**-Title c:**

**Abstract**

**Introduction**

Environmental crisis poses a current threat to humankind and other species (Krajhanzl, 2010) and human behavior, organizations, and technologies created to meet human needs and desires are vastly responsible for this environmental crisis (Corral, 2010, 2012; Stern, 2000). Given that human action is a major source of environmental degradation, drastic behavioral and lifestyle changes play a key role in reducing environmental deterioration (Corral, 2010; Whitmarsh et al., 2021). The urge to reduce environmental damage is a call to study the barriers and drivers of pro-environmental behavior (PEB) (Whitmarsh et al., 2021).

PEB encompasses a variety of intentional behaviors that aim to positively impact the environment or reduce damage to it (Kollmuss, & Agyeman, 2002; Steg & Vlek 2009). Typical PEBs include recycling or limiting the production of residues, avoiding using a personal vehicle in favor of public transport, implementing a plant-based diet or joining a political organization advocating for the environment. While PEB categorizations vary, a useful distinction in considering PEB individual vs collective PEB.

Individual PEB refers to actions aiming at protecting the environment that a single individual on their own can consistently implement, provided they count on the appropriate infrastructure surrounding them (e.g., recycling and using public transportation assuming that there are appropriate recycling containers and sufficient available public transport). On the other hand, collective pro-environmental behaviors include actions aimed at promoting environmental protection through collaborative endeavors requiring the coordination of a large number of people such as promoting environmental-friendly legislature through political action or protesting.

While both appear to be important, collective PEB could be a more critical behaviour since most greenhouse gas emissions are not caused by massive individual behaviour but rather by the actions of large corporations and conglomerates that are regulated by political, rather than individual concerns (Ando et al., 2010; Whitmarsh et al, 2021).

As environmental issues are behavioral issues, behavioral science can make core contributions to sustainability (Koger & Scott, 2016). Within the field of psychology, several theoretical frameworks have been developed and applied to address the question of why individuals engage in (or refrain from engaging in) pro-environmental behaviors (Koger, & Scott, 2016; Kollmuss & Agyeman, 2002).

***Theory of Planned Behavior***

The Theory of Planned Behavior (TPB) is one of the most widely used models to study behaviour change in general, and specifically, pro-environmental behavior (Ajzen, 1991; Rau et al., 2022). This model proposes that individual’s intention to engage in a behavior is explained by their own evaluation of the behavior (attitudes), relevant others' approval or disapproval of the behaviour (subjective norms), and the resources and opportunities available to perform it (perceived control). Attitudes, subjective norms and perceived control directly influence the intention to carry out a behaviour, which in turn influences whether people carry out that behaviour. Interestingly, perceived control also is taken to have direct influence on behaviour, not mediated by intention.

Multiple studies have used TPB to explore pro-environmental behaviors (Blok et al., 2015; Gkargkavouzi et al., 2019; Greaves et al., 2013; Jiang et al., 2018; Oreg et al., 2006). For example, the results of Greaves et al. (2013) showed that attitudes, subjective norm, and perceived control were significantly related to intentions aimed to conserve energy and make green decisions in the workplace. However, perceived control was not significantly related to recycling intentions; suggesting that different pro-environmental behaviors have diverse correlates among those considered by TPB. Moreover, Pet al. (2019) research suggests that intention is a main predictor of private sphere (i.e., individual) PEB.

***Social Norms***

In the TBP model, the norm variable (subjective norm) is defined as the approval of a behaviour. However, social norms are also defined by the typicality of behaviour, as noted by other authors (Bicchieri, 2019). In this study, we will consider both components of social norms: the prescriptive component (i.e. subjective norm in TPB), which comprehends the expectations we believe the others have about our behavior; and the descriptive component of social norms, related to the own expectations about the behaviors of others (Bicchieri, 2019).

