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Environmental behavior patterns across clusters of European Union countries: Uncovering heterogeneity in the attitude-behavior-context relationship

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A R T I C L E I N F O

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A B S T R A C T

This study examines how European Union (EU) citizens systematically differ in their environmental attitude-behavior relationships according to country-level contextual drivers. Using Eurobarometer data and a multi-level latent class regression model, we identified four attitude-behavior relationships that we labelled, according to mean environmental behavior scores, as environmentalist, pre-environmentalist, less-environmentalist, and non-environmentalist. Regarding their distribution across the EU, we identified four country clusters reflecting pattern similarities that we labelled green, yellow-green, brown, and gray clusters. We found that the attitude-behavior relationship was weaker for more environmentalist patterns than for less environmentalist patterns. Furthermore, more environmentalist patterns were associated with more privileged social positions. As expected, the country clusters reflected socioeconomic development levels (more developed countries were environmentally greener). In the interest of reducing inequality in the distribution of environmentally healthy and vital ecosystems, we suggest that EU environmental policies should mainly address the environmental behaviors of countries classified as brown and gray.

1. Introduction

Research into sustainable consumption and environmental behaviors has to date been conducted in single countries (He et al., 2019; Pisano and Hidalgo, 2013; Sun et al., 2019) or in sets of highly heterogeneous countries (Oreg and Katz-Gerro, 2006; Pisano and Lubell, 2017; Y. Wang, 2017). It has also focused on the mean influence of sociopsychological drivers of environmental behaviors (Hines et al., 1987; Klöckner, 2013; Morren and Grinstein, 2016) and on how country-level drivers moderate their influence. In the latter case, the attitude-behavior framework has been further developed, as the attitude-behavior-conditions (A-B-C) framework, to include the influence of context on individual-level drivers of sustainable environmental behaviors (Black et al., 1985; Guagnano et al., 1995; Pisano and Lubell, 2017; T. Wang et al., 2021; Y. Wang, 2017).

Few studies have closely examined the existence of individual and contextual heterogeneity in the A-B-C *relationship*. The relationship between attitude and behavior depends not only on the context, but also systematically differs among groups of individuals, giving birth to a set of A-B-C *relationships*, in plural. Failing to take into account the existence of systematic heterogeneity in samples regarding the A-B-C relationship may inflate variability in model estimators, reducing the model's statistical significance and predictive capacity. As far as we are aware, there is no study underpinned by systematic statistical analysis that questions the homogeneity of the A-B-C *relationship*. Assuming homogeneity in the A-B-C relationship may mask several *relationships* between environmental drivers and environmental behavior.

In this research, we are interested in uncovering systematic heterogeneity and its determinants for the A-B-C relationship in Europe. More specifically, we are interested in (1) how environmental behaviors of Europeans systematically differ according to the A-B-C model, and (2) the extent to which systematic differences among European countries can be reduced to a few distinct clusters, each with a similar mix of environmental behaviors. This fact is of particular importance for policy makers, because, to be able to design better environmental policies, the European Union (EU) needs to know how Europeans systematically differ in their behaviors and whether heterogeneity can be reduced to a few sets of countries. According to Aldrich and associates (Aldrich et al., 2007), individuals need to be classified according to different behavior patterns and expected responsiveness to government policies. Hence,

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environmental policies need to be well grounded in Europeans' behaviors and expected responses, and their design thus requires systematic unobserved heterogeneity in sustainability patterns and systematic differences between EU countries to be explored.

We understand the EU to be composed of individuals with different attitude-behavior patterns, based in country clusters that differ in terms of their environmental practices. Our study thus aims to uncover systematic differences in individual-level drivers of environmental behaviors and their distributions across the EU. We also explore how individual environmental behavior patterns are related to social position (social categories and resources), and how clusters reflect countries' socioeconomic development and culture.

The remainder of this paper is structured as follows. Section 2 introduces the theoretical background, focused mainly on the A-B-C environmental model. Section 3 describes our methodology, data, and analyses. Section 4 reports our results. Section 5 discusses our findings, implications, and limitations. Finally, we conclude with a brief summary.

1.1. Theoretical framework

1.1.1. Attitude-behavior-context model

While early research into the relationship between individuals' inner sociopsychological processes and environmental behaviors assumed a direct relationship between attitudes and behaviors (Fishbein and Ajzen, 1975; Schwartz, 1970; Kollmuss and Agyeman, 2002), further research has provided evidence that the relationship is more complex (Gupta and Ogden, 2006, 2009; Oskamp et al., 1991; Wiederhold and Martinez, 2018). Since the attitude-behavior relationship would seem to depend on other individual- and contextual-level drivers, Guagnano and associates (Guagnano et al., 1995) proposed the attitude-behavior-conditions (A-B-C) model to explain the social mechanisms that connect sociopsychological drivers with contextual or ecological drivers. Note that below we prefer to use the broader concept of 'context' rather than 'conditions'.

Environmental behavior nowadays is understood to reflect a combination of individual-level rational and pro-social motivations. Rational behavior is when, under ordinary conditions, individuals act according to their own best interests. Pro-social behavior reflects an individual's personal connection with their social and natural contexts and with future generations. Depending on the individual, rational motivations may influence behavior more than pro-social motivations, and vice versa.

Environmental psychology models explaining attitudes and behaviors have been constructed from the theory of planned behavior (TPB) (Ajzen, 1985), the norm-activation model (NAM) (Schwartz, 1977), the new environmental paradigm (NEP) (Dunlap and Liere, 1978) and the value-belief-norm theory (VBN) (P. C. Stern et al., 1999). Research has found that knowledge of environmental problems, and of their consequences and possible solutions (actions, skills and strategies), influence environmental behaviors (He et al., 2019; Jiménez Sánchez and Lafuente, 2010; Pisano and Hidalgo, 2013). Attitudes to the environment, which reflect favorable or unfavorable feelings toward particular aspects or objects related to the environment (Gifford and Sussman, 2012), can be split into two components (Kurisu, 2015): environmental attitudes, and attitudes toward environmental behaviors. Perceived behavioral control refers to an individual's perceptions of whether their behavior can bring about environmental change (Ajzen, 1985, 2005). Finally, subjective environmental norms represent environmental values and attitudes regarding others, i.e., expectations that people will act morally (Morris et al., 2015). Consequently, we can expect individuals with differing levels of those five theoretical constructs (i.e., sociopsychological predictors) – environmental knowledge, environmental attitudes, attitudes toward environmental behaviors, perceived behavioral control and subjective environmental norms – to systematically differ in their behaviors.

