire.

Appendix B

Table S2

The Original Climate Change Attitude Survey and the Translation to Portuguese.

Name	Items in English	Instruction and items in Portuguese
		Indique, por favor, a sua posição em relação às afirmações listadas abaixo utilizando a seguinte escala: 1 = discordo totalmente 2 = discordo 3 = não discordo, nem concordo 4 = concordo 5 = concordo totalmente
condition	1. I believe our climate is changing	1. As condições climáticas estão a mudar.
worry	2. I am concerned about global climate change	2. Preocupam-me as alterações climáticas globais.
proof	3. I believe there is evidence of global climate change	3. As alterações climáticas globais estão cientificamente comprovadas.
impact	4. Global Climate change will impact our environment in the next 10 years.	4. As alterações climáticas vão ter impacto no nosso meio ambiente nos próximos 10 anos.
future	5. Global Climate change will impact future generations	5. As alterações climáticas vão ter um impacto nas gerações futuras.
diference	6. The actions of individuals can make a positive difference in global climate change	6. As ações individuais podem fazer uma diferença positiva quanto às alterações climáticas.

Name	Items in English	Instruction and items in Portuguese
humans	7. Human activities cause global climate change	7. As atividades humanas são uma das causas das alterações climáticas globais.
negative	8. Climate Change has a negative effect on our lives	8. As alterações climáticas têm um efeito negativo nas nossas vidas.
my part	9. I can do my part to make the world a better place for future generations	9. Posso fazer a minha parte para tornar o mundo melhor para as gerações futuras.

Note. The Name column refers to the nomenclature use to describe the items throughout the dissertation. The numeration behind each item represents the order they appeared on the online questionnaire.

Appendix C

Table S3

Frequency of Ecological Behaviour Scale in Portuguese and Original Items that Inspired the Creation of the Scale in Portuguese.

Name	Items in English	Instruction and items in Portuguese
		A seguir será apresentada uma lista de comportamentos que têm um impacto no meio ambiente. Por favor, indique a frequência com que realiza cada um deles utilizando a seguinte escala: (1) Nunca (2) Raramente (3) Algumas vezes (4) Frequentemente (5) Sempre
	Transportation	**Transportes**
public	1. Use public transportation?	1. Uso transportes públicos.
foot	7. Walk or cycle instead of driving?	7. Vou a pé ou de bicicleta em vez de ir de carro.
flight	13. Avoid long-distance flights (lasting six hours or more)?	13. Evito fazer voos de longa distância (6 horas ou mais).
no plain	18. Prefer to travel by train/bus/boat instead of plane?	18. Prefiro viajar de comboio, autocarro ou barco em vez de avião.

Name	Items in English	Instruction and items in Portuguese
	Energy Conservation	**Conservação de Energia**
lights	2. Turn of the lights when leaving the room?	2. Apago as luzes ao sair da sala/quarto.
heat	8. Cut down on heating or air conditioning to limit energy use?[1]	8. Reduzo o aquecimento ou o ar condicionado para poupar energia.
TV	14. Turn your TV off when leaving the room?	14. Desligo a televisão ao sair da sala/quarto.
household	19. Try to reduce your domestic energy consumption (insulate home, installed solar panels LED lights)?	19. Tento reduzir o consumo doméstico de energia (isolar a casa, instalar painéis solares, usar luzes LED)
	Water Conservation	**Conservação de Água**
shower	3. Limit your time in the shower in order to conserve water?	3. Reduzo o tempo no duche para poupar água.
w.machine	9. Wait until you have a full load to use the washing machine or dishwasher?[1]	9. Espero até ter a máquina cheia de roupa ou louça para a ligar.
tap	15. I close the tap while brushing my teeth	15. Fecho a torneira enquanto escovo os dentes.
	Food	**Alimentação**
meat	4. Reduce meat products in your diet (e.g., beef, pork, poultry)?	4. Reduzo o consumo de carne (vaca, porco, aves).
eggs	10. Reduce eggs and dairy products in your diet?	10. Reduzo o consumo de ovos e produtos lácteos.
fish	16. Reduce fish in your diet.?	16. Reduzo o consumo de peixe.
vegetables	20. Include vegetable and fruit consumption?	20. Aumento o consumo de legumes e frutas.
	Waste Managment	**Manutenção de Resíduos**
waste	5. I try to reduce the production of waste	5. Tento reduzir a produção de lixo.
sort	11. I separate the various types of garbage for recycling	11. Separo os vários tipos de lixo para reciclagem.
disposable	17. Cut down on your consumption of disposal items (e.g., plastic bags from the supermarket)?	17. Reduzo o uso de itens descartáveis (sacos de plástico, máscaras descartáveis).
leftover	21. Throw food leftovers to the garbage?	21. Aproveito as sobras de comida.
	Sustainable Purchase	**Compra Sustentável**
test	6. Buy products that are against animal testing?	6. Compro produtos que não são testados em animais.
local	12. Buy local products?	12. Compro produtos locais.