Studies have shown the significant impact of social norms in PEB, and the necessity of differentiate the effects of prescriptive norms versus descriptive norms in the behavior; therefore, no assuming an equal effect of both (Cialdini et al., 1990). Also, the researchers found that variables external to the ones initially contemplated, like other psychological, environmental or social variables, were essential to fully understand the impact of social norms in the PEB (Cialdini et al., 1990). Specifically, studies as the one made by Yaming et al. (2020), show that providing normative information of both descriptive and prescriptive components through messages and cards could promote fuel efficiency related behaviours. Taking into account, other physical, psychological and social variables relevant to the promotion of PEB as established by other authors previously.

Another example is a study by Bernstein and Puttick (2014). In this study, they provided prescriptive and descriptive normative information to one group and a non-normative control message to another group to promote reported energy conservation behaviour. The results showed significant differences in saving behaviours when normative information was presented to participants who were more engaged in saving, suggesting that personal variables are relevant when presenting normative messages.

***Environmental Consciousness***

Environmental consciousness (EC) is another framework that brings together a set of variables related to individuals' likelihood to engage in pro-environmental behavior (Fockaert et al., 2023; Sánchez & Lafuente, 2010). EC includes affective, dispositional, cognitive, and active dimensions of PEB. The affective dimension involves concern about environmental degradation and support for a pro-environmental worldview. The dispositional dimension includes valuing personal involvement, responsibility, and feelings of self-efficacy towards protecting the environment. On the other hand, the cognitive dimension includes the knowledge about environmental problems and beliefs about how to deal with them. Finally, the active dimension includes individual and collective pro-environmental behaviors (Fockaert et al., 2023; Sánchez & Lafuente, 2010). The dispositional and cognitive dimensions of environmental consciousness have shown a strong influence on green purchase intention, with the dispositional dimension being the variable with the stronger influence on behavioral intention (Nguyen et al., 2022). Also, Brenneis et al. (2022) found that attitudinal dimensions understood in terms of environmental concern were associated with the intention to donate to a pro-environmental organization.

***New Ecological Paradigm***

Another variable related to pro-environmental behavior that is considered in the affective dimension of environmental consciousness framework is ecological ideology (Sánchez & Lafuente, 2010). The New Ecological Paradigm (NEP) scale aims to measure different ecological ideologies in response to the rise of anthropic climate change; ecocentrism, anthropocentrism and limit awareness. An ecocentric ideology emphasizes the need to establish a balance between humans and nature, as opposed to a worldview that views nature as something to be legitimately subjugated and exploited by humankind (i.e., anthropocentric ideology). On the other hand, limit awareness refers to the belief that resources on Earth are limited and should therefore be managed carefully to preserve them for our future (Barker et al., 2019; Dunlap & Van Liere, 1978; Dunlap, 2008; Gomera et al., 2013; Gomera et al., 2013; Sánchez & Lafuente, 2010).

Some authors understand these ideologies as values, which influence the way of conceiving the environment (Gheith, 2013). Therefore, these affect our beliefs about the consequences of environmental damage, our capacity to reduce it, and of our range of possibilities for concrete action (Gheith, 2013). Research on pro-environmental behavior has shown that elderly people and females had higher levels of ecocentrism (Gheith, 2013). Also, it has been found that people with a more ecological worldview have higher levels of intention to act pro-environmentally; as well as more likely to engage in pro-environmental consumer behavior and value the environmental credentials of the product as important when purchasing food (Barker et al., 2019; Polonsky et al., 2014; Suárez et al., 2007). Pahl et al. (2005) found that people with an ecological worldview who also perceived high environmental risk, reported more pro-environmental behavior.

While research has shown a great number of factors involved in pro-environmental behaviour the relative importance of each one is still misunderstood making it difficult to design cost-effective interventions aiming at facilitating pro-environmental behaviours. In addition, there is a gap in the literature on how the variables presented above are related, as well as their relevance specifically in Latin American contexts. Although ecological ideologies have been associated with attitudinal and cognitive factors, they have not been studied in relation to the other variables included in the current study, and more specifically these as being mediated by these variables. Hence, this correlational study aims to explore the role of ecological worldview, social norms, attitudes, knowledge about each specific PEB, behavioural control and behavioral intention on reported individual PEB (using public transportation, sorting waste, reducing consumption) and collective PEB (supporting an environmental organization and asking people not to litter).