Hypothesis H1. Europeans systematically differ in their environmental behaviors.

While psychological research has focused on attitudes and behaviors, sociological research has studied how an individual's social position (based on social categories and resources) and residence in different societies shape the behavior of individuals (Bourdieu, 1979; Giddens, 1984). Sociological research acknowledges that individuals have the capacity to act independently of what is expected from their social position, and to make choices that explain behavioral variations – variations that are not accounted for by temporal social structures (Katz-Gerro et al., 2020). Consequently, while individuals holding particular social positions may have similar behaviors, agency differences may account for differing attitudes regarding the environment. The agency-structure opposition upholds the homology hypothesis regarding the environment, i.e., that systematic differences in behaviors reflect differing attitudes and social positions of individuals (Gifford and Sussman, 2012; Kollmuss and Agyeman, 2002).

To explain discrepancies, therefore, we need to account for social differences that explain the social mechanisms underpinning sustainable behaviors (Guagnano et al., 1995). Consequently, researchers have tried to identify the social categories and resources that not only influence behavior, but that also modify the impact of rational and pro-social motivations on environmental behaviors (Ertz et al., 2016; Geiger et al., 2019; He et al., 2019).

Hypothesis H2. Europeans' environmental behaviors differ systematically depending on their social position.

Furthermore, the social structures that limit or benefit individuals may have several social levels. Black and associates (Black et al., 1985) examined the indirect effect of market drivers (e.g., fuel price fluctuations) on the relationship between energy-saving attitudes and behaviors. Two years later, the first meta-analysis of research into environmental behaviors proposed that situational drivers (e.g., economic constraints, social pressures, and opportunities to choose different actions) may directly influence such behaviors (Hines et al., 1987). However, neither of those studies proposed a clear and detailed theoretical framework that usefully blended individual and contextual levels. It was Stern and Oskamp (P. Stern and Oskamp, 1987) who developed the first comprehensive theoretical framework that considered the relationship between individual and contextual drivers and individual behaviors; this framework was popularized by Guagnano and associates as the A-B-C model (Guagnano et al., 1995). According to this theoretical framework, environmental behavior (B) is the outcome of both personal attitudes (A), and conditions (C) – what we refer to more generically as context, i.e., the socioeconomic setting in which consumers operate (Black et al., 1985), at the micro- (individual and family), meso- (community), and macro-level (country) (Guagnano et al., 1995; Olli et al., 2001). Consequently, the A-B-C model proposes that the attitude-behavior relationship may be moderated by the environmental decision-making context. Twenty years on, this model has proved useful in explaining private and public pro-environmental behaviors (Dhir et al., 2021; Ertz et al., 2016; Xu et al., 2017).

1.1.2. Differing A-B-C model context levels

In the first A-B-C study, Guagnano and associates (Guagnano et al., 1995) analyzed the impact of having a recycling bin in the household (a structural driver), finding that bin presence directly and indirectly promoted recycling behaviors, given the same motivations: "This relationship indicates that the effect of providing bins was to remove a major barrier to action consistent with pre-existing attitudes" (Guagnano et al., 1995, p. 713).

Heath and Gifford (Heath and Gifford, 2002), in a study framed within the TPB (Ajzen, 1985), analyzed the direct and indirect impacts of a university travel pass aimed at reducing student car use; not only did public transport use increase significantly, attitudes and beliefs concerning public transport also changed for the better. This finding would suggest that contextual drivers may positively moderate the effect of attitudes on behaviors.

At the macro-level, external drivers are broadly classified as physical, financial, legal, and societal factors (Guagnano et al., 1995). An individual's behavior may thus be affected by a country's affluence, income inequality, environmental regulations, taxation, infrastructures, and culture, to just name a few factors (Welch and Southerton, 2019, p. 33). For instance, studies have shown that the influence of environmental values on behavior is different in Japan and in the Netherlands (Aoyagi-Usui et al., 2003), that the influence of environmental concerns on behavior is stronger in the USA than in India (Muralidharan et al., 2016), and that the relationship between environmental values, attitudes, and behaviors differs between England, Germany, Portugal, and Spain – countries with different structural conditions in terms of economic development, social context, and cultural values (Paço et al., 2013). Similar differences have been reported for EU countries (Liobikienė et al., 2016).

Hypothesis H3. The environmental behavior patterns of Europeans differ systematically in their distribution among country clusters.

Hypothesis H4. The environmental behaviors of EU countries differ systematically according to country socioeconomic development and culture.

1.1.3. Heterogeneity in the attitude-behavior relationship

Few studies have closely examined individual and contextual heterogeneity in the A-B-C model. One exception – suggesting the importance of studying contextual heterogeneity – is a study by Dolnicar and Grün (Dolnicar and Grün, 2009), who, in testing the hypothesis that individuals differ systematically in their environmental behaviors depending on situational contexts, found systematic differences (reflected in six behavioral patterns) in attitude-behavior relationships that changed depending on the context: everyday life or holidays. Farizo and associates (Farizo et al., 2014) studied water protection preferences in England and Wales, finding that heterogeneity could be reduced to five behavior patterns shaped by the living conditions of individuals, and suggesting, furthermore, that similarities and differences in behaviors may be geographically distributed.