Note. The factors highlighted in bold where not revealed to the participants.

Appendix D

Table S4

The Original Dragons of Inactions Psychological Barrier Scale Items and the Translated Version to Portuguese.

Name	Items and instructions in English	Items and instructions in Portuguese
	The participants were asked to select one behavior that they or others believed should be done to help the environment, but which they were not doing now, or were not doing often enough: eating less meat; taking public transport, cycling, or rather than driving; reducing water use (e.g., taking shorter showers, repairing leaks); making more eco-friendly purchases; recycling all items permitted by their local programs. After selecting a behavior, participants were presented with the 24-item psychological barrier scale and asked to rate their agreement with each of the items on a 7-point Likert scale, from "strongly disagree" to "Strongly agree."	Por favor, selecione da lista abaixo um comportamento que: (1) acredite ser relevante para ajudar o meio ambiente (2), mas que não está a fazer agora, ou não com frequência suficiente: •Comer menos carne •Caminhar, usar transportes públicos ou bicicleta em vez do carro •Usar mais camadas de roupa para se aquecer em vez de aumentar o aquecimento.[a] •Reduzir o consumo de água (duches mais curtos, reparar fugas) •Fazer compras mais amigas do ambiente (produtos ecológicos ou locais, não pré-embalados) •Reciclar o máximo de acordo com o que é possível no seu local de residência Agora, com o comportamento escolhido em mente (_____) indique até que ponto as seguintes afirmações se aplicam a si numa escala de 1 (discordo totalmente) a 7 (concordo totalmente).
	Change Unnecessary	**Mudança Desnecessária**
	1. There's not much point in me making this change because I feel confident that technological innovators will solve environmental problems.	1. Não vale a pena mudar, pois confiante que os avanços tecnológicos vão resolver os problemas ambientais.
	6. Humans are powerless when it comes to saving the earth, so there is no need to change	6.Os seres humanos são impotentes para salvar o planeta, portanto não é preciso mudar.
	11. These problems are so far in the future, so there is no need to act.	11.Os problemas ambientais vão acontecer num futuro distante, não é preciso agir agora.
	16. Changes likes this are not really necessary for me because environmental conditions are likely to remain ok in my area.	16.Esta mudança no meu comportamento não é realmente necessária, porque as condições ambientais certamente vão manter-se boas na minha área.
	21. There is no pressing need to change because nature has great resiliency, and our actions are trivial.	21.Não há razão urgente para mudar porque a Natureza é muito resistente e as nossas ações são triviais.
	Conflicting Goals and Aspirations	**Objetivos e Aspirações em Conflito**