**Method**

***Participants and Procedure***

We conducted a quantitative pre-registered[[1]](#footnote-2), cross-sectional correlational study in the first semester of 2023 in a private university in Colombia and the area surrounding the campus.447 participants (Mean age = 22.1±7.5, range; Gender: 67.3% women, 30.6% men, 1.57% non-binary, 0.45% would rather not say) were recruited from the university campus and surrounding neighborhoods (university members 386, neighbors 61). Participants who did not study, live, or work in the neighborhood were excluded. Before completing the entire survey, participants were informed of the purpose of the study and asked to provide informed consent (see table 1 for full demographics).

Participants were invited to complete the survey. According to each participant’s needs survey was self-administered or administered by the research team. The survey includes demographic data (age, gender, education level, occupation, number of children, number of people economically dependent on the participant, and socioeconomic status). It also encompasses questions about social norms, attitudes, knowledge, behavioral control, behavioral intention, and frequency of behavior for five specific PEB (i.e., using public transportation, sorting waste, reducing consumption, supporting an environmental organization, and asking people not to litter)[[2]](#footnote-3).

***Materials***

**Ecological ideology.**

Ecological ideology was measured using an adaptation of the NEP scale from Gomera, Villamandos, and Vaquero (2013). The measurement of ecocentric, anthropocentric, and limit awareness ideologies consisted of thirteen items, which were evaluated using a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree).

**Psychological variables.**

Social norms, attitudes, knowledge, behavioral control, behavioral intention and reported behavior were adapted from the General Ecological Behavior survey (Carabias Barceló, 2002). Each item was measured using a 5-point Likert scale. Social norms were assessed using two questions that inquired about the typicality of each PEB (descriptive norms) and the degree to which participants thought the behavior is approved by others (prescriptive norms). Attitudes were assessed through a single item asking how positive or negative each PEB is. Knowledge was assessed by asking participants how well they knew how to perform each PEB correctly. Behavioral control was measured by asking participants how easy it was for them to perform each behavior. There was also an item that asked about the participants' intention to perform each PEB. Finally, the reported frequency of each behavior was used to assess reported behavior.

**Results**

**Pre-registered analysis**

***The CFA of NEP Scale***

The factorial structure of the NEP scale was assessed using confirmatory factor analysis (CFA). The model demonstrated good fit to the data, supporting the expected three-factor structure (χ² (62) = 176.139, p < .001, CFI = 0.963, TLI = 0.954, RMSEA = 0.071, SRMR = 0.060). Reliability analysis revealed high internal consistency for the factors α = 0.876 for eco-centrism, α = 0.859 for anthropocentrism, and α = 0.872 for limit awareness.

***PEB Factorial Structure***

To determine the factorial structure of PEB, we explored the possible dimensions visually using a scree plot. We included the 5 items that asked about the reported frequency of each behavior and confirmed the results with an exploratory factorial analysis. The analysis revealed a unifactorial solution in which the load of using public transportation is low. The solution accounts for 40.9% of the variance in the observed variables, but the root mean square of residuals (RMSR = .137) is unsatisfactory. To confirm the scale's reliability, we conducted analyses using Crombach's alpha (α=.6) and McDonald's omega (ω=.7). The distinction between transport and other behaviors lacks a clear theoretical basis. Therefore, we will analyze each behavior separately.

***Model Analysis***

We ran a two pre-registed SEM models reflecting theorized links between variables for each target behaviour. Complete models assume that ideological variables’ effect (ecocentrism, anthropocentrism and limit conscience) on intent and reported behaviour are completely mediated by perceived control, attitudes and social norms towards the behaviour. Hence, complete models are a serial mediation models where ideological variables effect on reported behaviours are mediated by psychosocial variables and intent (see fig 1). Control models directly apply TPB and all considered variables effect on reported behaviours are mediated by intent except for perceived control (see fig 2). Thus, we ran both complete and control models for each considered behaviour.