Consequently, to identify suitable strategies to improve environmental sustainability, the extent to which environmental behaviors are context-dependent is not only of theoretical interest, but also of paramount importance (Dolnicar and Grün, 2009). However, none of the studies reviewed so far have analyzed how and why attitude-behavior relationships may systematically differ within and across EU countries (Gross and Telesiene, 2017; Schaffrin and Schmidt-Catran, 2017).

2. Methodology

2.1. Data

Data was provided by the 2017 Special Eurobarometer 468 public opinion survey on the environment carried out in the 27 EU member states[1] plus the UK (EU27+UK), available from the GESIS data center (European Commission and European Parliament, 2018). The sample includes data on 27,881 individuals aged ≥15 years surveyed between 23 September and 2 October 2017. Individuals were sampled according to a standard multistage probability procedure and interviews were conducted using computer-assisted personal interview techniques. In each country, a number of sampling points was drawn with probabilities proportional to population size (for total coverage of the country) and to population density (European Commission and European Parliament, 2018). See Table 1 for country's sample size.

2.2. A-B-C model measures

2.2.1. Individual environmental behaviors

Individual environmental behaviors – the dependent variable – were measured from two batteries of questions regarding 15 environmental practices (see Supplementary Appendix Table A1), measured as 15 dummy indicators, with scores for all the items summed between 0 and 15. Overall mean score was 3.869 and variance was 0.874 (Cronbach's alpha .68). This variable reflects a wide variety of private-sphere environmental behaviors, such as public transport use (e.g., walking instead of using a car), eco-friendly purchases (e.g., buying local products), reduced resource consumption (e.g., cutting down on water consumption), and eco-vehicle purchases (e.g., buying an electric car), etc. The 15 indicators are described in Table A1.

2.2.2. Individual sociopsychological predictors

The five predictors were measured as follows. Environmental attitudes and attitudes toward environmental behaviors were measured from questions regarding individuals' concerns about environmental problems (Hayward, 1990; Kurisu, 2015) and their attitudes to governmental environmental policies. Perceived behavioral control was measured through two indicators: a question regarding role in protecting the environment and a question regarding whether polluters should pay for environmental damage. The latter question reflected the fact that, since behaviors can instigate change, individuals should be made responsible for changing their behavior. Subjective environmental norms were measured (in a similar way to Kurisu (2015)) as normative statements about what should be done to solve environmental problems, with questions reflecting environmental expectations regarding others.

Finally, the Eurobarometer survey records three main sources of environmental information, and we assumed that the more sources of information used by Europeans, the better their knowledge. Responses were therefore summed to create an environmental knowledge scale, scored from 0 to 3 (more sources indicated better environmental knowledge). Any 'don't know' response was coded as a missing value (see Supplementary Appendix Table A2 for individual-level independent variables).

Table 1 reports descriptive statistics for individual environmental behaviors for the EU27+UK. Compared to countries located in the south and southeast of Europe, Scandinavian countries obtained higher scores for environmental behaviors, perceived behavioral control, and environmental knowledge, and lower scores for environmental attitudes, attitudes toward environmental behaviors, and subjective environmental norms. So, at first glance, our results may represent two groups: southern-eastern and northern-western countries.

As the Eurobarometer survey was not developed to collect data on particular theoretical drivers, we conducted exploratory factor analysis (EFA) to obtain evidence for the capacity of indicators to discriminate among individual-level drivers (Wood et al., 2015). Factors were extracted using principal component analysis (PCA) and varimax rotation, aided by the 'psycho' package (Makowski, 2018) implemented in the R Environment and Language for Data Analysis (R Core Team, 2020). The scree test was used to determine the number of factors to retain (see Supplementary Appendix Figure A1). For the first four components, the cumulative percentage of variance was 65%. Note that the portion of explained variance needs to be judged according to the research context, and can be as low as 50%–60% in social sciences and humanities (Williams et al., 2010). We found that the four-factor matrix structure could be interpreted in terms of environmental attitudes, subjective environmental norms, attitudes toward environmental behaviors, and perceived behavioral control. All loadings were higher than 0.5, so we could assume that the solution discriminates among those four theoretical constructs (see Supplementary Appendix Table A3).

[1] Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

Table 1
Mean individual environmental behavior and theoretical construct (predictor) scores for EU27+UK.

Country	Environmental behaviors	Perceived behavioral control	Environmental attitudes	Attitudes toward environmental behaviors	Subjective environmental norms	Environmental knowledge	Sample size
Austria	4.407	6.778	16.076	8.961	13.460	2.602	1026
Belgium	4.932	6.929	16.408	9.986	13.881	2.476	1000
Bulgaria	2.749	6.991	17.467	10.432	14.797	2.132	1036
Cyprus	3.179	7.320	18.756	11.089	15.211	2.137	501
Croatia	2.661	6.834	16.616	9.740	13.750	2.082	1020
Czech Republic	3.713	6.674	15.995	9.062	13.589	2.496	1007
Denmark	5.089	7.154	15.594	9.531	14.607	2.674	1002
Estonia	3.703	6.815	16.184	9.496	13.874	2.494	1007
Finland	4.941	6.878	15.687	9.270	14.357	2.717	1010
France	4.686	6.967	16.669	9.926	14.166	2.489	1016
Germany	4.580	7.182	15.904	9.895	13.875	2.373	1535
Greece	3.287	6.970	17.732	9.834	14.713	2.368	1008
Hungary	3.693	6.698	16.301	10.022	14.286	2.182	1050
Ireland	4.252	7.314	17.048	10.313	14.991	2.474	1002
Italy	3.614	6.859	17.170	9.768	14.111	2.162	1027
Latvia	4.209	6.898	17.408	9.856	14.126	2.520	1002
Lithuania	3.113	6.778	16.851	9.870	14.133	2.256	1003
Luxembourg	5.165	6.979	16.942	9.827	14.071	2.331	504
Malta	4.796	7.223	17.891	9.872	14.595	2.310	497
Netherlands	5.371	7.366	15.044	9.546	14.046	2.784	1003
Poland	3.094	6.557	16.265	9.823	13.520	2.059	1009
Portugal	2.609	6.875	16.313	10.231	14.677	1.967	1062
Romania	3.079	6.728	16.491	9.965	13.937	2.132	1031
Slovakia	3.559	6.668	16.418	10.122	14.307	2.136	1084
Slovenia	4.679	7.166	17.323	10.322	14.343	2.219	1025
Spain	3.494	6.944	16.854	10.389	14.393	1.959	1009
Sweden	6.256	7.476	15.821	10.073	14.557	2.840	1027
United Kingdom	4.107	7.213	16.073	9.448	14.819	2.321	1368
EU27+UK overall	3.869	6.933	16.427	9.832	14.187	2.287	27881

Table 2
Model selection (Bayesian information criterion): environmental behavior patterns and country clusters.