Name	Items and instructions in English	Items and instructions in Portuguese
	2. Making this change would interfere too much with my other goals in life. 7. I'm concerned that this change will take up too much of my time	2.Fazer esta mudança iria interferir demasiado com os meus outros objetivos de vida. 7. Preocupa-me que esta mudança tome muito do meu tempo
	12. I can't change because I'm invested in my current lifestyle.	12. Não mudo porque gosto do meu estilo de vida atual.
	17. These issues are important to me but it's too hard to change my habits.	17. As questões ambientais são importantes para mim, mas é muito complicado mudar os meus hábitos
	22. I haven't changed because I'm afraid this wouldn't work.	22. Não mudei, pois acho que não iria funcionar para mim.
	Interpersonal Relations	**Relações Interpessoais**
	3. Making this change would be criticized by those around me.	3. Esta mudança seria criticada pelas pessoas com quem convivo.
	8. I would be letting certain people down if I made this change.	8. Iria desiludir algumas pessoas se fizesse esta mudança
	13. I'm worried that my friends would disapprove if I made this change.	13. Preocupa-me que os meus amigos desaprovem esta mudança.
	18. If I made the necessary change, I would probably be embarrassed when others noticed what I was doing	18. Se fizesse esta mudança, provavelmente teria alguma vergonha quando os outros reparassem nisso.
	Lacking Knowledge	**Falta de Conhecimento**
	4. There's so much information out there that I am confused about how to make this change.	4.Há por aí tanta informação que para mim é confuso como fazer esta mudança.
	9. I don't understand enough of the details about how to make this change.	9.Não percebo bem os detalhes de como fazer esta mudança.
	14. I'd like to change but I'm not sure where to begin.	14.Gostava de mudar, mas não sei por onde começar.
	19. It's the government's responsibility to regulate this change. [b]	19. É responsabilidade do governo promover esta mudança (criar incentivos, meios e estruturas).
	Tokenism	**Tokenismo**
	5. The pro-environmental efforts that I currently engage in make further changes unnecessary.	5. Os comportamentos pró-ambientais que já faço tornam desnecessárias outras mudanças.
	10. I've already made sacrifices to solve environmental problems, so there is no need for me to do more.	10. Já fiz sacrifícios para mitigar os problemas ambientais, por isso não tenho que fazer mais nada.
	15. I previously have made important effort in this, so there is no need for me to make further changes	15. Já fiz antes grandes esforços pelo meio ambiente, por isso não preciso de mudar mais.

Name	Items and instructions in English	Items and instructions in Portuguese
	20. My environmental actions already make enough of a difference.	20. As minhas ações ambientais já fazem a diferença.
	23. It's not fair for me to change when really, it's industry that's causing the majority of environmental problems.	23. Não é justo ser eu a mudar, quando na verdade é a indústria que está a causar a maior parte dos problemas ambientais.
	24. The government should make it easier for me to change, if it really has the best interest of the environment in mind.[b]	24. Se o governo quiser mesmo fazer o melhor pelo ambiente, deveria facilitar a minha mudança de comportamento.

Note. The factors highlighted in bold where not revealed to the participants.

[a] Due to a programming error this behavior was not included in our final sample.

[b] These items were not included in the final Canadian scale but were recommended to be included in the case of major role of the government in fighting climate change in the country. We decided to include it to assess if it would provide relevant information to the Portuguese context.

Appendix E

Consent Form

O presente estudo está inserido no âmbito de uma dissertação de mestrado na faculdade de psicologia e de ciências da educação da universidade do porto.

O objetivo deste estudo é perceber, por um lado, as atitudes e crenças dos portugueses em relação às alterações climáticas e, por outro, recolher dados sobre a frequência de comportamentos ecológicos. Para esse efeito, pedimos que responda a um conjunto de questões sobre as suas perceções em relação ao meio-ambiente e as alterações climáticas bem como algumas questões sociodemográficas (por exemplo, idade, local de residência). o questionário demorará cerca de 15 minutos a preencher. Podem participar: indivíduos maiores de 18 anos, falantes do português que sejam residentes em Portugal.

A participação neste estudo é completamente voluntária e todas as respostas e informações anónimas. este estudo não envolve riscos acrescidos para os participantes. pode terminar a sua participação a qualquer momento, se assim o desejar, bastando apenas fechar o navegador. Os dados recolhidos serão usados para fins académicos e científicos e partilhados anonimamente com outros investigadores aquando da apresentação da tese de mestrado e publicação do estudo num jornal científico.