**Using Public Transportation.**

***Complete model.***

The CFI (.49 < .90), RMSEA (.29 > .05) and TLI (-.259 < .90), AIC (= 8013), BIC (= 8138) indexes suggest a poor fit for the complete model. We did not find direct or indirect effects of ideologies on intention of using public transportation. Nonetheless, we found direct relations between attitude (β = 0.37; p < 0.001), prescriptive norm (β = 0.26; p < 0.001) and behavioral control (β = 0.32; p < 0.001) with intention. We found a direct effect of intention and reported behavior (β = 0.40; p < 0.001) and an effect of behavioral control on reported behavior (β = 0.31; p < 0.001), suggesting a partial mediation of intent on the relationship between perceived behavioral control and reported behaviour.

***Direct model.***

The CFI (1 > .90), RMSEA (0 < .05) and TLI (1 > .90), AIC (= 936.5), BIC (= 975.55) indexes suggest a satisfactory fit. We found significant and negative relation between anthropocentrism (β = -0.21; p = 0.049) and attitude (β = -0.15; p = 0.002) with reported behaviour, as well as a positive relation between intention (β = 0.32; p < 0.001), behavioral control (β = 0.12; p = 0.014), prescriptive (β = 0.27; p < 0.001) and descriptive norm (β = 0.15; p < 0.001) with reported behavior.

***Comparison.***

We compared fit of complete vs control model to determine whether observed fit differences were significant and could be safely interpreted. Results suggest that direct model has significantly better fit, (Chi2 = 0) compared to the complete model (Chi2 = 555.72, p < 0.001).

**Sorting waste.**

***Complete model.***

The CFI (.59 < .90), RMSEA (.24 >.05) and TLI (-.001< .90), AIC (= 6996.5), BIC (= 7121.47) indexes suggest a poor fit for the complete model. We did not find direct effects of ideologies on intention of sorting waste. Nonetheless, we found direct relations between knowledge (β = 0.18; p < 0.001), attitude (β = 0.29; p < 0.001), prescriptive norm (β = 0.13; p < 0.001) and behavioral control (β = 0.2; p < 0.001) with intention. Also, we observed a significant negative relationship between limit awareness and attitude (β = -0.072; p = 0.044), suggesting that relationship between limit awareness and intent is fully mediated by attitude. We found a direct effect of intention and reported behavior (β = 0.37; p < 0.001) and an effect of behavioral control on reported behavior (β = 0.42; p < 0.001), suggesting a partial mediation of intent on the relationship between perceived behavioral control and reported behavior.

***Direct model.***

The CFI (1 > .90), RMSEA (0 < .05) and TLI (1 > .90), AIC (= 928.49), BIC (= 967.54) indexes suggest a satisfactory fit. We found significant relation between knowledge (β = 0.4; p < 0.001), behavioral control (β = 0.25; p < 0.001), prescriptive (β = 0.18; p < 0.001) and descriptive norm (β = 0.13; p = 0.004) with reported behavior.

***Comparison.***

We compared fit of complete vs control model to determine whether observed fit differences were significant and could be safely interpreted. Results suggest that direct model has significantly better fit, (Chi2 = 0) compared to the complete model (Chi2 = 369.11, p < 0.001).

**Using reusable bags.**

***Complete model.***

The CFI (.67 < .90), RMSEA (.19 >.05) and TLI (.17< .90), AIC (= 6658.32), BIC (= 6783.29) indexes suggest a poor fit for the complete model. We find direct effects of ecocentrism on intention of reducing consumption (β = 0.19; p = 0.016). We observed a significant relationship between ecocentrism and behavioral control (β = 0.21; p = 0.048), and with prescriptive norm (β = 0.29; p = 0.023); suggesting that relationship between ecocentrism and intent is partially mediated by behavioral control and prescriptive norm. Also, we found direct relations between knowledge (β = 0.074; p = 0.04), attitude (β = 0.26; p < 0.001), prescriptive norms (β = 0.1; p = 0.001) and behavioral control (β = 0.17; p < 0.001) with intention. Also, we observed a significant relationship between anthropocentrism and attitudes (β = 0.18; p = 0.049), suggesting that relationship between anthropocentrism and intent is fully mediated by attitude. We found a direct effect of intention and reported behavior (β = 0.32; p < 0.001) and an effect of behavioral control on reported behavior (β = 0.40; p < 0.001), suggesting a partial mediation of intent on the relationship between perceived behavioral control and reported behavior.