Patterns	Clusters				
	1	2	3	4	5
1[a]	105448				
2	104314	102849	102466	102349	102355
3	104182	102775	102345	102242	102233
4	104166	102724	102313	**102205**	102216
5	104185	102734	102325	102223	102248

[a] If the number of consumer patterns is 1, by definition the number of country clusters is restricted to 1 (Bijmolt et al., 2004) in terms of considering the multilevel property of individual-level observations.

2.2.3. Individual social indicators

The social indicators used to control for the social composition of the sample were age (15–24, 25–39, 40–54, ≥55 years), gender (men, women), education level (≥15, 16–19, ≥20 years, still studying, no full-time education), income measured by proxy according to difficulty paying bills (most of the time, from time to time, never), community type (rural area or village, small/medium-sized town, large town/city), and household size (1, 2, 3, ≥4 persons).

2.2.4. Country drivers

A country's socioeconomic development was measured as per capita gross domestic product (GDP) for 2017 (expressed in terms of purchasing power parity in USD), sourced from the World Development Indicators (World Bank, 2017). Educational development, reflecting mean years of education for adults and expected years of education for children, was scored according to the 2017 Education Index – sourced from the Human Development Report dataset (Human Development Report, 2017) – between 0 and 1 (low and high educational development, respectively). Income inequality was scored, using the 2017 Gini Index (Eurostat, 2020), between 0 and 100 (lowest and highest inequality, respectively). Data on local environmental issues was obtained from the Environmental Performance Index, jointly published every two years by Yale and Columbia Universities in collaboration with the World Economic Forum; scores range from 0 to 100 (Hsu et al., 2016), with higher scores indicating greater environmental sustainability (i.e., fewer environmental issues). For the EU countries, scores for 2016 (the year closest to the Eurobarometer survey) were taken for 19 indicators organized into several weighted categories (health, air quality, sanitation and drinking water, water resources, agriculture, forests, fisheries, biodiversity, habitat, climate, and energy). Finally, as a reflection of culture, individualism-collectivism was measured using Hofstede's index published in May 2020 (https://geerthofstede.com/research-and-vsm/dimension-data-matrix/; see also Hofstede, 2001); values range from 0 to 100, with higher scores indicating greater individualism (see Supplementary Appendix Table A4).

2.2.5. Analysis

To avoid biased estimators and inconsistent results (Ortega-Egea et al., 2014), we use a multilevel latent class regression model that systematically consideres attitude-behavior relationships to differ across clusters of individuals, and the mixture of the latter to differ across countries. Latent class models assume that any population is composed of clusters of individuals that differ according to a set of criteria (McCutcheon, 1987). While we do not know to which cluster each individual belongs, we do know that, once we identify the right number of clusters, the association among the set of criteria inside each cluster vanishes (Lazarsfeld and Henry, 1968). The latent class model has been extended to latent class regression models (Wedel and Kamakura, 1998), and subsequently, to latent class multilevel regression models (Vermunt, 2003).

The multilevel extension of latent class regression simultaneously

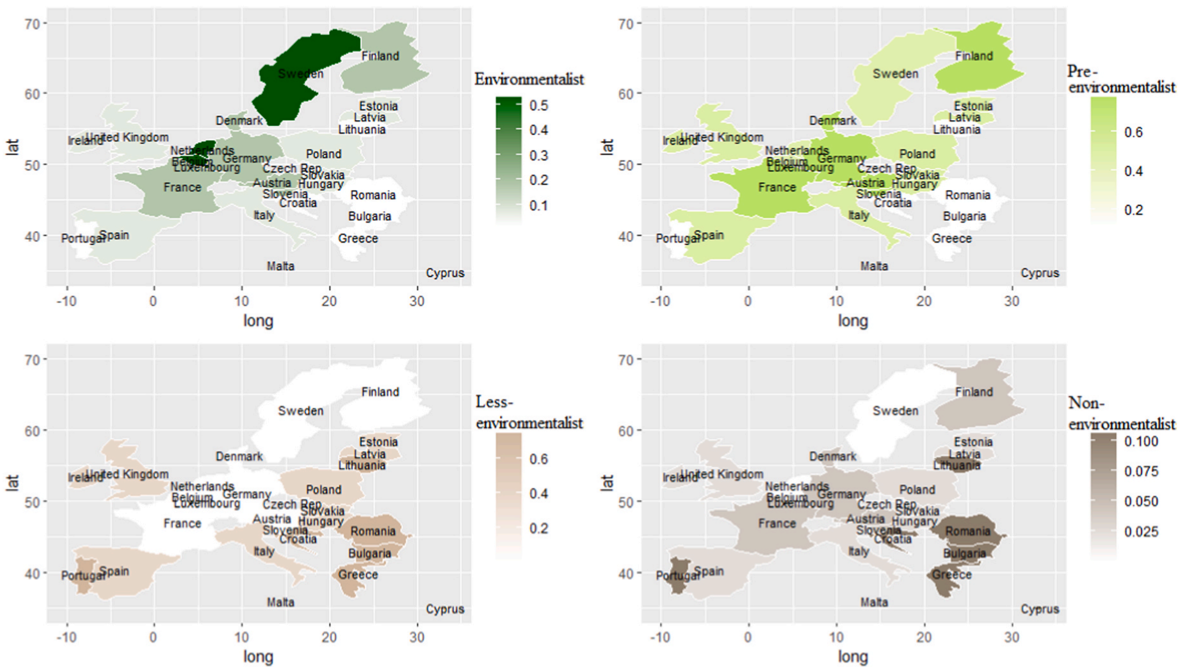

Fig. 1. Distribution of four environmental behavior patterns across four EU27+UK country clusters.