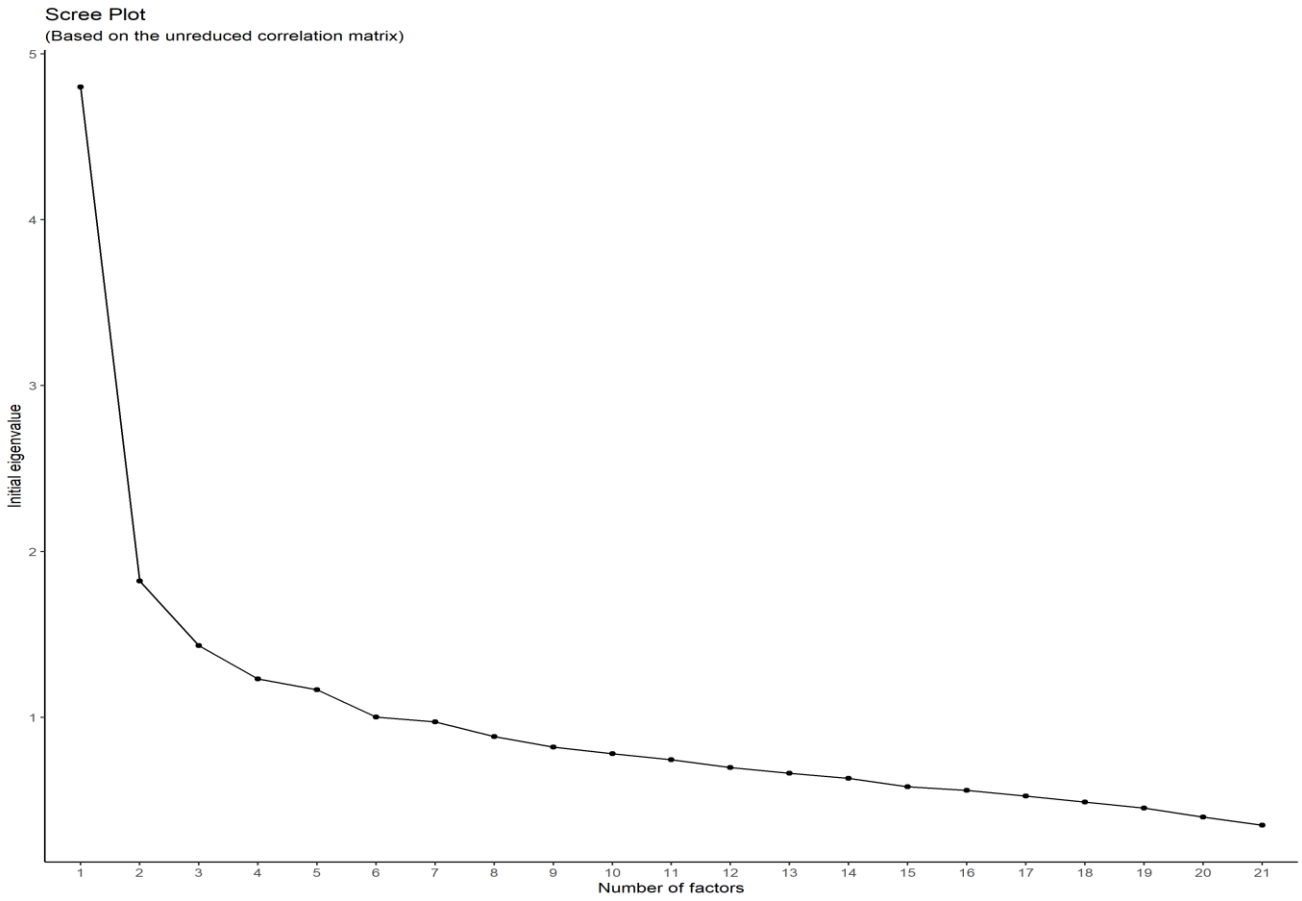
Debriefing

As alterações climáticas são cada vez mais notórias. Este estudo visa compreender as perceções dos portugueses em relação a estas alterações e como elas se relacionam com comportamentos pro-ambientais. As suas respostas irão contribuir para a construção do conhecimento sobre esta temática. Mais especificamente, com esta recolha procuramos saber se existe uma relação entre crenças sobre alterações climáticas, preocupações e frequência de ação climática. Um segundo objetivo consiste em compreender se existem barreiras psicológicas que dificultam a adoção de comportamentos que podem mitigar as alterações climáticas. Estas barreiras podem estar relacionadas com achar que é desnecessário mudar, existência de conflitos entre estes comportamentos e outros objetivos pessoais, pressão social ou falta de conhecimentos.