***Direct model.***

The CFI (1 > .90), RMSEA (0 < .05) and TLI (1 > .90), AIC (= 855.8), BIC (= 894.85) indexes suggest a satisfactory fit. We found significant relation between knowledge (β = 0.1; p = 0.006), behavioral control (β = 0.26; p < 0.001), prescriptive (β = 0.13; p = 0.002) and descriptive norm (β = 0.2; p < 0.001) with reported behavior.

***Comparison.***

We compared fit of complete vs control model to determine whether observed fit differences were significant and could be safely interpreted. Results suggest that direct model has significantly better fit, (Chi2 = 0) compared to the complete model (Chi2 = 252.75, p < 0.001).

**Supporting an environmental organization.**

***Complete model.***

The CFI (.59 < .90), RMSEA (.23 >.05) and TLI (-.002< .90), AIC (= 7435.21), BIC (= 7560.18) indexes suggest a poor fit for the complete model. We did not find direct effects of ideologies on intention of supporting an environmental organization. We observed a significant relationship between limit awareness and knowledge (β = 0.18; p = 0.001), and with prescriptive norm (β = 0.15; p = 0.004); suggesting that relationship between limit awareness and intent is fully mediated by knowledge and prescriptive norm. Also, we found direct relations between knowledge (β = 0.093; p = 0.012), attitude (β = 0.32; p < 0.001), prescriptive norms (β = 0.17; p < 0.001) and behavioral control (β = 0.39; p < 0.001) with intention.

Likewise, we observed a significant relationship between anthropocentrism and attitude (β = 0.26; p = 0.008), suggesting that relationship between anthropocentrism and intent is fully mediated by attitude. We found a direct effect of intention and reported behavior (β = 0.3; p < 0.001) and an effect of behavioral control on reported behavior (β = 0.5; p < 0.001), suggesting a partial mediation of intent on the relationship between perceived behavioral control and reported behavior.

***Direct model.***

The CFI (1 > .90), RMSEA (0 < .05) and TLI (1 > .90), AIC (= 969.83), BIC (= 1008.88) indexes suggest a satisfactory fit. We found significant relation between limit awareness (β = 0.11; p = 0.005), knowledge (β = 0.29; p < 0.001), behavioral control (β = 0.34; p < 0.001), prescriptive norm (β = 0.14; p = 0.002) and intention (β = 0.24; p < 0.001) with reported behavior.

***Comparison.***

We compared fit of complete vs control model to determine whether observed fit differences were significant and could be safely interpreted. Results suggest that direct model has significantly better fit, (Chi2 = 0) compared to the complete model (Chi2 = 354.66, p < 0.001).

 **Asking people not to litter.**

***Complete model.***

The CFI (.69 < .90), RMSEA (.2 >.05) and TLI (-.23< .90), AIC (= 7606.92), BIC (= 7731.89) indexes suggest a poor fit for the complete model. We did not find direct effects of ideologies on intention of asking people not to litter. We observed a significant relationship between limit awareness and behavioral control (β = 0.11; p = 0.0045), and with prescriptive norm (β = 0.17; p = 0.001); suggesting that relationship between limit awareness and intent is fully mediated by behavioral control and prescriptive norm. Also, we found direct relations between attitude (β = 0.28; p < 0.001), prescriptive norms (β = 0.14; p < 0.001) and behavioral control (β = 0.34; p < 0.001) with intention.

Likewise, we observed a significant relationship between ecocentrism and prescriptive norm (β = 0.47; p = 0.001), suggesting that relationship between ecocentrism and intent is fully mediated by prescriptive norm. We found a direct effect of intention and reported behavior (β = 0.40; p < 0.001) and an effect of behavioral control on reported behavior (β = 0.46; p < 0.001), suggesting a partial mediation of intent on the relationship between perceived behavioral control and reported behavior.