Table 3
Classification errors for the selected model.

Classification statistics	Europeans' patterns	Country classes
Classification errors	0.3155	0.0001
Reduction of errors (Lambda)	0.3973	0.9998
Entropy R-squared	0.3802	0.9993
Standard R-squared	0.3391	0.9996

identifies clusters of individuals, homogenous within individual-level patterns, whose distribution differs across clusters, in our case, of countries. Nesting individuals within countries makes it possible to consider that countries belonging to different clusters will differ in terms of the distribution of individual-level patterns. In our case, the multi-level latent class regression model consisted of mixed behavior patterns at the individual level and mixed distributions of those patterns within countries. In this model, regression parameters are allowed to differ across individual patterns and across their distributions in country clusters (level 2 units).

We used LatentGOLD 4.0 statistical software (Vermunt and Magidson, 2005) to estimate our model parameters. The dependent variable (individual environmental behaviors), as a summation index, was modelled following Poisson regression (Faria and Gonçalves, 2013), whereas the theoretical predictors were assumed to follow a normal distribution. Individual-level social indicators, treated as inactive covariates, were assumed to follow a multinominal distribution. Clusters of individuals, reflecting environmental behavior patterns, were described using social indicators, while clusters of countries were described using country-level drivers.

3. Results

3.1. Model selection

The process of estimating different models is described in Table 2. To identify the best model, the 21 models that combined individual-level

Table 4
Europeans' environmental behavior patterns.

	Pattern 1 (Pre-environmentalist)	Pattern 2 (Less-environmentalist)	Pattern 3 (Environmentalist)	Pattern 4 (Non-environmentalist)	Sample size	
Class size	0.4720	0.3274	0.1545	0.0460	23854	
Mean environmental behavior score	4.3463	2.8649	6.0605	2.0945	**Statistical tests**	
Theoretical constructs (predictors)					Wald (=)	p
Intercept	1.3804	0.9858	1.7733	0.1844	572.5518	<0.0001
Perceived behavioral control (exp((β))	0.1330	0.0252	0.0899	0.8396	52.9108	<0.0001
	(1.14)	(1.03)	(1.09)	(2.32)		
Environmental attitudes (exp((β))	0.1238	0.0915	0.0992	0.7524	16.2952	<0.0001
	(1.13)	(1.10)	(1.10)	(2.12)		
Attitudes toward environmental behaviors (exp((β))	0.0546	0.0641	0.0623	0.0885	0.7227	0.87
	(1.06)	(1.07)	(1.06)	(1.09)		
Subjective environmental norms (exp((β))	0.0935	0.0525	0.1159	0.4975	24.7374	<0.0001
	(1.10)	(1.05)	(1.12)	(1.64)		
Environmental knowledge (exp((β))	0.2779	0.2686	0.0252	−0.1407	167.6259	<0.0001
	(1.32)	(1.31)	(1.03)	(0.87)		
R^2	0.3033	0.1824	0.1500	0.6014	0.5066	
CAIC (based on LL)					102244.4	

environmental behavior patterns and different country clusters were simultaneously estimated. The best overall model was selected according to the lowest Bayesian information criterion (BIC) value (highlighted in bold in Table 2) based on log-likelihood (Vermunt and Magidson, 2005): the BIC value decreased until a model reflecting four individual patterns and four country clusters was obtained, and then increased for more complex models. Missing values were removed using list-wise deletion, leaving 23,854 individuals out of the original sample of 27, 881 individuals.

Table 3 reports the classification errors for the selected model, reflecting four individual patterns and four country clusters, and also contains information on how well we can predict the classification of individuals and countries, i.e., on how well the clusters are separated. Posterior class membership probabilities were used to estimate the proportional classification errors, proportional reductions in classification errors, a measure based on entropy, and the standard R-squared. Note that the statistics suggest that, while the classification of countries in clusters is accurate, behavioral patterns are not so well separated.

To what extent do Europeans systematically differ in their environmental behaviors?

In seeking systematic differences between Europeans (hypothesis H1), the individual-level latent class regression models linked environmental behaviors to the five predictors (environmental attitudes, attitudes toward environmental behaviors, perceived behavioral control, subjective environmental norms, and environmental knowledge). Posterior membership probabilities were estimated from the model parameters and used to classify individuals in just one pattern of behavior, i.e., in the cluster for which posterior probability was highest (Vermunt and Magidson, 2005).

Table 4 depicts the strength of the attitude-behavior relationships for each of the four environmental behavior patterns. The upper part reports pattern size, sample size (without missing values), and mean environmental score for each behavior pattern, and the lower part – which shows the association of predictors with behaviors – reports the Wald statistic reflecting different attitude-behavior relationship strengths across the EU, the predictive capacity (R-squared) of each pattern, the overall predictive capacity of the model, and the consistent Akaike information criterion (CAIC) value for the complete model. Note that we can reject the null hypothesis for all the predictors except for attitudes toward environmental behavior; thus, hypothesis H1 is largely supported, as Europeans do systematically differ in terms of the strength of the attitude-behavior relationship, except for attitudes toward environmental behaviors.

Overall, the explanatory capacity of the model was satisfactory (R-squared = 0.51) according to standards (usually around 0.3) in environmental behavior studies (He et al., 2019; Klöckner, 2013). However, explanatory capacity varied depending on behavior patterns: it was highest (R-squared = 0.60) for pattern 4 (with the lowest mean behavioral score, 2.09) and lowest (R-squared = 0.15) for pattern 3 (with the highest mean environmental score, 6.06).