Appendix F

FigureS1

Scree Plot for the Pro-Environmental Scale Items based on the Unreduced Correlation Matrix



FigureS2

Scree Plot for the Pro-Environmental Scale Items based on Parallel Analysis

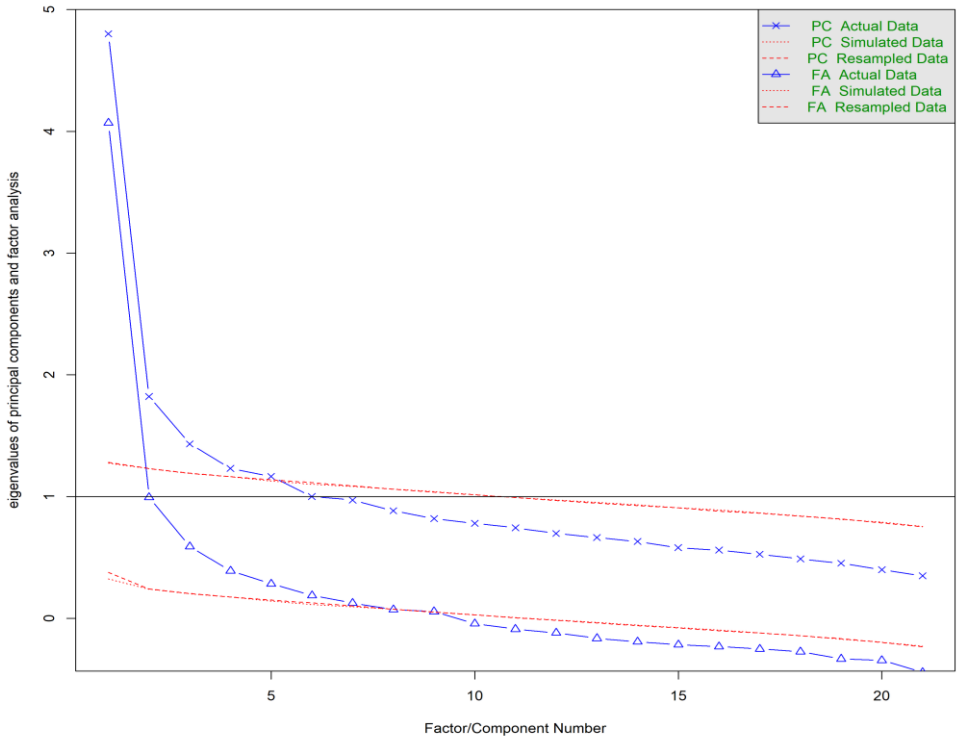


Table S5

Results From a Exploratory Factor Analysis of the Pro-Environmental Behavior Scale (PEBS).

PEBS item	Factor loading				
	1	5	3	4	2
Factor 1: Reuse					
5. I try to reduce the production of waste	**.79**	.04	-.04	-.09	.05
11. I separate the various types of garbage for recycling	**.60**	−.03	−.15	-.02	.07
17. Cut down on your consumption of disposal items (e.g., plastic bags from the supermarket)?	**.56**	.08	-.04	-.08	.03
12. Buy local products?	**.55**	-.03	−.05	-.11	-.03
Factor 2: Driving					
1. Use public transportation?	−.18	-.01	.01	.11	**.71**
7. Walk or cycle instead of driving?	.15	.01	.07	-.08	**.51**
Factor 3: Flying					
13. Avoid long-distance flights (lasting six hours or more)?	−.13	.06	**.76**	-.13	-.05
18. Prefer to travel by train/bus/boat instead of plane?	-.06	.01	**.69**	-.08	.15
Factor 4: Saving					
2. Turn of the lights when leaving the room?	-.05	.01	-.05	**.69**	-.15
14. Turn your TV off when leaving the room?	-.10	.05	-.05	**.61**	-.01
15. I close the tap while brushing my teeth	-.02	.02	-.11	**.41**	.15
Factor 5: Food					
4. Reduce meat products in your diet (e.g., beef, pork, poultry)?	.19	**.72**	-.08	-.04	-.01
10. Reduce eggs and dairy products in your diet?	-.14	**.77**	.06	.09	-.03
16. Reduce fish in your diet.?	-.15	**.78**	.13	0	.04

Note. The extraction method was principal axis factoring with an oblique (Promax with Kaiser Normalization) rotation. Factor loadings above .40 are in bold. Items with no loadings above .40 were removed

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