***Direct model.***

The CFI (1 > .90), RMSEA (0 < .05) and TLI (1 > .90), AIC (= 959.54), BIC (= 998.89) indexes suggest a satisfactory fit. We found significant relation between limit awareness (β = 0.1; p = 0.01), knowledge (β = 0.11; p = 0.0014), behavioral control (β = 0.43; p < 0.001) and intention (β = 0.34; p < 0.001) with reported behavior.

***Comparison.***

We compared fit of complete vs control model to determine whether observed fit differences were significant and could be safely interpreted. Results suggest that direct model has significantly better fit, (Chi2 = 0) compared to the complete model (Chi2 = 261.4, p < 0.001).

**Discussion**

This paper aimed to explore the role of ecological worldview, social norms, attitudes, knowledge, behavioural control and behavioral intention on reported individual PEB (using public transportation, sorting waste, using reusable bags) and collective PEB (supporting an environmental organization and asking people not to litter). The previously named correlations were analyzed through two models, a complete model suggesting a mediation of ideological variables (i.e. anthropocentrism, ecocentrism and limit conscience) by psychological ones (social norms, perceived behavioural control, attitudes, knowledge and intention) and a direct model purporting no mediational hypotheses. Results suggest that the latter model has better fit in all the studied behaviours suggesting that ideological and psychological variables linked to pro-environmental behaviour have independent effects, making any of them hem viable candidates for pro-environmental behaviour.

According to the complete model, the relationship between behavioural control and reported behaviour is partially mediated by intention. Different psychological variables were related to intention in different behaviours, and in all behaviours intention was significantly related to reported behaviour and mediated the relationship between these psychological variables and reported behaviour. Specifically, we observed that attitudes towards the considered behaviour has a significant relationship with intent in all the behaviors, and is a mediator between anthropocentrism and intention in using reusable bags and in supporting an environmental organization, and between limited awareness and intention in the case of sorting waste. Suggesting that attitude change is a potentially relevant variable to foster green behaviours across multiple considered behaviours. In this sense, future interventions should apply persuasion techniques (REF) to foster pro-environmental behaviour as a complement to nudging approaches (REF).

Similarly, the prescriptive norm, taken to be what people perceive others expect them to do (REF) correlates significantly with intention in all behaviors, and mediated the relationship between ecocentrism and intention in using reusable bags and asking people not to litter; and between limited awareness and intention in supporting an environmental organization and asking people not to litter. In this sense, our study suggests that green behaviour depends to some extent on perceptions about other people’s attitudes and expectations about green behaviour. In this sense, much like other socially relevant behaviours (REF Bichieri) green behaviour is better understood as a social, group-level phenomenon, rather than simply a personal choice.

We found that using public transportation was the behavior with the fewest variables involved and no significant correlations with any ideology. Suggesting that using public transportation is not explained by considered variables but rather issues of availability of transportation and access. Regarding the other variables, knowledge about how to properly carry out the behaviour was relevant in sorting waste, in using reusable bags and supporting an environmental organization, where in the latter it acted as a mediator between limit awareness and intention. Finally, it was found that in the complete model of all analyzed behaviors the descriptive norm had no effect on intention nor on reported behaviour suggesting that what leverages green behaviour is what other people find normatively correct, rather than what other people actually do.

**Limitations**

 Lack of diversity in the sample may limit the generalizability of the findings. Indeed, most participants were students from middle-high income and relatively young which may limit the generalizability of our results to older or less educated samples. Also, causal hypotheses in our study are purely based on literature. Since we did not observe longitudinal data or experimentally assigned conditions causal paths cannot directly be ascertained. Future work should strive to further respond to these limitations by collecting more diverse samples and experimentally manipulating some of these variables to ensure their causal impact.

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1. Pre registration available at: <https://aspredicted.org/ae78a.pdf> [↑](#footnote-ref-2)
2. Complete materials, raw data files and complete data analysis scripts are freely available at: https://osf.io/mfqz8/ [↑](#footnote-ref-3)