According to the upper part of Table 4, environmental behavior patterns can be interpreted as follows: pattern 1 (47.2% of Europeans) is characterized by the second-highest environmental behavior score (4.35) and moderate predictive capacity (R-squared = 0.30); pattern 2 (32.7% of Europeans) is characterized by a low environmental behavior score (2.86) and low predictive capacity (R-squared = 0.18); pattern 3 (15.4% of Europeans) has the highest environmental behavior score (6.06) and the lowest predictive capacity (R-squared = 0.15); and finally, pattern 4 (4.6% of Europeans) has the lowest environmental behavior score (2.09) and the highest predictive capacity (R-squared = 0.60). We labelled the four patterns according to environmental behavior scores (highest to lowest) as 'environmentalist' (pattern 3), 'pre-environmentalist' (pattern 1); 'less-environmentalist' (pattern 2) and 'non-environmentalist' (pattern 4), representing 15.4%, 47.2%, 32.7% and 4.6% of Europeans, respectively.

Since we modelled environmental behavior following a Poisson distribution, to better interpret the impact of parameters on the expected number of environmental behaviors, we transformed the β into exp(β) parameters, interpreted as the relative impact of an environmental driver. For the environmentalists (with the highest behavioral score), all predictors increased behavioral score from 3% to 12%; for the pre-environmentalists, while there was only a marginal increase for most predictors, environmental knowledge increased the overall score by 32%; for less-environmentalists, environmental knowledge increased the behavioral score by 31%, while the other predictors produced a 3%–10% increase; finally, for non-environmentalists (with the lowest behavioral score), the predictors with the greatest impact were environmental attitudes, perceived behavioral control, and subjective environmental norms (112%, 132%, and 64% increases, respectively), while there was only a marginal increase (9%) in attitudes toward environmental behaviors, and a decrease (13%) for environmental knowledge. We therefore found support for hypothesis H1, which proposed that Europeans systematically differ in their environmental behaviors.

3.2. *To what extent do Europeans' environmental behaviors differ systematically depending on their social position?*

Table 5 shows the chi-square of independence tests and the row profiles of the social indicators. Rejecting the null hypothesis, we found a significant relationship between behavior patterns and social indicators (age, gender, education, income, area of residence, and household size). Thus, hypothesis H2 was supported.

Table 5 also provides evidence on how social indicators systematically differed in the distribution of social categories across environmental patterns. To determine whether a row profile was overrepresented in an environmental behavior pattern, we compared each social category row profile with each pattern size, with a higher row profile value meaning that the category level was over-represented in the pattern (patterns are indicated in bold).

According to Table 5, therefore, the four environmental behavior patterns can be broadly profiled as follows: environmentalists are mainly men aged ≥55 years, well-educated and with a high income, who live alone in a small/medium-sized town; pre-environmentalists have a similar profile, except that most such individuals did not receive full-time education; less-environmentalists are mainly women aged 15–24 years, with a lower education level and income than the environmentalists, who live in large towns/cities in households of three people; finally, non-environmentalists have a similar profile to less-environmentalists, except that they are mainly men, without full-time education and with a low income (they struggle to pay bills), who live in a rural area/village in households of three people. The social patterns depicted in Table 5 therefore support hypothesis H2, that Europeans' environmental behaviors differ systematically depending on their social position.

To what extent do the environmental behaviors of Europeans differ systematically in their distribution among country clusters?

Table 6 depicts country cluster sizes and the distribution of environmental behavior patterns in those clusters. Four countries were classified in cluster 1 (Belgium, Luxembourg, the Netherlands, Sweden), seven in cluster 2 (Austria, Denmark, Finland, France, Germany, Malta, Slovenia), ten in cluster 3 (Czech Republic, Estonia, Italy, Ireland, Hungary, Latvia, Poland, Spain, Slovakia, United Kingdom), and seven in cluster 4 (Bulgaria, Croatia, Cyprus, Greece, Lithuania, Portugal, Romania). We therefore found support for hypothesis H3 that proposes that European patterns of environmental behaviors systematically differ in their distribution among clusters of countries. Note that, in Table 6, the environmental behavior patterns over-represented in each country cluster are indicated in boldface.

In accordance with researcher proposals for color-coding countries along a continuum from green to gray (Geiger, et al., 2021), and bearing in mind that pro-environmental behavior is often known as green behavior (Stern, 2000), we color-coded country clusters according to the

Table 5
Associations between Europeans' environmental behavior patterns and social position indicators.

Behavior patterns		Environmentalist	Pre-environmentalist	Less-environmentalist (0.3274)	Non-environmentalist (0.0460)	p
(class size)		(0.1545)	(0.4720)			
Inactive covariates						
Age	15–24 years	12%	45%	**37%**	**6%**	<0.001
	25–39 years	14%	45%	36%	5%	
	40–54 years	15%	46%	34%	5%	
	≥55 years	**17%**	**49%**	30%	4%	
Gender	Man	**16%**	**48%**	31%	**5%**	<0.001
	Woman	15%	47%	**34%**	4%	
Education (age on terminating full-time education)	≤15 years	12%	45%	**38%**	5%	<0.001
	16–19 years	13%	46%	36%	5%	
	≥20 years	**20%**	50%	26%	4%	
	Still studying	15%	48%	32%	5%	
	No full-time education	18%	**53%**	21%	**8%**	
Income (difficulties paying bills)	Most of the time	7%	31%	**53%**	**9%**	<0.001
	From time to time	10%	40%	44%	6%	
	Never	**18%**	**52%**	26%	4%	
Community type	Rural area/village	16%	47%	32%	**5%**	<0.001
	Small/medium town	**16%**	**49%**	31%	4%	
	Large town/city	14%	44%	**37%**	5%	
Household size	1	**17%**	**51%**	28%	4%	<0.001
	2	**17%**	48%	30%	**5%**	
	3	13%	44%	**38%**	**5%**	
	≥4	14%	44%	37%	**5%**	

Table 6
EU27+UK country clusters reflecting the distribution of environmental behavior patterns.

Country cluster				
Behavior pattern (cluster size %)	1 Green (14%)	2 Yellow-green (25%)	3 Brown (36%)	4 Gray (25%)
Environmentalist	**0.5294**	0.1815	0.0761	0.0188
Pre-environmentalist	**0.4698**	**0.7745**	**0.5050**	0.1244
Less-environmentalist	0.0006	0.0010	**0.3942**	**0.7506**
Non-environmentalist	0.0002	0.0430	0.0247	0.1061
Country-mean environmental score	5.2571	4.5669	3.8421	3.0289

Green countries: Belgium, Luxembourg, the Netherlands, Sweden**Yellow-green countries:** Austria, Denmark, Finland, France, Germany, Malta, Slovenia**Brown countries:** Czech Republic, Estonia, Italy, Ireland, Hungary, Latvia, Poland, Spain, Slovakia, United Kingdom**Gray countries:** Bulgaria, Croatia, Cyprus, Greece, Lithuania, Portugal, Romania.

Table 7
EU27+UK country socioeconomic development and culture indicators.

	Green	Country clusters Yellow-green	Brown	Gray	p
Economic development: per capita GDP in USD	61075.91	48236.83	39930.11	29024.67	**<0.001**
Educational development: Education Index	0.89	0.89	0.86	0.81	**<0.001**
Income inequality: Gini Index	27.57	27.22	30.09	34.12	**<0.001**
Environment: Environmental Performance Index	84.45	87.87	85.74	85.24	**<0.001**
Individualism score	73.27	59.52	67.25	35.54	**<0.001**
Country-mean environmental score	**5.2571**	**4.5669**	**3.8421**	**3.0289**	

mix of individual patterns, from green, the color of renewal and hope and an announcement of life (Lewis, 1996, p.2) to gray, the color of devastated nature, using yellow-green and brown (Brick et al., 2017) to reflect variations within that green-gray continuum. The country clusters were composed as follows: cluster 1/green (n = 4), formed of 53% environmentalists and 47% pre-environmentalists; cluster 2/yellow-green (n = 7), formed mainly of pre-environmentalists (77%) and environmentalists (18%); cluster 3/brown (n = 10, the largest cluster), formed mainly of pre-environmentalists (50%) and less-environmentalists (39%); and finally, cluster 4/gray (n = 7), formed mainly of less-environmentalists (75%), non-environmentalists (11%) and pre-environmentalists (12%). Fig. 1 depicts the color-coded four clusters reflecting the four different environmental behavior patterns mapped onto the EU27+UK.

To what extent do the environmental behaviors of EU countries differ systematically according to country socioeconomic development and culture?

Table 7 reports *t*-test results jointly with mean country-level indicator values. We found that score differences across country clusters were statistically meaningful for all five country-level drivers: socioeconomic development, educational development, income inequality, environmental performance, and individualism-collectivism. We thus reject the null hypothesis and find support for hypothesis H4, proposing that environmental behaviors of EU countries differ systematically according to country socioeconomic development and culture.

In terms of evidence of systematic differences in country-level indicators, the mean values for each country cluster in Table 6 indicate the following (highest to lowest environmental scores): green countries have the highest socioeconomic development score, high income equality (the lower the index the more equally distributed the income), high educational scores, and the highest individualism scores, but have the lowest environmental performance score; yellow-green countries have the highest educational and environmental performance scores, the second-highest socioeconomic development score, the lowest income inequality score, and the second-lowest individualism score; brown countries have low socioeconomic and educational development scores, greater income inequality, and higher environmental performance and individualism scores; and finally, gray countries have the lowest socioeconomic and educational development scores, the second-lowest environmental performance score, the highest income inequality score, and the lowest individualism score.

4. Discussion

Research into the A-B-C relationship has typically focused on the effect of theoretical drivers on individual behaviors and the moderating effect of social factors, while other research has focused on how contextual drivers directly influence behaviors and moderate the impact of individual-level sociopsychological predictors (He et al., 2019; Pisano and Lubell, 2017; Y. Wang, 2017). However, our focus was on to what extent environmental behaviors of Europeans systematically differ according to the A-B-C model, and to what extent systematic differences among European countries can be reduced to a few differentiated clusters, each representing similar environmental behaviors.

We selected the best model in a single step using multilevel latent class regression analysis (Vermunt, 2003; Vermunt and Magidson, 2005; Bijmolt et al., 2004), grouping Europeans according to their behaviors and sensitivity to five sociopsychological predictors (environmental attitudes, attitudes toward environmental behaviors, perceived behavioral control, subjective environmental norms, and environmental knowledge). Clusters of countries were identified according to distributions of environmental behavior patterns; i.e., countries belonging to the same cluster reflected a similar within-country distribution of individual environmental behaviors.

In identifying four attitude-behavior relationship patterns for Europeans we found support for hypothesis H1, that Europeans systematically differ in that relationship. Patterns were labelled according to behavior scores – from more (higher scoring) to less (lower scoring) environmental behaviors – as environmentalist, pre-environmentalist, less-environmentalist and non-environmentalist. All environmental patterns were related to individuals' social position, as expected according to hypothesis H2, proposing that Europeans' environmental behaviors differ systematically depending on their social position. However, predictive capacity was not as expected. The predictive capacity of the attitude-behavior model was lowest for the environmentalists and highest for the non-environmentalists. This surprising attitude-behavior relationship suggests that sociopsychological drivers have a greater impact on the behaviors of less environmentally oriented Europeans than on the behaviors of more environmentally oriented Europeans.

We therefore found support for the proposition that individuals classified in each environmental behavior pattern varied systematically according to their social position (social categories and resources). This finding is consistent with previous studies suggesting that environmentalists are mostly men (Mostafa, 2007), older (Finisterra do Paço et al., 2009; Golob and Kronegger, 2019), wealthier (do Paço and Raposo, 2009; Rowlands et al., 2003), and well educated (Golob and Kronegger, 2019; Ortega-Egea et al., 2014), and live in small households (Poortinga et al., 2004) in small/medium-sized towns (Berenguer et al., 2005).

In uncovering environmental behavior patterns, we identified four clusters of EU countries that varied according to the distribution of those patterns. We thus found support for the hypothesis H3, that EU countries systematically differ according to the distribution of individual environmental behavior patterns. Furthermore, patterns with higher scores were overrepresented in country clusters with higher socioeconomic, educational, and individualism scores, and lower income inequality scores, supporting the proposition that culture and country socioeconomic development have an undeniable effect on behaviors (Liobikienė et al., 2016; Milfont, 2012; Morren and Grinstein, 2016; Pisano and Lubell, 2017; Soyez, 2012). Environmentalists and non-environmentalists were mainly found in the country clusters classified as green (Belgium, Luxembourg, the Netherlands, Sweden) and gray (Bulgaria, Croatia, Cyprus, Greece, Lithuania, Portugal, Romania), respectively – two contrasting country clusters with important differences in terms of socioeconomic development and culture. In a word, countries' structural drivers were correlated with environmentalism level. Previous studies have reported that western and northern EU countries are more pro-environmental than southern and central EU countries, which, in turn, are more pro-environmental than eastern EU countries (Bozonnet, 2017; Butkeviciene and Morkevicius, 2017). The environmental pattern of countries supports hypothesis H4, which proposes that the environmental behaviors of EU countries differ systematically according to country socioeconomic development and culture.

To date, we have identified no study underpinned by systematic statistical analysis that questions this reality that breaks with stereotypes about EU sustainability as a whole. Our results show, for instance, that Malta, a southern European island, is, environmentally speaking, greener than Ireland, the United Kingdom, and northern European countries. Such findings would suggest that further research is needed to find additional evidence on the environmental behaviors of Europeans.

Another interesting finding was that environmental knowledge had a negative effect on environmental behaviors for non-environmentalists, refocusing our attention on context drivers in the A-B-C model. Non-environmentalists were located mostly in gray countries, which had the lowest educational scores. Possible explanations for this negative effect of environmental knowledge on environmental behaviors may be misinterpreted or misunderstood information as a consequence of a lower educational level or media misinformation; furthermore, gray countries had the highest collectivism scores, which suggests that more importance may be attached to information transmitted by family, friends, neighbors and colleagues. Future studies should therefore consider educational level and culture orientation of individuals in investigating the specific effects of different information sources on environmental behaviors, so as to identify patterns that can be focused on by customized policies aimed at fostering sustainability behaviors.

The patterns of the attitude-behavior relationship suggest that sociopsychological predictors have less explanatory power for environmentalists and more explanatory power for non-environmentalists. The first study that used the A-B-C model identified a similar pattern (Guagnano et al., 1995), finding that the importance of sociopsychological predictors may be reduced by favorable pro-environmental settings. The NAM (Schwartz, 1977), for instance, was less significant in explaining behavior in households with recycling bins (Guagnano et al., 1995). We suggest, therefore, in line with other authors (Gupta and Ogden, 2006, 2009; Oskamp et al., 1991; Wiederhold and Martinez, 2018), that the strength of the effect of attitudes on behavior depends on contextual drivers and the social position of individuals.

The shape of attitude-behavior relationships may be grounded in theories of motivations, intrinsic motivators (attitudes), and extrinsic motivators (incentives). Similar attitudes may lead people to similar environmental behaviors in the same context – whether the social context (doing as other people do) or the economic context (responding to external incentives). However, similar attitudes may also lead people to behave differently in different country contexts. The motivation crowding-out theory suggests that external incentives, whether positive or negative, may undermine intrinsic motivations (Bruno et al., 2017; Peng and Liu, 2020). Research has also found that the influence of internal motivators diminishes once people become accustomed to external social or economic motivators (Frey, 1997; Rommel et al., 2015; Heyman and Ariely, 2004; 2009).

4.1. Limitations and future research

Our study has some limitations that open up opportunities for future research. The first limitation is inherent to using secondary data: we had no power to determine environmental indicators of individual-level behaviors and predictors, and so were constrained in how they were measured. A second, and related, limitation, concerns the aggregate nature of the A-B-C model, which reflects research into private-sphere but not public-sphere environmental behaviors.

Attitude-behavior theories such as the NAM (Schwartz, 1977), the TPB (Ajzen, 1985) and the VBN (Stern, 2000) could be applied to further explore this topic, broadening studies to include other attitude variables that depend on specific behaviors. Heterogeneity in theories could also be examined in more detail using a hybrid multilevel causal model (Lamberti et al., 2017, 2021). A final suggestion is that more detailed analyses could delve into the influence of political history, law, taxation, and international relationships on the A-B-C model (Bodur and Sarigöllü, 2005; Dolnicar and Grün, 2009; Ortega-Egea et al., 2014).

5. Summary

Our study is, as far as we are aware, the first that examines how Europeans systematically differ, depending on their EU country context, in their environmental behaviors and their attitude-behavior relationships. We contribute to sustainability knowledge by providing evidence of socially distributed heterogenous attitude-behavior relationships, of a heterogenous mix of behaviors in different EU countries, and of EU country clusters with similar country-level drivers and similar distributions of individual-level environmental behavior patterns. We also provide an explanation for heterogenous attitude-behavior relationships based on the crowding-out effect of external motivators.

Since environmental behaviors are the outcome of internal and external drivers, interventions need to be tailored according to the attitudinal and contextual limitations or opportunities for pro-environmental behaviors in individuals. Indirectly or directly incorporating contextual drivers in attitude-behavior relationships is essential to the design of more focused environmental policies. Our findings, we hope, will help policy makers design better environmental action plans that consider systematic differences in the individual environmental behaviors of Europeans and their distribution across EU countries.

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CRediT authorship contribution statement

Öykü H. Aral: Formal analysis. **Jordi López-Sintas:** Research design.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2023.135936.

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